

Full-day, in home validation of infant body position measurements from inertial sensors

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Abstract

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## **Current Study**

### **Methods**

**Participants**

**Apparatus**

**Procedure**

**Body position annotation**

**Body position classification**

### **Results**

**Goal 1: Optimize and validate body position classification model**

**Goal 2: Assess classification accuracy over long recordings**

**Goal 3: Examine wear time and compliance in full-day data collection**

**Goal 4: Determine sensitivity of classification to measure age differences in body position**

### **Discussion**

## References

Table 1

*Summary statistics for model performance metrics shown separately for group and individual models.*

Metric	Group			Individual		
	Median	Mean	SD	Median	Mean	SD
Overall Accuracy	0.908	0.848	0.143	0.936	0.919	0.071
Balanced Accuracy	0.909	0.897	0.074	0.916	0.907	0.072
F1	0.813	0.827	0.101	0.873	0.870	0.089
Sensitivity	0.840	0.836	0.123	0.848	0.840	0.121
Pos Pred Value	0.822	0.815	0.125	0.915	0.899	0.108
Kappa	0.769	0.757	0.160	0.846	0.820	0.141

Table 2

*Correlations between human-coded and model-predicted body position durations across the entire long delay period. Correlations are provided within each posture and overall, and computed separately using group and individual models with and without outlier participants.*

Position	With Outliers		Without Outliers	
	Group	Individual	Group	Individual
Held	-0.02	0.16	0.55	0.63
Prone	0.97	0.83	0.97	0.84
Sitting	0.72	0.93	0.91	0.97
Supine	0.84	0.93	0.94	0.97
Upright	0.84	0.93	0.99	0.94
Overall	0.79	0.90	0.95	0.96

Table 3

*Correlations between human-coded and model-predicted body position durations using 10-minute bins during the long delay period. Correlations are provided within each posture and overall, and computed separately using group and individual models with and without outlier participants.*

Position	With Outliers		Without Outliers	
	Group	Individual	Group	Individual
Held	0.45	0.44	0.57	0.56
Prone	0.96	0.81	0.96	0.88
Sitting	0.72	0.93	0.91	0.93
Supine	0.75	0.93	0.90	0.94
Upright	0.93	0.95	0.97	0.95
Overall	0.80	0.92	0.92	0.94

Table 4

*Summary of age differences in full-day body position for younger (4- to 7-month) and older (11- to 14-month) infants. Values shown are the mean percent of time for each body position averaged across infants in each group. Standard deviations are shown in parentheses. Descriptive statistics are shown separately for group and individual models.*

Position	Group		Individual	
	Younger	Older	Younger	Older
Upright	7.6% (8.9)	18.6% (7.4)	9.9% (13.1)	18.7% (8.4)
Sitting	26.3% (12.1)	44.4% (10.1)	20.2% (16.3)	46.9% (13.3)
Prone	13.8% (13.5)	14.4% (6.0)	11.9% (9.9)	16.9% (10.6)
Supine	37.9% (23.2)	14.0% (8.4)	39.4% (30.3)	10.0% (9.5)
Held	12.7% (6.9)	8.5% (5.4)	17.6% (19.9)	7.4% (7.6)



