

Adult Patients for Technicians

Lee B. Murdaugh, RPh, PhD



LEARNING OBJECTIVES

- Explain how drug disposition in adults is impacted by kidney, liver, and other biological functions.
- Discuss how medication dosing for adults differs from other patient populations.
- Recognize factors that influence medication administration to adults.
- Discuss how medication-related problems affect adult medication therapy.
- Describe how to manage medication therapy in adult patients.

Drug Disposition in Adults

Biological processes responsible for drug disposition are fully developed in adult patients (18 to 65 years of age). However, throughout adulthood these functions may experience changes that can alter drug disposition. Kidney and liver function begins to decline as adults age, resulting in changes in the body's ability to metabolize and excrete medications. Other age-related changes that can affect drug disposition include decreased stomach acid secretion, decreased total body water, and increased body fat. Because physiological changes that develop with age do not occur consistently among individuals or consistently in all organ systems within one person, their effect on drug disposition may not be predictable. Therefore, individualized drug therapy is necessary. Other factors that may affect biological function include acute or chronic disease states and lifestyle choices (e.g., substance abuse, nutritional habits, and physical activity).

Adult Medication Dosing

Recommended medication dosages for adults have been established and are reported in the package labeling for medications and drug information references. Doses are usually reported as microgram (mcg), milligram (mg), or gram (g) per dose but may be expressed in other ways such as mg/kg/day, mg/kg/dose, and mg/m² (body surface area [BSA]).

However, recommended dosages may not be appropriate for patients with impaired biological processes that consequently affect parameters such as absorption, distribution, metabolism, and excretion. For example, liver or kidney dysfunction can reduce the elimination of some medications (e.g., anti-infectives), thereby requiring reductions in doses or increases in the dosage interval.

Dosages may also be based on blood drug concentrations. Examples of medications that can be initially dosed and then monitored and adjusted using pharmacokinetic data and the patient's response include aminoglycosides and phenytoin.

Dosage adjustments may be needed when switching from one dosage form or route of administration to another because of differences in physiochemical and drug disposition properties (e.g., salt form and bioavailability). Medications that require dosage adjustments from one dosage form to another include levothyroxine, phenytoin, verapamil, diltiazem, and propranolol. For example, the intravenous dose of levothyroxine is 50% of the oral dose.

Medication Administration in Adult Patients

In general, adults tolerate all dosage forms and routes of administration. However, the choice of dosage form, route, and method of administration, and other components of medication administration are dependent on patient-specific factors (e.g., concurrent disease states) and the availability of appropriate medication preparations. Seriously ill patients may not be able to take medications by mouth, thereby requiring the use of alternative routes of administration, such as parenteral and rectal routes, or via a nasogastric tube that necessitates the use of liquid dosage forms. In these instances, medications not available as oral liquid formulations must be modified for use. Crushed tablets and the contents of emptied capsules may be mixed with beverages, soft foods, enteral formulas, or extemporaneously prepared in syrups and other liquid vehicles. However, problems can occur when some products are altered. Sustained-release and enteric-coated products should not be crushed because the bioavailability of the medication will be altered. Foods, enteral formulas, and liquid vehicles can interact with medications and alter bioavailability and other physiochemical properties. Some patients susceptible to fluid overload (e.g., those with renal failure) may require oral liquid and parenteral medications to be prepared in more concentrated forms when appropriate concentrations are not commercially available. Care must be taken to ensure that appropriate concentrations and diluents are used.

Medication-Related Problems in Adults

Medication-related problems that may occur in adults include the following¹:

- Adverse drug reactions (ADRs)
- Drug interactions
- Therapeutic duplication
- Inappropriate drug selection
- Subtherapeutic dosing
- Overdose/toxicity
- Drug use without an indication
- Omission of medication

Many factors increase the potential for ADRs and other medication-related problems in adults. Adults often take a large number of medications to treat concurrent chronic illnesses, such as diabetes and hypertension (high blood pressure). Multiple diseases often mean more medications, thereby increasing the potential for ADRs because of possible additive drug effects, interactions, nonadherence, and other medication-related problems. The presence of concurrent disease states can affect the disposition of, as well as response to, medications. For example, kidney and liver insufficiency may lead to decreased metabolism and elimination of medications, resulting in drug accumulation and toxicity. Polypharmacy (the use of multiple medications) may also interfere with laboratory tests used in monitoring disease states and medication therapy.

Certain factors of an individual's lifestyle, such as the presence of substance abuse (e.g., tobacco, alcohol, or illicit drugs), the use of nutritional supplements, and the level of physical activity may also produce physiological changes that affect drug disposition. Examples include decreased blood theophylline concentrations resulting from smoking tobacco or the relationship between consumption of alcohol and acetaminophen toxicity in chronic alcohol users.

Inactive ingredients in medication formulations (e.g., ethanol, sucrose, sorbitol, and dyes) may have adverse effects on adult patients. For example, medication formulations containing ethanol can negatively affect some disease states (e.g., diabetes and alcoholism) and produce a drug reaction when

given in combination with certain medications (e.g., metronidazole). Formulations containing large amounts of sucrose (e.g., some psyllium products) may impact blood glucose control in patients with diabetes. Excess sorbitol may produce diarrhea and abdominal cramping.

