

BACKGROUND

- Body Surface Area (BSA) calculations are used during many different clinical scenarios including blood flow during bypass indexed to BSA
- Dosing of medications especially those with narrow therapeutic indices are based on calculated BSA
- BSA is calculated and not measured based on height and weight with 6 commonly used formulas
- Obesity has significant influence on BSA calculations and the performance of common BSA formulae in normal, overweight, and obese children is unknown

METHODS

- IRB approval using de-identified data
- Retrospective design
- 1000 subjects, ages 2-17, cardiac (non-CPB) procedures
- Categorized according to BMI and further by age and sex
- BSA calculated based on 6 commonly used formula

RESULTS

- Of 1000 subjects, 16.7% and 14.1% were overweight and obese, respectively; there were 51.2% girls in sample population
- Boys were taller, heavier, and higher BMI and calculated BSA by all formulae than girls (Table 1)
- Comparison of BSA change as a function of BMI category for all 6 formula demonstrated close approximation in normal BMI children and significant dispersion with increasing BMI category
- The commonly used Du Bois – Du Bois formula underestimated BSA in overweight and obese children; the Yu formula produced the lowest BSA values across all BMI groups (Figure 1)

RESULTS (continued)

Table 1. Anthropometric and body surface area data according to BMI and gender groups

	Overall	Normal BMI	Overweight	Obese
N	1000	692	167	141
Weight (kg)	45.7±22.0	38.8±17.9	51.9±19.8	67.4±26.5
Height (cm)	145.1±26.2	143.7±27.3	148.5±22.8	148.7±23.4
BMI (kg/m ²)	20.2±5.3	17.9±2.8	22.4±3.1	29.1±6.2
Mosteller	1.33±0.43	1.24±0.40	1.44±0.39	1.65±0.45
DuBois-DuBois	1.33±0.43	1.25±0.41	1.43±0.39	1.60±0.44
Haycock	1.34±0.44	1.24±0.40	1.45±0.40	1.67±0.46
Boyd	1.34±0.42	1.25±0.39	1.45±0.39	1.64±0.44
Gehan	1.35±0.43	1.25±0.40	1.46±0.39	1.67±0.45
Yu	1.27±0.41	1.19±0.38	1.38±0.38	1.57±0.43

Table 2. Population Data Characteristics Categorized by BMI with BSA Calculations

	Overall		Normal BMI		Overweight		Obese	
	Male	Female	Male	Female	Male	Female	Male	Female
N	488	512	337	355	84	83	67	74
Weight (kg)	46.8±22.4	44.7±21.5	41.0±18.3	38.6±17.6	51.3±20.5	52.4±19.2	70.2±27	64.8±26
Height (cm)	147.7±25.9	142.6±26.2	146.4±26.7	141.0± 27	148.7±23.7	147.3±22.1	153±24.0	144.4±22.1
BMI (kg/m ²)	20.0±5.1	20.4±5.5	17.9±2.7	17.8±3.0	21.9±3.0	22.8±3.2	28.8±6.1	29.3±6.2
Mosteller	1.36±0.44	1.3±0.43	1.27±0.40	1.21±0.40	1.44±0.41	1.45±0.38	1.71±0.46	1.59±0.44
DuBois-DuBois	1.36±0.43	1.3±0.43	1.28±0.41	1.22±0.41	1.43±0.41	1.43±0.38	1.66±0.45	1.54±0.43
Haycock	1.37±0.44	1.3±0.44	1.27±0.40	1.21±0.40	1.45±0.41	1.46±0.38	1.73±0.47	1.62±0.45
Boyd	1.37±0.43	1.31±0.42	1.28±0.39	1.22±0.39	1.44±0.40	1.45±0.37	1.70±0.45	1.59±0.43
Gehan	1.38±0.43	1.32±0.43	1.29±0.40	1.22±0.40	1.46±0.40	1.47±0.38	1.73±0.46	1.62±0.44
Yu	1.30±0.42	1.25±0.41	1.22±0.38	1.16±0.38	1.37±0.39	1.38±0.36	1.63±0.44	1.52±0.42

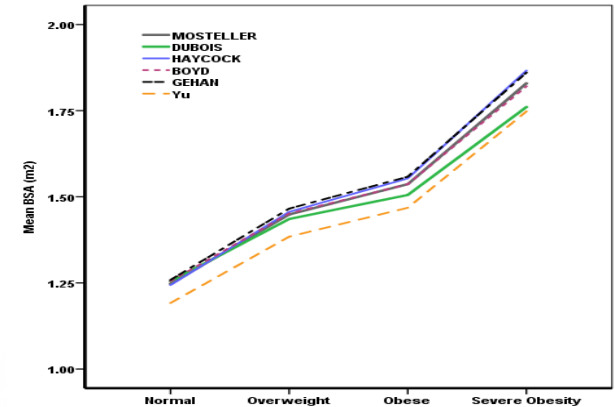


Figure 1. Comparison of the BSA as a function of BMI category

CONCLUSION

In children undergoing elective operations, many of the common BSA estimation formulae demonstrated poor agreement with increasing BMI category. These differences among calculations are so great that they may affect therapeutic interventions. Perioperative care-givers need to be aware of the limitations of these formulae in overweight and obese children. Estimation formulae that consider a child's obesity status are urgently needed.

REFERENCES

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