CHAPTER 3

Nutritional Epidemiology and Research Methods

CHAPTER OUTLINE

- Introduction
- Epidemiology in Community Health
- Nutritional Epidemiology
- Interpretation of Cause and Effect in Nutritional Epidemiology
- Types of Public Health Nutritional Epidemiology Research
- Descriptive Measures of Community Health
- The Epidemiological Methods
- Quantitative and Qualitative Methods
- Types of Sampling
- Concepts of Collaborative Research
- Reporting Research Results
- Epidemiological Approaches to Community Health Assessment

LEARNING OBJECTIVES

- Define nutritional epidemiology.
- Discuss the different types of epidemiological research.
- Discuss the difference between quantitative and qualitative research methods.

Introduction

Community and public health nutrition research has increased over the years, but nutritionists must continue to increase the scientific knowledge base that is unique to their practice to provide high-quality, scientifically oriented, evidence-based services and solutions to today's nutrition-related health conditions. **Community nutrition research** is defined as the "organized study of a trend at both the basic and more applied levels that focuses on social, structural, and physical environmental inequities through active involvement of community members, organizational representatives, and researchers in all aspects of the research process with the specific topics varying between investigators and the public."[1] Learning to conduct successful research and epidemiological studies is crucial to community nutrition.

Epidemiology is the study of the determinants, occurrence, and distribution of health and disease in a defined population.[2,3] It studies scientifically the factors that affect the health of individuals in the community. It also serves as the foundation for intervention programs that use evidence-based information to address the prevention of health conditions.[2-4] Today, epidemiologists employ a range of study designs, from observational to experimental, with the purpose of revealing unbiased relationships between **exposures** (e.g., nutrition, biological agents, stress, or chemicals) and outcomes (e.g., diseases, wellness, and health indicators). Epidemiological studies are usually categorized as follows[3,5]:

- Descriptive (organizing data by time, place, and person)
- Analytic (aiming to examine associations or commonly hypothesized causal relationships, and incorporating a case-control or cohort study)
- Experimental (clinical or community trials of treatments and other interventions)

This chapter discusses the basic research process and epidemiological studies in dietetic practice. A more advanced research process is presented in Appendix F.

Epidemiology in Community Health

Epidemiological and demographic measures and research methods are used to study health-related conditions. For example, they are used to investigate outbreaks of food poisoning, chickenpox, measles, and acquired immunodeficiency syndrome (AIDS). They are also used to investigate environmental conditions, lifestyles, health-promotion strategies, and other factors that affect health.[6] The science of epidemiology is important to community and public health nutritionists because it can be utilized to assess and understand health, diseases, and injury in a community or target population. Epidemiology is a population-focused applied science that uses research and a statistical data collection methodology to determine the following[7]:

- The population that is affected by a disease or disorder
- The incidence or prevalence of a health problem in the community
- The likelihood the causes and risk factors contributing to the health problem may or may not be determined

One example of epidemiological research in the community is that of the Racial and Ethnic Approaches to Community Health Across the United States (REACH U.S.) Program. The Centers for Disease Control and Prevention (CDC) created REACH U.S. to address the problem of health disparities among different racial and ethnic groups and to show that the health status of groups most affected by health inequities can be improved. REACH U.S. supports strategies that address health disparities throughout the life span.[8] One of the success stories of the REACH U.S. program was conducted at the Genesee County (Michigan) Health Department. The department coordinated a multifaceted community effort to reduce the high death rates among African American infants born in and around Flint, Michigan. The program's activities included the following[8]:

- Case-management services designed to reach pregnant women and new mothers in high-risk areas of the county
- Community dialogue sessions designed to educate residents about infant death rates and available resources
- Workshops conducted to help participants understand the connections between racism and health care

Social marketing efforts were used to communicate important health messages about how to reduce infant deaths, and a medical services committee was formed to identify and promote best clinical practices.

Results showed that the death rate for African American infants in Genesee County dropped from a high of 23.5 deaths per 1,000 live births in 1999 to a low of 15.2 in 2005. In comparison, the rate among Caucasian American infants in 2005 was 6.3 deaths per 1,000 live births. The disparity ratio between African Americans and Caucasian Americans also dropped from a high of 3.6 African American infant deaths for every 1 Caucasian American infant death in 2001 to 2.4:1 in 2005.[8]

Nutritional Epidemiology

Nutritional epidemiology is the study of dietary intake and the occurrence of disease in human populations.[9] In nutritional epidemiology, accurate quantification of nutritional exposure is critical. Exposure is the characteristics or agents (e.g., food, medications, time in the sun) that a person comes in contact with that may be related to disease risk (see **TABLE 3-1**).[10] It is complicated and challenging to evaluate and associate dietary intake with disease risk. For instance, cigarette smoking can be accurately assessed as an activity with a simple yes or no question. It has been reported that cigarette smoking is addictive, and smokers seem to be consistent in their habits, instead of stopping and starting. Most smokers seem to smoke about the same number of cigarettes per day, and, because of the expense, most people know how many cigarettes they smoke per day.[11,12]

In comparison, it is difficult for clients to report accurately the food consumed for more than 1 week because they may consume hundreds, even thousands of different foods during that period. In addition, the difficulty may be due to the following[9]:

- Other people preparing the meals (e.g., restaurant, friends, spouse, prepackaged foods) so that the client does not know what, or how much, he or she has consumed
- Seasonal variations in food intake
- Life events (e.g., weekends, holidays, vacations, birthdays)

Indeed, the daily variability in food intake makes it difficult to identify any critically consistent pattern.[13] This means that researchers must depend on food composition databases to calculate the exposure variable. These issues have made it difficult to obtain consistent and strong evidence about how diet affects disease risk.

In the past 20 years, nutritional epidemiological research has focused on nutrient-based analyses to help guide the search for underlying causes of disease risk.

TABLE 3-1 Examples of Exposures Relevant to Nutritional Epidemiological Studies

Exposure	Diet-Related Example	Other Example
Agent that may cause or protect from disease	Fruit and vegetable consumption may provide protection against colon cancer, heart disease, and stroke.	Physical activity may provide protection against colon cancer, obesity, and heart disease.
Constitutional host factors	Persons can have a genetic predisposition to nutrition-related diseases (e.g., diabetes, heart disease, cancer).	Older adults and low-income individuals are more predisposed to chronic disease.
Other host factors	Food preferences learned during childhood can determine food choices.	More educated adults may have better disease screening.
Agents that may confound the association between another agent and disease	Correlation between dietary constituents (e.g., a diet high in fruits and vegetables is usually low in calories and fat and high in antioxidants).	Alcohol and substance abusers and smokers are less likely to engage in physical activity.
Agents that may modify the effects of other agents	Fruits and vegetables may protect against lung cancer among smokers.	Smoking causes an increased risk for lung cancer.
Agents that may determine the outcome of disease	Malnutrition.	Medical treatment and medical nutrition therapy.

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However, food-based hypotheses and analyses have been shown to complement this philosophy and can be an effective method to link food intake to a health condition. For example, Ness and Powles [14]conducted a systematic review of the reported associations between the consumption of fruits and vegetables and the risk for cardiovascular diseases. Results showed that 9 of 10 ecological studies, 2 of 3 case-control studies, and 6 of 16 cohort studies found a significant protective association between the consumption of fruits and vegetables and coronary heart disease. For stroke, 3 of 5 ecological studies and 6 of 8 cohort studies found a significant protective association with consumption of fruits and vegetables. For total circulatory disease, one of two cohort studies reported a significant protective association.[15] Hence, the tools and methods of nutritional epidemiology can be developed to deal with scientific issues unique to the biology of chronic diseases. Specifically, epidemiological methods were designed to address the following[9]:

- The length of time for disease development
- The multifactorial nature of chronic diseases
- The fact that research using human beings prevents direct observations of cause and effect

Interpretation of Cause and Effect in Nutritional Epidemiology

Epidemiology is the study of associations, and statistical methods are used to test the strength of these associations. However, it is important to note that the existence of a statistically significant association does not indicate that the observed relationship is one of cause and effect. For any observed association, the following should be considered[16,9]:

- The observed association may be due to chance.
- The association may be due to improper study design or implementation or inappropriate analysis of data.
- The association may be weak or strong.
- A credible biological mechanism may exist.
- There could be an association between exposure and the outcome.
- The significance of the results depends on the context of all the available evidence. Causality is supported when studies that are conducted at different times, using different methods, and performed among different populations show similar results.
- The result correlates with other criteria of causality (given in Appendix G).