Nonadherence is another factor that may cause medication-related problems. Methods of administration, frequency of dosing, and combinations of medications all affect patient adherence to medication therapy. Nonadherence generally increases as the number of different medications increases and as the frequency of dosing increases. Unpleasant side effects and the cost of medications are other factors that may cause therapy to be interrupted or discontinued. Patients may be nonadherent with medication regimens that are complex, inconvenient, or require lifestyle changes. In addition, patients may not understand or recall medication therapy information, or they may not understand how to use measuring and administration devices correctly.

The use of multiple physicians and pharmacies and self-medication with nonprescription medications purchased over the counter (OTC), herbal products, and dietary supplements can also increase medication-related problems, such as therapeutic duplication, drug–drug interactions, and the incidence and severity of ADRs.

Managing Medication Therapy for Adults

Medication therapy for adults should be carefully managed to ensure positive therapeutic outcomes and minimize medication errors and other medication-related problems. Proper selection and monitoring of medication therapy includes consideration of the following factors:

- Presence of concurrent disease states
 - Kidney and liver function and other factors involved in drug disposition
 - Physical and psychological considerations (e.g., physical and mental abilities and hearing or vision acuity)
 - Socioeconomic factors (e.g., income, education level, family relationships and support systems, and cultural and religious beliefs)
 - Lifestyle choices (e.g., substance abuse, nutritional habits, and level of physical activity)
 - Drug characteristics (e.g., drug disposition parameters, dosage form, dosing frequency, side effect profile, method of administration, monitoring requirements, and cost)
- Precautions that can minimize medication-related problems in adults include the following:
- Ensure complete and accurate medication orders and records. Orders should include medication name, dose, dosage form, strength, route, frequency or rate, the site of administration (when appropriate), and the intended use of the medication.
 - Use appropriate doses. Modify doses for patients with kidney insufficiency or liver dysfunction, as well as for those who are obese or severely underweight. Adjustments may also be necessary when changing from one dosage form or route of administration to another. Adjust doses, if necessary, to ensure that doses are appropriate.
 - Use a system of double checks. Have another individual check the accuracy of calculations, dilutions, and other measurements.
 - Use unit-dose or unit-of-use packages. These packages minimize the need for calculations and preparation of medications outside of the pharmacy.
 - Avoid polypharmacy whenever possible, and keep medication regimens simple. Some medications can benefit multiple conditions, thus reducing the number of medications used or the required dosage of another medication because of additive effects. For example, an angiotensin-converting enzyme inhibitor can treat congestive heart failure and hypertension plus protect kidney function in a patient with diabetes and heart disease. If possible, choose drugs with a low dosing frequency.
 - Nonpharmacological management should be considered when appropriate (e.g., exercise, dietary changes).
 - Monitor for ADRs and drug interactions.
 - Monitor the patient's response to medications and blood drug concentrations, when appropriate. Monitoring ensures therapeutic efficacy and reduces the potential for ADRs.
 - Educate patients. A critical part of patient education is the assessment of the patient's (or caregiver's) level of comprehension and tailoring communication to meet the patient's needs. For each therapy, counsel patients and caregivers about dosing

schedules, side effects, and expected therapeutic outcomes as well as demonstrate administration techniques and measurement of doses. Use communication methods that overcome barriers to effective counseling. Discourage nonprescription medication use, unless directed by a physician or pharmacist, and encourage patients to inform healthcare providers if using nonprescription medications, herbal products, or dietary supplements.

Reference

1. Strand LM, Morley PC, Cipolle RJ, et al. Drug-related problems: their structure and function. *DICP Ann Pharmacother*. 1990;24(11):1093-1097.

Competence Checklist

Name: _____ Date: _____

KNOWLEDGE AND SKILLS	YES	NO
Demonstrates ability to identify adult patients		
Ensures patient age is documented on the medication profile		
Describes how biological functions, such as kidney and liver function, decline with age and the effect this may have on drug disposition		
Explains how concurrent disease states, stress, and lifestyle choices can have a pronounced effect on biological functions, drug disposition, and the dose required for therapeutic effect		
Recognizes physical and psychological barriers that may make it difficult for patients to understand how to take their medications		
Recognizes dosage forms and routes and methods of medication administration appropriate for adult patients		
Selects appropriate medication formulations, dosage forms, and routes and methods of administration based on patient-specific needs		
Recognizes that dosage adjustments may be needed when switching from one dosage form or route of administration to another		
Accurately prepares extemporaneous formulations and dilutions of commercially available products, using appropriate procedures and correctly performing necessary calculations		
Recognizes medications that should not be crushed to facilitate administration to adults		
Explains how all patients, including adult patients, are susceptible to serious ADRs		
Recognizes factors that increase the risk of medication-related problems in adult patients		
Takes appropriate precautions to minimize the risk of medication errors and other medication-related problems in adult patients		
NOTES		

Competence certified by

Date