



Summary of Clinical Findings Relating to Epinephrine

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SUMMARY

Epinephrine is a valuable and potentially life-saving medication, but it has a narrow therapeutic index where errors in dose or route can cause severe harm or death. Medical providers from all areas of healthcare make errors with epinephrine a high percentage of the time and at a higher rate than with other medications. Sadly, negative outcomes are common enough that they have been described as reaching epidemic levels. Healthcare providers should use significant caution when administering epinephrine and healthcare systems should have strategies in place to avoid epinephrine dosing errors.

EPINEPHRINE IS A HIGH-ALERT MEDICATION

Epinephrine is a necessary, life-saving drug and is on the WHO's list of essential medications. However, it is also incredibly powerful and is listed as a high-alert drug by the Joint Commission, the Institute for Safe Medical Practice (ISMP) and the United States Food and Drug Administration. This means that if epinephrine is given in the wrong dose or the wrong route it can result in harm up to and including death.

RL Campbell, et al. Epinephrine in Anaphylaxis. *Journal of Allergy and Clinical Immunology Practice*, 2015 Jan-Feb;3(1):76-80. <https://www.ncbi.nlm.nih.gov/pubmed/25577622>

Sood JD, et al. Too much of a good thing is it bad? Adrenaline on trial. *NZ Med*, 2007 Apr 13;120(1252):U2494. <https://www.ncbi.nlm.nih.gov/pubmed/17460744>

EPINEPHRINE IS FREQUENTLY DOSED INCORRECTLY

Studies testing the performance of health care workers while dosing epinephrine find a high rate of errors and consistent failures to administer correct doses. Epinephrine often has a higher rate of error than other medications—notwithstanding its status as a high-alert medication. This magnifies the danger as risk is a function of both the severity of error and the likelihood of harm.

When Hoyle et al. reviewed real world data for charts of 5,547 pediatric prehospital transports over a two-year period, they found that **epinephrine was the medication that had the highest percentage of incorrect doses. Transport crew error rates with concentrated epinephrine were over 60%. When 1 mg/mL epinephrine was administered via the wrong route, the mean deviation from correct dose was 808%--the largest deviation observed for any medication in the study.**

Hoyle, JD, et al. Medication Dosing Errors in Pediatric Patients Treated by Emergency Medical Services. *Prehospital Emergency Care*, 2012 Jan-Mar;16(1):59-66. <https://www.ncbi.nlm.nih.gov/pubmed/21999707>



Lammers, et al. studied the performance of 142 paramedic crews while managing anaphylaxis and their findings were astonishing. **54% of the time the teams made a dosing error with epinephrine, over 20% of the time the error was a deviation of greater than 500% and 14% of the time concentrated epinephrine was given incorrectly via IV route—a potentially fatal error.**

Lammers, R, et al. Medication errors in prehospital management of simulated pediatric anaphylaxis. Prehospital Emergency Care, 18(2), 295–304. <https://www.ncbi.nlm.nih.gov/pubmed/24401046>

The studies that focus on epinephrine referenced above suggest that error rates in prehospital settings for epinephrine administration can be significantly higher than the overall error rates for pediatric medication dosing errors found in comprehensive meta studies.

Benjamin, Lee, et al. “Pediatric Medication Safety in the Emergency Department.” Pediatrics, American Academy of Pediatrics, 1 Mar. 2018, pediatrics.aappublications.org/content/141/3/e20174066

Epinephrine errors are not limited to prehospital care. Pennsylvania found that errors had reached epidemic levels across all areas of healthcare including emergency, inpatient, surgery, outpatient and anesthesia. Errors with concentrated epinephrine were significantly higher than those observed with other medications.

Pennsylvania PSRS Patient Safety Advisory 2006 Sep;3(3):16-7. Let's Stop this "Epi"demic!—Preventing Errors with Epinephrine. http://patientsafety.pa.gov/ADVISORIES/Pages/200609_16.aspx

Errors with epinephrine have been so widespread in all areas of healthcare that the ISMP has issued multiple alerts and reports in an effort to limit the harm of improper epinephrine administration.

ISMP Canada Safety Bulletin, Vol 17, Issue 6. Epinephrine Use for Anaphylaxis – A Multi-Incident Analysis. <https://www.ismp-canada.org/download/safetyBulletins/2017/ISMPCSB2017-06-EpinephrineAnaphylaxis.pdf>

ISMP MSA 2/26/15. EPINEPHrine for Anaphylaxis: Auto-injector or 1 mg Vial or Ampul? ISMP MSA, 2/26/2015. <https://www.ismp.org/resources/epinephrine-anaphylaxis-autoinjector-or-1-mg-vial-or-ampul>