It is not uncommon in the field of nutritional epidemiology for a cause-and-effect relationship to be beyond doubt. However, research information should not be ignored or discarded.[17] One must exercise caution and use thoughtful consideration before acting on epidemiological evidence. This chapter's Successful Community Strategies feature presents a successful cohort research study that verified the association between plant-based diets and the rate of mortality.

Types of Public Health Nutritional Epidemiology Research

Public health nutritional epidemiology research and research design can be divided into observational and experimental/clinical categories. The difference between an experimental and an observational study is the control the researcher may have over participants, the methods and procedures, and the exposures (see **FIGURE 3-1**). In an experimental/clinical study, the researchers can control some of the clients' entire dietary intake. In an observational study, the researcher does not intervene in or manipulate the clients' dietary intake.[9,18,19] We will first discuss observational studies. The types of observational studies for individuals include *cross-sectional, case-control*, and *cohort/prospective* studies; observational studies of groups are referred to as *ecological studies*. After that, we will discuss experimental studies. Figure 3-1 presents types of epidemiological research design.

Observational Studies of Individuals

In a **cross-sectional study**, sometimes described as prevalence or descriptive survey, nutrient intake and outcome are both measured at the same point in time.

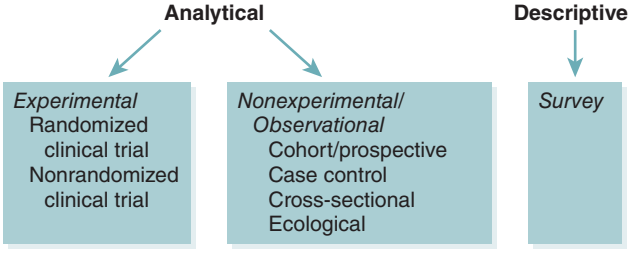

FIGURE 3-1 Types of epidemiological research design.

The aim of the study is to describe the relationship between diseases and dietary intake in a specified community at a particular time. It can provide a snapshot of the frequency and characteristics of a disease in a population at a particular point in time.[20] An example of a cross-sectional study question would be: What is the association between nutrient intake and disease outcome? For example, the National Health and Nutrition Examination Survey (NHANES) and the International Study on Macronutrients and Blood Pressure (INTERMAP) are cross-sectional studies. INTERMAP is a cross-sectional study of associations between macronutrients and blood pressure. In this study, participants had their blood pressure measured twice on each of four occasions and completed a 24-hour recall on each day that their blood pressure was measured.[18,11,21] Similarly, the National Center for Health Statistics conducts the NHANES survey biannually to measure the health and nutritional condition of adults and children living in the United States. The survey utilizes both questionnaire and examination techniques. In this study, a sample of 1,890 12- to 16-year-olds with measured height and weight were obtained from the NHANES III survey to identify factors to potentially combat obesity in 12- to 16-year-olds with one or two obese parents and those with no obese parents. NHANES III surveys were conducted in two stages: 1) an initial interview was conducted in the respondents' homes, where health histories and sociodemographic characteristics were obtained, and 2) 3 weeks later, dietary intake assessments and physical examinations were conducted on the participants in a mobile examination center.

Results show that eating breakfast every day or some days was significantly protective against obesity in adolescents with obese parent(s), and this proved to be the strongest protective factor in this group of children. Findings from the NHANES studies have been used to create public health education and intervention programs.[22,15,23]

In nutritional **case-control studies**, also referred to as retrospective and case-referent studies, persons recently diagnosed with a diet-related disease and a group of persons without the disease (the control) from the same population are interviewed concerning their dietary habits. The differences between both groups' findings are compared. Case-control studies are a commonly used method of observational epidemiological studies. The aim of this type of study is to identify the cause of a disease among a group of people, or the cause-and-effect relationships of the health condition.[24] Typical study questions could be: Do people with the disease or health condition have a different lifestyle than persons who have not been diagnosed with the health condition? Or, do people diagnosed with hypertension smoke cigarettes and consume foods higher in sodium than persons without hypertension?[18] For example, in 2004, Lubin et al.[25] conducted a case-control study in Israel. The aim of the study was to determine the association between body size and the risk for breast cancer. The study used a population of 1,065 breast cancer patients, 964 surgical controls, and 981 neighborhood controls. Heights and weights at three periods throughout the participants' lives (at age 18, for "most of adult life," and most recent) were ascertained. The authors analyzed these parameters and the body mass index (BMI) for each period, as well as BMI changes throughout life, controlling for age, menstrual status, and ethnic origin. Results showed an increase in risk for breast cancer with greater recent BMI among postmenopausal women ages 60 years and older.[25]

In another retrospective study, the Alaska Native Medical Center diabetes program analyzed diabetes care and outcomes audit data from 1994 to 2004 to evaluate the impact of the Special Diabetes Program for Indians (SDPI) funding on process and intermediate outcomes.[26] Congress established the SDPI grant program in 1997 to respond to the diabetes epidemic among American Indians and Alaska Natives. The SDPI program provides funding for diabetes treatment and prevention services at 399 Indian Health Service (IHS) and Tribal and Urban Indian Health Programs in all 12 IHS areas across the United States. The IHS Division of Diabetes administers the program with guidance from the Tribal Leaders Diabetes Committee.[27] The researchers conducted a retrospective analysis of data[28,29] from randomly selected standardized medical records for trends from regional sites in Alaska. Results show that hemoglobin A1c, total and low-density lipoprotein (LDL) cholesterol, triglycerides, and blood pressure significantly improved from the pre-SDPI to the SDPI period.

In **cohort studies**, sometimes called prospective, follow-up, and longitudinal studies, baseline risk factors are evaluated and participants are followed over time to monitor disease occurrence. It is the analytic method of epidemiological studies. Participants are typically free of disease. A typical study question would be: Do people with a higher intake of a nutrient develop or die from a particular disease more frequently or sooner than persons with a lower intake? Cohort studies are usually very large, exceeding 50,000 participants; may take many years to be conducted; and are expensive.[28] An example of a cohort study is the Women's Health Initiative (WHI), a 15-year study investigating the degree to which diet, hormone replacement therapy, calcium,

TABLE 3-2 Dietary Assessment in Different Study Sessions

Study Situation	Methods Commonly Used
Cross-sectional	24-Hour recall; food frequency questionnaire (FFQ); brief methods
Case-control (retrospective)	FFQ; diet history
Cohort	FFQ; diet history; 24-hour recall
Intervention	FFQ; brief methods; 24-hour recall
Clinical screening	24-Hour recall; brief methods; diet history
Surveillance	24-Hour recall; brief methods

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and vitamin D might prevent heart disease, breast and colorectal cancer, and osteoporosis in postmenopausal women. The main advantage of cohort studies is that exposure to potential risk factors is assessed before the development of the disease. **TABLE 3-2** shows examples of cohort studies.

TABLE 3-3 presents examples of cohort studies utilizing nutrition assessments.

