

Part **1**

Introduction to Public Health Nutrition

Introduction to Public Health Nutrition

Natalie Stein, MS, MPH

“Let food be thy medicine and medicine be thy food.”—Hippocrates, 400 B.C.

Learning Objectives

- Define public health nutrition.
- Identify the role of public health nutrition in addressing the core functions of public health and the 10 essential public health services.
- Place public health nutrition in the context of global public health efforts.
- Recognize current and emerging global concerns in public health nutrition.
- Understand the roles of nutritionists and others who may be involved in public health nutrition efforts.

Case Studies: A Typical Monday in the Lives of Two Mothers

Case Study: Nicole, Los Angeles, California, United States

On this Monday morning in Los Angeles, California, 30-year-old Nicole wakes up at 5:00 a.m. to get ready for work. She lives with her 11-year-old son, John; her 3-year-old daughter, Paula; and her mother, Sarah, in a two-bedroom apartment. Nicole is a single mother.

Nicole leaves the apartment at 5:30 a.m. She rarely takes breakfast with her to work because she is in a rush and she knows that she can quickly get an inexpensive breakfast sandwich or burrito at any of the fast-food restaurants near her workplace, a courthouse in Los Angeles about

10 miles away from her mother’s apartment. John participates in the national **School Breakfast Program (SBP)** and **National School Lunch Program (NSLP)**, and will eat a free breakfast at school, probably including cereal, a breakfast sandwich or burrito with cheese, egg, and sausage, or pancakes or waffles with sausage and syrup. After he leaves for school, Sarah will have fried eggs, with toast, and give her granddaughter cereal and whole milk. For lunch, the two of them usually have sandwiches with processed meat and American cheese, peanut butter and jelly sandwiches, or tortillas filled with ground beef and cheese. Sometimes they add some canned vegetables or potato chips. Sarah and Paula both enjoy oranges, bananas, and watermelon for snacks. Common options for John’s school lunch include pasta with meat, turkey burgers, and sandwiches, served with a vegetable, a fruit, and reduced-fat milk.

Nicole does not have a car, so she walks a couple of blocks to the bus stop, catches the bus, and walks three blocks at

the other end. She works as a cashier and dishwasher in a cafeteria in the basement of the courthouse from 6:30 a.m. to 3:30 p.m., Monday through Friday. She wishes that she could stay home with Paula as she did with John when he was little, but knows she can count on her mother to take good care of her. At work, Nicole gets free soft drinks and a \$5 credit to use at the cafeteria for lunch. She usually gets the daily special, often a fried chicken sandwich or hamburger that comes with onion rings or French fries.

When she gets out of work, Nicole takes the bus back to her neighborhood. Because her neighborhood has a high crime rate, she is always grateful that her work hours allow her to get home before dark. On her walk home from the bus station, she buys a beef tamale from a local Mexican fast-food restaurant for her mother to take for dinner. Sarah leaves for her evening job as a custodian in a local elementary school, and Nicole gets to spend the evening with John and Paula. For dinner, Nicole makes macaroni and cheese from a box and serves it with frozen greens that she serves with butter.

After John finishes his homework and he and Paula go to bed, Nicole watches television to help her relax. She has a few cookies during the evening before going to bed at 10:30 p.m. Her mother will be home around 11:00 p.m. Sometimes Nicole thinks about going back to school, as she used to dream of, but she does not see how it can be possible when she and her mother are both working minimum-wage jobs to provide for John and Paula.

With a **body mass index (BMI)** of 31, Nicole is classified as obese. Since she has no health insurance and rarely visits a doctor, she does not know that her blood sugar levels are in the category of prediabetes. John is of normal weight, but Paula is already overweight. Sarah is also obese, and is on medications to control her high blood pressure.

