N111: Introduction to Pharmacology

Leslie Martinez, MSNEd, RN
Los Angeles County College of Nursing & Allied Health
leslmartinez@dhs.lacounty.gov

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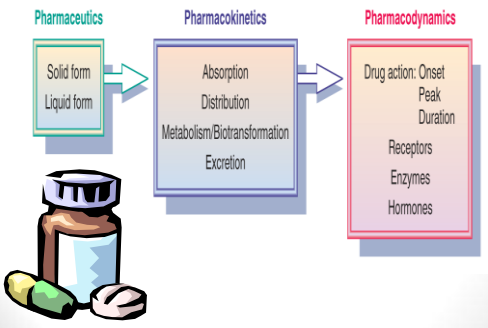
Drug Action →



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Pharmaceutic Phase

Disintegration

- Breaking down of a tablet into smaller particles

Dissolution

- A drug becoming a solution to aid crossing the biologic membrane

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Pharmaceutic Phase

- **Excipients**
  - Inert fillers that enhance drug dissolution & absorption
- **Enteric Coated**
  - Resists disintegration in the acidic stomach
  - Teaching considerations
- **Food Considerations**
  - Enhances or interferes with dissolution
  - Dilutes drug concentration = ↓irritation

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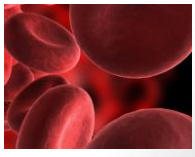
Pharmacokinetic Phase

- **1~Absorption**
  - Movement of drug from GI tract to body fluids
- **2~Distribution**
  - Process of drug becoming available to body fluids & tissues



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Pharmacokinetic Phase

- **3~Metabolism**
  - Inactivated by liver enzymes converted:
    1. H20 soluble substance
    2. Metabolite for renal excretion

- **4~Excretion**
  - Via urine
    1. Renal dysfunction
    2. Urine pH

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Absorption Variables

1. Lipid-soluble & Nonionized
   - Absorbed faster through GI membrane
2. Water-soluble & Ionized (carrier)

1. IM injections
   - Deltoid vs. Gluteus
2. subQ injections

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Bioavailability

- % of drug that reaches systemic circulation

- **Oral Route**
  - Occurs after absorption & hepatic drug metabolism
  - < 100% bioavailability
  - 3-5 times higher dose than IV dose
- **IV Route**
  - 100% bioavailability

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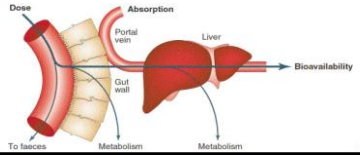
Bioavailability Variables

1. Drug form
2. Route of administration
3. GI mucosa & motility
4. Food & other drugs
5. Liver metabolism changes or inadequate hepatic blood flow



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Aspirin 650 mg Half-life

3 hrs	-	325 mg	-	1st ½ life 50%
6hrs	-	162 mg	-	2nd ½ life 25%
9 hrs	-	81 mg	-	3rd ½ life 12.5%
12 hrs	-	40 mg	-	4th ½ life 6.25%
15 hrs	-	20 mg	-	5th ½ life 3.1%
18 hrs	-	10 mg	-	6th ½ life 1.55%

- Short ½ life: 4 to 8 hrs
- Long ½ life: > 24 hrs

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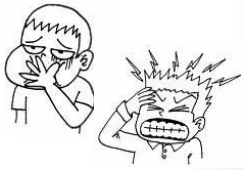
Pharmacodynamic Phase

- Study of drug concentration & the way it effects the body



- **Primary**
  - Desired effect
- **Secondary**
  - Desirable or undesirable effect

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Pharmacodynamic Phase

- **Onset**
  - Time it takes for drug to take minimal effects
- **Peak**
  - Time of highest blood or plasma concentration
- **Duration**
  - Length of time drug has a pharmacologic effect

Creatinine Clearance

- **CLcr**
  - **Most accurate** lab test determining renal function
  - **GFR** function ↓ = ↓ **CLcr**
  - **Dose adjusting**
    - Elderly
    - Renal dysfunction

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Pharmacodynamic Phase

- **Agonist**
  - Drug that produces a response
  - i.e. Isoproterenol; stimulates beta 1 & 2 receptors → HR increase & bronchodilation
- **Antagonist**
  - Drugs that block a response
  - i.e. Cimetidine; blocks histamine → prevents gastric acid secretion

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Pharmacodynamic Interactions