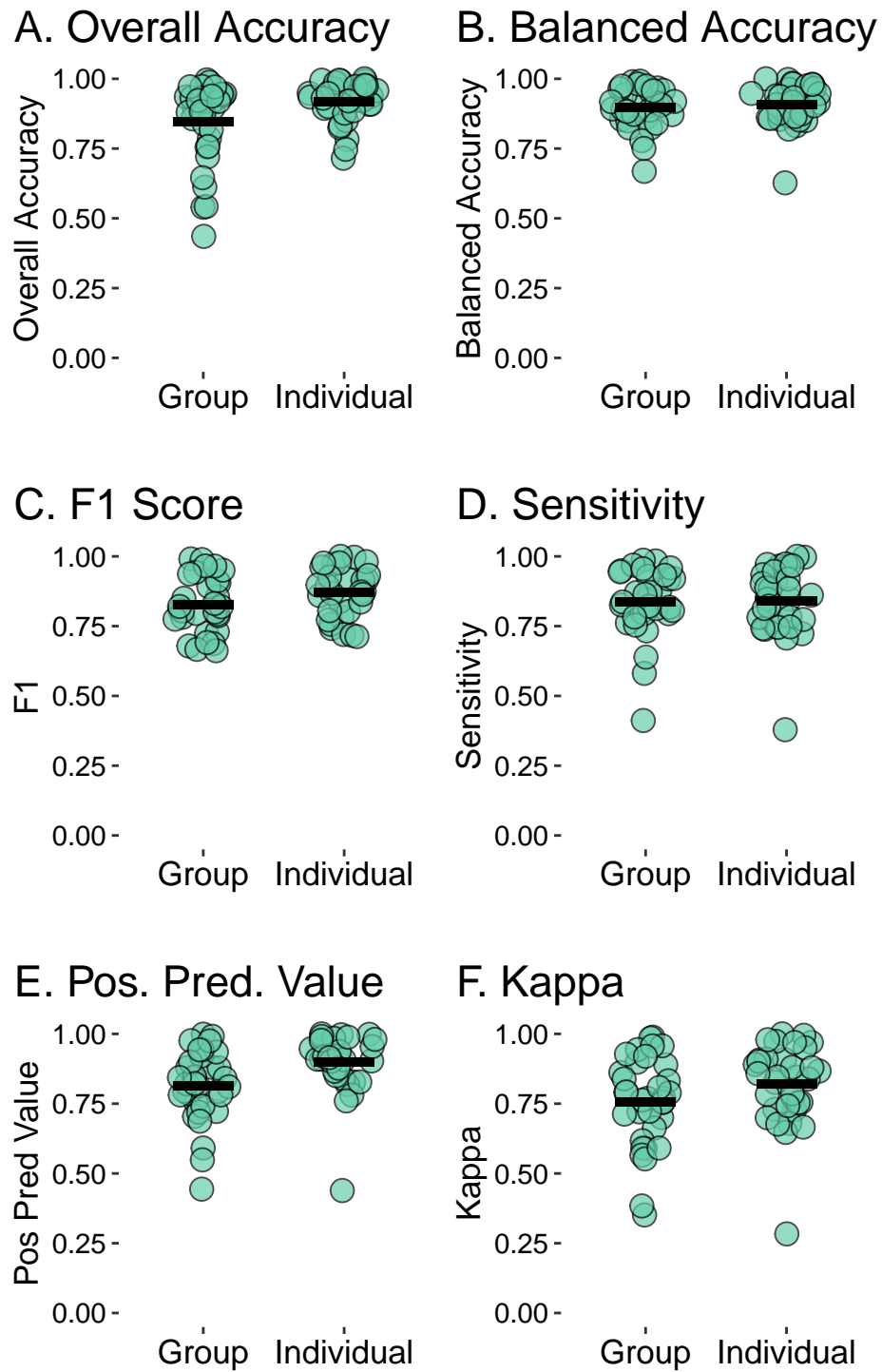