Case Study: Buseje, Shire Highlands, Great Rift Valley, Malawi

On this same Monday morning, Buseje wakes up at dawn, 10,000 miles away from Nicole and Paula. She lives in a two-room thatched hut with her husband, her 8-year-old daughter, her 5-year-old son, and the 4-year-old boy who used to be their neighbor. Now, he is an orphan; the boy's mother died giving birth to him, and his father died from malaria last year. Buseje treats him like one of her own children, as is typical of how members of this community care for each other. He is about the same age as her second daughter would have been if she had not succumbed to malaria at the age of 2 years.

ED/AU: should this be Nicole and Sarah? or Nicole and her family?

Millennium Development Goal 6: Combat HIV/AIDS, Malaria and Other Diseases. Target 6.C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

Reproduced from the United Nations. (n.d.). 2015 Millennium Development Goals. Retrieved from <http://www.un.org/millenniumgoals/>. Accessed August 13, 2013. This source is used for all Millennium Development Goals in this chapter.

Buseje makes breakfast for the family over the fire outside their home. They have a watery gruel, called *nsima*, made with corn meal. She gives the children and her husband some tea with sugar. She does all of the cooking over a fire in an adjacent room; only 9% of Malawi has electricity, and rates in rural areas range from 1–3% of households.¹ Her daughter joins the village schoolchildren as they pass by Buseje's hut on their walk to school. When there is too much work to be done at home, Buseje's daughter skips school. Although public school is free in Malawi, half of schoolchildren do not complete fourth grade.²

Millennium Development Goal 5: Improve Maternal Health. Target 5.A: Reduce by three-quarters the maternal mortality ratio

Buseje always puts the needs of her children and husband before her own needs. The warm, humid season in Malawi goes from November to April, and today, a day in October, marks the sixth month without rain. The family has been without much dietary diversity for weeks now. They still have plenty of corn and cassava, but not much else. Buseje suffers from iron-deficiency anemia, which makes her tired and susceptible to infections. Her children are already deficient not only in iron, but also in vitamin A. **Stunting** and **wasting** remain prevalent despite the nutrition rehabilitation units that are part of the World Food Programme's Country Program to fight malnutrition in Malawi.³

Millennium Development Goal 1: Eradicate Extreme Poverty and Hunger. Target 1.A: Halve, between 1990 and 2015, the proportion of people who suffer from hunger

During the day, Buseje watches the younger children. They feed the chickens, gather firewood, and then go to the market, where Buseje exchanges some fish for some fruit. After a lunch of more *nsima* and fruit, Buseje repairs a hole in the roof of their thatched-roof hut. This will help them stay dry during the coming rainy season. Buseje's daughter comes home from school, and her husband returns

from the village, where he spent the day with the other men from the village. Buseje and her daughter serve *nsima*, some goat meat, and tea with sugar.

Discussion Questions

- Which nutritional concerns and associated health consequences do the women and their families face?
- What are the underlying causes of suboptimal diets and health for Nicole and Buseje?
- Which public health programs are available to assist the two women and their families?
- Which nutritional challenges do Nicole, Buseje, and their respective families face due to economic, racial/ethnic, geographic, gender, and other disparities?

Introduction

Adequate food and water are basic human needs. Sufficient energy (measured in calories), protein, fat, carbohydrates, water, vitamins, and minerals are necessary for preventing deficiencies, allowing proper growth, maintenance of body weight, and physiological function. Nutritional status is a significant determinant of health status. Malnutrition was, until recently, the main nutrition concern worldwide. Overnutrition, associated with obesity and chronic diseases, has now emerged as a significant and growing threat. Some regions simultaneously experience the presence and effects of undernutrition and overnutrition.