- Additive
  - When two drugs with similar actions are administered simultaneously
  - = sum of the effect of 2 drugs
    - Desirable or undesirable
- Synergistic (Potentiating)
  - When two or > drugs are given together, one can potentiate the other (increase effectiveness)
  - Desirable or undesirable

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Pharmacodynamic Interactions

- Antagonistic
  - When two drugs have opposite effect, the meds cancel each other out
  - Desirable (antidote) or undesirable
- Common symptoms of drug-drug interactions
  - Nausea, GI upset
  - Headache, dizziness

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Toxic Effects

- **Therapeutic Range**
  - Range between min & max effective concentration in the blood
- **Therapeutic Index**
  - Ratio that measures the margin of the effective dose & the lethal dose
  - **Low** ~ Narrow margin of safety
  - **High** ~ Wide margin of safety

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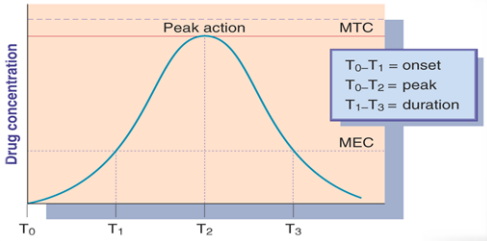
Pharmacodynamics

- **MEC =** Minimum Effective Concentration
- **MTC =** Minimum Toxic Concentration



The time-response curve evaluates three parameters of drug action: (1) Onset, (2) Peak, and (3) Duration.

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Therapeutic Ranges & Toxic Levels

(mcg/ml)	Therapeutic Range	Toxic Level
Dilantin	10-20	>30
Tegretol	6-12	>12-15
Depakote	50-100	>100

- **Loading dose**
  - Lrg dose to achieve rapid MEC in the plasma

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Special Considerations

- **Side Effects**
  - Physiologic effects not r/t desired drug effects
  - Teaching opportunity
- **Adverse Reactions**
  - Unintended, undesirable mild to severe side effects at normal doses
  - i.e. Anaphylaxis & Hypersensitivity
  - Report & document

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Peak & Trough

Peak

- Indicates rate of drug absorption
- Highest level of plasma concentration at a specific time
- Blood drawn at proposed **peak time**
- Peak time is dependent on route

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Peak & Trough

Trough

- Indicates rate of drug elimination
- Lowest level of plasma concentration just before med administration
- Blood drawn **minutes before med administration**

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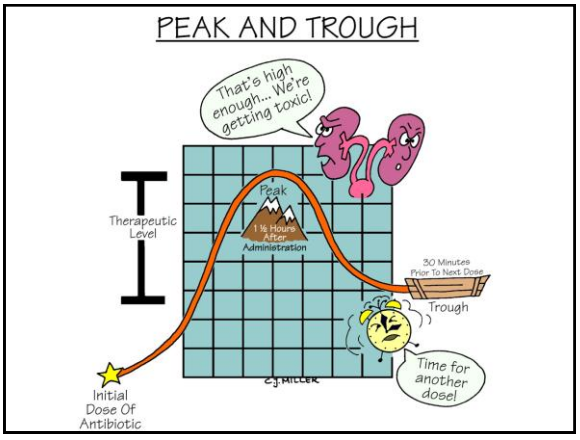

Peak & Trough

- **Narrow Therapeutic Index Meds**
  - Aminoglycosides
  - Anticonvulsants
- **Gentamicin**
  - **Peak = 30 min after IV infusion completed**
  - **Peak** 5-10 mcg/dl Toxic Peak > 12 mcg/dl
  - **Trough** < 2 mcg/dl Toxic Trough > 2 mcg/dl

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Food & Drug Administration (FDA)

- Protects Public Health by assuring the safety, efficacy & security of:
  - Human & animal drugs, 80% food supply, biological products, medical devices, radiation emitting devices…
- Responsibilities
  - Speeding innovations that make meds more effective, safe & affordable
  - Helping public get accurate, science-based info on meds & foods to improve health

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Federal Legislation: Federal Food, Drug & Cosmetic Act

- Monitors & regulates the manufacturing & marketing of drugs
- Requires approval before marketing
- Clinical Trials
- Labels & packaging

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Federal Legislation: Controlled Substance Act

- **Regulation of Controlled Substances**
- **Narcotic Drug Use & Abuse**

1. Promotion of drug education & provisions
2. Strengthening of enforcement authority
3. Establishment of tx & rehab. facilities
4. Designation of schedules for controlled drugs