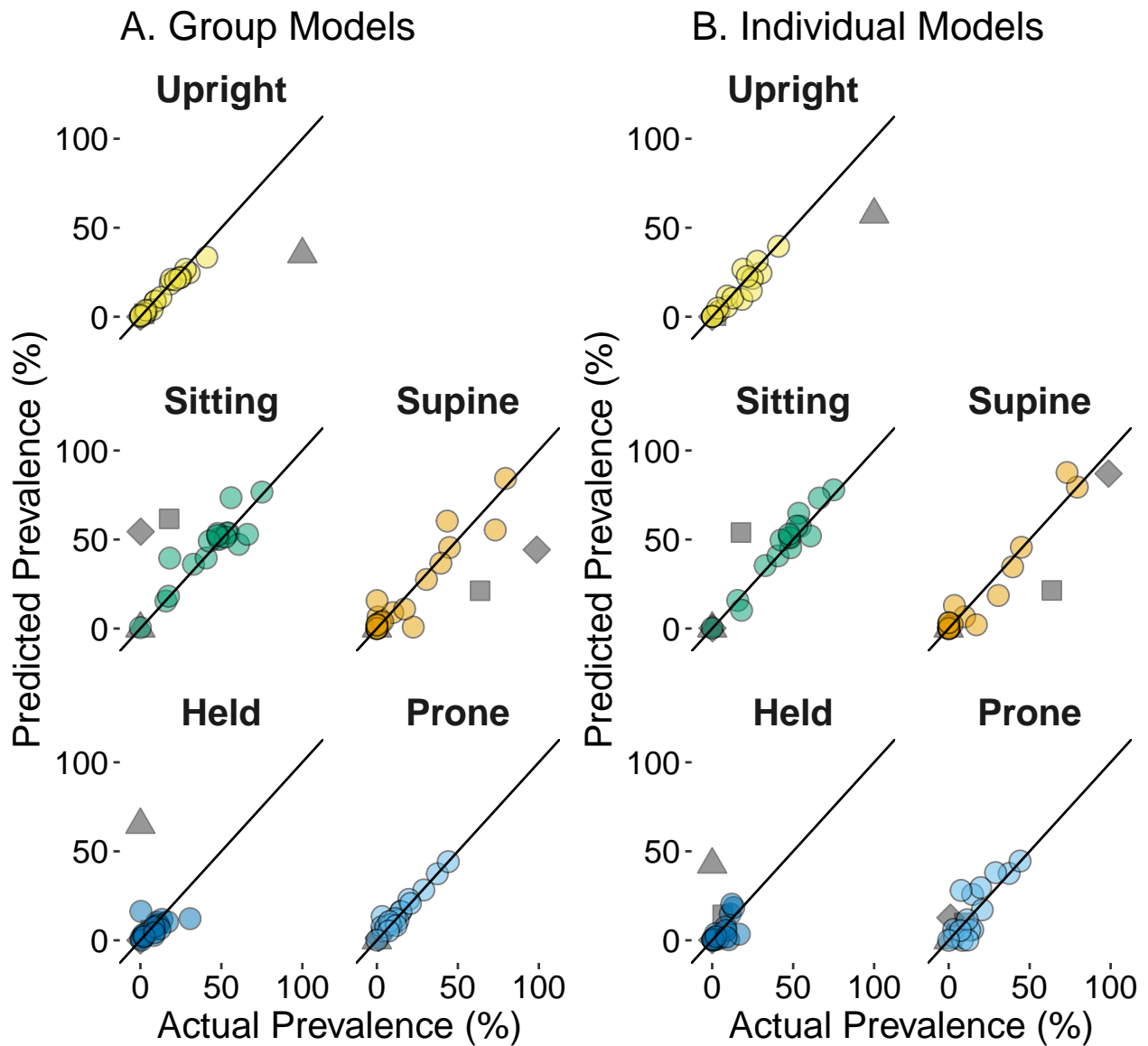


