

**“Risky Business”**  
A Focus on Medication Safety  
Issues in Pharmacy

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**Objectives**

- Distinguish between adverse drug events (ADEs), medication errors, and adverse drug reactions(ADRs), and potential adverse drug events.
- Know the “high risk” drug classes most associated with adverse drug events (ADEs)
- Understand common features of high risk medications that make them “high risk”
- State role(s) of a technician concerning medication safety

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**Introduction**

- Adverse drug events (ADEs) account for approximately 19% of all injuries
  - ADEs are associated with increased morbidity and mortality
  - ADEs lead to prolonged hospitalizations
  - ADEs increase costs of care
- Institute of Medicine estimated that 1.5 million *preventable* ADEs occur annually in U.S. accounting for \$3.5 billion in additional cost.

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### Definitions

- ADEs are injuries resulting from medication use – including physical harm, mental harm, or loss of function
- Medication errors refer to any mistakes occurring in the medication use process
- ADEs compared to medication errors are a more direct measure of patient harm
- At least 25% of all medications-related injuries are preventable

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### Definitions (continued)

- Adverse drug reactions (ADRs) are non-preventable ADEs that occur due to the pharmacologic properties of the drug
- Potential ADEs are medication errors that pose significant risk, but DO NOT cause harm to the patient
  - Also called near-miss errors or close calls
  - Include errors that are detected and intercepted by a patient or clinical staff before patient is affected

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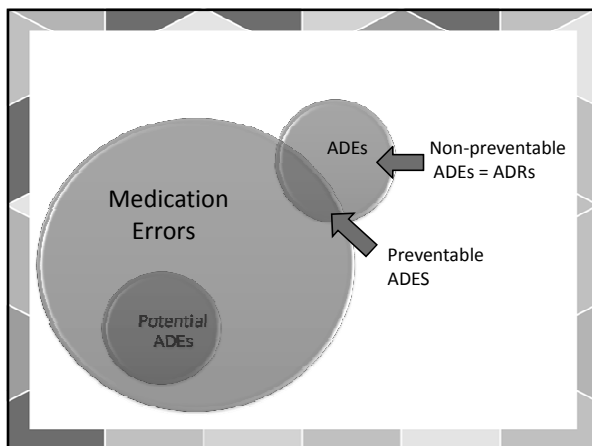
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### Classification of ADEs

- 1) Prior to hospitalization
  - Outpatient setting important cause of emergency room visits and hospital admissions
- 2) During hospitalization
  - ADE prevention study found that more than 25% of ADE's were preventable
- 3) Hospital discharge
  - Incidence of ADEs for patients discharged home was 11% in one study – 27% preventable

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### Hospital Discharge

- Transition of care period especially vulnerable:
  - Medication errors
    - Duplicate therapy
    - Failure to reconcile medications before discharge
  - Failure to follow up on pending test results
  - Failure to complete follow-up tests, procedures and consultations

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### High-risk Settings

- ADEs can occur in any area of the hospital
- ICU most common area for ADEs:
  - High stress environment
  - Patients receive more medications in ICU
  - Most medications are IV
    - Higher risk of miscalculation of doses
    - Errors due to inappropriate infusion rates
  - Patients in ICU generally have multiple severe comorbidities and are often sedated
  - Increased risk of unintentional discontinuation of medications necessary for chronic disease states

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### High Risk Populations

- Children:
  - Must tailor doses to age, weight, or body mass index
  - More difficult for children to recognize when there is a problem
- Elderly:
  - Multiple comorbidities
  - Diminished physiologic reserve
  - Frequent use of multiple drugs
  - Diminished mental acuity

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### Harm – not all result of error!

- Some harm may be prevented by improving medication management
- Changing prescribing patterns
- Adding other therapies to minimize side effects
- Identifying harm to stop it before it becomes serious
- Providing prophylactic treatment in ICU

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### Drug classes associated with ADEs

- Anticoagulants
- Anti-hyperglycemic agents
- Narcotics
- Sedatives
- Antibiotics
- Antipsychotics
- Chemotherapy agents

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### Highest Priority Preventable ADEs

- Outcome results from IOM Committee identified that 3 high-priority preventable ADEs accounted for 50% of all reports:
  - 1) Overdoses of anticoagulants or insufficient monitoring associated with hemorrhagic events
  - 2) Overdoses or failure to adjust for drug-drug interactions of opiate agonists resulting in respiratory depression
  - 3) Inappropriate dosing or insufficient monitoring of insulins associated with hypoglycemia