Observational Studies of Groups

Ecological studies compare collective data that represent entire populations. An ecological study focuses on the comparison of groups, not individuals. The purpose of an ecological analysis may be to make biological implications about the association between exposure (e.g., water contaminant) and disease outcome in various communities within a population or to make ecological inferences about effects on group rates.[4] Ecological studies may be very useful for monitoring national trends in health, social, cultural, economic, and environmental factors that influence health that cannot be measured at an individual level. For example, migration studies, a type of ecological study, show a significant increase in the risk for several chronic diseases, such as breast cancer, when people move from an Eastern to a Western country.[24,25,34]

Experimental Studies

Experimental studies involve intentional alteration of or intervention in the course of a disease. Nutritional intervention studies include metabolic studies and randomized clinical trials.[9,18] In metabolic or feeding studies, the researcher develops nutritionally adequate diets that vary on one or more components, to investigate the effect of this diet on internal physiological reactions (e.g., carbohydrate, lipid, and energy utilization and storage in relation to obesity and diabetes), metabolic processes (e.g., absorption, transport, and utilization of minerals, vitamins, and protein), and specific enzyme systems in experimental animals and humans.[14] An example of an experimental study is a metabolic ward study that reported changes in total cholesterol from changes in intakes of saturated and polyunsaturated fatty acids and dietary cholesterol.[18,35-37] Crossover research design is common in metabolic/feeding studies. In this design, each volunteer participant serves as his or her own control.

Another type of experimental study is the randomized clinical trial, which is a prospective study in which participants are randomly assigned to intervention and control groups. The participants are followed over time to assess the effectiveness and safety of the intervention after randomization.[34] An example of a randomized study is the Fracture Intervention Trial, which was designed to test the hypothesis that hormone replacement therapy would reduce the rate of fracture in postmenopausal women.[38]

Genetic Epidemiological Studies

Genetic epidemiological studies use genetic epidemiology and molecular epidemiology. The investigation could be a cross-sectional and/or an intervention study. In genetic epidemiology, a question could be: Do genes determine eating behaviors, such as how much one eats, preferences for certain types of foods, and frequency or patterns of eating?[18,39] Research implies that there is a resemblance among family members for these behaviors, but it is not clear whether genes, shared environments, or both are the cause.[40,41] In molecular epidemiology, questions relate to the physical and hormonal mechanisms leading to taste preferences, hunger, and satiety. For example, taste receptors are clearly genetically determined, although the gene(s) may not all be identified yet.[35,42] For example, genes encoding hormones and proteins that regulate hunger and satiety have just been identified recently.[36,43,44] It has been known for some time that certain enzyme deficiencies, which have a genetic cause, give rise to specific nutritional problems; examples of these are phenylketonuria and galactosemia.[36,43]

TABLE 3-3 Examples of Cohort Studies Utilizing Nutrition Assessments[30-33]

Cohort Study	Years Conducted	Sample Studied	Purpose	Nutritional Intake Assessment	Results
Early risk factors for increased adiposity: A cohort study of African American subjects followed from birth to young adulthood	Baseline: Between 1959 and 1965	447 African American pregnant women	The aim of this study was to identify risk factors, present at birth, for increased adiposity in adulthood in an African American population	Baseline: Anthropometric measurements and socioeconomic factors	Three variables measured at birth were independently associated with adiposity in young adulthood.
Framingham Study: Heart and Vascular Disease Program Dietary patterns, smoking, and subclinical heart disease in women: opportunities for primary prevention from the Framingham nutrition studies	1947–1972	1,423 women in the population-based Framingham Offspring/Spouse group	To investigate the relationship between a heart-healthy dietary pattern and subclinical heart disease in women, and to identify potential opportunities for primary prevention	Ultrasound at 12-year follow-up Food Frequency Questionnaire and 24-hour recall	Women who ate a heart-healthy diet at baseline had less cardiovascular disease risk factor profiles. Women who had heart-healthy eating pattern, plus avoidance of smoking, had lower chances of subclinical heart disease.
Family Structure and Childhood Obesity, Early Childhood Longitudinal Study—Kindergarten Cohort	1998–1999	Kindergarten (n = 14,493), third grade (n = 11,855), and fifth grade (n = 10,036)	This study examines the effect of number of parents and number of siblings on children's body mass index and risk of obesity	Face-to-face assessments or interviews, telephone interviews, and questionnaires, height and weight, body mass index (BMI)	Children living with single mothers had more tendency to obesity by fifth grade than were children living with two parents. Children with siblings had lower BMI and were less likely to be obese than children without siblings. Also, living with a single mother or no sibling was associated with increases in BMI from kindergarten through fifth grade.
Nurses' Health Study: Waist circumference, waist-to-hip ratio, and risk for breast cancer in the Nurses' Health Study.	1986 through May 1994	47,382 U.S. registered nurses	The associations of waist circumference and waist-to-hip circumference ratio with risk for breast cancer	Waist circumference, hip circumference, and waist-to-hip ratio. Questionnaire	Higher waist circumference is associated with the risk for breast cancer, especially among postmenopausal women.

Sources:

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Huang Z, Willett WC, Colditz GA, Hunter DJ, et al. Waist circumference, waist:hip ratio, and risk of breast cancer in the Nurses' Health Study. *Am J Epidemiol.* 1999;150(12):1316-1324.

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Stettler N, Tershakovec T, Zemel B, Leonard MB, et al. Early risk factors for increased adiposity: A cohort study of African American subjects followed from birth to young adulthood. *Am J Clin Nutr.* 2000;72:378-383.

Descriptive Measures of Community Health

Descriptive epidemiological studies explain the occurrence of disease and are collected using various methods. The data are then assembled based on time (e.g., changes of eating habits over a long period), place (geographic areas), and person (e.g., age, gender, ethnicity, lifestyle).[5,45] These data can be used to quantify the extent and location of nutrition problems within a population and to suggest associations between diet and disease that can be evaluated in analytic research.[39,46]

Demographic Measures

Demography is an analytic tool used to measure a population by recording births, deaths, age distribution, and other vital statistics.[6,7] Some human characteristics, or demographics, may be associated with wellness or illness. Age, race, gender, ethnicity, income, and educational level are important demographics that may affect health outcomes. For example, men are more likely than women to develop certain heart diseases, and African Americans are more likely than Caucasian Americans to experience hypertension.[23,29,47] Community nutritionists must be familiar with the demographic characteristics of the community they serve and with the health problems associated with that community before developing a health promotion program.

Morbidity and Mortality

Epidemiology studies both wellness and illness. Wellness is hard to measure; therefore, the measures of health are expressed in terms of morbidity (illness) and mortality (death).[6] The CDC's website (http://www.cdc.gov) is an excellent source of morbidity and mortality data organized by states and for select cities.[48]

Incidence and Prevalence

Two types of disease frequency measures are used to determine the morbidity rate in a defined population—incidence and prevalence. Incidence is the rate of acquisition of a new health condition or the number of persons in a defined population who *developed* the condition during a specified period.[6] The calculation of incidence, therefore, requires that a population be followed over a period in a prospective or cohort (forward-looking) study.[38,45]

On the other hand, prevalence is the total number of persons in the defined population who *are affected by* a certain disease or condition at a specified time. This includes both new and existing cases.[39,38] Therefore, prevalence may be calculated in a "one-shot" cross-sectional ("slice of time") or retrospective (backward-looking) study.[6]

Interpretation of Incidence and Prevalence. In both incidence and prevalence, it is important to clearly define the condition being studied; otherwise, scientists may make a mistake in differentiating between incidence (new cases) and prevalence.[49,50] Scientists must allow enough time to identify new cases to determine incidence and prevalence. This period must be long enough to adequately detect the condition, especially in the case of rare diseases or diseases with a low rate of diagnosis. However, the period cannot be so long that it will be affected by mortality and other follow-up losses.[51]

Measures of incidence and prevalence provide different information and have different implications. For example, an increase in the prevalence of diabetes or endometrial cancer means that there are more persons with these health conditions in the population. This may be due to more new cases (in other words, increased incidence) or because individuals with these health conditions are living longer. In either case, the community may need to direct resources toward treating the problem. However, if knowledge of incidence is lacking, it will be difficult to decide whether to target the resources toward primary prevention or toward secondary and tertiary treatment services.