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Schedule I

- High abuse potential
- No accepted medical use in U.S.
- Not accepted for use under medical supervision
- Heroin, Hallucinogens & Marijuana

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Schedule II

- Accepted for medical use
- High potential for drug abuse
- Severe physical & psychological dependency risk
  - Meth, Demerol, Morphine, Oxycodone, Cocaine

2.5 years later

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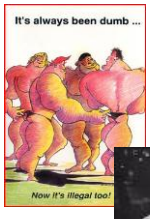
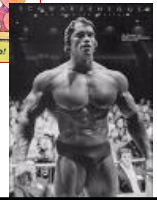
Schedule III





- Medically accepted
- Potential abuse < Schedule I & II
- Moderate or low physical dependence or high psychological dependence risk
  - Anabolic steroids, Codeine preparations, barbiturates

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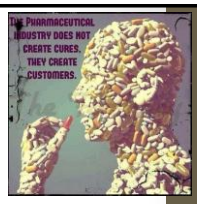
Schedule IV



- Medically accepted
- May cause dependence
- Limited physical dependence or psychological dependence relative to the drugs in Schedule III
  - Phenobarbital, Benzodiazepines, Lorazepam, Valium, Xanax

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Schedule V

- Medically accepted

- Cough syrups with codeine, lomotil

- Very limited potential for dependence

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Nursing Responsibilities

- ☑ Account for controlled substances
- Records/Inventory
- Countersign~
  - Waste vs. lost
  - Morphine 6 mg IVP
- Scan medications
- ☑ Double lock
  - ☑ Locked room & Pyxis
- ☑ Access to keys
  - ☑ Med room
- ☑ Mandatory abuse reporting

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Over the Counter (OTC) Medications

- Advantages
  - Convenience, cost
- Potential serious complications
  - Additive effect, non disclosure, reactions
- Nursing responsibilities/Teaching
  - Reconciliation, use of 1 pharmacy, labels, dosing

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Herbal Therapies

- Plant/plant part used for its scent, flavor, or therapeutic property
  - >$60 billion annual industry
- Non-FDA regulated
  - Dietary Supplement Health and Education Act 1994
    - Reclassified as "Dietary Supplements"
    - Can note physiological effects
    - Can not state preventative, diagnostic or curative effects

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Herbs: Potential Hazards

- Black Cohosh
  - Potentiates effects of insulin, oral hypoglycemic, and antihypertensive drugs
- Goldenseal and Kava
  - Contraindicated in pregnancy
- Licorice (excessive)
  - Increased BP & potassium excretion, lethargy, heart failure

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Herbs: Nursing Responsibility

- Complete list of herbal & OTC preparations
  - Include teas, tinctures, tablets, and dried herbs
  - Name, brand, dose, frequency, side effects and client's perceived effectiveness
- Teaching
  - Encourage as "integrative" modality
  - Potential interactions w/ prescribed medications
    - High risk: elderly & three or more drugs for chronic conditions
  - Dietary considerations

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Pediatric Considerations

- Pediatric pharmaceutical
  - Research/profit margin
  - Pediatric Equity Act

- Pharmacokinetics
  - Absorption: varies by age/weight/health status
  - Distribution: affected by body fluid composition
  - Metabolism: neonate/infant vs. adolescent
  - Excretion: decreased < 9 months and adolescence

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Pediatric Considerations

- Family-centered care
  - Caregiver teaching
- Cognitive assessment
- Atraumatic care
  - Eliminate/minimize psychological & physical distress of children and their family

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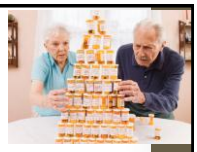
Older Adult Considerations



- 85% take medications
- Polypharmacy
  - Multiple HCPs, herbal/OTC therapies, shared/duplicate meds, discontinued meds
- Intentional vs. unintentional noncompliance
- Effects
  - Confusion, falls, malnutrition, renal/liver issues

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Older Adult Considerations

- Absorption
- Distribution
- Metabolism
- Excretion

- Dose adjusting
  - Weight, adipose tissue, labs, health problems
- Teaching
  - Use of one pharmacy/Carry list

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Nurse Practice Act

- **Drug Administration Laws**
  - Vary state to state
  - Civil Court prosecution
- **Misfeasance**
  - Wrong drug or dose resulting in death

