



Population Risk Factors and Trends in Health Care and Public Policy

Betsy Haughton, EdD, RD, LDN; Jamie Stang, PhD, MPH, RD, LN

EXECUTIVE SUMMARY

Many factors affect the current and future practice of dietetics in the United States. This article provides an overview of the most important population risk factors and trends in health care and public policy that are anticipated to affect the current dietetics workforce and future of dietetics training and practice. It concludes with an overview of the state of the current workforce, highlighting the opportunities and challenges it will face in the future. Demographic shifts in the age and racial/ethnic composition of the US population will be a major determinant of future the dietetics profession because a growing population of older adults with chronic health conditions will require additional medical nutrition therapy services. Dietetics practitioners will work with an increasingly diverse population, which will require the ability to adapt existing programs and services to culturally diverse individuals and communities. Economic factors will affect not only the type, quantity, and quality of food available in homes, but also how health care is delivered, influencing future roles of registered dietitians (RDs) and dietetic technicians, registered (DTRs). As health care services consume a larger percentage of federal and corporate expenditures, health care agencies will continue to look for ways to reduce costs. Health promotion and disease prevention efforts will likely play a larger role in health care services, thus creating many opportunities for RDs and DTRs in preventive care and wellness. Increasingly, dietetics services will be provided in more diverse settings, such as worksites, community health centers, and home-care agencies. To address population-based health care and nutrition priorities effectively, dietetics practice will need to focus on appropriate evidence-based intervention approaches and targets. The workforce needs to be skilled in the delivery of culturally competent interventions across the lifespan, for all population groups, and across all levels of the social-ecological model for primary, secondary, and tertiary prevention. Because there is an assumption that the dietetics profession will experience rates of attrition of 2% to 5% based on historical workforce data, an important consideration is that the current dietetics workforce is limited in terms of diversity. An increasingly diverse population will demand a more diverse dietetic workforce, which will only be achieved through a more focused effort to recruit, train, and retain practitioners from a variety of racial, ethnic, social, and cultural backgrounds. In addition, the geographic distribution of RDs and DTRs must be addressed through strategic planning efforts related to dietetics training to provide access to and delivery of services to meet population needs. Furthermore, the health care workforce is projected to bifurcate as a result of growth in demand for the "frontline workforce" that works in direct patient contact. This bifurcation will require the dietetics profession to consider new practice roles and the level of education and training required for these roles in relation to how much the health care delivery system is willing and able to pay for services. There are many challenges and opportunities for the dietetics workforce to address the changing population risk factors and trends in health care and public policy by working toward intervention targets across the social-ecological model to promote health, prevent disease, and eliminate health disparities. Addressing nutrition-related health needs, including controlling costs and improving health outcomes, and the demands of a changing population will require careful research and deliberation about new practice roles, integration in health care teams, workforce supply and demand, and best practices to recruit and retain a diverse workforce.

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THERE ARE MANY FACTORS THAT have an impact on the current and future practice of dietetics. Demographic shifts in the US population, changes in the prevalence rates of acute and chronic diseases, consumer trends in health care, changes in eco-

nomie conditions that have an impact on access to healthful food, and shifts in public policy all affect the demand for and utilization of dietetics services. Although it can be difficult to project future trends, current data are useful for estimating the influence of these indicators.

This article, part of a series of technical articles to guide the dietetics profession as we move forward to meet the changing demands for dietetics services, will attempt to gather and evaluate data regarding these factors and determine how they will affect dietetics training and practice. This article will also provide a snapshot of the current dietetics workforce, including strengths, weaknesses, and gaps.

POPULATION RISK FACTORS

Demographic Trends Affecting the Practice of Dietetics

In 2009, there were 307 million residents in the United States, an increase of 26 million since 2000 (1). The US Census Bureau estimates the US population will comprise approximately 420 million people by 2050 (2,3). More than 30% of the growth in the US population is attributed

to immigration (4); the proportion of residents who were born outside of the United States increased from 6% to 12% between 1980 and 2007 (5).

The racial and ethnic distribution in the United States will continue to change through the middle of this century. By 2050, it is estimated that 50% of the population will be white non-Hispanic, 14% black, 24% Hispanic, 8% Asian, and 4% other (3). The shift in the racial and ethnic background of the US population will require that dietetics practitioners be knowledgeable of the health care needs and food-related customs of people from a variety of backgrounds, including those from other parts of the world. Furthermore, differences in health behaviors and beliefs, traditional health practices, chronic disease risk factors and prevalence rates of disease, disparities in health risk factors and outcomes, and trends in disability will have an impact on the demand for and requirements of dietetics services. Dietetics education and training programs will need to provide appropriate learning opportunities so that dietetics practitioners are prepared to meet the needs of an in-

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creasingly diverse population of consumers.

The age distribution across the US population is also expected to change dramatically over the next few decades. Through the middle of the century, the percentage of older Americans—individuals aged 65 years and older—will increase from 12% to 20% of the entire population, representing the largest shift to date in age-related demographics. Currently, approximately one quarter of the US population is younger than age 18 years, a proportion that is projected to remain largely unchanged through at least 2050 (1-3). Furthermore, although people aged 18 to 44 years and 45 to 64 years currently compose approximately 38% and 25% of the population, respectively, by the middle of the century, these percentages are anticipated to decline to 34% and 22%, respectively.

The changes in percentages of people aged 65 and older will occur because of generational changes in birth rates as well as increased life expectancy. Life expectancy has increased dramatically in the past century among all racial and ethnic groups; however, racial and ethnic disparities in life expectancy exist. White males born in 2006 can expect to live 76 years, whereas their black counterparts can expect to live 70 years; white females born in 2006 can expect to live 81 years compared with 77 years for black females (6,7). Furthermore, although women have consistently lived longer than men and continue to do so, the sex gap in life expectancy has been closing, and it is anticipated that this trend will continue during the next few decades.

Longer lifespans and an aging population will likely result in increased prevalence of chronic diseases more common among older adults, such as hypertension, diabetes, end-stage renal disease, some types of cancer, Alzheimer's disease, and dementia and will affect the demand for dietetics services as these chronic health conditions frequently dietary intervention. Older adults are also more likely to be admitted to hospitals and nursing homes, where dietetics practitioners (registered dietitians [RDs] and dietetic technicians, registered [DTRs]) will oversee their nutrition care.

