Estimating weight of children undergoing anesthesia

Ackwerh R, Nafiu O
University of Michigan, Ann Arbor, MI, USA

Introduction
Many therapeutic interventions in pediatric anesthesia require an accurate weight of the patient. This is particularly important when using drugs with narrow therapeutic indexes. For the vast majority of children presenting to hospital, clinicians are able to obtain an actual weight. However in acute medical, trauma and surgical cases this is often not possible or appropriate and so an estimation of the child's weight is required.

There are many different methods used to estimate children's weights. The most popular of these include the length based Broselow tape and the age based Advanced Pediatric Life Support (APLS) formula. The Advanced Pediatric Life Support Society recommend that the APLS formula, (age+4) x 2, is used during resuscitation of medically unwell patients. It is the most common method of weight estimation worldwide. The formulas origins are vague but appear to date back to 1950s Europe.14 It was then possibly validated using 1979 NCHS data.10 It has the benefit of being a relatively simple formula however, it is only valid for children aged 1-10 years. The APLS formula has generally been shown to significantly underestimate the weight of children growing up in the developed world.

With the rising prevalence of childhood obesity in the United States, many of these formulae are likely to be inapplicable to the current population of children. To this end we sought to determine how accurately the commonly used formulae for weight estimation predict the weight of children undergoing anesthesia at our Institution.

Methods
Using a retrospective, observational design, we extracted demographic data on all children aged 1-17yr who underwent elective non-cardiac surgery at our Institution. Routine measurement of height and weight is mandatory prior to elective surgery in our hospital. We then computed each child's estimated weight using the APLS formula, (Weight = (Age + 4) x 2), the Luscombe & Owens formula (Weight = (Age x 3) + 7) and determined the percentage difference between the child's actual weight and the estimated weight using these formulae.

Results
We reviewed the records of 26453 children (42.7% females and 57.3% males). The mean age for the study population was 7.33(4.9) years while the mean height was 107.3cm (45.2) cm and the mean weight was 31.2 (16.5) kg. The APLS formula underestimated the weight in 47.3% of children while the Luscombe formula underestimated weight in only 16.4% of children.

Conclusion: Estimation of weight is sometimes needed in the perioperative setting. The APLS formula significantly underestimates the weight of children. The Luscombe formula while not perfect appears to better approximate the current prevailing weight of children undergoing surgery.

Reference:
2. Luscombe MD, Owens BD. Weight estimation in resuscitation: is the current formula still valid? Arch Dis Child 2007;92:412e15