Each day consists of actions that affect dietary intake and nutritional status, but, as the above case studies illustrate, individual dietary behaviors vary greatly. Dietary patterns such as high consumption of added sugars, solid fats, and sodium, and low intakes of vegetables and whole grains put Nicole, and her family, at risk for obesity and chronic diseases that are prevalent in the United States and other industrialized nations. In contrast, Buseje's diet, frequently consisting of low energy intake and insufficient micronutrients due to poor dietary diversity, places her at risk for **underweight**, infections, and nutrient deficiency diseases. Each mother in the case studies could improve her nutrition status with healthier diet choices, but these choices are not always within an individual's capacity. Factors interfering with optimal nutrition may include the following:

- Inadequate knowledge about nutrient needs and how to meet them.
- High food cost or low personal income, making nutritious foods unaffordable.

- Lack of availability of nutritious foods for reasons such as lack of roads or means of transportation, seasonal unavailability, drought, natural disasters, war, and inability to store food.

Public health targets populations, with the objective of improving individuals' lives. Public health nutrition programs can lead to improvements in each of the mothers' diets and nutritional status, as well as better health, increased productivity, and higher quality of life.

- Nutrition education programs could help Nicole improve her choices for herself and her family. Improvements can include choosing more vegetables and whole grains, ordering lower-fat, lower-calorie menu items, and getting more physical activity. These changes could help her maintain a healthy weight, thus lowering the risk for obesity-related diseases.
- Nutrition assistance programs could provide healthy foods and information on how to use them. Interdisciplinary programs can help reduce crime rates and improve neighborhood sidewalks. Helpful policies could include a requirement for workplace cafeterias to sell low-cost healthy foods. These programs could help Nicole, her mother, and her daughter to eat better and exercise more.
- More widespread nutrition and community-based livelihood programs could lead to increased availability of nutritious foods in Malawi, while increased gender equality could lead to a greater contribution from Buseje's husband and a proportionate share of the nutritious foods for Buseje.

This chapter defines public health nutrition using an accepted definition of public health as a foundation, and expands on the basic concept. The chapter will also introduce some of the current primary nutrition-related concerns worldwide and the scope of public health programs in addressing them. Finally, identification of various careers pertinent to public health nutrition can engage readers from a variety of backgrounds in the book's content and assist them in planning their own careers.

What Is Public Health Nutrition?

Public health does not have a formal universal definition; rather, it is often described by its theories, roles, objectives, and/or approaches. Charles-Edward A. Winslow, an influential American bacteriologist, was an early and strong

supporter of public health. His description from 1920 is still accurate today. According to Winslow, public health is:

the science and the art of preventing disease, prolonging life, and promoting physical health and efficiency through organized community efforts of the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance of health.⁴

Reproduced from Winslow, C. E. A. (1920). The untilled field of public health. *Modern Medicine*, 2, 183.

No single, universally accepted definition of public health nutrition exists, but it can be described by adapting Winslow's portrayal of public health to the arena of nutrition. This will be done in the following sections.

“the science and the art. . .”

Science is objective, and art is subjective. This description of public health is just as appropriate for public health nutrition. Nutrition is the study of nutrient digestion, absorption, transportation, metabolism, and storage in the body and excretion from the body. This science recognizes six classes of nutrients: water, carbohydrates, fat, protein, vitamins, and minerals. The objective nutritional sciences, drawing on sciences such as biology, biochemistry, and immunology, describe nutrient metabolism and function, human requirements for energy and nutrients, and food sources of nutrients.

As much as possible, public health nutrition programs should be evidence-based, the product of gathering evidence through scientific studies and critical appraisal of that evidence.⁵

Nutritional epidemiology generates data on nutrition and health outcomes in populations through observational studies and experimental trials. Epidemiologists study population-wide patterns, such as prevalence and changes in patterns, and investigate possible causes. Biostatisticians use data to assess and identify widespread nutritional deficiencies or unhealthy eating patterns, draw conclusions about potential relationships between dietary intake and health outcomes, monitor nutrient status in populations, and design and evaluate interventions.

Public health nutrition is a combination of science and art. Existing scientific evidence regarding a specific nutritional issue is not always complete or consistent; even when it is, the healthiest course is not always taken. Returning to the second case study as an example, gender equality generally is associated with increased societal productivity and better nutrition and health; however, persistent disparities in gender roles continue to harm Malawian families like Buseje's. The art of public health nutrition may be necessary to understand and overcome political, logistical, and cultural barriers before science-based public health nutrition interventions can be successful.