Home care services for elderly people also will be in demand as life expectancy increases, and RDs and DTRs will be needed to manage the nutrition care of acutely and chronically ill older adults and are likely to work as part of a comprehensive home health care team.

However, much of this impact on demand is contingent on funding. An increased need does not automatically result in increased reimbursement.

Socioeconomic Factors Limiting Access to Healthy Food

Access to food will continue to be an issue for many Americans. In addition to limita-

tions of daily activity, there is a variety of reasons why individuals lack access to healthful foods, including limited access to food within the community, lack of housing with food storage and preparation capabilities, and economic factors that affect the ability to purchase food. The proportion of individuals living in poverty is currently estimated at 14.3% (8). There are disparities in rates of poverty, however, with 9% of whites, 26% of blacks, 25% of Hispanics, and 12% of Asian Americans living in poverty. More than one in five children lives in poverty, compared with 13% of people aged 18 to 64 years and 9% of adults aged 65 and older. Among those living below the poverty line are 7% of working families, 25% of households affected by unemployment, and 15% of households affected by layoffs (9). Compared with individuals living in higher-income households, individuals living in poverty are less likely to have adequate access to health care services and adequate food supplies.

Approximately 15% of the US population experienced food insecurity—defined as a reduced quality, variety, or desirability of diet with little or no indication of reduced food intake—in 2008 (10,11). Approximately 6% of US residents reported very low food security, defined as multiple indications of disrupted eating patterns and reduced food intake (10,11). The prevalence of food insecurity varies greatly, with the highest rates among families living in poverty, single-parent families with children, and non-white households. Individuals and families living in large cities or rural areas experience food insecurity more often than those living in suburbs or small cities and towns.

Regional differences exist with food insecurity—it is most common in the South, moderately common in the Midwest and West, and least common in the Northeast. Families and individuals living in poverty are eligible for food-assistance programs, such as the Supplemental Nutrition Assistance Program (SNAP); the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); Child and Adult Care Feeding Program; Summer Food Service Program; and The Emergency Food-assistance Program (12). Food-assistance program use is common among food-insecure households, with 55% utilizing the National School Lunch Program, SNAP, and/or WIC (13). One in five food-insecure households obtains food from a food pantry and 3% eat meals at an emergency food kitchen. All children can participate in the National School Breakfast and Lunch Programs; however, the costs of the meals vary by family income. Similarly, all adults older than 65 years can participate in congregate dining programs with out-of-pocket costs varying by income status. As food-assistance programs continue to grow to meet the

increasing demand of families and individuals living in poverty, opportunities to consult with or administer these programs and services will present for RDs and DTRs.

Access to an adequate supply of healthful foods is an issue that affects people of all income levels and is of concern to many dietetics practitioners. Data from the US Department of Agriculture suggest that approximately 6% of US households experience access-related problems that limit the purchase of the type or quality of food. Among US households, 3% live from one-half mile to 1 mile from a supermarket and lack access to a vehicle or other mode of transportation; 2% live at least 1 mile from a supermarket and do not have vehicle access (13)—this situation is more prevalent in low-income rural and urban areas, the same areas in which food insecurity rates are higher.

RDs and DTRs in the community nutrition and public health sectors will continue to play an important role in the area of food insecurity and food access. These roles will include direct service provision; program management; outreach and marketing of programs; evaluation of food and nutrition assistance programs; and, over the next few decades, administration of food and nutrition assistance programs designed to meet the needs of the increasingly diverse population.

Trends in Chronic Diseases and Health Conditions

Overweight and obesity are common health conditions associated with an increased risk for cardiovascular disease, stroke, type 2 diabetes, some types of cancer, hypertension, osteoarthritis, and gallbladder disease (14-18). Currently, 68% of adults have a body mass index (BMI; calculated as kg/m^2) >25 (classified as overweight) and 34% are obese, with a BMI >30 (14). Among adults, 6% have a BMI >40 . Although the prevalence of overweight and obesity has increased considerably in the past several decades, recent data suggest that the rates have remained more stable in the past 8 years (14).

The incidence of overweight (BMI ≥ 85 th percentile but <95 th percentile for age and sex) among US children and adolescents is 32% (19). Seventeen percent of youth are considered obese (BMI ≥ 95 th percentile), and 12% have a BMI ≥ 97 th percentile for age and sex. Overweight and obesity among youth are correlated with higher rates of hyperlipidemia, hypertension, liver disease, sleep disorders, orthopedic disorders, and obesity later in adulthood (20). As with adults, the dramatic increase in rates of child and adolescent overweight and obesity seen in the past 2 decades seems to be leveling off; however, it is not clear if this trend will continue long-term (19).

The health care costs associated with obesity and related comorbid conditions

are thought to be substantial. A recent study indicates that health care costs related to obesity are mounting for private and public payers (21). Diet and physical activity are considered the cornerstones of lifestyle management in preventing and treating overweight and obesity among youth and adults (15,20).

Heart disease is currently the leading cause of death among US adults, followed by cancer, stroke, chronic lower respiratory disorders, accidents (unintentional injuries), and diabetes (22,23). Age-adjusted rates of mortality from cardiovascular disease and stroke have decreased substantially in the past 50 years; however, the rates of underlying chronic conditions that contribute to cardiovascular and cerebrovascular mortality remain high. Hypertension, a risk factor for both diseases, is present in 32% of adults aged 45 to 64 years, with 51% of adults aged 65 to 74 years reporting hypertension (22). Nutrition, physical activity, and weight management are key elements in the prevention and treatment of hypertension, heart disease, and stroke (24).

Elevated serum cholesterol levels place individuals at higher risk for cardiovascular disease. During the past 2 decades, the proportion of the US population with high cholesterol levels declined from 20% to 16%, partly as a result of public education and screening for hypercholesterolemia and the introduction of medications to reduce serum cholesterol levels (22). Women are more likely to have elevated cholesterol levels than are men of the same age. For example, 24% of women aged 65 years and older have elevated cholesterol levels compared with 11% of men in that same age bracket. Medical nutrition therapy (MNT) and advice to increase physical activity and reduce intake of dietary and saturated fat, often provided by RDs, are considered the first lines of treatment for hyperlipidemia (24).