Here is a specific example of differentiating incidence from prevalence. In a community health center, 120 infants free from measles are followed for 3 weeks. In this period of time, 45 developed measles. Remember, incidence gives an approximation of the likelihood (or risk) that a client will develop a particular health condition during a specified period. Therefore, there is an incidence rate of 45 per 120 (or 37.5 percent) during the 3-week period. However, prevalence computes the proportion of a given population with the problem. So at the same community health center, 150 infants were screened for the presence of measles and 30 infants were affected. This results in a prevalence of measles of 20 percent (30 ÷ 150). In this case, prevalence means the proportion of infants with the problem (e.g., measles) at the specified period.[52] The formulas for calculating both are in **BOX 3-1**.

Rates

The mathematical measures used to articulate incidence and prevalence are known as rates. Epidemiological studies must relate the occurrence of a health condition to the population base. Rates express a mathematical relationship in which the numerator is the number of persons experiencing the condition, and the denominator is the population at risk, or the total number of persons who have the possibility of experiencing the condition.

BOX 3-1 The Formulas for Both Prevalence and Incidence

Incidence rate (IR) = Number of new cases (people who developed the disease) during a specified period

$$IR = \frac{\text{Number of new cases (people who developed the disease) during a specified period}}{\text{Total number of a defined population at risk at the time of getting the disease}}$$

Prevalence = Number of both existing and new cases during a specified period

$$P = \frac{\text{Number of both existing and new cases during a specified period}}{\text{Total number of a defined population at risk}}$$

The formula for calculating rate is shown in the following section.[6] Epidemiologists use rates to examine the experiences of particular groups of people at specified times, in different cities or countries. Another important use of rates is in calculating the risks to individuals and groups of experiencing an event such as a heart attack or an occurrence such as cancer or obesity.

Example of a Rate. In the United States, an acceptable definition for infant mortality rate is the number of deaths during the first year of life (i.e., the number of both neonatal and postneonatal deaths) per 1,000 live births. To calculate infant mortality rate, add the number of neonatal (the first 28 days of life) and postneonatal (between the 28th and 365th days of life) deaths and divide by the number of live births; then, multiply the result by 1,000. The numerator represents the number of infants experiencing the "condition" of dying in the first year of life, and the denominator represents the population of infants at risk of dying in that year.[3,53]

If 500,000 live births and 10,000 infant deaths were reported in the United States for a given year, the rate can be calculated as follows[6]:

1. Infant mortality rate = $\frac{\text{Number of infant deaths (age < 1 year during time interval)}}{\text{Total live births during time arrival}} \times 1{,}000$
2. Divide 10,000 by 500,000 = 0.020 of the infants died during the first year of life.
3. Because it is difficult to relate to 0.020 infants, multiply 0.020 by a constant, in this case 1,000, resulting in 20 infants who died during the first year of life per 1,000 live births. This means that the infant mortality rate was 20 infant deaths per 1,000 live births for that year.

Interpretation of Rates. International comparisons and rankings of infant mortality should be interpreted with caution. For example, a study investigated how infant mortality rates are reported in the United States, Norway, and Israel. Results showed that the United States reported live births less than 750 g, whereas other countries did not report live births less than 750 g. Disparities among countries resulted from differences in birth and death registration practices. [48]

Also, to determine if the population in a specific community is at greater or lesser risk for a condition, the research must compare the rates for the community with rates from similar communities, the state, or the country. Most often, rates are based on data from a calendar year, which may create some problems. When calculating an infant mortality rate, it is important to recognize that some of the infants who die during a given calendar year may not be a part of the demographics, such as those who died in 2005 but who were actually born in 2004 and thus were not part of the 2005 population at risk. Also, some of the infants who were born in 2005 might die in 2006 and not be reflected in the 2005 infant mortality rate.[6] A cohort research study (discussed earlier) can help overcome the limitations of the conventionally calculated calendar year rate.[48]

Think About It

What type of research methodology did Peter use for his case-control study?

Peter, a nutrition professor, received funding from the Special Diabetes Program for Indians to conduct further analysis on the data he collected from diabetes care and nutrition education program. The information he collected included the participants' dietary preferences, knowledge, and awareness of diabetes care, attitude about nutrition education, and management of diabetes.

The Epidemiological Methods

Epidemiological research methods can be descriptive, analytic, or experimental. Although all can be used in studying the occurrence of disease, the method used most often is descriptive epidemiology. Once the basic epidemiology of disease has been described, analytic methods can be used to study the disease further, and an experimental approach can be developed to test a hypothesis.[3]

In epidemiological studies, the investigator attempts to identify risk factors for particular diseases,

conditions, behaviors, or risks that result from particular causes, such as environmental or industrial agents.[50,54] Epidemiology uses different methods—such as statistical, pathological, clinical, demographic, microbiological, and sociological—to study disease processes. These are not exclusive to epidemiology; however, the ways in which they are used distinctively define the epidemiological method.[39] The following examples use the investigation of the diet–disease hypothesis to show the scientific approach of epidemiologists.

Observation

There are many instances of disease control based on epidemiological observations. In an observational study (descriptive method), the investigators observe the behaviors of participants without interfering. For example, epidemiological researchers observed consistently that vegetarian groups in the United States and overseas have lower blood pressure than nonvegetarians in most studies. The term *vegetarian* includes several heterogeneous groups, but in general, vegetarian diets are usually high in whole grains, beans, fruits, and vegetables, and sometimes fish, dairy products, and eggs. The aspects of the vegetarian diet that have been observed to be protective against hypertension include low intake of animal products and high intake of potassium, magnesium, fiber, and (sometimes) calcium.[52]

Counting Cases or Events

Counting cases is a descriptive epidemiological method sometimes useful for health policy. It can be used to know the number of people with a particular characteristic or number of events that occurred in a given region or community. For example, the migration studies of indigenous populations showed that the prevalence of hypertension increased because of urbanization. With urbanization, people consumed more processed foods and less fresh foods (that were previously available). In addition, researchers observed lifestyle changes (e.g., lack of physical activity, overeating) that caused increases in body weight, sodium intake, and dietary fat during the process of acculturation.[55]

Relating Cases or Events to Population at Risk

Inherent in the epidemiological method is the need for measuring the number of disease cases or events in a population and relating the number of cases to a population base. Cases that fit the case description are identified, counted, and correlated to time, place, and individuals. In reviewing 53 observational studies of calcium and hypertension, 5 studies were prospective and 48 were cross-sectional, of which 4 also contained a longitudinal component. Various dietary methodologies were used; the most common was the 24-hour dietary recall. Most studies controlled for age, sex, and BMI, with variable control for other confounding variables.[56] Together, these studies showed only modest associations between calcium and blood pressure. But in the beginning, the higher calcium and magnesium content of "hard" water, and its relation to cardiovascular mortality, triggered epidemiological inquiry into the relationship of both minerals to blood pressure.[57]

Making Comparisons

Another scientific approach epidemiologists use is making comparisons. The Dietary Approaches to Stop Hypertension (DASH) sodium multicenter trial, for example, was created to resolve the controversy surrounding sodium intake and blood pressure.[58] The effect of dietary composition on blood pressure is an important public health topic. The National Heart Lung and Blood Institute funded the DASH study, which compared the effects of three sodium levels on blood pressure versus a control. The subjects were asked to eat either a control diet typical of intake in the United States or the DASH diet, a diet rich in fruits, vegetables, and low-fat dairy foods; low in saturated fat, total fat, and cholesterol; high in dietary fiber, potassium, calcium, and magnesium; and moderately high in protein. Within each diet (control and DASH), subjects ate foods with high, intermediate, and low levels of sodium. The investigators found that reducing the sodium intake from the high to the intermediate level reduced systolic blood pressure by 2.1 mm Hg.[58,59] Reducing the sodium intake from the intermediate to the low level caused additional reductions of 4.6 mm Hg on the control diet and 1.7 mm Hg on the DASH diet. The effects of sodium intake were observed in those subjects with and without hypertension, all races, and both women and men. Compared to the control diet with the highest sodium level, the DASH diet with the lowest sodium level reduced systolic blood pressure by 8.9 mm Hg in subjects with hypertension and 7.1 mm Hg in those without hypertension.[56]