“... of preventing disease, prolonging life, and promoting physical health and efficiency. . .”

While clinical healthcare in general and clinical nutrition in particular focus on treatment and rehabilitation, public health and, more specifically, public health nutrition emphasize disease prevention and promotion of well-being. More than half of the world's population is malnourished and currently experiencing or at risk for experiencing nutrition-related diseases. Consumption of adequate quantities of nutritious food reduces protein-energy malnutrition and nutrient deficiency diseases and infectious diseases. In contrast, overnutrition leads to obesity, which affects 500 million adults worldwide⁶ and increases the risk of chronic diseases, such as type 2 diabetes, heart disease, and cancer, which are expected to threaten more than two-thirds of the world's population by 2020.⁷ Public health nutrition focuses on healthy eating to prevent these diseases and minimize their effects.

The availability and accessibility of sufficient healthy foods, and encouragement of people to eat them, fall within the domain of public health nutrition.

“... through organized community efforts. . .”

Community-based approaches allow programs to reach large numbers of people. A pediatrician's recommendation that a child be provided with more foods high in calcium and vitamin D, for example, may result in that child's parents seeking more food sources. On a larger scale, a national policy requiring that fortified milk, a high-calcium food, contain vitamin D, together with a national school meal program that includes vitamin D–fortified milk, can result

in improved calcium and vitamin D status for millions of schoolchildren.

A vitamin A supplementation program serves as an example of efforts that require careful organization as well as support by various community members to be successful. An intervention designed to reduce vitamin A deficiency among schoolchildren includes children who receive supplements, parents who encourage their children to take them, teachers who dispense the supplements, physicians to oversee local programs, public health educators to explain why the supplements are needed and how to take them, and government at various levels to regulate and administer the program.

Public Health Core Competency 4: Cultural Competency Skills 2: Recognizes the role of cultural, social, and behavioral factors in the accessibility, availability, acceptability, and delivery of public health services

Reproduced from Council on Linkages Between Academia and Public Health Practice. 2010 May. Core Competencies for Public Health Professionals. Washington, DC: Public Health Foundation. http://www.phf.org/resourcestools/Documents/Core_Competencies_for_Public_Health_Professionals_2010May.pdf. Accessed August 13, 2013. This source is used for all Public Health Core Competencies in this chapter.

Public Health Core Competency 5: Community Dimensions of Practice Skills 3: Identifies stakeholders

“... of the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene...”

A premise of public health is that individuals and communities require wholesome environments to be healthy. Interventions can include regulations on pollutants, vaccinations, and education on—and facilities for—handwashing. More specific to nutrition are clean water for drinking and irrigation and clean soil for crops. Prevention of nutrient deficiencies, such as vitamin A and iron, can reduce the impact of infectious diseases, such as diarrheal diseases, which currently kill millions of children annually worldwide. Education on handwashing and other personal hygiene measures can reduce foodborne illness. A clean environment

and personal hygiene can mitigate millions of annual cases of food poisoning and illness due to contaminated water.^{8,9,10}

“... the organization of medical and nursing services ...”

Health care is basic to health. To effectively reach the public, rather than just a privileged minority, medical and nursing services must be organized into functional health-care systems. Along with care facilities and medical supplies, infrastructure required to deliver the 10 essential public health services includes “a capable and qualified workforce,”¹¹ which can be achieved with a greater number and consistency of education programs for health professionals, such as more dietetics programs. “Up-to-date data and information systems” may include laws requiring better records as well as use of the latest technology, such as mobile health applications for smartphones that allow patients to remotely interact with dietitians to manage diabetes through diet. “Public health agencies capable of assessing and responding to public health needs” require funding to operate, authority to respond to needs, and regulations outlining administration and duties.

