

Comparison of a hybrid pediatric weight estimation method (Handtevy™) to the Broselow™ length based tape

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Study Objectives

1. Validate the correlation between predicted weights using the Handtevy™ age-based system and published pediatric normal weights.
2. Compare the predictive validity of the Handtevy™ LBT to the Broselow™ LBT.

Methods

2,456 pediatric patients (NHANES 2011-2012 dataset) were used in this study.

1. Compared agreement between actual and predicted weights using Bland-Altman plots.
2. Pairwise comparisons using a Bonferroni adjustment on the percentage difference between predicted and actual weights for newborn through 10-year olds.

Results

1. Rater agreement between the Handtevy™ age-based system and measured NHANES weights shows a significant prediction, with 71% of the variance accounted for in the model.
2. A Bland-Altman plot demonstrates only 5.5% percent of the measurements outside of the limits of agreement (95% CI, -25.67 to 24.12). **Figures 2, 3**
3. In a comparison of the two length based tapes, paired t-tests demonstrate that the Handtevy™ LBT is more accurate 62% of the time. Both length based techniques become less accurate as a subject's weight increases. **Table 2**
4. To compare the Handtevy™ age-based system to the Broselow™ LBT, pairwise comparisons were used to compare the percentage difference between predicted and actual weights for each BMI category. The Handtevy™ age-based system performed statistically better ($p < 0.05$) for underweight, normal weight, and obese children. No difference was found for overweight children. **Figures 5**

Conclusions

Predicted weights from the Handtevy™ age-based weight estimation method accurately predict pediatric normal weights. A comparison of two length-based tapes demonstrates increased accuracy of the Handtevy™ LBT over the Broselow™ LBT. The Handtevy™ age-based system outperforms the Broselow™ LBT for underweight, normal weight, and obese children.

Handtevy Tape			Broselow Tape		
Age	Length (cm)	Weight (kg)	Age	Length (cm)	Weight (kg)
NB	< 59.5	4	n/a	< 51.8	3
4 mo	< 67.07	6	n/a	< 54.9	4
6 mo	< 74.29	8	n/a	< 59.1	5
1 yr	< 83.82	10	n/a	< 66.8	6.5
2 yr	< 95.32	12	n/a	< 74.1	8.5
3 yr	< 102.07	15	n/a	< 83.7	10
4 yr	< 108.26	17	n/a	< 95.3	13
5 yr	< 115.09	20	n/a	< 108.2	17
6 yr	< 121.52	22	n/a	< 121.3	21
7 yr	< 126.52	25	n/a	< 130.7	27
8 yr	< 130.96	27	n/a	< 143.2	33
9 yr	< 135.96	30			
10 yr	< 143.03	35			
11 yr	< 149.06	40			
12 yr	< 156.05	50			
13 yr	< 163.03	60			

Explanation of lengths: Handtevy - NB is 4kg and length is less than 59.5 cm. 4 month old is >59.5 cm and < 67.07 cm etc. Explanation of lengths: Broselow - 4 kg infant is >51.8 cm and < 54.9 cm. No age association on the Broselow.

Figure 2. Actual by Predicted Plot for Handtevy (Newborn through 10 Years)

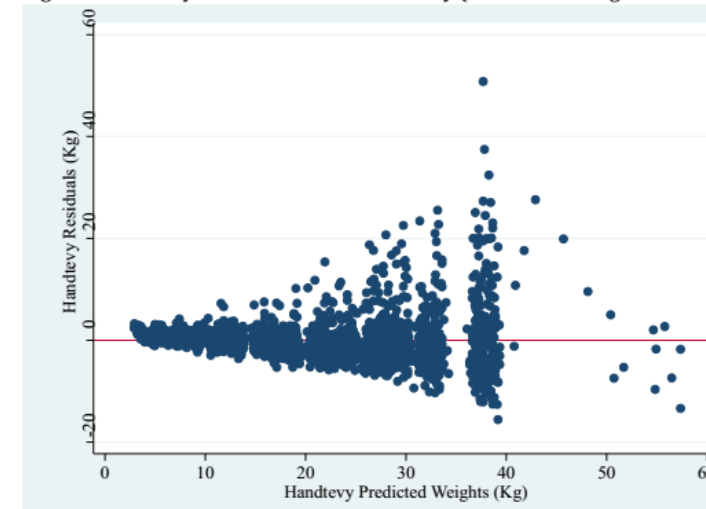


Figure 3. Actual by Predicted Plot for Broselow (0 through 143.03 cm)

