CHAPTER 10

Epidemiology and Disease

Learning Outcomes

1. Define epidemiology and pharmacoepidemiology.
2. Describe the roles of epidemiology in public health.
3. Explain the meaning of epidemiological terms such as incidence, prevalence, epidemic, odds ratio, and relative risk.
4. Given data about a disease in a population, identify who has increased or decreased risk of illness or death.
5. Explain how epidemiology can promote more funding for research and programs that address a specific disease.

Introduction

Epidemiology is a collection of study designs and analysis methods used to describe disease behavior in a population so that preventive actions can be taken to reduce disease. This chapter will begin with a short introduction to epidemiology and its origin. One facet of epidemiology that focuses on medication use (i.e., pharmacoepidemiology) will be presented; examples involving medications and pharmacy services will be used throughout the chapter to illustrate concepts and study designs. To further describe epidemiological terms and study designs, a medication error case will serve as an example of a preventable cause of disease and explore various methods for describing the magnitude of the problem—who is affected by it, when it happens, and why it happens. The fictitious case will employ counts and frequency rates obtained through observation, measures of associations, inferences of causation, and experimental designs to test interventions created to reduce risk. The many roles of epidemiology will be presented at the end of the chapter.

Public Health in the Context of Medication Errors

Medication use can help patients feel better and return to a state of health. Medication can also create a number of risks, including death. The risks created by the use of medications have been dubbed drug-related problems (DRPs), which include problems created by using a medication that is not needed or not using a medication that is needed, taking an inappropriate product or dose, having an adverse reaction to the medication, and inadvertently creating drug interactions with other substances.[1] Many of the drug-related problems are caused by errors, which means they are preventable causes of injury and disease.

In addition to being preventable, medication errors have been responsible for sufficiently large numbers of injuries and death to make them a public health concern. In the United States, annual medication error related injuries and deaths have been estimated at 1.5 million and 7,000, respectively. At least a quarter of the medication-related deaths are preventable.[2] The medication-related death rate, including those deaths caused by errors, is somewhere between the fourth and sixth leading cause of death in the United States.[3]

Not all medication errors cause injury or death, therefore, confusion exists about what should be measured when studying this public health problem. It is generally agreed that most medication errors are caught and corrected before a patient is exposed to the medication so no harm is done. However, as long as errors are occurring, prevention is critical to avoiding the risk of one of those errors causing injury or death. Prevention requires understanding the problem; researchers have focused on the steps in the medication ordering, dispensing, and use process to identify where errors occur. For example, in one study, the most common types of errors were administering improper dose (41%), giving wrong drug (16%), and using wrong route (10%).[4]

Definition of medication error

Because of confusion about what constitutes a medication error, the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) created the following definition:[5]

Disease, injury, and death may be caused by clinically used medications. Some of those injuries and deaths are due to medication errors. Because such errors are a preventable cause of injury and death, there is great interest in finding their causes so preventive measures can be implemented.

"A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use."