Healthy People 2020: Objective PHI 4: Increase the proportion of 4-year colleges and universities that offer public health or related majors and/or minors

Healthy People 2020: Objective PHI 8 (Developmental): Increase the proportion of Healthy People 2020 objectives that are tracked regularly at the national level

Reproduced from the U.S. Department of Health and Human Services. [Healthypeople.gov](http://www.healthypeople.gov/2020/default.aspx). Retrieved from <http://www.healthypeople.gov/2020/default.aspx>. Last updated July 30, 2013. Accessed August 13, 2013.

“... for the early diagnosis and preventive treatment of disease ...”

With its focus on prevention, public health can be thought of as “going upstream.” Rather than intervening downstream, when people are already in need of treatment, public health attempts to intervene upstream, nearer to the source of health threats, to promote favorable and prevent poor health outcomes as much as possible. **Primary prevention** targets healthy individuals to prevent diseases and their risk factors. An example is the mandatory addition of thiamin (vitamin B1), riboflavin (vitamin B2), and niacin

(vitamin B3) to fortified grains in the United States to prevent deficiencies of these nutrients among healthy adults. **Secondary prevention**, which often includes screening to enable early detection of risk factors, targets individuals with risk factors to prevent the disease from developing. With objectives including reduced mortality from heart disease and better management and awareness of blood cholesterol levels by patients and health professionals, the National Cholesterol Education Program (NCEP) promotes regular screening for and rapid treatment of high cholesterol levels, a risk factor for heart disease.¹² **Tertiary prevention** aims to prevent or delay complications of a disease. Children with night blindness, an early sign of vitamin A deficiency, can be given vitamin A supplements to prevent progression to permanent blindness and/or death.

Early diagnosis and preventive treatment are also evident in surveillance programs. National surveys for surveillance include the National Health and Nutrition Examination Survey (NHANES) in the United States¹³ and the China Health and Nutrition Survey (CHNS).¹⁴ Such surveys can expose trends such as changes in nutritional status and their potential relationships with social patterns, policy changes, and economic patterns. The United Nations Administrative Committee on Coordination/Subcommittee on Nutrition identifies long-term program planning, timely warning (for example, early warning of famine conditions to allow for implementation of emergency food aid), and program management as additional purposes of nutrition surveillance.¹⁵

“... and the development of the social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance of health.”

Public health nutrition programs are cooperative social efforts. They can include government at national, state, and local levels; private sector entities; families or other target populations; community leaders, such as religious leaders and nonprofit organizations. A school-based community garden program, for example, might be targeted toward elementary school children in a low-income neighborhood. In addition to involving the children and their teachers, the project might involve parents, who could volunteer to help with the gardening; local stores, which could donate seeds and tools; media, which could publicize the program; and local council members, who could advocate for continued funding.

The infrastructure supporting medical services must not only exist but be accessible in order to be effective for the public. Supplementary nutrition programs increase the likelihood of low-income households receiving enough food. Referral programs, such as the Women, Infants, and Children (WIC) program in the United States, can assess nutritional status of participants and refer to needed medical services. Developing nations may struggle to provide their communities with food or nutrition education for reasons including remoteness, political turmoil, and lack of adequate foods.

Core Functions and Essential Public Health Services

The **core functions** of public health are **assessment**, **policy development**, and **assurance**. The Institute of Medicine has identified 10 essential public health services that fulfill these functions.¹⁶

Essential Public Health Services and Examples Within Assessment

1. Monitor health status to identify community health problems.
Example: National surveys can assess diet intake and nutritional status measures to identify potential problems, such as obesity, nutrient deficiencies, and chronic disease prevalence.¹⁷
2. Diagnose and investigate health problems and health hazards in the community.
Example: Ongoing surveys can identify alarming trends, such as increases in obesity rates or nutrient deficiencies, or widening disparities between different communities.

