1. Medication errors #1 cause of medical errors in US

2. ED third most common site for medication errors
   a. 3.6% of patient inappropriate dose
   b. 5.6% of prescriptions inappropriate
   c. Up to 16% of all prescriptions
   d. MEDMARX study
      i. 49% of medications errors in ED reach patient
      ii. 3% cause harm

3. 76.3% of all ED patients receive medication or immunization

4. Distractions are leading cause of medication errors
   a. Ordering
   b. Procuring
   c. Delivering
      i. Illegible text
      ii. Incorrect dose

5. Reduction recommendations
   a. ED Pharmacist
   b. Computer Physician Order Entry
      i. Double Edged Sword
   c. Medication reconciliation on all ED patients
   d. Clear documentation of allergies
   e. Clear documentation of contraindicated medications for the patient
   f. Neuromuscular blocking agents stored with special warnings
   g. Look alikes and sound alikes appropriately isolated
   h. Double check high alert medications

6. Crowding increases medication errors

7. High Alert Medications
   a. Classes/ Categories of Medications
      i. adrenergic agonists, IV (e.g., EPI NEPhrine, phenylephrine, norepinephrine)
      ii. adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetalol)
      iii. anesthetic agents, general, inhaled and IV (e.g., propofol, ketamine)
      iv. antiarrhythmics, IV (e.g., lidocaine, amiodarone)
      v. antithrombotic agents, including: anticoagulants (e.g., warfarin, low-molecular-weight heparin, IV unfractionated heparin)
      vi. Factor Xa inhibitors (e.g., fondaparinux)
      vii. direct thrombin inhibitors (e.g., argatroban, bivalirudin, dabigatran etexilate, lepirudin)
ix. glycoprotein I lb/II la inhibitors (e.g., eptifibatide)

x. cardioplegic solutions

xi. chemotherapeutic agents, parenteral and oral

xii. dextrose, hypertonic, 20% or greater

xiii. dialysis solutions, peritoneal and hemodialysis

xiv. epidural or intrathecal medications

xv. hypoglycemics, oral

xvi. inotropic medications, IV (e.g., digoxin, milrinone)

xvii. insulin, subcutaneous and IV

xviii. liposomal forms of drugs (e.g., liposomal amphotericin B) and conventional counter-parts (e.g., amphotericin B desoxycholate)

xix. moderate sedation agents, IV (e.g., dexmedetomidine, midazolam)

xx. moderate sedation agents, oral, for children (e.g., chloral hydrate)

xxi. narcotics/opioids

xxii. IV

xxiii. transdermal

xxiv. oral (including liquid concentrates, immediate and sustained-release formulations)

xxv. neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)

xxvi. parenteral nutrition preparations

xxvii. radiocontrast agents, IV

xxviii. sterile water for injection, inhalation, and irrigation

xxix. (excluding pour bottles) in containers of 100 mL or more

xxx. sodium chloride for injection, hypertonic, greater than 0.9% concentration

8. Injection Medications Safety
   a. One needle one syringe
   b. Purchase single doses whenever possible
      i. If you have to open more than two vials you have the wrong dose
   c. Clean hub prior to entry
   d. Date all multi-dose vials
   e. Hand hygiene prior to and after gloves
   f. Medications should be prepared by pharmacists

9. Calculation errors in pediatric dosing
   a. 10 fold errors
      i. Decimal point errors
      ii. More pronounced in smaller children when 10 fold dose fits in single syringe
   b. Variable concentration preparations
      i. Ketamine
         1. 10 mg/cc
         2. 100mg/cc
         3. 500mg/cc
   c. Paper ordering
   d. Manual calculations
   e. Drug delivery pumps
   f. Color Coding reduces errors

10. Consideration of double check system
   a. Complacency