Diabetes is a risk factor for cardiovascular disease and an individual cause of mortality. The age-adjusted rates of diabetes have increased in the past 2 decades. Recent estimates suggest that 11% of the adult population older than 20 years has diabetes (22,23,25). Rates of diabetes increase with age—2.5% of adults aged 20 to 39 years old, 10% of adults aged 40 to 59 years, and 23% of adults aged 60 and older have diabetes. Rates are higher among nonwhite populations and among men of all racial and ethnic backgrounds.

Prediabetes, or impaired glucose tolerance, is present in an estimated 7% of US adolescents and 26% of US adults, or 57 million Americans (25). It is expected that rates of diabetes and prediabetes will continue to increase as the population ages. Other factors that can increase diabetes rates include high rates of overweight and obesity among children and adults and increases in the number of nonwhite people

in the United States who are at higher risk for these conditions.

Approximately one third of cancers are related to poor nutrition and lack of physical activity, with up to 20% of cancer mortality related to overweight and obesity (26). These lifestyle risk factors have been associated with higher rates of cancer in the breast, ovaries, endometrium, colon, kidney, esophagus, pancreas, and gallbladder. Being overweight or obese can increase the likelihood of cancer recurrence and decrease survival rates for some types of cancer. RDs will continue to play an important role in the treatment of cancer using MNT, and RDs and DTRs increasingly will be involved in cancer prevention by providing nutrition education and lifestyle management, including obesity prevention and treatment.

A substantial proportion of the US population suffers from a limitation of activity; that is, reductions in physical, mental, and emotional well-being that interfere with the ability to engage in age-appropriate daily activities, including the planning, preparation, and consumption of meals, related to chronic health conditions (27,28). Currently, 9% of school-aged children and up to 25% of adults aged 18 to 65 years have a limitation of activity (29). In adults older than 65 years, the rate of limitation of activity in the noninstitutionalized population is estimated at 62%. For older adults, the typical causes are primarily musculoskeletal conditions, followed by mental illness, heart disease, hearing loss, diabetes, pulmonary disease, and dementia. Among children, learning disabilities, attention-deficit hyperactivity disorder, other neuromuscular conditions, speech disorders, and intellectual disability are the leading causes of activity limitations. Preterm birth (birth before 37 weeks' gestation) and low birth weight (birth weight <2,500 g) are risk factors for disabilities among children. In the past 4 decades, rates of low birth weight and very low birth weight (birth weight <1,500 g) have increased (22). As technology to save the lives of premature and very-low-birth-weight babies advances, it is expected that rates of disability among children secondary to these causes will also increase.

Nutrition services are key components of treatment for many of the causes of limitations of activity, such as the following:

- Individuals with sight and musculoskeletal disorders often require specialized education to enable them to shop for and prepare food and to feed themselves.
- Many of the medications used to manage symptoms of physical and mental health-related chronic conditions that limit daily activity have implications for nutritional status requiring

dietary intervention and monitoring.

- Schools are mandated to provide food substitutions or modifications for children with special health care and/or dietary needs (30).
- Specialized nutrition support is often required for preterm and low birth weight babies.

RDs and DTRs will play a vital role in meeting the needs of individuals with limitations of activity in home, schools, and social service and community agencies serving disabled individuals and residential care settings, in addition to more traditional acute-care facilities.

MNT is a key component in treating many of the chronic conditions mentioned previously; in fact, it is considered the cornerstone of treatment for diabetes, hypertension, and cardiovascular disease (24,31-33). If there is funding, increases in rates of these chronic conditions should create more demand for RDs to provide MNT services in acute-care, ambulatory-care, and community-based settings.

Lifestyle risk-factor modification and weight-management services are essential components of health-promotion and disease-prevention programs. RDs and DTRs will play a more frequent role in providing lifestyle and weight-management services as part of health-promotion and disease-prevention efforts within worksites, schools, community clinics, health clubs, social service programs, and other community settings.

TRENDS IN HEALTH CARE AND PUBLIC POLICY

Traditionally, health care has been delivered in acute-care settings through hospitals and hospital-based services. Advances in health care and industry-wide implementation of cost-savings strategies have led to a dramatic change in the delivery of health care services. Individuals increasingly receive health care services in ambulatory rather than acute-care facilities. In 1990, there were 1,213,327 hospital beds available in the United States, but by 2007, there were 945,199 beds available (22). Many former hospital-based services, including renal dialysis, minor operations, and management of conditions such as newly diagnosed diabetes are now performed on an outpatient basis, often in independent facilities that are not associated with a hospital or other health care system.

Patients with complex medical conditions, often requiring ongoing MNT services, are discharged early from hospitals with increasing frequency (22). Data from the National Hospital Discharge Survey show that the average length of inpatient hospital stay was 7.3 days in 1980, but only 4.8 days in 2005 (34), with most patients spending 3 days or less in a single visit. More and more often, patients are

required to seek care in an outpatient setting or in their homes. Thus, RDs will more commonly provide MNT in smaller and more specialized facilities within community health centers and related organizations or within the homes of homebound, ill patients rather than within acute-care settings.

MNT has been proven cost-effective, particularly with regard to outpatient nutrition services for chronic health conditions such as diabetes, hyperlipidemia, and hypertension (35,36). (There is evidence for health care cost improvements from inpatient MNT, but it is not as strong as the evidence for outpatient nutrition services.) Home management of complex medical conditions requiring parenteral nutrition has been shown to reduce health care costs by \$4,860 to \$5,400 per month (Canadian dollars)* (37). As health care costs continue to rise, such cost-effective services offered within homes will likely increase. Preventive health care services will also play an increasingly important role.

In 2010, the *Patient Protection and Affordable Care Act* (HR 3590) became law. Under this legislation, the next decade expects to see reforms in the current health care system designed to expand health care coverage to most Americans, to reduce the growth of health care costs over time, and to ensure that Americans have access to affordable health insurance that meets their lifetime needs (38). Following are two important aspects of this historic legislation that will affect the provision of dietetics and nutrition services in the next decade (39):

- the reorientation of the health care system away from acute disease management and toward a preventive care and wellness model; and
- the implementation of an improved health care delivery and payment system that integrates health care services of multiple providers through an emphasis on medical homes and community health centers.