Essential Public Health Services and Examples Within Policy Development

3. Inform, educate, and empower people about health issues.
Example: Messages regarding healthy food choices, such as encouragement to consume three high-calcium foods per day, delivered through media such as billboards, social media, and newspaper and television campaigns; in addition, healthcare providers can distribute similar messages via brochures provided by campaign leaders.

4. Mobilize community partnerships to identify and solve health problems.
Example: Health fairs are collaborative opportunities. Employers and local businesses can sponsor the events, schools can host them, healthcare providers can provide screenings and information on health resources, dietitians can supply educational materials on healthy eating, and children and parents can participate in activities such as healthy cooking classes, gardening, and a fun walk.
5. Develop policies and plans that support individual and community health efforts.
Example: To support a fortification program aimed at schoolchildren, the national government might require all schools to provide fortified foods in school meals in order to receive government reimbursement.
10. Research for new insights and innovative solutions to health problems.
Example: The Health Professionals Follow-up Study (HPFS)²⁰ and Nurses' Health Study,²¹ led by Harvard School of Public Health with funding from the National Cancer Institute, include more than three decades' worth of data investigating diet–disease relationships. This information can be used to develop policies and public health recommendations.

Courtesy of NPHPS/CDC.

Essential Public Health Services and Examples Within Assurance

6. Enforce laws and regulations that protect health and ensure safety.
Example: State and local health departments can regularly inspect¹⁸ providers that administer public health programs, such as food retailers that participate in the Supplemental Nutrition Assistance Program to supply low-income households with food.
7. Link people to needed personal health services and ensure the provision of health care when otherwise unavailable.
Example: Medicare, the U.S. federal health insurance program for adults over age 65 and individuals with disabilities, covers medical nutrition therapy for patients with diabetes whose doctors refer them, and diabetes management education and supplies for individuals with diabetes.¹⁹
8. Assure a competent public health and personal health-care workforce.
Example: Public health degree programs can include standardized objectives, such as the core competencies of public health.
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services.
Example: Regular program evaluation, which may consider cost-effectiveness; outcomes such as dietary intake, blood sugar, or serum folate; or program reach, can allow programs to be improved, expanded, and/or modified.

The Global Public Health Nutrition Landscape

International organizations, such as the World Health Organization (WHO) within the United Nations (UN), may coordinate emergency food aid and micronutrient supplement programs and work with communities and nations to implement successful programs.²² National and state governments collect surveillance data, provide technical assistance as needed, evaluate programs, and develop and enforce policies, such as allotment of funds for nutrition assistance programs. Local entities, such as local health departments, schools, and food banks, are responsible for directly supplying health services, such as enrollment for nutrition assistance programs, provision of school meals, and referrals to healthcare providers. Nonprofit and volunteer organizations, university extension programs, workplaces, and hospitals are additional partners in improving the public's nutrition.

Traditionally, the major global nutrition concern was undernutrition. Hunger and protein deficiencies cause mortality, stunting, wasting, and underweight, and impair immune function. **Micronutrient** deficiencies also increase risk of mortality and infections, and specific vitamin and mineral deficiency diseases have their own consequences. Better nutrition knowledge and public health programs, such as surveillance, food fortification, and nutrition education, have greatly reduced or virtually eliminated certain deficiencies in many parts of the world; for example, **pellagra**, or deficiency of niacin (vitamin B3), is rare among healthy Americans due to grain fortification programs, and mandatory universal salt iodination can effectively eliminate endemic **goiter** due to iodine deficiency. However, hunger and protein and micronutrient deficiencies remain prevalent in developing nations. Deficiencies of iron, iodine, and

vitamin A affect billions worldwide and can increase risk of death, blindness, infections, impaired cognitive and physical growth, and numerous other morbidities.²³ Various forms of undernutrition are familiar to Buseje, introduced in the second case study at the beginning of this chapter, and her community.