In another comparative study, the Caucasian Prospective Investigation into Cancer and Nutrition (EPIC) study recruited 20,343 participants for a cohort study. The participants had no hypertension. The investigators examined whether the Mediterranean diet (see the Successful Community Strategies feature in this chapter), and olive oil in particular, can reduce blood pressure. Results showed that intakes of olive oil, vegetables, and fruit were associated with a reduction in blood pressure

whereas intakes of cereals, meat and meat products, and alcohol were associated with higher blood pressure.[60]

In addition, another study conducted a 1-year randomized controlled trial to determine the degree to which dietary change is influenced by providing seven home-delivered therapeutic meals weekly to adults age 60 years or older with hyperlipidemia or hypertension. Fifty percent of participants received seven therapeutic meals per week for 12 months. The nutrients that make up the DASH diet were measured using 24-hour food recalls at baseline, 6 months, and 12 months. Results showed that delivery of seven DASH meals per week increased compliance with dietary recommendations among noncompliant older adults with cardiovascular disease.[61]

Developing the Hypothesis

The hypothesis or research question is an assumption written in a clear, concise manner about what the investigator thinks will happen in the research project. For example, after reviewing the results of the migration studies and the vegetarian group's studies in the United States, researchers developed the hypothesis that diets low in sodium and high in fruits, vegetables, and fiber can reduce blood pressure.

Testing the Hypothesis

In testing the hypothesis, research observations have shown a direct relationship between higher sodium intake and higher blood pressure across population groups.[9,13] The INTERSALT study (International Study of Salt) measured the relationship between 24-hour urinary sodium excretion and blood pressure in 10,079 men and women from 52 centers around the world.[13] Results showed a positive relationship between mean urinary sodium excretion and blood pressure; that is, the participants' blood pressure increased with an increase in sodium excretion. A slight positive relationship also was observed when the researchers adjusted for alcohol and BMI. The researchers also reported a strong positive relationship between sodium intake and the slope of blood pressure increase with age across populations, indicating a role for sodium in age-related blood pressure increase.

In a recent reanalysis of the original INTERSALT data, corrected for measurement error due to the use of single 24-hour urine collections, results were stronger: a 100 mmol/day (2,300 mg sodium) increase in urinary sodium was associated with an increase of 3 to 6 mm Hg in systolic blood pressure and of 0 to 3 mm Hg diastolic blood pressure.[62,63] In a meta-analysis of observational studies, Law et al.[64] reported stronger results than INTERSALT, especially in the elderly and those with higher baseline blood pressures, but diet and other variables were not assessed in a standard manner across studies.[9]

Drawing Scientific Inferences

The data showing that diet modification can prevent and lower blood pressure are significant. The intervention approaches and methods involved in some data collection are still being clarified. Because of a variety of research design limitations, inadequate statistical power, and measurement issues, studies of single nutrients (except for potassium) have mainly been inconsistent.[65] However, when several nutrients, lifestyle, or dietary factors are combined in the same intervention studies, as in the DASH study, blood pressure was effectively reduced.[66] It has been shown that nutrients have interactive effects when they are consumed together in a diet.[62] In addition to the DASH dietary pattern, other factors such as reduced sodium intake, weight loss, and moderate alcohol intake have been shown to reduce blood pressure. Simultaneous observance of several recommendations (as with the DASH diet) is likely to be the best strategy for preventing and lowering blood pressure. Future research should center on methods to motivate and maintain dietary changes for controlling blood pressure, plus address the unanswered nutritional hypotheses.

The implication of these findings is that the success of dietary intervention depends on support from clinicians, government agencies, private institutes, and industries at both the population and individual levels. In particular, industries can improve the nutritional value of the food supply, such as reducing the sodium and fat content of processed foods; this is a very critical role in implementing dietary changes. Dietetic and other healthcare professionals must also play a significant role in educating the public and promoting adherence to nutritional guidelines for the prevention of hypertension and other health conditions.[16,67]

Conducting Experimental Studies

Another scientific approach that epidemiologists use is conducting experimental studies. One such study examined the effects of garden-based nutrition education on adolescent fruit and vegetable consumption. Sixth-grade students at three different elementary schools were used as a control group and two treatment groups. Students in the treatment groups participated in a 12-week nutrition education program, and one treatment group also participated in garden-based activities. Students in all three groups were required to complete three 24-hour food-recall workbooks before and after the intervention. Results showed that

adolescents who participated in the garden-based nutrition intervention increased their servings of fruits and vegetables more than students in the control groups. Also, the experimental group's vitamin A, vitamin C, and fiber intake increased significantly.[68]

In an analytical research design, the aim is to evaluate hypotheses based on existing knowledge or findings. The DASH trial, discussed earlier, was a randomized, multicenter, controlled feeding study to compare the effects of three dietary patterns on blood pressure. The control group consumed fruits and vegetables and a combination diet (having less total fat, less saturated fat, and less cholesterol than the fruit and vegetable diet or the control diet). The dietary patterns differed in selected nutrients hypothesized to alter blood pressure. This study examined the food-group structure and nutrient composition of the study diets and participant nutrient consumption during the intervention. Participants consumed the control dietary pattern during a 3-week start-up period. They were then randomized either to continue on the control diet or to change to the fruits and vegetables or the combination diet for 8 weeks. Sodium intake and body weight were constant during the entire feeding period. Analysis of variance models compared the nutrient content of the three diets.

Targeting a few nutrients thought to influence blood pressure resulted in diets that were very different in their food-group and nutrient composition. The control and fruits and vegetables diets contained more oils, table fats, salad dressings, and red meats and were higher in saturated fat, total fat, and cholesterol than was the combination diet. The fruits and vegetables and combination diets contained relatively more servings of fruits, juices, vegetables, and nuts/seeds, and were higher in magnesium, potassium, and fiber than was the control diet. Both the fruits and vegetables and combination diets were low in sweets and sugar-containing drinks. The combination diet contained a greater variety of fruits, and its high calcium content was obtained by increasing low-fat dairy products. In addition, the distinct food grouping pattern across the three diets resulted in substantial differences in the levels of vitamins A, B_6, C, and E; folate; and zinc.[69]

FIGURE 3-2 presents examples of the scientific method used by epidemiologists.

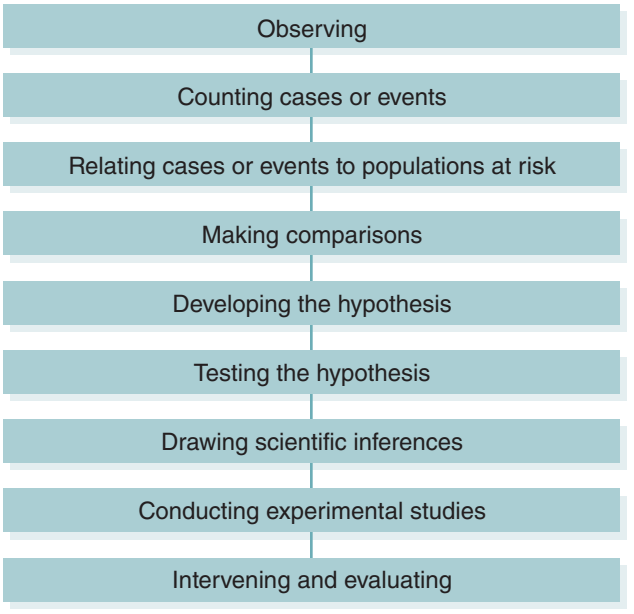

FIGURE 3-2 Examples of the scientific method of epidemiologists.