Funding for public health and prevention services included in the *Patient Protection and Affordable Care Act* will strengthen community-based services such as employee screenings and wellness programs, incentives for employees

*This study was performed using Canadian dollars as the measurement. The conversion to US dollars would be \$3,738-\$4,154 (based on a conversion factor of \$1.3 Canadian:\$1 US dollar, using the average historical Canadian/American exchange rate data found at <http://research.stlouisfed.org/fred2/data/EXCAUS.txt> on January 10, 2012).

who meet health targets (such as weight loss and improved serum lipid profiles), and reimbursement for annual wellness exams. An emphasis on developing health-promotion and disease-prevention programs in rural and underserved areas is included in this new health care legislation, which might provide expanded roles for RDs, particularly in the area of annual wellness exams. Rural health initiatives can also increase the demand for RDs and DTRs to offer telehealth services, defined by the Academy of Nutrition and Dietetics as follows (40):

... the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration, [that] includes both the use of interactive, specialized equipment, for such purposes as health promotion, disease prevention, diagnosis, consultation, and/or therapy, and non-interactive (or passive) communications, over means such as the Internet, E-mail, or fax lines, for communication of broad-based nutrition information that does not involve personalized nutrition recommendations or interventions.

The Centers for Medicare and Medicaid Services recognizes RDs as health care providers who can provide telehealth services for select medical conditions, including diabetes and some forms of kidney disease (41). Telehealth and other electronic forms of conveying MNT and/or health-promotion and disease-prevention services will open avenues for RDs to reach individuals and groups that might not currently have access to dietetics services. Dietetics education programs will need to teach future practitioners the skills necessary to adopt and utilize electronic health communication technologies.

A mandate for nutrition labeling on select restaurant menus and vending machines is also included in the *Patient Protection and Affordable Care Act*. This requirement will provide additional opportunities for RDs and DTRs to work with commercial foodservice operations to analyze recipes, develop more nutrient-dense foods, and improve menu options for individuals who wish to eat a healthful diet away from home.

Intervention Approaches to Address Population-Based Health Care and Nutrition Priorities

Addressing these population priorities requires a dietetics workforce that is skilled in delivering interventions informed by research across the lifespan; for all population groups; and across all levels of the social-ecological model for primary, secondary, and tertiary prevention. Although

there are myriad intervention models and approaches, this article will briefly introduce life-course interventions—completed by health-equity approaches that are delivered across the levels of the social-ecological model—as a conceptual framework to consider the current dietetics workforce in relation to population priorities. These interventions will be described in this section and are depicted in the Figure.

Life-Course Theory-Based Interventions.

One way to conceptualize the importance of nutrition across the life cycle is life-course theory, which proposes that biological and behavioral risk and protective factors determine health trajectories (42,43). Specifically, optimal health trajectories result when risk factors are reduced and protective factors are increased throughout life, but especially during key developmental periods. Dietetics practitioners then, have a role in healthy aging from preconception onward by timing appropriate and effective interventions that will have future and long-term impacts on health (44). These interventions are to reduce risk factors and increase protective risk factors during each critical developmental period and typically are delivered to individuals, families, and small groups.

As the overall US population ages, the dietetics workforce will need knowledge and skills related to geriatric nutrition and delivery of services in a variety of access points, including senior home care with and without home-delivered meals, assisted living and extended care facilities, and nursing homes. They also will need to be skilled not only in chronic disease prevention and treatment, but also in how to work with elderly people, who might have limited mobility and might wish to remain actively engaged in their own food purchasing, food preparation, and storage activities. It will not be enough to advise these individuals regarding “what” and “how” to eat, as these active seniors will want and need to prepare and consume meals consistent with their mobility. At the same time, as new health technologies help sustain and extend life, dietetics practitioners will need skills to help promote health for young and old, including those with metabolic disorders, developmental delays, and physical activity limitations.

Health Equity and Social Determinants of Health Models.

Health disparities disproportionately affect particular population groups, such as minority populations, those less educated, and those living in poverty (45,46). Individuals within these groups might know what a healthful diet is, but what they consume is influenced by social, governmental, and legal systems that negatively affect their ability to consume a healthful diet

