

Avoiding Antibiotic Dosing Errors Within the Pediatric Population

Antibiotics are one of the most incorrectly dosed classes of drugs in the pediatric patient population.¹ Suboptimal doses of antibiotics lead to therapeutic failure, deterioration of clinical condition, and the development of drug resistant organisms. A study published by the USC School of Medicine estimated that 11 per 100 hospitalized pediatric patients will experience an adverse drug event.¹ This represents 1.23 adverse drug events per 1,000 doses. The authors found that 22% of the adverse drug events were preventable, most of which caused temporary harm.¹ Ensuring that the patient is receiving correct doses of their medication is vital for therapeutic success while reducing the risk of adverse drug events.

The table below lists drugs that are commonly under dosed at Children's and the minimum doses that the patient should receive according to indication. Doses should be adjusted for poor renal function when appropriate.

Drug	Lowest Appropriate Dose for Any Indication	Lowest Appropriate Dose for Infections Requiring Higher Doses (Meningitis, Osteomyelitis, ect.)
Ampicillin	50 mg/kg/day	300 mg/kg/day
Ampicillin/Sulbactam	100 mg/kg/day ¹	300 mg/kg/day ¹
Piperacillin/Tazobactam	240 mg/kg/day ²	300 mg/kg/day ²
Clindamycin	20 mg/kg/day	40 mg/kg/day
Vancomycin	20 mg/kg/dose Q8H ³ ; goal trough 10-15 mcg/mL	20 mg/kg/dose Q8H; goal trough 15-20 mcg/mL
Sulfamethoxazole/Trimethoprim	6 mg/kg/day ⁴	12 mg/kg/day ⁴

1. Dosing based on ampicillin component.
2. Dosing based on piperacillin component.
3. For neonates and patients with abnormal renal function, the dose may be lower (15 mg/kg/dose) with an interval of Q12H or Q24H.
4. Dosing based on Trimethoprim component.

Unasyn (ampicillin/sulbactam), Zosyn (piperacillin/tazobactam), and Bactrim (sulfamethoxazole/trimethoprim) are antibiotics that are often dosed incorrectly because these drugs contain 2 components. The dosing of the Unasyn combination product is based on the ampicillin component. When ordering Unasyn, it is important to remember that the 3-gram vial contains 2 grams of ampicillin and 1 gram of sulbactam. Zosyn is dosed based on the piperacillin component. Each 3.375-gram vial of Zosyn contains 3 grams of piperacillin and 0.375 grams of tazobactam. Each 4.5-gram vial of Zosyn contains 4 grams of piperacillin and 0.5 grams of tazobactam. The dose of Bactrim is based on the trimethoprim component despite the sulfamethoxazole component being listed first in Lexicomp.

Another common dosing error within Children's of Alabama occurs during medication reconciliation. Many parents know how many milliliters of medication they administer to their

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child. However, the strength of the medication is not known or stated on the outpatient medication record. As many liquid medications come in different concentrations, knowing the strength of the medication is vital to determine the exact milligrams of drug the patient is receiving. Errors have occurred where the patient's dose in milliliters is entered into the outpatient medication record in milligrams, leading to the patient receiving the incorrect dose (10-fold overdoses in some instances). If the strength of the medication is not known while performing a medication reconciliation and the parents are unable to provide the prescription bottle, the patient's pharmacy should be contacted.

It is very important to be vigilant to prevent dosing errors as they can result in patient harm and poor outcomes. An observational study estimated that patients in the PICU who receive inappropriate doses of antibiotics had a 7-fold higher risk of developing new-onset organ dysfunction, required a longer PICU stay, and prolonged duration of mechanical ventilation. These patients also had a higher risk of PICU mortality. However, patients that received the correct dose of antibiotics for their bodyweight and age had a lower risk of organ dysfunction and significantly more favorable outcomes.² When dosing antibiotics, it is crucial to remember that patients can be harmed by overdosing leading to adverse effects and by under dosing leading to treatment failure.

References:

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2. Tafelski S, Gratopp A, Richter F, Kramer S, Spies C. Observational clinical study on organ dysfunction associated with dosing of antibiotics in a Pediatric Intensive Care Unit. *Minerva Pediatrica* [Internet]. 2016Nov10 [cited 2019Aug22];70(4):331–9. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27830927>