



UNIT 1

REVIEW OF MATHEMATICS

1. Importance of Accurate Pharmacy Calculations

- Introduction
- Impact of Medication Errors
- Responsibility in Accuracy and Precision

2. Numbers and Numerals

- Introduction
- Numbers and Numerals
 - What is a number?
 - What is a numeral?
- Number Systems
 - Rational and real numbers
 - Place value
 - Rounding numbers

3. Review of Basic Math Operations

- Introduction
- Addition and Subtraction
- Multiplication and Division
- Working with Fractions
 - Decimal fractions
- Order of Operations



CH 1

IMPORTANCE OF ACCURATE PHARMACY CALCULATIONS

LEARNING OBJECTIVES

- ❑ Describe the role of the pharmacy technician as a member of the healthcare team.
- ❑ Discuss the impact of medication errors from a global healthcare perspective.
- ❑ Outline the pharmacy technician's responsibility in accurate and precise pharmacy calculations.

OUTLINE

INTRODUCTION

IMPACT OF MEDICATION ERRORS

RESPONSIBILITY IN ACCURACY AND PRECISION

INTRODUCTION

As a future pharmacy technician, you will play an integral role in optimizing patient outcomes and promoting medication safety with each patient encounter. Whether that encounter is direct via face-to-face customer service or indirect through preparation and dispensing of patient-specific medications, your role and responsibility as a member of the healthcare team cannot be understated. As contributing members of healthcare teams, pharmacy technicians are employed in virtually every practice setting, such as inpatient care (hospitals); community care (retail); ambulatory care (clinics); specialty pharmacy; long-term care (nursing homes); and mail order. Regardless of the setting, pharmacy technicians work closely with pharmacists and other members of the healthcare team to ensure patients receive the correct medication. Historically, the pharmacy technician's role has focused almost exclusively on the preparation and dispensing of medications. Now, thanks to advanced education and training programs, the current and future roles and responsibilities will continue to expand. Advanced roles may include supervisory responsibilities as well as work in areas such as sterile and nonsterile product admixture, pharmacy automation, health information technology, drug diversion, purchasing, and investigational drug services. Before pursuing advanced responsibilities, you must first build a solid foundation and competency of core tasks, with accurate pharmacy calculations being a cornerstone skill set regardless of the patient care setting. Pharmacy calculations are integral to medication dosing, which relies on a multitude of patient-specific factors including age, sex, weight, and organ (eg, kidney or liver) function.

Achieving competence in pharmacy calculations can help prevent patient harm.

IMPACT OF MEDICATION ERRORS

Pharmacy technicians play an important role in the identification, resolution, and avoidance of medication errors, including those that result from pharmacy calculation errors.¹ Elimination of medication errors is complex given the host of factors involved, including differences in knowledge and experience of healthcare workers, patient variability, work environments, computerized information systems, and medication-specific nuances.² According to the United States National Coordinating Council for Medication Error Reporting and Prevention, a medication error is defined as “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in control of the healthcare professional, patient, or consumer. Such events may be related to professional practice, healthcare products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use.”³ The Institute of Medicine reports (based on a single publication) that medication errors stemming from all causes may lead to 1 of 131 outpatient deaths and 1 of 854 inpatient deaths.⁴ In total, as many as 1.5 million people each year may be impacted by medication errors at a cost of \$3.5 billion annually due to death, injury, or extended hospitalization.⁵ While these mortality rates and associated costs are alarming, the ultimate goal is to prevent errors before they occur. Embedded within a pharmacy technician's role to avoid medication error is the underlying importance of performing accurate and precise pharmacy calculations.

RESPONSIBILITY IN ACCURACY AND PRECISION

In day-to-day conversation, the terms **accuracy** and **precision** are sometimes used interchangeably. There is a difference, however, and an understanding of both terms is important in pharmacy calculations. **Accuracy** means the closeness of a measurement to its true value. For example, let's say the true weight of a bowling ball is 14 pounds. If

you weigh the bowling ball with a scale and get 11 pounds, the scale is not accurate. If you weigh the bowling ball and get 14 pounds, then the scale is accurate. **Precision** refers to how close two or more measurements are to each other. In the previous example of measuring the true weight of a 14-pound bowling ball, if you weighed the ball twice and each time got 11 pounds, the scale is precise but not accurate. The ideal scenario is having a scale that is both accurate and precise, in which case weighing the bowling ball two or more times would yield the actual weight of 14 pounds each time. While this example of accuracy and precision may not initially resonate with your future role as a pharmacy technician, keep in mind that every pharmacy calculation you make must be accurate and precise. Every pharmacy calculation you execute has a true (ie, accurate) result, and you must be able to reproduce this result consistently (ie, precisely) to avoid patient harm.

The most important job of anyone who works in a pharmacy is to ensure that every patient receives the appropriate medication. Solving the practice problems at the end of each subsequent chapter will prepare you to undertake this responsibility safely.

REFERENCES

1. Brown MC. Introduction to pharmaceutical calculations. *Am J Pharm Educ.* 2003;67(2):67.
2. World Health Organization. *Medication Errors: Technical Series on Safer Primary Care.* Geneva, Switzerland: World Health Organization; 2016.
3. National Coordinating Council for Medication Error Reporting and Prevention. *What Is a Medication Error?* New York, NY: National Coordinating Council for Medication Error Reporting and Prevention; 2019. <https://www.nccmerp.org/about-medication-errors>. Accessed October 22, 2019.
4. Kohn LT, Corrigan J, Donaldson Molla S, eds; Institute of Medicine Committee on Quality of Healthcare in America. *To Err is Human: Building a Safer Health System.* Washington, DC: National Academy Press; 2000.
5. Institute of Medicine. *Preventing Medication Errors.* Washington, DC: The National Academies Press; 2007. <https://doi.org/10.17226/11623>. Accessed October 23, 2019.

PRACTICE PROBLEMS

1. The true volume of soda in a standard aluminum can is 355 mL. A student pours a can of soda into a separate container four different times and measures the volume to be 335, 336, 334, and 335 mL, respectively. Which statement below best describes the student's measurements?
 - a. They are neither precise nor accurate.
 - b. They have good accuracy.
 - c. They have good precision.
 - d. They have poor precision.
2. Four students are asked to measure the temperature of a solution, using the same thermometer, that has been sitting at room temperature (70°F) for 3 days. The students report the following results: 65, 79, 88, and 59°F. Which statement below best describes the student's measurements?
 - a. They are precise and accurate.
 - b. They are neither precise nor accurate.
 - c. They are accurate.
 - d. They are precise.

GLOSSARY

Accuracy—The closeness of a measurement to its true value.

Precision—How close two or more measurements are to each other.