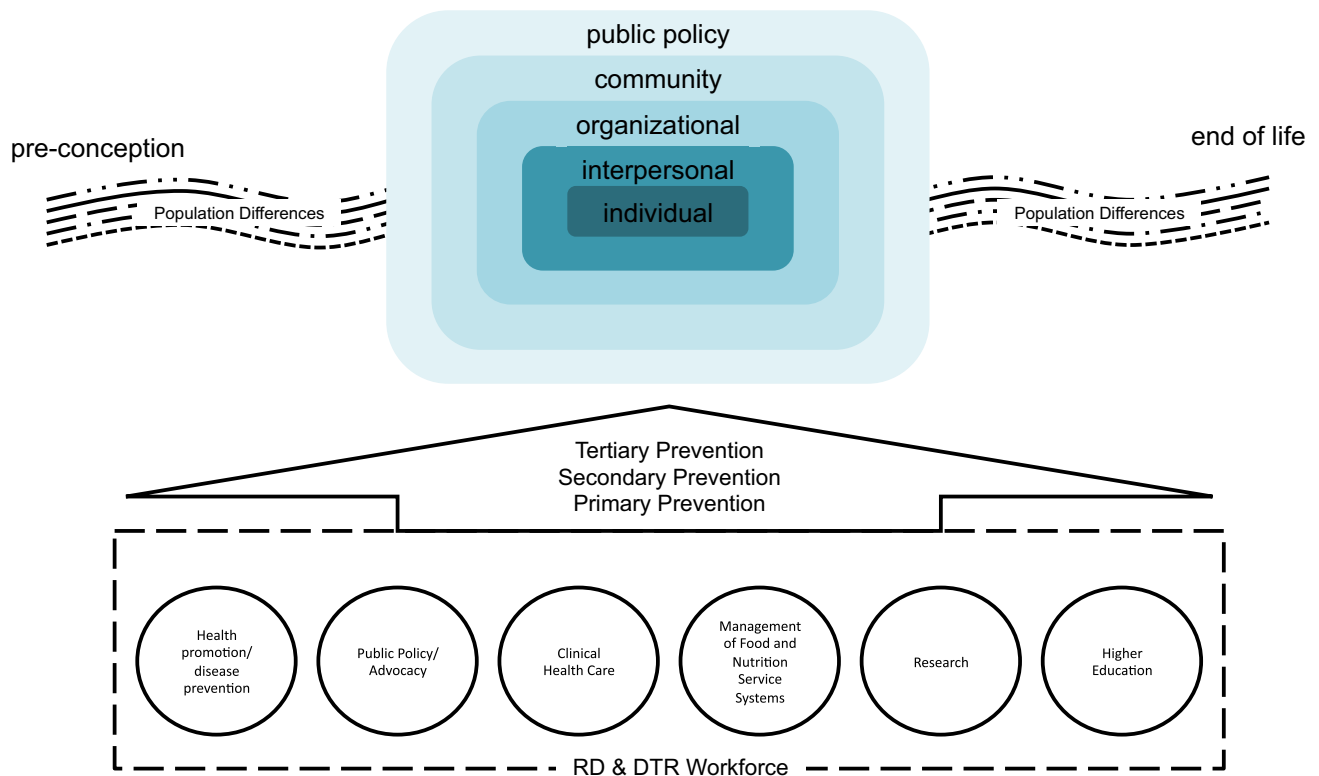


Figure. Framework for dietetics practice as prevention and interventions across the social-ecological model to promote health and eliminate health disparities through the life course. Figure concept courtesy of Shannon Looney, Knoxville, TN.

and be physically active—for example, fresh fruits and vegetables might not be available or affordable, and neighborhoods might be unsafe for physical activity (47,48). If dietetics practitioners are to help address health disparities to optimize health trajectories, then they need knowledge and skills regarding environmental and policy interventions that integrate principles of social justice, human rights, and social capital and that can focus on the economic and social barriers that promote or prevent the procurement, preparation, and consumption of healthful foods (49,50). These interventions require population- and system-level knowledge and skills of dietetics practitioners.

Culturally Competent Interventions and Systems. One characteristic that life-course, social determinants of health, and health-equity interventions have in common is that they need to be culturally competent to be accessible to all. Cultural competence is defined by Cross and colleagues (51) as “a set of congruent behaviors, attitudes, and policies that come together in a system, agency, or among professionals and enable the system, agency or those professionals to work effectively in cross-cultural situations.” According to this definition, cultural competence relates not only to how individual dietetics practitioners practice and inter-

act with others who are different from themselves, but also to the means by which their workplaces make services culturally accessible to all.

Whether dietetics practitioners are interacting with individual patients or clients, families, community members, or other health professionals with whom they work, they need to have awareness, knowledge, and skills that enable effective cross-cultural interactions that positively affect interventions and professional exchanges (52-55). Although individual cultural competence is important, dietetics practitioners also need the knowledge and skills to participate in crafting institutional policies and practices that are culturally competent and in collecting and using disparity data that can be applied to design effective interventions for specific populations (38,56,57).

Closely aligned with cultural competence is workforce diversity (58,59), which is frequently described by demographic characteristics of the workforce, such as race and ethnicity, compared with those of the population served. Although diversity itself will not make individuals or organizations culturally competent, it will help to promote use of nutrition and health care services by under-represented groups, who are more likely to seek services from professionals whom they see as similar to themselves (58). Thus, the dietetics and nutrition work-

force needs to be culturally competent as well as diverse.

Levels of Prevention. The life-course approach is consistent with promoting health and preventing overweight and obesity and chronic diseases. Primary prevention requires approaches to avert biological risk factors, such as elevated serum cholesterol and hypertension, and to increase protective factors, such as access to safe and affordable, healthful foods. Examples of primary prevention are environmental and policy approaches to increase physical activity, such as street-scale urban design and land-use policies (60), policies to support local food systems, nutrition and calorie labeling in restaurants and vending machines, policy interventions about types of foods available in schools (61,62), worksite wellness programs to promote healthful eating and physical activity (63), point-of-decision prompts to encourage stair use (60), social support interventions in communities to increase physical activity (64), and behavioral interventions to reduce screen time (65).

Secondary prevention requires approaches to reduce existing risk factors. These interventions can be delivered with individuals and small groups, such as intensive behavioral interventions for adults with hyperlipidemia (66) and for sustained weight loss in obese adults (67).

Secondary prevention also can be delivered as targeted media campaigns for early detection and screening and as nutrition education and food-assistance programs to reduce nutritional risk, such as that provided through WIC.

Tertiary prevention requires clinical approaches to treat disease. Examples are case-management interventions to improve glycemic control in diabetes-management programs (68), behavioral and family-based counseling as part of multi-component pediatric weight-management programs to treat overweight children (35,36), and multicomponent coaching and counseling interventions to reduce and maintain weight loss (69).

Each of these three prevention levels requires different knowledge and skill sets. Primary prevention requires practitioners to consider interventions that change the wide range of influences on individual and population behaviors. Secondary prevention requires practitioners to consider how to reduce risk factors, which can be influenced not only by the environments where people live, work, and play, but also by how people interact with each other and what they know about what constitutes a healthful diet and how to select, prepare, and consume it. Tertiary prevention requires practitioners to focus on disease treatment and then, specifically, to consider how to engage the individual and the family and caregivers with whom he or she interacts to control, treat, and ameliorate the disease through MNT.

Intervention Targets. While primary, secondary, and tertiary prevention describe the purpose of nutrition interventions, the social-ecological model conceptualizes intervention targets (70,71), which influence what and how people eat and how physically active they are. At the individual level, interventions are designed to change what people know, their skills, and behaviors, so that they have improved eating and health outcomes; these intervention strategies increase motivation, self-efficacy, and behavioral capability. At the interpersonal level, interventions are designed to change how people within an individual's social network influence that person's eating and physical activity; these intervention strategies include parenting interventions, buddy programs, and approaches to change social norms about appropriate food-portion sizes. Interventions at the individual and interpersonal levels include nutrition counseling in outpatient settings and peer group sessions in WIC facilities or a worksite.

