

# DRUG DOSING FOR OVERWEIGHT AND OBESE PATIENTS - SCH

## PRACTICE GUIDELINE<sup>®</sup>

### DOCUMENT SUMMARY/KEY POINTS

- Traditionally children are dosed according to total body weight (TBW) with consideration of age with the assumption of normal size and function. However, this may not hold true for obese children since an increase in weight is not composed of similar proportions of tissue.
- There is limited data available on dosing obese children, recommendations made are extrapolated from pharmacokinetics and adult obesity data.
- Doses must be based on the patient characteristics, characteristics of the patient and the clinical scenario.
- Care must be taken that doses do not exceed that of adult recommendations.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

<b>Approved by:</b>	SCHN Policy Procedure and Guideline Committee	Medicine Advisory Group (MAG) SCH
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## CHANGE SUMMARY

- Document replaces C.20.22 Drug dosing in Obesity:
- Inclusion of specific medication recommendations and advice
- Updated definitions of 'obese' and 'overweight' in keeping with Centres for Disease Control and Prevention (CDC)

## READ ACKNOWLEDGEMENT

- Clinical Staff prescribing, dispensing or administering medications should read and acknowledge this document.

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## 1 Background

The measures used in this guideline should be approximated using standard gender specific BMI for age; Stature for age and weight for age growth charts, which are widely available in paediatric health care facilities and can be accessed at <http://www.cdc.gov/growthcharts/>

### Definitions and Terms<sup>10</sup>

Term	Definition
Body Mass Index (BMI)	BMI is weight in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ).
Overweight	<b>Children 2 years or older</b> BMI-for-age at or above the 85 <sup>th</sup> and below the 95 <sup>th</sup> percentile compared with children of the same age and sex. <b>Children under 2 years of age:</b> BMI normative values are not available. Weight-for-height values above the 95 <sup>th</sup> percentile in this age group can be categorized as overweight.
Obese	<b>Children 2 years to adolescence:</b> BMI-for-age at or above the 95 <sup>th</sup> percentile on the BMI for age charts compared with children of the same age and sex. <b>Adolescents:</b> Obesity may be defined as BMI at or greater than the 95 <sup>th</sup> percentile OR $30\text{kg}/\text{m}^2$ , whichever is lower.
Underweight	BMI-for-age below the 5 <sup>th</sup> percentile
Ideal body weight OR Estimated Body Weight <sup>11</sup>	Desirable body weight for a particular age and height that is optimal for nutrition status. For method of estimation used at SCH see below for calculating IBW in an overweight or obese child.
Total Body Weight (TBW)	The measured weight of the patient.

## 2 Calculating Ideal Body Weight (IBW)<sup>11</sup>

### *In overweight or obese children*

If the age and height are known, a height-for age growth chart will indicate the percentile at which to read the "ideal" weight from a weight for age growth chart. This method is sometimes referred to as the Moore method

### *In underweight children*

For underweight, malnourished or inactive children, drug dosing should be based on total body weight (TBW) while taking into consideration general nutritional status and precautions regarding possible altered drug clearance e.g. renal and hepatic function.

## 3 Considerations in Overweight and Obesity

Traditionally children are dosed according to total body weight (TBW) with consideration of age with the assumption of normal size and function. However, this may not hold true for obese children since an increase in weight is not composed of similar proportions of tissue. Using TBW for dosing obese children can result in supra therapeutic levels of medication as seen with paracetamol dosing. Conversely, use of ideal body weight can produce sub therapeutic levels.

Obese children have significantly higher total body water, body volume, lean mass, fat mass and bone mineral content. They also have an increased hydration of lean mass which is attributed to increased extracellular water. The increases in fat mass are substantially more than that of lean mass. While this varies between individuals and ethnic groups approximately 75% of excess weight may be assumed to be fat mass and the remaining 25% lean mass.

### 3.1 Dosing in Obesity and Overweight

#### **Loading Dose**

Loading dose is usually based on the volume of distribution (VD). However, other factors to consider include body composition, blood flow and plasma protein binding. The relation of volume of distribution (VD) to increased lean mass hydration is not known in obese children.