Quantitative and Qualitative Methods

The methodologies appropriate for answering the research question need to be considered. Quantitative methods have been the standard methodology used in nutrition research because they depend on isolation of one or more variables that can be measured and analyzed statistically. In quantitative (objective) research, random sample surveys and structured interviews are used to collect mostly quantifiable data that are analyzed using statistical techniques. This method promotes gathering data that can be verified by another researcher and generalized to other populations. Deductive reasoning, objectivity, quasi-experiments, statistical techniques, and control characterize these methods.[70]

Although many nutrition research questions are open to traditional methodologies, others require a different approach. There is a growing acceptance of nutrition science as a composite of different viewpoints and varied research methodologies.[70,71] Although recognition of qualitative (subjective) methods for scientific study is relatively recent in nutrition literature, they began to be used in the United States during the late 1800s.[5] Qualitative strategies were used to reveal the rapidly developing social problems in cities at that time caused by industrialization, urbanization, and mass immigration. Munhall and Boyd[72] stated that qualitative descriptions encouraged social change by making urban problems visible to the public.

Qualitative methods may be more beneficial for a particular incident being studied. For example, qualitative approaches are rarely appropriate in genetic engineering but may be appropriate when analyzing a social behavior, such as food choice and dieting. They use semi-structured or interactive interviews to collect data relating to people's judgments, attitudes, preferences, priorities, and/or perceptions about a nutrition issue; the data are then analyzed through sociological

or anthropological research techniques. Inductive reasoning, subjectivity, discovery, description, and the meaning of an experience to an individual or groups typify qualitative methods.[73]

Both quantitative and qualitative data collection methods can be combined in a single research study. This is known as a mixed method study. For example, adding subjective and open-ended questions to a standard household survey could provide a better approach to defining and measuring poverty.[74] The use of mixed methods will increase as the ability to acquire and analyze large amounts of quantitative data improves along with improvements in electronic technologies. For example, it is now possible to measure and record in an accessible database every step and movement made by an individual, as well as every word he or she speaks and hears.[74]

An example of research that utilized both quantitative and qualitative methods was a study that examined the awareness and acceptability of brown rice in Chinese adults, and the possibility of introducing brown rice into their diet. This was part of a large, long-term randomized clinical trial to lower the risk for acquiring type 2 diabetes. The authors used questionnaires (quantitative) and focus-group discussions (qualitative) to collect data from participants, who resided in Shanghai. The focus group discussion was about their dietary preferences, purchasing practices for specific varieties of rice, and their knowledge and awareness of brown rice. Ninety-four percent of the participants consumed white rice daily; only 8 percent of the participants had previously consumed brown rice. Before tasting, most participants considered brown rice inferior to white rice in terms of taste and quality. However, after tasting brown rice and learning about its nutritional value, the majority indicated greater willingness to consume brown rice. The main barriers to acceptance were the perception of rough texture and unpalatable taste, as well as higher price. All participants suggested that large-scale promotion was needed to change societal attitudes toward brown rice. In addition, most of the participants articulated their willingness to participate in a future long-term brown rice intervention study. These results provided valuable information for the design of the future brown rice intervention trial and highlighted the importance of increasing awareness about the nutritional value of brown rice.[75]

Another example is a community audit qualitative and quantitative research method in which researchers drive through a community to observe its physical and social attributes, mainly through windshield tours and **ground truthing**. Ground truthing is a verification process that uses data gathered by direct observation to validate data gathered from secondary sources.[76] This method was used to conduct research in 10 communities in a rural eastern North Carolina county. The purpose of the study was to describe an approach to conducting a community audit (consisting of windshield tours and ground truthing) to compute resources, to assess community characteristics, and to inform revisions to a community guide on nutrition and physical activity resources. Community audits have been used for epidemiological studies and in program planning for health-promotion interventions.[77] In this study, the researchers used Google Earth mapping software to examine commercial and residential districts for the presence of sidewalks using both aerial and street-level views. They also determined the number of fast-food restaurants through the Reference USA business database. The researchers compared their observations on community characteristics with available secondary data sources to examine the level of agreement. The initial resource guide included 42 resources; the community audits identified 38 additional resources. Results showed that there was moderate to high agreement between windshield tour observations and secondary data sources for several community characteristics, such as number of fast-food restaurants (67 percent agreement) and existence of sidewalks (100 percent agreement). Moreover, the audit resulted in an enhanced understanding of the related barriers and facilitators to lifestyle change. The techniques presented in this article may serve as a model for health-promotion professionals in other rural communities.[76]

Types of Sampling

Regardless of the type of research methodology, the research questions and methodologies chosen must guide the plan for data analysis. It is helpful to identify the computer software that will assist with data analysis and decide how results will be presented. For example, the researcher may want to prepare tables for the data once they are collected. These tables will help ensure all the data necessary for answering the research questions have been collected.

The research questions and plan for data analysis will guide sample selection and size. There are many methods of sample selection, but two will be considered here: random and deliberate sampling. **Random sampling** means that every case or participant has an equal opportunity to be included in the study.[5] For example, first the target group or community is informed about the research study's purpose/aim, as well as its risks, and is asked to participate. Then, individuals consenting to participate in the study are assigned randomly to one, two, or more treatment or intervention groups. The individuals randomized to receive the standard intervention treatment serve as the control group. The main

TABLE 3-4 The Nine Steps for the Development of a Questionnaire

Steps	Examples
Decide the information required.	Dietary behavior, cultural influence, physical activity, food insecurity
Describe the target participants.	Pregnant women, teenagers, children, older adults, households, college students
Select the research methodology appropriate for the target participants.	Food frequency questionnaire, 24-hour questionnaire, and others
Decide on question content.	Nutrient intake, physical activity levels, food availability, demographics
Develop the question wording.	Avoid technical terms and jargon, be clear and concise, measure one thing per question, avoid leading questions
Put questions into a meaningful order and format.	Administer by telephone, in-person, online, mail.
Check the length of the questionnaire.	Keep the questionnaire short
Pretest the questionnaire.	Administer the questionnaire to a few participants for feedback and modification
Develop the final survey form.	Getting the permission from participants. If it is online, how it looks, consider the readability

factor is random assignment; that is, chance determines the intervention assignment. **Deliberate sampling** means that specific target groups or communities are invited to participate in the study.[5] The choice of research methodologies will determine the characteristics of the sample population.

After consultation with a statistician, the researcher determines the factors, such as the sample size, gender, and age range. The researcher may use power analysis software to help determine sample size. Most of the time, it is impossible to know the exact number of people living in the community being studied, so the nutritionist may estimate the total population based on census data.

General Rules for Writing Survey Questions

In addition, the nutritionist may need to write or modify an existing questionnaire for collecting data from the targeted community. The general rules for writing a survey questionnaire include, but are not limited to, the following[78]:

- Measuring the fundamental concept it is intended to obtain
- Must not measure other concepts
- Must mean the same thing to all respondents
- Must determine the hypotheses around which the questionnaire is to be designed

TABLE 3-4 presents nine steps involved in the development of a questionnaire.[79,78]

Concepts of Collaborative Research

Collaboration is very important in research and sometime is required for community types of grants. Collaboration involves mutual participation in decision making and working with others toward a common goal. It is a process of joint decision making in an atmosphere of shared respect and cooperation.[73] Collaboration should always involve interaction among community nutritionists, clients, and other healthcare practitioners. Nutrition professionals work as members of a team in all healthcare settings. In community nutrition settings, the nutritionist is part of a multidisciplinary team that includes other healthcare workers, as well as community organizations, social service agencies, and the judicial system. The multidisciplinary team can conduct research studies that can benefit the public. The need for collaborative research is especially

strong now due to the prevalence of health disparities in the United States. In addition, there is a belief that partnerships between researchers and community members can contribute not only to the ability of communities to effectively address local issues, but also to the development of new knowledge.[80,81]

Successful collaboration requires that the multidisciplinary team develop a common purpose, communicate to coordinate efforts, and recognize the unique and complementary skills possessed by each team member. Each team member brings special abilities and expertise to the collaborative process. Collaboration does not work when one team member designs a research project or nutrition program and then "coordinates" by informing others of the plan. For a nutrition program or research to be successful, collaboration must be a joint effort on the part of the clients and all team members to identify mutual goals and acceptable means for meeting those goals.[82]

Although they do share some similarities, collaboration and coordination are different. **Coordination** is the act of managing interdependencies among activities. It is the ability to manage services without gaps or overlaps.[80] The nutritionist, as coordinator, may or may not consult others when carrying out a management function. Collaboration, on the other hand, involves joint decision making between two or more people.