At the institutional/organizational level, interventions are designed to change the policies, practices, and environments of where people go to school, work, and eat away from home—for example, moving a school from simple awareness of the need to change competitive food policies to

adopting new policies that are implemented and institutionalized as standard practice (72).

Community-level interventions are intended to change the neighborhood and community environments where people live—for example, by improving access to healthful foods and safe places to be physically active. Example interventions are participatory research strategies that engage community members in assessing their neighborhood environments, including access to healthful and affordable food, and then in developing projects to reduce barriers and take advantage of opportunities. Policy and system-level interventions are intended to change the social structures, policies, and systems that affect many of the other intervention targets in the social-ecological model; these intervention strategies include political action, lobbying, and policy advocacy to reform health care, including the role of nutrition and dietetics and nutrition and menu labeling regulation development and food-assistance guidelines. Community-, policy-, and system-level interventions focus on population health.

Research and Practice

The overall dietetics workforce will need knowledge and skills to participate in primary, secondary, and tertiary interventions across the life course and target different levels of the social-ecological model. The knowledge and skills used, which require critical thinking skills for analysis and decision making for participating in activities such as analyzing research publications, will need to be informed by current research. It also is important to recognize the important role that some dietetics practitioners will have in generating and contributing to this research, which can range from the most basic level (eg, from the genomic, subcellular, cellular, and multiorgan system levels) to that of human behaviors related to eating and physical activity and to that of environments and policy that influence these behaviors (eg, levels of the social-ecological model) (73).

Current Dietetics Workforce: Who Are They and How Do They Practice?

In 2008, the Academy of Nutrition and Dietetics Foundation and Commission on Dietetic Registration (CDR) completed a comprehensive needs assessment of US dietetics practitioners using a stratified probability sample (74,75). Results from this study estimated a total of 75,418 RDs and 4,027 DTRs at that time. Current data about this workforce can be considered in relation to population priorities and used to estimate future workforce needs to address these priorities.

Workforce Diversity

RDs are, as a group, predominantly female, white/non-Hispanic or Latino, and in their mid-40s; a substantial proportion are considering retirement by 2019 (74,75). The proportion of males is very low among RDs and DTRs (4% of DTRs and 3% of RDs).

DTRs are more diverse with regard to a number of racial and ethnic indicators. More DTRs compared with RDs are black (6% of DTRs vs 2% of RDs), Hispanic or Latino (4% vs 3%), or "other" (2% vs 1%), and fewer are white/non-Hispanic (78% vs 84%) or Asian (3% vs 5%). A striking difference in the two groups is that DTRs in general are older than RDs, with a median age of 48 years compared to a median age of 45 years among RDs. Only 12% of DTRs, compared with 25% of RDs, are younger than 35 years. More than 20% of DTRs and RDs (23% for both) are 55 years or older, which is the time frame for considering early retirement and retiring (74,75). Indeed, based on historical workforce data, there is an assumption of an attrition rate (a percentage that comprises CDR-credentialed dietetics practitioners who will leave the workforce for reasons of emigration, extended leave, retirement, or death) of 2% to 5% in dietetics (76). This suggests an aging workforce comparable to that of the US population overall and of other health professions, including nursing (77).

As a largely female, older, and white/non-Hispanic workforce, these data suggest that the profession has an important responsibility to address not only cultural competence as the nation becomes increasingly more diverse, but also diversity of the future workforce itself through recruitment and retention strategies to promote diversity and replacements due to retirements.

Current and Future Practice Areas

The majority of RDs and DTRs, 48% and 51%, respectively, currently practice in clinical health care (Table 1). This suggests that almost half of all RDs and DTRs are especially involved in tertiary and secondary prevention and in individual-level and interpersonal-level interventions related to clinical health care. It is less clear how the remaining DTRs and RDs are practicing relative to the three prevention levels or the social-ecological model. However, there is growing emphasis on the importance of primary prevention and environmental and policy interventions with regard to their impact on population health—and this translates to an important role for dietetics practitioners who are trained with the necessary skill sets. How dietetics practitioners position themselves to be part of these interventions might be critical for future practice.

Table 1. Primary practice areas for registered dietitians and dietetic technicians, registered, working in the dietetics profession: 2008 needs assessment compared to new practice areas

Primary practice area (2008) ^a	Registered dietitian (%) ^a	Dietetic technician, registered (%) ^a	New practice areas (2010) ^{bcd}
Clinical, inpatient	21	29	Clinical health care
Clinical, outpatient	17	1	
Clinical, long-term care	10	21	
Community nutrition	11	8	Health promotion/disease prevention
Food and nutrition management	8	15	Management of food and nutrition services
Consultation/business practice	4	1	NA ^e
Education/research	8	5	Research Higher education
Multiple	11	10	NA
Other	4	3	NA Public policy/advocacy

^aSource: Rogers (75).

^bSource: American Dietetic Association. Report to the House of Delegates: Final Report of the Phase 2 Future Practice and Education Task Force. July 15, 2008, unpublished.

^cSource: Gilbride J, Parks S, Dowling R. Framework for analyzing supply and demand for the dietetics profession. 2011, unpublished.

^dSource: Collier (78).

^eNA=not applicable.

Shifting Intervention Approaches and Changing Practice Roles

Comprehensive health care reform stipulated in the *Patient Protection and Affordable Care Act* and projections about the future health care workforce have implications for the dietetics profession over the long-term. As noted previously, the health care reform bill has three goals:

- health insurance coverage for the uninsured;
- improved affordability and stability of coverage for those with health insurance; and
- slow growth of health care costs (38).

Implementation will shift from a fee-for-service payment model to preventive, patient-centered approaches, including the patient-centered medical home and accountable care organization models, and a reformed delivery system with more primary care providers, medical homes, and community-based health centers (39).

While future dietetics practitioners will continue to have a role in tertiary prevention, particularly related to chronic disease management, they clearly have the potential for expanded roles in primary and secondary prevention in individual- and interpersonal-level interventions. As members of specialized and integrated care teams, dietetics practitioners will play an important role, but they will need to position themselves to other team members and to health insurers as recognized providers of nutrition and dietetics services.