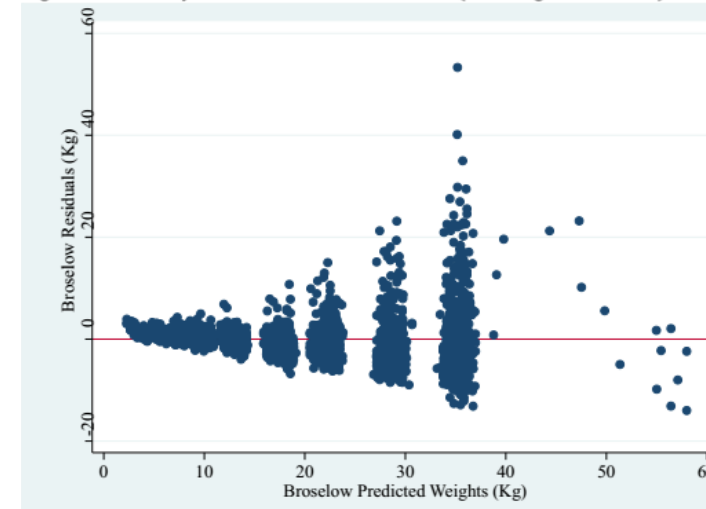


Table 2. Performance Comparison of Prediction Methods Based on Age Stratum

	Handtevy Tape	Broselow Tape	Difference	P
Newborn	-.16 (.02)	-.28 (.02)	-.12 (.02)	0.000
4-Month	-.12 (.01)	-.14 (.01)	-.02 (.01)	0.000
6-Month	-.05 (.13)	-.06 (.01)	-.01 (.01)	0.000
1-Year	-.02 (.01)	-.08 (.01)	-.06 (.01)	0.000
2-Years	-.02 (.11)	.02 (.11)	.00 (.00)	NS
3-Years	.04 (.11)	.13 (.12)	-.09 (.01)	0.000
4-Years	.04 (.11)	.01 (.10)	.03 (.01)	0.000
5-Years	.08 (.13)	.10 (.14)	-.02 (.00)	0.000
6-Years	-.05 (.11)	-.01 (.11)	.04 (.00)	0.000
7-Years	.05 (.16)	.11 (.17)	-.06 (.01)	0.000
8-Years	.01 (.17)	-.01 (.16)	.00 (.00)	NS
9-Years	.03 (.18)	.11 (.19)	-.08 (.01)	0.000
10-Years	.02 (.21)	-.03 (.19)	.05 (.02)	NS