Figure 1. Metrics



*Figure 2.* Overall agreement between human-coded body position and model-predicted body position in the long-delay period. Agreement for group models is shown in (A) and agreement for individual models is shown in (B). Plots are shown separately for each body position with a reference line that indicates perfect agreement; each point in a plot represent data for a single participant. The three outlier participants are plotted in dark gray, with a different shape marking each individual.

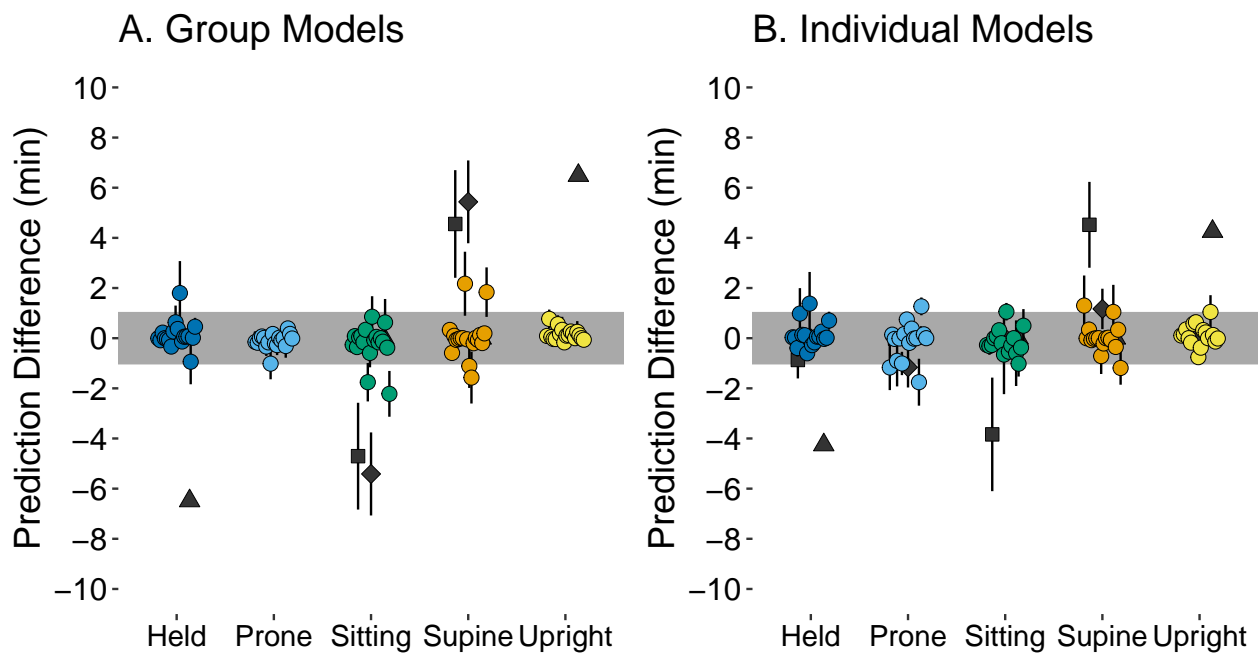
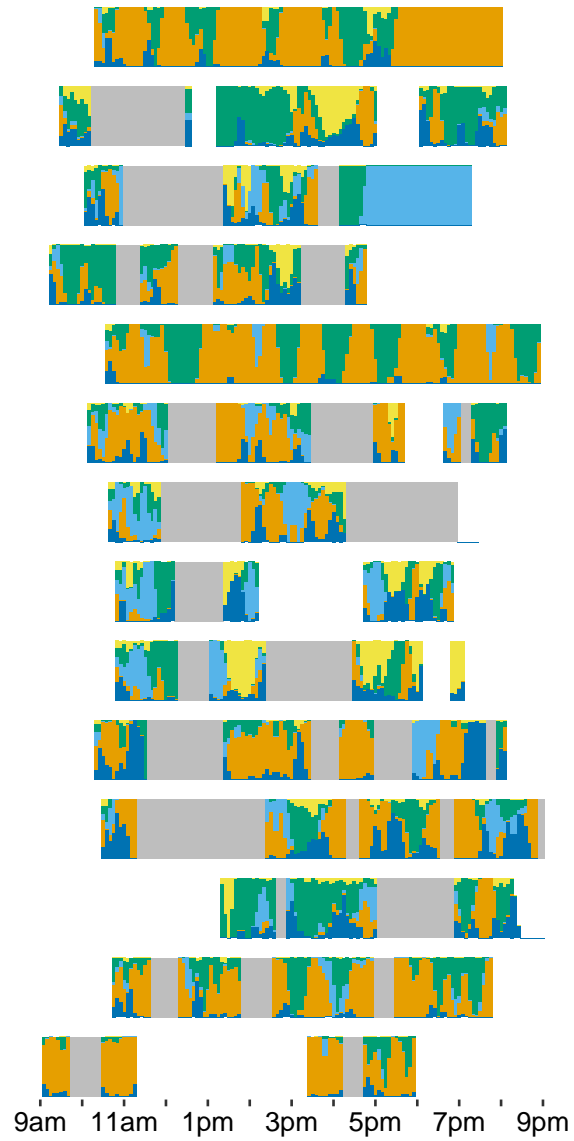


Figure 3. Prediction performance (difference in minutes between human-coded and model-predicted body position) for 10-minute bins in the long delay period. Each point shows the mean and SE for a single participant for each body position, summarizing the prediction difference for each of their 10-minute bins. Points falling within the gray shaded region indicate that average prediction errors were less than 1 minute. Performance is plotted separately for (A) group models and (B) individual models. The three outlier participants are plotted in dark gray, with a different shape marking each individual.