At the same time that health care reform is implemented, health care employ-

ers, insurers, and individuals will continue to look for ways to control health care costs, particularly related to personnel. Health care workforce projections from the Bureau of Labor Statistics for 2008 to 2018 are for substantial growth in the “frontline workforce” of health care personnel with a bachelor’s degree or less and who will have extensive direct patient contact [(78-80) (and American Dietetic Association. *Report to the House of Delegates: Final Report of the Phase 2 Future Practice and Education Task Force*. July 15, 2008, unpublished; Gilbride J, Parks S, Dowling R. Framework for analyzing supply and demand for the dietetics profession, 2011, unpublished), such as home health aides and personal and home care aides. As health care costs increase, individuals also will seek lower-cost alternatives. For example, elderly adults may seek home-based care instead of long-term, institutionalized care. Others may seek services offered by health educators or fitness trainers and aerobics instructors to help them change their diet and become more physically active. This growing trend of the frontline workforce has been noted within the public health nutrition workforce through enumeration surveys conducted by the Association of State and Territorial Public Health Nutrition Directors since 1985. For example, data from 1999-2000 and 2006-2007 enumerations suggest a considerable increase in the proportion of breastfeeding peer counselors (0.4% vs 12.6%) working with the WIC program (81). Whereas the Bureau of Labor Statistics projects that RD and DTR positions will grow at rates of

9.2% and 13.9%, respectively, from 2008 to 2018, these increases are less than that projected for other sectors of the health care workforce, such as home health aides (50.0%), personal and home care aides (46.0%), recreation and fitness workers (21.2%), and health educators (18.1%) (79). These projections suggest an important role for dietetics practitioners, who will remain providers of patient-care services, but also might assume increased responsibilities as consultants and managers of those in the frontline workforce, who will have more extensive and expanded direct-care contact.

Related to growth of the frontline workforce is bifurcation of the health care workforce (78), as the proportions of personnel with lower levels of education (associate’s degree or less) and those with higher levels of education (graduate degree) increase, but the proportion of staff with bachelor’s degrees decreases. The tension of employers trying to control personnel costs and professional associations trying to advance their professions will only continue. It will be important for the Academy of Nutrition and Dietetics and CDR to consider what level of education and training is appropriate in relation to how much employers are willing to pay (78,82,83). What qualifications are required for future dietetics positions and what will the market bear for quality, nutrition-related health outcomes? Currently, survey findings range from 34% of RDs having an advanced degree in dietetics, food, nutrition, or a related field (74,75) to up to half of all RDs having any advanced degree (85), whereas only 1% of DTRs having an advanced degree

Table 2. State-specific ratios of dietetics practitioners per 100,000 population, United States

State	Population Ratio						
	RDs ^a			DTRs ^b			
	n	RD per 100,000 ^c	Rank	State	n	DTR per 100,000 ^c	Rank
North Dakota	356	55.0	1	Maine	105	8.0	1
New Hampshire	480	36.2	2	Ohio	721	6.2	2
Minnesota	1,894	36.0	3	Wisconsin	226	4.0	3
Nebraska	641	35.7	4	Connecticut	107	3.0	4
Massachusetts	2,287	34.7	5	Minnesota	144	2.7	5
Vermont	209	33.6	6	New York	526	2.7	6
Connecticut	1,179	33.5	7	Pennsylvania	230	1.8	7
Wisconsin	1,875	33.2	8	New Hampshire	23	1.7	8
Rhode Island	341	32.4	9	Nebraska	31	1.7	9
Ohio	3,728	32.3	10	New Jersey	143	1.6	10
South Dakota	261	32.1	11	Florida	265	1.4	11
Colorado	1,574	31.3	12	North Dakota	8	1.2	12
Kansas	871	30.9	13	Washington	82	1.2	13
Iowa	925	30.8	14	Missouri	70	1.2	14
Pennsylvania	3,749	29.7	15	Indiana	73	1.1	15
Maryland	1,692	29.7	16	Arizona	74	1.1	16
Washington	1,970	29.6	17	California	405	1.1	17
Montana	283	29.0	18	Illinois	129	1.0	18
New York	5,578	28.5	19	Colorado	47	0.9	19
Idaho	441	28.5	20	Oregon	35	0.9	20
New Jersey	2,437	28.0	21	Massachusetts	56	0.8	21
Delaware	246	27.8	22	Arkansas	24	0.8	22
Michigan	2,738	27.5	23	Virginia	64	0.8	23
Utah	747	26.8	24	Maryland	46	0.8	24
Kentucky	1,150	26.7	25	Vermont	5	0.8	25
Illinois	3,435	26.6	26	Louisiana	30	0.7	26
Maine	349	26.5	27	West Virginia	12	0.7	27
Missouri	1,579	26.4	28	South Dakota	5	0.6	28
Louisiana	1,184	26.4	29	Tennessee	37	0.6	29
North Carolina	2,460	26.2	30	Idaho	9	0.6	30
Hawaii	336	25.9	31	Michigan	57	0.6	31
District of Columbia	153	25.5	32	Rhode Island	6	0.6	32
Tennessee	1,584	25.2	33	North Carolina	47	0.5	33
Alaska	175	25.1	34	Kentucky	21	0.5	34
Indiana	1,600	24.9	35	Texas	119	0.5	35
Oklahoma	911	24.7	36	Nevada	12	0.5	36
Virginia	1,923	24.4	37	Delaware	4	0.5	37
Alabama	1,140	24.2	38	South Carolina	18	0.4	38
Oregon	911	23.8	39	Alabama	17	0.4	39

(continued on following page)

Table 2. State-specific ratios of dietetics practitioners per 100,000 population, United States (continued)

State	Population Ratio						
	RDs ^a			DTRs ^b			
	n	RD per 100,000 ^c	Rank	State	n	DTR per 100,000 ^c	Rank
Mississippi	698	23.6	40	Kansas	10	0.4	40
Arkansas	679	23.5	41	Oklahoma	13	0.4	41
California	8,416	22.8	42	District of Columbia	2	0.3	42
Wyoming	120	22.0	43	Montana	3	0.3	43
Texas	5,136	20.7	44	Iowa	9	0.3	44
Arizona	1,304	19.8	45	New Mexico	5	0.2	45
New Mexico	397	19.8	46	Georgia	24	0.2	46
Florida	3,644	19.7	46	Mississippi	7	0.2	47
Georgia	1,879	19.1	48	Wyoming	1	0.2	48
South Carolina	870	19.1	49	Alaska	1	0.1	49
West Virginia	310	17.0	50	Utah	3	0.1	50
Nevada	422	16.0	51	Hawaii	1	0.1	51
Puerto Rico	202	5.1	52	Puerto Rico	1	0.0	52

^aRD=registered dietitian.