* Calculated as (predicted weight - actual weight) / actual weight

Figure 5. Bland-Altman Plot for Handtevy 0 through 10 years of Age

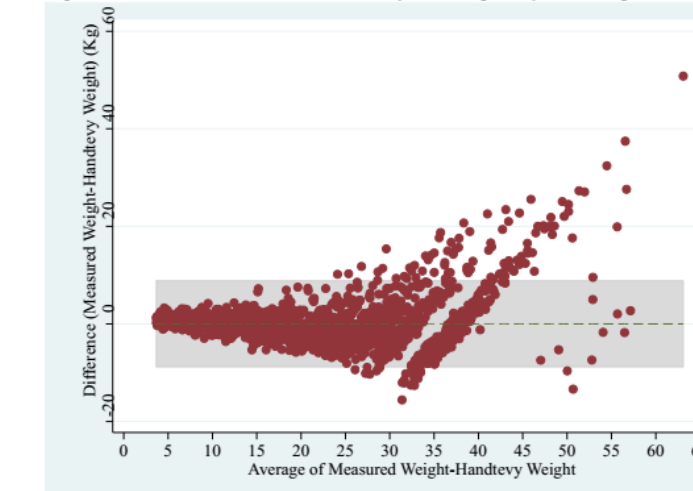
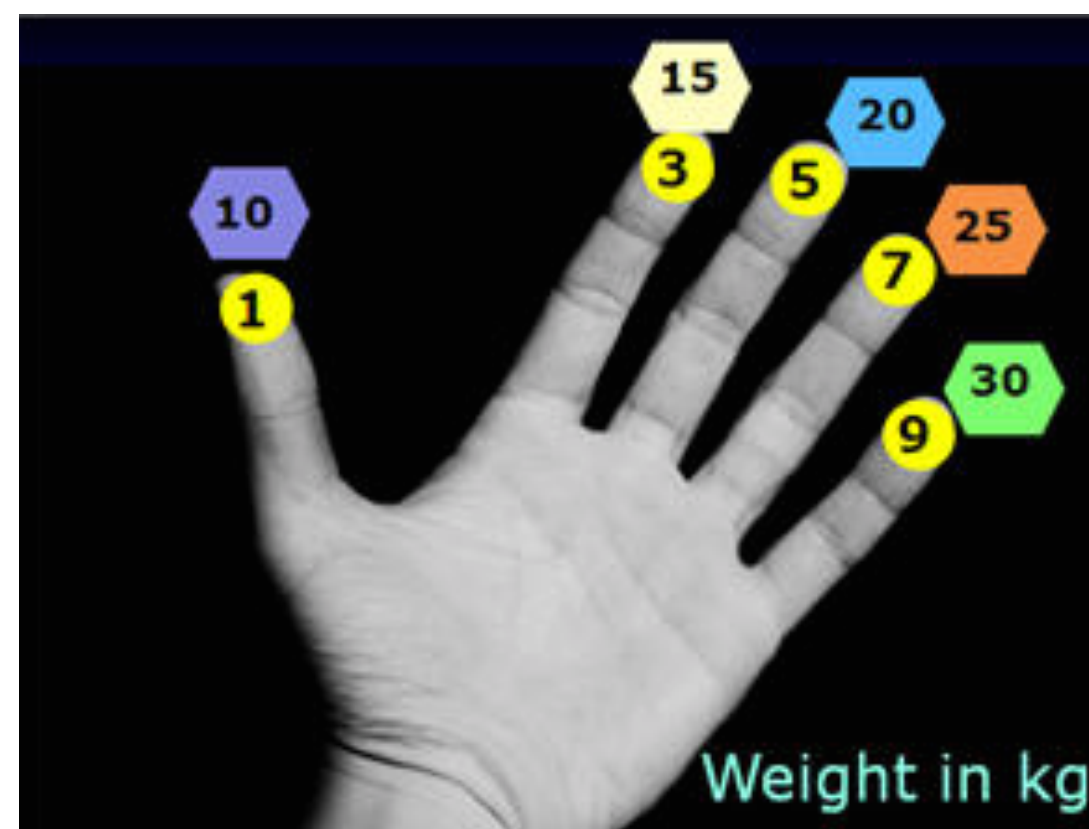
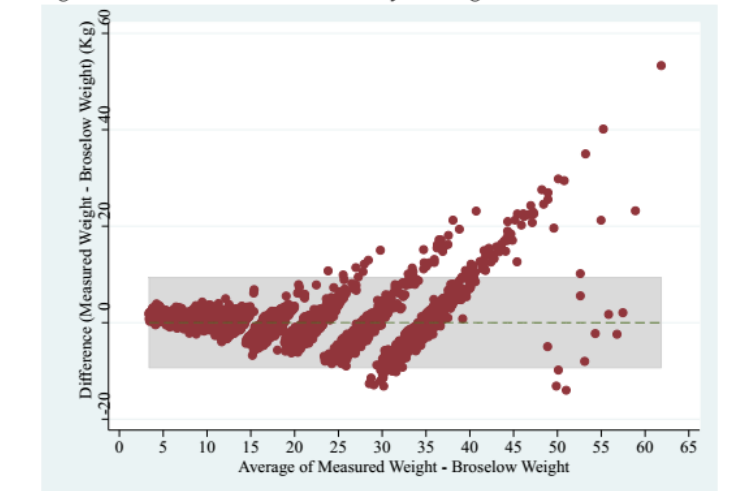


Figure 5. Bland-Altman Plot for Handtevy 0 through 143.03 cm



References

- Black K, Barnett P, Young S. Are methods used to estimate weights in children accurate? Emerg Med (Fremantle).2002;14 (2):160- 165
- Mohadjer L, Montaquila JM, Waksberg J, et al. National Health and Nutrition Examination Survey. III. Weighting and estimation methodology. Prepared by Westat Inc for National Center for Health Statistics, Hyattsville, MD. NHANES III Reference Manuals and Reports (CD-ROM). Hyattsville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 1996
- National Center for Health Statistics. Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-1994. Department of Health and Human Services Publication No (PHS) 94-1308 (Vital and Health Statistics; Series 1, No 32). Hyattsville, MD: National Center for Health Statistics; 1994