A. 4–7 Months



B. 11–14 Months

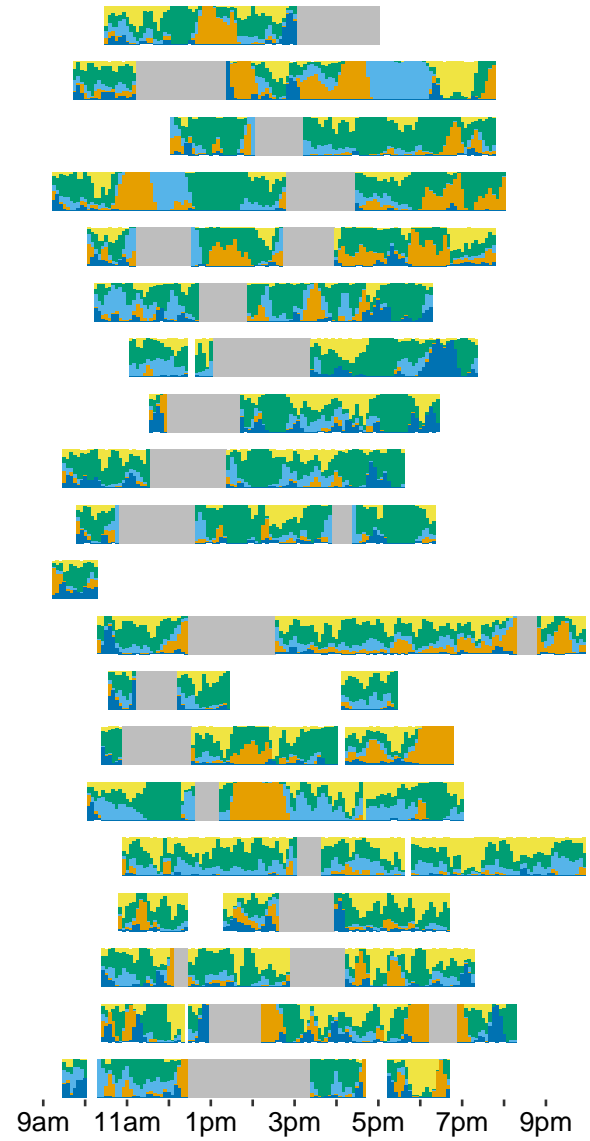


Figure 4. Timelines

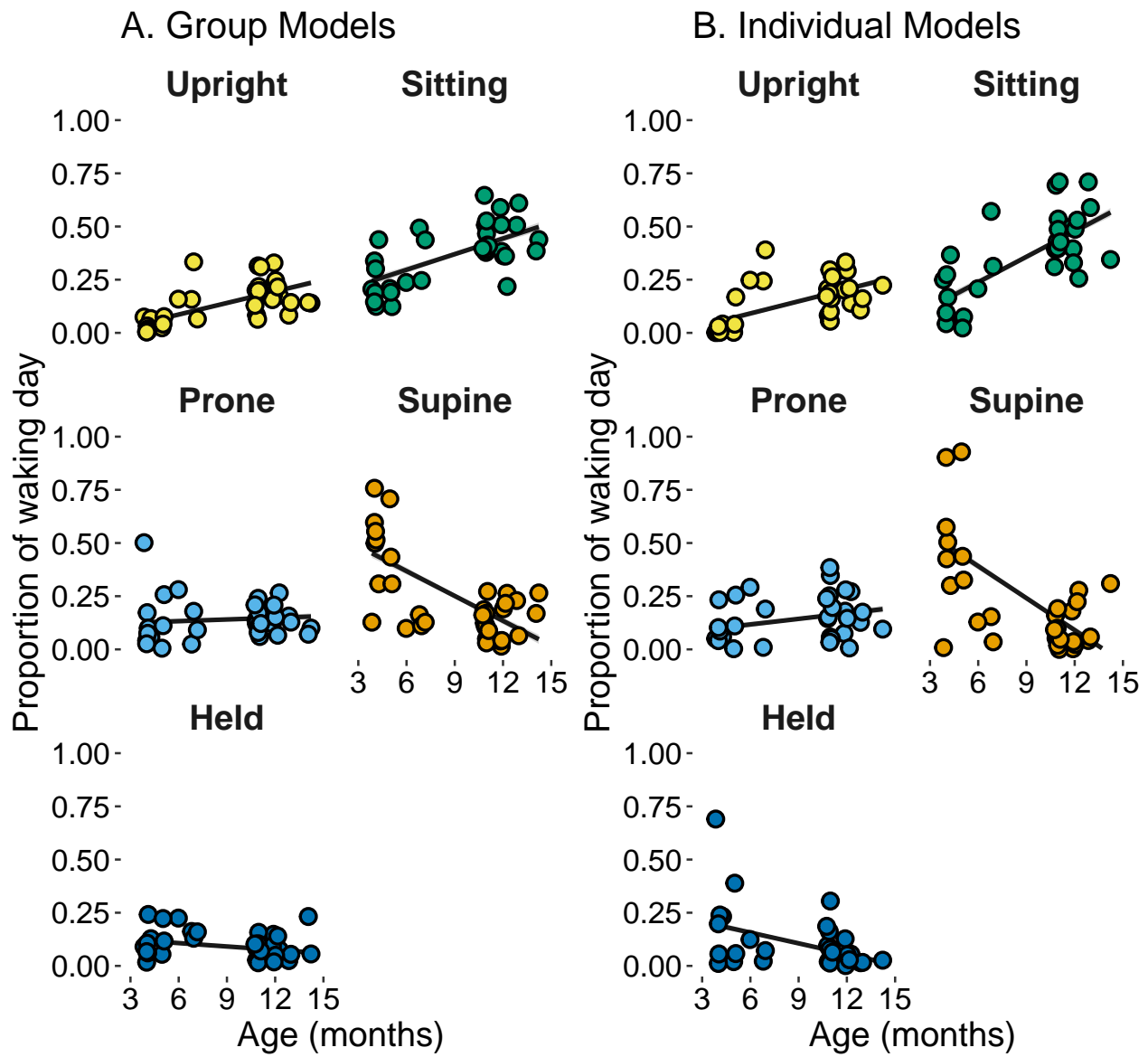


Figure 5. Age trends