While continuing efforts to reduce undernutrition, global public health nutrition attention must increasingly be paid to overnutrition. Since 1980, obesity and overweight have doubled in prevalence worldwide, and 35% of adults are overweight or obese.²⁴ Obesity is not only a grave problem in wealthy nations; as developing nations experience the **nutrition transition**, they face the **dual burden of malnutrition**, or coexistence of obesity and undernutrition. Obesity increases the risk for numerous noncommunicable chronic diseases (NCDs), such as heart disease, diabetes, stroke, and osteoarthritis, and NCDs are now responsible for more than half of all deaths in the world.²⁵ Many of these deaths and diseases are preventable with improved diet, including weight control, and physical activity, which are WHO public health priorities.²⁶ Nicole and her family, introduced in the first case study at the beginning of this chapter, experience many of the nutritional and health concerns attributable to a Westernized diet and lifestyle.

Maternal and child nutrition is another area with increasing recognition of its significance. Maternal malnutrition can lead to poor pregnancy outcomes such as maternal perinatal death and **low birthweight (LBW)** or premature babies. Breastfed infants can develop nutrient deficiencies if maternal nutritional status is not adequate. Another way to improve infant health is by promoting **exclusive breastfeeding** and eventually the appropriate addition of **complementary foods** to the infant's diet. Public health nutrition, supplementary food, education, and policy programs can address these and other areas, such as nutrition for children in preschool and grade school. The WHO's Global Targets 2025 "to improve maternal, infant and young child nutrition" include reducing maternal anemia, reducing stunting and wasting, increasing exclusive breastfeeding, reducing LBW incidence, and avoiding an increase in childhood overweight.²⁷

Careers in Public Health Nutrition

Whether the concern is obesity, chronic diseases, micronutrient deficiencies, suboptimal maternal and young children

nutrition, chronic undernutrition, or acute malnutrition in emergency situations, public health nutrition relies on numerous professionals with diverse background and talents, and varying degrees of training specifically in public health and nutrition. The public health nutrition workforce carries out the essential functions of public health. People involved in any particular public health nutrition program depend on the community-specific factors such as needs, resources, culture, and history. They can work in clinics and hospitals, state and local health departments, government agencies, food manufacturers and health clubs in the private sector, schools, workplaces, faith-based and other community organizations, and research institutions.

Professionals specifically trained in nutrition or dietetics can work with any of the above institutions. Health educators can deliver messages to patients, employees, healthcare professionals, and students in hospitals, university extension programs, grade schools, and workshops. Sample topics include diet and exercise for diabetes management, weight loss and/or control, prenatal nutrient needs, and healthy cooking. Lactation consultants promote and facilitate breastfeeding through education and support. Specialists in specific life stages can assist with menu planning in schools, hospitals, and senior centers.

Because of the scope of nutrition problems, public health professionals both with and without much formal nutrition training are likely to be directly or tangentially involved in public health scenarios related to nutrition. Researchers design, conduct, and analyze data from scientific studies, and epidemiologists also examine surveillance data to identify potential areas of concern and the effects of public health programs.

Other experts may seem farther afield, but they are just as critical. Economists can guide cost-effective programs as well as make policy recommendations based on larger regional, national, and international interests. Land use and transportation experts, agriculturists, and urban planners help develop communities that make the best use of their food resources and have the roads and transportation available so that individuals can access food sources and so that food can be transported in and out of the region as needed. Environmentalists need consider implications for food production as they develop land use policies. Politicians and advocates influence policy decisions ranging from healthcare benefits, nutrition labeling requirements, and funding of research and other programs to requirements for school meals.

Conclusion

Poor nutrition is among the leading global causes of mortality and morbidity, with obesity, chronic and acute undernutrition, and nutrient deficiencies threatening more than half of the world's population. Nutritional

status can be improved, but community-based, population-level efforts are required to have significant impact. Governments, nonprofit and community organizations, universities, and the private sector can effectively collaborate to develop programs with greater and more lasting impact than individuals' own efforts.

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