^bDTR=dietetic technician, registered.

^cBased on personal communication (with Chris Reidy, RD, September 2010) and Readex Research (74).

(74,75). What level of education and credential is required to address individual and population needs (84)? Training a qualified and marketable workforce will require educational institutions and programs to have goals and curricula aligned with workforce and population needs (82).

Location of the Dietetics Workforce in Relation to Population Need

The location of dietetics practitioners geographically and within communities can affect availability, access, and delivery of services, which raises additional questions about the dietetics workforce. Are there areas where there are shortages in dietetics services? Within communities and within facilities and agencies, how well do the types and numbers of dietetics practitioners match the needs of individuals and populations served? Answers to these questions relate to health equity and quality of care. For example, medically underserved, minority, and rural populations typically have more limited access to health care and higher rates of chronic disease (86). Shortages of primary care health professionals have been identified in >75% of rural counties; many of these counties have no primary care provider (87). Similarly, RD shortages in rural communities also exist (39).

There are limited data and research available on where dietetics practitioners

are located; whether they practice at the primary, secondary, or tertiary prevention levels; and how they practice across the lifespan and across the levels of the social-ecological model. Moreover, there are few staffing ratio recommendations available to interpret the number of people served by dietetics practitioners in these different capacities. The staffing recommendation used for public health dietetics practitioners with population/system responsibilities in support of core public health functions is 1:50,000 (88), but this recommendation dates to 1978 and its validity has not been tested.

Currently, the Academy of Nutrition and Dietetics Research Committee and Clinical Nutrition Management Dietetic Practice Group is developing inpatient staffing models for RDs (89). The WIC program also has been involved in research to develop professional staffing requirements for local WIC agencies (90). However, even with staffing ratio recommendations, it is difficult to determine workforce shortages and needs because the distribution of personnel differs across and within states and within communities and facilities (91).

A gross view of the overall dietetics workforce across the United States is revealing in this regard. Table 2 shows the number of RDs and of DTRs per 100,000 population, based on 2009 state populations and data from CDR (Chris Reidy, CDR Executive Director, personal communica-

tion, October 2010). The state-specific ratios (expressed per 100,000 people) range from 55.0 in North Dakota to 16.0 in Nevada—so, in contrast to Nevada, where there are only 16 RDs for every 100,000 residents, North Dakota, representing the best ratio of RDs per person, has 55 RDs for every 100,000 people in need of primary, secondary, and tertiary prevention, across the lifespan, and for interventions across the social-ecological model. These data demonstrate important state-specific differences in available RDs per population and suggest considerable differences in the availability of RDs for needed services, technical assistance/consultation, supervision, and management.

Table 2 reveals some additional points worth noting:

- Among the 10 states with the best ratio of RDs per 100,000 people, five are in the New England region of the United States.
- The ratios of DTRs per 100,000 are even lower than that for RDs, ranging from the best ratios of 8 DTRs per 100,000 in Maine to 0.1 DTRs per 100,000 in Hawaii.
- Among the top 10 states for the best ratios of RDs per population, six states—New Hampshire, Minnesota, Nebraska, Connecticut, Wisconsin, and Ohio—also have the best ratios for DTRs.

- Among the 10 states with the worst ratios for RDs per population, three states—New Mexico, Georgia, and Wyoming—also have the worst ratio for DTRs per population.

There is a paucity of research about why these ratios exist and what their implications are, which also suggests another challenge for the dietetics workforce: understanding the dietetics infrastructure, including what it is like (eg, the numbers and types of nutrition-related personnel, qualifications, experience, professional development needs, and how and where they practice) and its relationship to health care and health outcomes.

CHALLENGES AND OPPORTUNITIES

There are clear needs for the current and future dietetics workforce to address nutrition-related chronic disease across prevention levels and across the life-course by working toward intervention targets across the social-ecological model to promote health, prevent disease, and eliminate health disparities. How this labor force works within the practice areas identified by Rogers (92) is affected by the cost of health care and health care reform to control costs and improve health outcomes as quality and efficiency of care are improved (93). Nutrition and dietetics has an important role in preventive services and as a therapeutic agent in chronic-disease management. As the demand for prevention and health care services increases, members of the dietetics profession will need to think carefully about new practice roles, particularly related to environment and policy interventions and integration in health care teams, and work with an increasingly bifurcated health care workforce, which might require more consultation and technical assistance. In addition, the profession as a whole needs to think carefully about how to promote recruitment and retention of a diverse and culturally competent workforce that also is skilled in helping develop culturally competent systems of care in the agencies, facilities, and communities where they work.

It will behoove the profession to consider not only where dietetics practitioners are located, but also what staffing ratios are appropriate for different intervention targets, such as population/system-level interventions and clinical and ambulatory care interventions. There is a clear need for research related to the nutrition and dietetics workforce to understand the relationship of the workforce supply with demand and how the workforce fits with other health care professionals. The challenges are considerable, but proactive leadership, willingness to explore options, and engagement with a broad spectrum of stakeholders will help shed light on how to plan for the future.

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AUTHOR INFORMATION

B. Haughton is a professor, Department of Nutrition, The University of Tennessee, Knoxville. J. Stang is an associate professor, Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis. Address correspondence to: Jamie Stang, PhD, MPH, RD, LN, Division of Epidemiology and Community Health, University of Minnesota, School of Public Health, Suite 300 West Bank Office Building, 1300 South 2nd St, Minneapolis, MN 55454. E-mail: stang002@umn.edu

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