Collaboration also can enhance the opportunity for obtaining grant money. Many granting agencies encourage collaborative efforts. A community nutritionist can collaborate with statisticians, epidemiologists, nurses, social workers, physicians, and colleagues to complement his or her nutrition expertise.[39] Collaboration is especially helpful for a new university faculty member, first-time grant seeker, or nutritionist who wants to change his or her focus area of research. Community nutritionists can find collaborators by networking with colleagues and community members and communicating with other professionals or experts in the area of interest.

Amuwo and Jenkins[81] outlined four distinct phases necessary for successful partnership building in community-based research, based on their experiences with collaborative work: networking, cooperation, collaboration, and partnership. Within these four phases, they identified 12 concrete, systematic steps that a partnership-building effort must complete in a rather sequential order, as follows[81]:

1. Involve the community early so they can see the importance of the program.
2. Be aware that partnership building is a nonlinear procedure.
3. Recruit and empower important community-based personnel.
4. Conduct a community needs assessment (both human and capital resources).
5. Recognize that other grassroots community organizations are potential partners.
6. Recruit community-based staff.
7. Engage in strategic planning.
8. Meet training needs.
9. Involve other relevant community members, public institutions, and organizations.
10. Communicate and pursue research and service agendas at the community level.
11. Facilitate the transfer of knowledge.
12. Maintain trusting and collaborative relationships.

Reporting Research Results

Reporting research findings is an essential aspect of conducting research activities. Reporting the results of research outcomes in professional journals and at professional meetings facilitates the growth and use of nutrition knowledge. By applying research results, nutritionists can institute social change. Policy makers, other professionals, and the community can then learn that the research findings are relevant and applicable. The results of a study involving the community could support expansion of community or public health nutrition services. The nutrition profession is in urgent need of research documenting the cost effectiveness of nutrition care. Effectiveness, however, can be measured in many ways beyond cost, including quality of care, client satisfaction, and the ability for a person to maintain independence.[83]

Epidemiological Approaches to Community Health Assessment

The changing disease patterns throughout the world are linked to changing lifestyles. One of the functions of epidemiological approaches is to determine the etiology or cause of the disease or risk factors for the disease. One way that epidemiologists study the cause and effect of disease is through a three-sided conceptual model known as the epidemiological triangle.[5] This model explains how changes in one element can influence the occurrence of a disease by increasing or decreasing an individual's risk for the health condition.

The Epidemiological Triangle

The epidemiological triangle explores health and disease using three elements: an agent, a host, and an environment (each of which is discussed in this section).

All three of the components of this model are of equal strength. **FIGURE 3-3** shows the model in its normal state of equilibrium. Equilibrium does not mean optimal health, but it does signal the usual patterns of illness and health in a population. Any change in one of the components (agent, host, or environment) will result in disequilibrium (i.e., a change in the usual patterns).[6]

The nutritionist using the epidemiological triangle in a situation such as teenage obesity might focus on diet as the agent causing teenage obesity. However, behavior also could be a factor. An example of a behavioral factor is a sedentary lifestyle that promotes weight gain. The nutritionist would strive to determine whether there has been a change in any of the possible agents.

The host factors are personal characteristics of the teenage population who are at risk for obesity and other health-related conditions, such as diabetes. The personal characteristics include age, ethnicity, gender, socioeconomic status, eating patterns, exercise behavior, and lifestyle. Some personal characteristics, such as gender, age, and ethnicity, are not modifiable, but others are. Characteristics that can be changed include nutritional status, physical activity, and income level. By evaluating these factors, it may be possible to identify groups of teenagers who are at an increased risk for dying from obesity-related health conditions.

Finally, the environment must be assessed. Environmental factors are external factors that encompass an agent and a host. They may be exclusively physical, such as climate or surroundings (e.g., an urban housing area in the Midwestern United States). An environmental factor also may have multiple levels, such as low, middle, and high socioeconomic status. Low socioeconomic status is associated with the reduced availability of health and social services.[84] High socioeconomic status is associated with excessive behaviors, such as heavy drinking, overeating, and risk taking.[85,86]

The analysis of these three areas—agent, host, and environment—should provide information regarding groups at risk for increased rates of obesity and may provide direction toward a program aimed at reducing the risks. Therefore, the epidemiological triangle can provide a useful guide for investigating different health problems of teenage obesity, as well as other health problems.

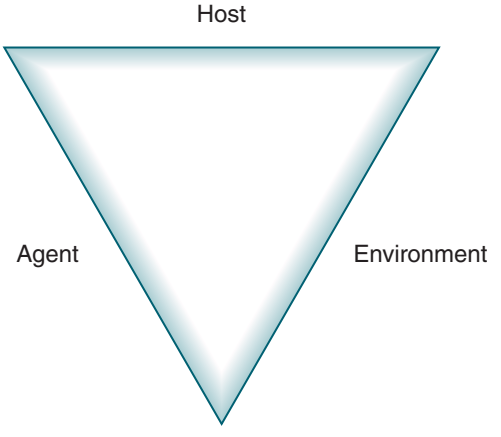

FIGURE 3-3 Epidemiological triangle model.
Modified from: Stanhope M, Lancaster J. *Community and Public Health Nursing*. 5th ed. St. Louis, MO: Mosby; 2000.

Successful Community Strategies

EPIC Elderly Cohort Research Study[87-97]

The Mediterranean diet has been reviewed in many studies because several of its components have been related to decreases in common chronic diseases. Ecological evidence suggests that such a diet may be beneficial to health, and variants of this diet have improved the prognosis of patients with coronary heart disease. The Mediterranean diet is characterized by a high intake of vegetables, legumes, fruits, and cereals; a moderate to high intake of fish; a low intake of saturated lipids but a high intake of unsaturated lipids, particularly olive oil; a low to moderate intake of dairy products, mostly cheese and yogurt; a low intake of meat; and a modest intake of ethanol, mostly as wine. Several studies have reported that a diet that adheres to the principles of the traditional Mediterranean diet is associated with longer survival. Trichopoulou and Vasilopoulou[87] used a 10-unit dietary score to determine whether adherence to a Mediterranean diet was associated with a longer life expectancy among elderly Caucasians. However, several studies have used variations of this score and reported opposite associations with overall mortality. These studies, however, relied on small samples of mostly elderly participants or only on the Greek population.

The Caucasian Prospective Investigation into Cancer and Nutrition (EPIC) study used a multicenter, prospective cohort study to investigate the role of biological, dietary, lifestyle, and environmental factors in cancer and other chronic diseases and to examine whether adherence to the modified Mediterranean diet, in which unsaturated fats were substituted for monounsaturated fats, is associated with longer life expectancy among elderly persons.

Between 1992 and 2000, 519,978 healthy volunteers were recruited in 23 centers from 10 European countries (Denmark, France, Germany, Greece, Italy, the Netherlands, Norway, Spain, Sweden, and the United Kingdom). After initial

(continues)

Successful Community Strategies (continued)

screening, only 74,607 individuals were included in the study. Data were collected from participants ages 60 or over. Information on the vital status of participants was obtained from mortality registries and by active follow-up. The earliest and latest years of follow-up were 1999 (some participants in the Netherlands) and December 2003 (most of the centers). Participants were classified as alive at last follow-up, dead, emigrated, refused to participate further, or unknown.

Dietary intakes were assessed through compatible instruments (food frequency questionnaires and, in some centers, records of intake over 7 or 14 days) that had been developed and validated within each center. In addition, a computerized instrument for recall of dietary intake over 24 hours was developed to collect information from a standardized random sample of the aggregate cohort. The aim was to calibrate the measurements across countries.