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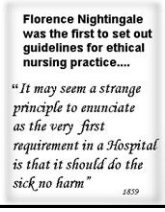
Nurse Practice Act

- **Malfeasance**
  - Correct drug by wrong route that causes death

- **Nonfeasance**
  - Omission that results in death



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Drug Names

- **Trade (Brand) Name**
  - **T**ylenol
- **Generic Name**
  - Universally accepted
  - **a**cetaminophen

- Orders
  - **acetaminophen (Tylenol)**

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Drug Information Resources

1. Nursing Drug Guides
2. Online sites
   - Micromedix (Intranet)
3. Smartphone applications
   1. Davis
   2. Micromedix
   3. Nurse Reference Center

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Black Box Warning: Policy 909

- Given when **safe administration** of drug carries risk of serious/life-threatening adverse effects
  - Strongest drug warning by FDA

- LAC+USC BBW list
  1. The Licensed Nurse will review & implement "RN Actions to Consider" prior to administering the drug
  2. Report adverse findings on Patient Safety Network

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High Alert Medications

- Medications that carry the risk of causing injury **when misused**
- **Safeguard to reduce the risk of error**
  - Limiting access
  - Auxiliary labels and automated alerts
  - Standardizing ordering, storage, preparation, & administration
  - Double checks/signature

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High Alert Medications

- **Examples:**
- Insulin (subQ & IV)
- Opiates & Narcotics
- Anticoagulants
- Chemotherapy
- Thrombolytics

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Joint Commission

- 2015 National Pt Safety Goals: Hospitals
- Medication reconciliation

Goal 1: Improve accuracy of pt identification
Goal 2: Improve staff communication
Goal 3: Improve medication safety
Goal 6: Improve alarm safety
Goal 7: Reduce HAI risks

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LAC+USC Policy 721 Medication Reconciliation

- Ensures the development of a complete & accurate list of medications
  - Pt moves from one area to another
  - Change in setting
  - New practitioner
  - Change in level of care

- 5 steps of Reconciliation

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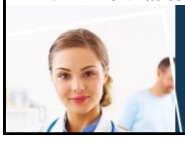
Nursing Process in Medication Administration

- Quality & Safety Education for Nurses (QSEN)
  - Knowledge, Skills, & Attitude

1. Patient & Family Centered Care
2. Collaboration & Teamwork
3. Evidence-based Practice
4. Quality Improvement
5. Safety
6. Informatics



QSEN Institute

Comprehensive, competency based resources to empower nurses with knowledge, skills, & attitudes to improve quality & safety across healthcare system

Assessment

- Systematic validation & documentation of info.
- Subjective Data
  - Current health hx, symptoms, current meds/ herbs/OTC, past health hx, and environment
- Objective Data
  - Physical health assessment
    - Gross/fine motor skills, visual impairment, dosing
    - Labs and diagnostics

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Nursing Diagnosis

1. Deficient knowledge r/t lack of information about drug interactions and OTC drugs AEB ingesting meds with dangerous additive effect.
2. Impaired urinary elimination r/t decreased fluid volume and renal immaturity AEB UO > 10 mL/hr and Cr level of 2.67.
3. Ineffective health maintenance r/t lack of transportation and income AEB multiple missed appointments and noncompliance with medication.

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Planning & Goal

- Goal setting
  - Client centered
  - Specify activity
  - Time frame
- Nursing intervention development
  - Focused on goal attainment
- The client will independently administer prescribed insulin by end of 4th session instruction.

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Implementation

- General teaching
- Administration
  - Nurse vs. client
- Diet
- Side effects
- Cultural considerations

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Medication Record Sheet

Name: **Family Physician:**

EXAMPLE

Generic Name	Instructions	Reason for Therapy	Duration	Side Effects
What is the name of your medication? What is the pill dosage?	When and how do you take this medication? With meals? With water? How many times a day?	Why are you taking the medication?	How long have you been taking this medication?	What are the side effects you experience when taking this medication?
Example: Ranitidine, 150 mg	Example: 1 tablet, twice a day, with meals	Example: Acid Reflux Disease Heartburn	Example: 6 months	Example: Headache, cramps, bloating, etc.

Generic Name	Instructions	Reason For Therapy	Duration	Side Effects

Evaluation

- Goal evaluation
- Not met/partially met
  - Nursing interventions/plan revision
  - Teaching

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