- *Hydrophilic drugs* are generally loaded based on ideal body weight (IBW)
- *Partially lipophilic drugs* are loaded based on an adjusted body metric with consideration of the variability in distribution.
- *Lipophilic drugs* distribute freely into fat tissue resulting in greater distribution. A larger dose may be needed for adequate response. Some recommend dosing lipophilic medications on TBW however this should be assessed on a case by case basis where the risks of toxicity are considered. For example, propofol and thiopentone are lipophilic and are recommended for IBW dosing.<sup>7</sup>

#### **Maintenance dose**

Maintenance dose selection is based on clearance rate for drugs predominantly determined by renal and hepatic function. The effect of obesity on metabolic activities in children is not known and measures of renal function in children are not validated in obesity.<sup>2</sup>

## 4 Medication Recommendations and Adjustments

Recommendations made are extrapolated from pharmacokinetics and adult obesity data. Final calculated doses should not exceed that of adults and where IBW is greater than 40kg patients may be dosed according to adult recommendations.

Consideration of other patient factors such as renal and hepatic function, drug interactions and comorbid states should also be considered when applying the recommendations below.

Medications that have not been listed below should be prescribed in consultation with pharmacy or after careful consideration of reference texts available.

## 4.1 Antimicrobials

Drug	Body metric for loading dose in mg/kg or mg/m <sup>2</sup>	Metric for maintenance dose in mg/kg or mg/m <sup>2</sup>	Comments/ recommendations
Aciclovir <sup>1</sup>		IBW	
Penicillins <sup>13</sup>	TBW	TBW	Estimate not based on clinical studies. Doses exceeding max adult doses not evaluated
Carbapenem <sup>2</sup>		TBW	doses exceeding max adult doses not evaluated
Cephalosporin <sup>2</sup>		TBW	doses exceeding max adult doses not evaluated
Ciprofloxacin <sup>1,13</sup>		(0.45 [TBW-IBW]) + IBW	
Gentamicin <sup>1,2</sup>		(0.4 [TBW-IBW]) + IBW	Therapeutic drug monitoring Level prior to second dose
Amikacin* <sup>2</sup>		(0.4 [TBW-IBW]) + IBW	Therapeutic drug monitoring Level prior to second dose
Vancomycin <sup>1,2</sup>	TBW	TBW	Recommendation assumes normal renal function. Drug level monitoring necessary
Tobramycin <sup>1,2</sup>		(0.4 [TBW-IBW]) + IBW	Therapeutic drug monitoring Level prior to second dose

## 4.2 Anticonvulsants

Drug	Metric for loading mg/kg or mg/m <sup>2</sup>	Metric for maintenance mg/kg or mg/m <sup>2</sup>	Comments
Phenytoin	(1.33 [TBW- IBW])+ IBW	IBW	Drug level monitoring
Carbamazepine <sup>2</sup>	IBW	IBW	
Benzodiazepines <sup>2</sup>	IBW**	IBW	**Multiple smaller loading doses to therapeutic endpoint may be a safer approach.

## 4.3 Miscellaneous

Drug	metric for loading dose in mg/kg or mg/m <sup>2</sup>	metric for maintenance dose in mg/kg or mg/m <sup>2</sup>	Comments
Opiates <sup>2</sup>	IBW	IBW	Intermittent bolus doses No data for infusions although IBW may be prudent
Ketamine <sup>6</sup>	IBW	IBW	
Digoxin <sup>2</sup>	IBW	IBW	Therapeutic drug monitoring necessary
Enoxaparin <sup>4</sup>	TBW	TBW	Therapeutic drug monitoring necessary
Heparin <sup>5,12</sup>	Do not exceed 5000 Units (adult loading)	TBW	For UFH infusion (therapeutic). Close monitoring every 4 hourly
Paracetamol <sup>3</sup>	IBW	IBW	Review dose and need See <a href="#">SCH paracetamol guideline</a>
Insulin	No information	No information	IV infusion based on IBW. Frequent BSL monitoring

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