Nutrient intakes were calculated using food composition tables specific to the country. Fourteen food groups and nutrients were considered: potatoes, vegetables, legumes, fruits, dairy products, cereals, meat and meat products, fish and seafood, eggs, monounsaturated lipids, polyunsaturated lipids, saturated lipids, sugar and confectionery (candy, pastry, etc.), and nonalcoholic beverages.

Results showed that an increase in the modified Mediterranean diet score was associated with lower overall mortality. When dietary exposures were calibrated across countries, the reduction in mortality was 7 percent (ranging from 1 to 12 percent). The study concluded that the Mediterranean diet, modified so as to apply across Europe, was associated with increased survival among older people.

Children and Adolescents, National Health and Nutrition Examination Survey[98]

The National Health and Nutrition Examination Survey (NHANES) is designed to assess the health and nutritional status of adults and children in the United States. The survey is a combination of interviews and physical examinations. The objective of this NHANES study was to describe perceptions of child weight status among U.S. children, adolescents, and their parents and to examine the degree in which personal and parental perception of weight status is associated with self-reported attempted weight loss.

The sample included 2,613 participants aged 8–15 years in the NHANES from the two most recent consecutive cycles (2007–2008 and 2009–2010). Classifications of weight perception were developed by comparing measured to perceived weight status. Multivariable logistic regression analyses were used to examine the association between weight misperception and self-reported attempted weight loss.

Results showed that among children and adolescents, 27.3 percent underestimated and 2.8 percent overestimated their weight status. Among parents, 25.2 percent underestimated and 1.1 percent overestimated their child's weight status. Logistic regression analyses showed that the odds of self-reported attempted weight loss was 9.5 times as high among healthy-weight children and adolescents who overestimated their weight status as among those who perceived their weight status accurately; the odds of self-reported attempted weight loss were 3.9 and 2.9 times as high among overweight and obese children and adolescents, respectively, who accurately perceived their weight status than among those who underestimated their weight status. Parental misperception of weight was not significantly associated with self-reported attempted weight loss among children and adolescents who were overweight or obese.

The authors recommended that to prevent childhood obesity both children and parents should be included in the education regarding the appropriate identification and interpretation of actual weight status. Interventions for appropriate weight loss can target children directly because of the child's perception of his or her weight status.

Learning Portfolio

Chapter Summary

- A community nutritionist is a member of a multidisciplinary team and can conduct research studies that can benefit the public.
- Epidemiological and demographic measures and research methods are used to study nutrition and health-related conditions.
- Measures of incidence and prevalence provide different information and have different implications. For instance, an increase in the prevalence of diabetes or breast cancer means that there are more persons with these health conditions in the population.
- Successful collaboration requires that the multidisciplinary team develop a common purpose, communicate to coordinate efforts, and recognize the unique and complementary skills possessed by each team member.
- The three components of the epidemiological triangle model are agent, host, and environment, and they are used to explore health and disease.

- In experimental studies, the investigator has control over participants, procedures, and exposures.
- Epidemiology is the study of associations, and statistical methods are used to test the associations. The existence of a statistically significant association does not indicate that the observed relationship is one of cause and effect. Causality is supported when a number of studies that are conducted at different times, using different methods, and performed among different populations show similar results.
- In quantitative research, random sample surveys and structured interviews are used to collect quantifiable data; qualitative research analyzes social behavior such as food choice and dieting.

Critical Thinking Activities

- Identify a research study in the literature relevant to community and public health nutrition. Then identify the strengths and limitations of the research.
- Communicate/present the research findings in class.
- Meet with the librarian as a class/group and learn how to use the Medline database; ERIC database; CINAHL database; Ingenta: The Global Research Gateway (http://www.ingenta.com), a portal to online information around the world; and other search engines for finding grant sources.

CASE STUDY 3-1: Collaboration Efforts Between Nutrition Students and Business

Damian and Monica, two senior baccalaureate nutrition students in a community nutrition course, had their community outreach experience at a rural community clinic. They were involved with the owner of a local candy factory in planning for disease prevention and health promotion activities for the employees. After consulting with the faculty member responsible for the course and the director of the community clinic, they designed a survey to distribute to employees to assess their needs for health education programming. The students submitted the survey, which included blood pressure screening, to the nutrition professor for approval before distributing it to the employees. The students also reviewed the medical records of the participants, with their consent.

Some of the employee priorities identified from the survey data that need to be addressed were the following problems:

- High blood pressure (160/90 on average)
- Smoking cessation (2 packs a day on average)
- Weight loss (average body fat percentage of 49 percent)
- High stress level

The students met with the factory owner, the faculty member, and a representative of the local chapter of the American Lung Association to plan for implementation of this initiative. A timeline was established to notify employees of an opportunity to participate in the weight loss, stress reduction, and smoking cessation program. This included notices distributed in employee paychecks and signs posted in prominent locations throughout the factory. The students discussed plans for conducting a research study related to implementation and evaluation of the weight loss, stress reduction, and smoking cessation program with the faculty member. The students collected a 3-day dietary record and observed that the participants consumed high-fat, high-sodium snacks and plenty of candy, mostly from the vending machine located in their break rooms. After reviewing their medical records with permission, data showed a fasting blood glucose level of 150/100 mg/dl.

Questions

1. What is community nutrition research?
2. What is the definition of epidemiology? Describe the methods of epidemiological studies. What kind of epidemiological study could Damian and Monica use for their proposed research study?
3. Describe each of the stages of the research process that Damian and Monica must understand.
4. What are the differences between collaboration and coordination? Who could Damian and Monica collaborate with (other than their current collaborators) on their new research study?
5. What is the epidemiological triangle? Describe a situation in which Damian and Monica could utilize the epidemiological triangle.
6. What is the difference between the quantitative and qualitative methods that Damian and Monica must know before they can carry out the project?
7. What are some of the negative implications of cigarette smoking?

(continues)

CASE STUDY 3-1: Collaboration Efforts Between Nutrition Students and Business

(continued)

8. What types of dietary assessments could be used in a cross-sectional research study? What type of dietary assessment would be useful for Damian and Monica's research study?
9. Describe the difference between incidence and prevalence that Damian and Monica must know before carrying out the project.
10. Work in small groups or individually to discuss the case study and practice using the Nutrition Care Process chart provided on the companion website. You can also add other nutrition and health-related conditions or assessments to the case study to make it more challenging and interesting.

Think About It

Answer: Qualitative research method

Key Terms

case-control study: Exposure and other characteristics of cases of the disease under investigation are compared with a control group of persons unaffected by the disease. The results are analyzed to acquire effect estimates.

cohort study: Groups of individuals, defined in terms of their exposures, are followed over time to see if there are differences in the development of new cases of the disease of interest (or other health outcome) between the groups with and without exposure.

collaboration: Working with others toward a common goal.

community nutrition research: Organized study of a trend at both the basic and more applied levels that focuses on social, structural, and physical environmental inequities through active involvement of community members.

coordination: Efficient management of services without gaps or overlaps.

cross-sectional study: Measures the prevalence of disease and measures exposure and effect at the same time.

deliberate sampling: Inviting specific people to participate in a study.

demography: An analytic tool used to measure a population by recording births, deaths, age distribution, and other vital statistics.

ecological study: Involves the investigation of a group of people, such as those living within a geographic area such as a region or state.

epidemiology: The study of the determinants, occurrence, and distribution of health and disease in a defined population. It studies scientifically the factors that affect the health of individuals in the community.

exposure: Characteristics or agents (e.g., food, medications, sunlight) that the participant comes in contact with that may be related to disease risk.

nutritional epidemiology: Study of dietary intake and the occurrence of disease in human populations.

random sampling: When every case or participant has an equal opportunity to be included in a study.

ground truthing: A verification process that uses data gathered by direct observation to corroborate data gathered from secondary sources.

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