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### Anticoagulant Agents

- PO agents:
  - Warfarin (Coumadin®)
  - Rivaroxaban (Xarelto®)
  - Dabigatran (Pradaxa®)
  - Apixiban (Eliquis®)
- IV, IM, SQ agents:
  - Heparin
  - Enoxaparin (Lovenox®)
  - Fondaparinux (Arixtra®)
- Joint Commission selected safe anticoagulation as National Safety Goal

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### Risk of bleed vs. Risk of clot

- Anticoagulants associated with serious and frequent ADEs in both inpatients and outpatients
- Anticoagulants accounted for 4% of preventable ADEs and 10% of potential ADEs
- Warfarin commonly involved in ADEs:
  - Complexity of dosing and monitoring
  - Lack of patient adherence
  - Numerous drug interactions
  - Dietary interactions that affect drug activity

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### Anti-hyperglycemic Agents

- Insulin is used to treat diabetes and elevated blood sugars
- Goal of therapy is to achieve control of blood glucose without causing immediate harm associated with hypoglycemia, or hyperglycemia
- Pharmacology of drug, complexity of dosing, and variety of available products all contribute to potential error and associated harm
- In ICU, even mild hypoglycemia is associated with increased mortality

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### Insulin – many varieties:

- Rapid-acting:
  - Aspart (Novolog®)
    - Onset 10-20 min- Duration 3-5 hrs
  - Lispro (Humalog®)
    - Onset 15-30 min – Duration 3-6.5 hrs
  - Glulisine (Apidra®)
    - Onset 10-15 min – Duration 3-5 hrs
- Short-acting:
  - Regular (Humulin R®, Novolin R®)
    - Onset 30-60 min - Duration 6-10 hrs

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### Insulin continued

- Intermediate acting:
  - Humulin L® (Lente) – zinc suspension
  - Novolin N® - NPH (cloudy)- zinc and protamine suspension
    - Onset 1-3 hours
    - Duration 16-24 hours
- Long-acting
  - Glargine (Lantus®)
    - Onset 1.1 hours
    - Duration 24 hours
  - Detemir (Levemir®)
    - Onset 0.8 – 2 hours
    - Duration 12-24 hours

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### Narcotics/Opiates

- Pain management is an important component of patient care
- Effective pain control is integral to good health and recovery from injury, surgery, and illness
- Goal of pain management is to control pain, but enable optimal functioning:
  - Rehab participation
  - Deep breathing to prevent atelectasis
  - Mobilization to prevent DVTs
  - Full participation in life activities in outpatient setting

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### Narcotic Harm

- May experience harm even with appropriate dosing
- Most common types of harm:
  - Over-sedation
  - Respiratory depression
  - Lethargy
  - Nausea, vomiting, constipation
  - Tolerance, dependence, and addiction

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### Narcotic Agents

Drug	Equianalgesic Dose (parenteral)	Equianalgesic Dose (oral)	Available Dosage Forms
Morphine	10 mg	30 mg	IR, CR, ER, IV
Hydromorphone (Dilaudid®)	1.5-2 mg	7.5-8 mg	IR, CR, ER, IV
Oxycodone	NA	20-30 mg	IR, CR
Oxymorphone	1 mg	10 mg	IR, ER
Hydrocodone (with APAP)	NA	30-45 mg	IR
Codeine	100-130 mg	200 mg	IR, CR, IV
Methadone	Variable	Variable	IR (tolerant only)
Meperidine	75 mg	300 mg	IR, SQ, IV
Fentanyl	0.1 mg	NA	IV, patch

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### Other Pain Medications

Drug	Equianalgesic (parenteral)	Equianalgesic dosing (oral)	Available Dosing Forms
Morphine	10 mg	30 mg	
Tramadol (Ultram®)	NA	300 mg	IR
Tapentadol (Nucynta CR®)	NA	NA (250-300 mg BID)	CR
Butorphanol	2 mg	NA	IV
Buprenorphine	NA	NA	Patch (5mcg/hr)
Nalbuphine	10 mg	NA	IV
Pentazocine	60 mg	180 mg	IV

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- ### Sedatives
- Sedatives are commonly used to treat patients during a hospital stay:
    - Sedation prior to procedures
    - Decrease anxiety
  - Sedatives and narcotics have a synergistic effect in depression of the CNS
  - Inappropriate use may cause oversedation, hypotension, delirium, lethargy and increased risk of falling (15%)
  - Some may lead to tolerance, dependence, and withdrawal symptoms
  - May cause bizarre “sleeping” activities

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- ### Sedative Agents
- Benzodiazepines can be used for many indications:
    - Seizure
    - Sleep
    - Anxiety
    - Alcohol withdrawal
    - Panic attacks
  - Z-class sedatives/hypnotics :
    - Sleep/Insomnia

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### Benzodiazepines

Drug	Comparative Doses	Major Indications
Alprazolam (Xanax®)	1 mg	Anxiety, Panic
Chlordiazepoxide (Librium®)	20 mg	Anxiety, Alcohol withdrawal
Clobazam (Frisium®)	10 mg	Seizures (adjunct)
Clorazepate (Tranxene)	15 mg	Anxiety, Alcohol withdrawal, seizures (adjunct)
Clonazepam (Klonopin®)	0.5 mg	Seizures, Panic
Diazepam (Valium®)	10 mg	Anxiety, Alcohol withdrawal, muscle spasms (adjunct), seizures (adjunct)
Flurazepam (Dalmane®)	30 mg	Insomnia
Lorazepam (Ativan®)	2 mg	Anxiety, alcohol withdrawal
Oxazepam (Oxepam®)	30 mg	Anxiety, alcohol withdrawal
Temazepam (Restoril®)	30 mg	Insomnia
Triazolam (Halcion®)	0.5 mg	Insomnia

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### Sedatives/Hypnotics

Drug	Comparative Doses	Major Indication
Eszopiclone (Lunesta®)	2 mg QHS	Sleep initiation and maintenance
Zaleplon (Sonota®)	10-20 mg	Insomnia
Zolpidem (Ambien®)	5 mg QHS	Sleep initiation and maintenance
Trazodone (Deseryl®)	50 mg	Alcohol withdrawal, GAD, insomnia, panic disorder

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### Drug classes associated with ADEs

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- Antibiotics
- Antipsychotics
- Chemotherapy agents

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**Antibiotics**

- Fluoroquinolones
  - Associated with tendon inflammation and rupture (especially with glucocorticoids)
  - Cardiac arrhythmias
  - *C.difficile* –associated infection
- Nitrofurantoin
  - Pulmonary toxicity
  - Liver toxicity
  - Lack of efficacy in patients with renal insufficiency

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**Antibiotics continued**

- Trimethoprim-Sulfamethoxazole (Bactrim®)
  - Hyperkalemia
  - Hypoglycemia (especially with sulfonylurea)
  - Severe dermatologic reaction (SJS and TEN)
- Aminoglycosides and Vancomycin
  - Renal failure and/or toxicity
  - Ototoxicity

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**Antipsychotics**

- Elevated risk of death when used to treat behavioral complications of dementia
- Increased risk of sudden death due to QT prolongation
- First generation antipsychotics cause sedation and anticholinergic effects
- Second generation antipsychotics may cause blood dyscrasias and orthostasis

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**Chemotherapy toxicities**

- Cardiac toxicity
- Edema
- Extravasation (infusion tissue damage)
- Liver toxicity
- Severe nausea and vomiting
- Bone marrow suppression
- Nerve toxicity
- Lung toxicity
- Kidney toxicity
- Stomatitis (mucosal breakdown and inflammation in mouth)
- Hemorrhagic cystitis (bleeding and irritation in lower urinary tract)

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**Common Features in High Risk Medications**

- Narrow therapeutic index
- Potential for wide individual variation in physiologic response
- Variable dosing regimens requiring:
  - Close monitoring
  - Dose adjustment
  - Calculation errors
  - Timing of administration errors

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**Role of Technician in Medication Safety**

- Every person in the pharmacy participates in safety procedures
- Every person in the pharmacy is always on the lookout for errors
- Technicians assist pharmacists in almost every aspect of pharmacy practice
  - Crucial in overall practice
  - Many activities have potential for error

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### Types of Errors

- Processing Errors
  - Processing correct drug under wrong patient
  - Processing incorrect drug under correct patient
  - Typing wrong directions on the label
  - Miscalculating the dose
  - Mislabeling the prescription
  - Failing to reconstitute medications prior to dispensing

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### Errors continued

- Improper identification of patient
- Labeling errors
- Physician/pharmacist errors
- Patient-based errors
- Making assumptions
  - When in doubt – ASK
- Multi-tasking
  - Stay focused and finish the task

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### Practice Points

- Focus on task at hand – minimize distractions
- Always double-check your work
- Ask questions – never assume
- Seek help if you are unsure
- Be observant – listen to patient’s concerns
- Always ask patient if they have questions for the pharmacist
- Follow systematic procedure

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### Technician's Role continued

- Always watch for any medication errors – requires technician to be alert to anything odd or different from ordinary procedures
- Quality of interaction with patient is critical
  - Develop good communication and listening skills
  - Acknowledge patient
  - Conduct yourself in a professional manner
  - Set the stage for customer satisfaction – be kind even when the patient may not be kind
- Prevention is the Key to Medication Safety!

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