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Healthy Nutrition: From Farm to Fork





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Opening Commentary

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The way we get people involved and motivated to make better choices is through the stories we tell. This issue of *Elevate Health* discusses the importance of sharing food and where it comes from with every young person in our lives and communities. My grandfather and mom shared everything about food with me at an early age: where it comes from, how to cook with it responsibly, and how to share it.

Learning these lessons improved the quality of my life immeasurably. I was never a picky eater because I helped garden and cook the food I grew. My self-esteem was higher because I was emotionally and physically involved in growing the family's food. I wanted to share it and eat it, too. Later, when I had a food budget of \$40 a week, it didn't scare me. I knew I could fend for myself in style by smart shopping: dried beans, buying pricy items like spices from the bulk section, shopping by unit price rather than item price, buying direct from farmers, and asking for the imperfect items. I could take a chicken, a few root vegetables, and canned goods and eat well for several days. Knowing about food has empowered me through my entire adult life. At 46, I believe eating a Mediterranean diet rich with olive oil, dark leafy greens, vegetables, seafood, and lean meats has blessed me with good blood pressure, a clear mind, and the energy to run 5 or 6 miles every morning.

It's an exciting time in farm and in food because more and more people are interested in making these food connections. I talk to families all the time that are cooking more and asking relevant food questions. Those conversations tell me that we are all getting into the kitchen and around the table as a family more and more. Dinner is happening again! It's so important to keep this momentum going. Building upon this movement starts with getting kids to the farmers' markets, the super market, or better yet, into the garden to learn where real food comes from.

As adults, we need to be responsible shoppers as well: know where your food comes from and how it was grown or raised. Learn to eat less processed food, buy sustainable seafood (even when buying things like canned tuna), and to leave no waste. When you have extra food, use it to help our food banks. If you have extra time and a green thumb, start a garden for your local public school. Feeding each other is the greatest of gifts and an easy one to give.

In this issue, Jamie Bachaus and Jennifer Otten explore the linkage between public health and food systems and provide a glimpse into recent evidence on how the U.S. food system impacts consumer food availability, affordability, and quality, and thus, nutrition and health. It also presents current initiatives and steps consumers can take to influence the food system.



Healthy Nutrition: From Farm to Fork



Improving our food systems, from farm to fork, can help support good health and nutrition. Healthy food systems can provide healthy food for all Americans.

Introduction

An assortment of food labels touting things such as “organic,” “free range,” and “local” inform us about how our food is produced, processed, and distributed. But what do we really know about the journey our food takes “from farm to fork” and how that impacts human health and nutrition?

This complex journey includes a range of steps taken to bring food to a population, including the inputs, actions, and outputs of growing, harvesting, processing, packaging, marketing, distributing, and disposing of food and its packaging, and is commonly referred to as our “food system.”¹⁻³ The current state of the U.S. food system has been described as one that simultaneously provides an overabundance of less healthy and more processed foods alongside inequitable access to healthier and affordable foods.^{4,5}

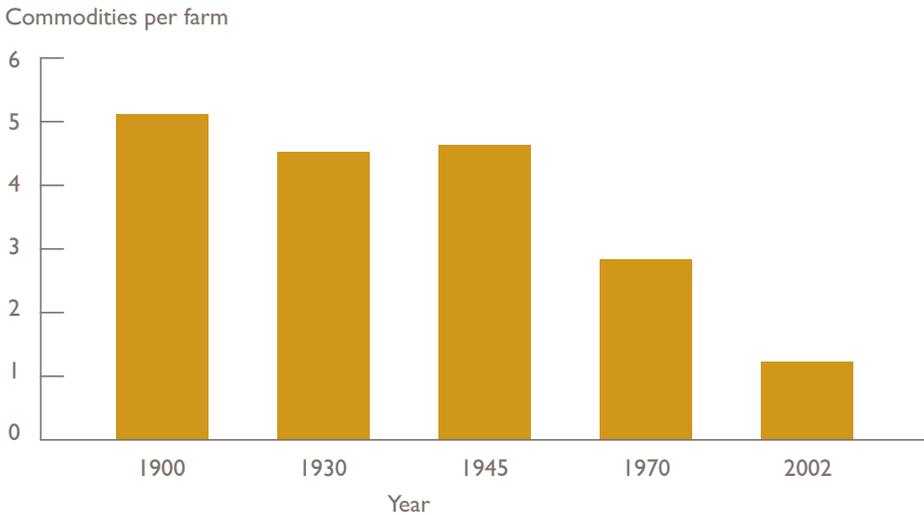
Until recently, the linkages between public health and food systems have not been a primary focus. But growing awareness around topics, such as the increase in antibiotic resistance in people because of the use of antibiotics in food-producing animals

and the loss of nutrients during heavy food processing, have prompted greater attention.⁶⁻⁹ In 2015, for the first time since its inception in 1980, the U.S. Dietary Guidelines Advisory Committee (DGAC)—jointly with the United States Department of Agriculture (USDA) and the U.S. Department of Health & Human Services (HHS)—has been charged with understanding the links between how our food is grown, produced, processed, and distributed as well as resulting impacts on human health.¹⁰

A healthy food system can support human health and nutrition in a number of ways. These include guiding what types of food are produced and available, how food is processed, reducing food waste in ways that improve food security, and reducing environmental health effects. This article provides a glimpse into recent evidence on how the U.S. food system impacts consumer food availability, affordability, quality, and thus, nutrition and health. It also presents current initiatives and steps consumers can take to influence the food system.



Figure 1. As farms have become more specialized, the number of commodities produced per farm has decreased¹³



Note: The average number of commodities per farm is a simple average of the number of farms producing different commodities (corn, sorghum, wheat, oats, barley, rice, soybeans, peanuts, alfalfa, cotton, tobacco, sugar beets, potatoes, cattle, pigs, sheep, and chickens) divided by the total number of farms.

Source: Compiled by Economic Research Service, USDA, using data from Census of Agriculture, Census of the United States, and Gardner (2002).

Understanding the Health and Nutrition Impacts of the Food Chain

Over the last several decades, industrialization has slowly transformed American society and its food system, including the mindsets of both consumers and producers. These changes include new technologies to increase efficiency and yield; affordable, ample fossil fuels; innovation of new, higher-yielding plant and animal breeds; more streamlined farm processes; and enhancements in transportation infrastructure. These changes make it much easier to move agricultural products seamlessly across the country and world; increase globalization of the marketplace; and cause demographic shifts to increasingly more urban populations.^{2,11–13} All levels of the food supply chain require inputs such as labor and energy, and produce outputs that directly or indirectly have implications for human health. These include natural resource inputs, such as water; external inputs, such as fertilizers and pesticides; and outputs that affect air and water quality.

Key to understanding the food supply chain is that it is not a linear process but a complex system in which components are deeply intertwined. A small modification in one link of the chain can affect another, intentionally or not.^{2,14} These shifts, along with changes in the economy and evolving policies, have altered the food system in ways that impact health. The following sections discuss several of these changes that impact each food system sector—production, processing, distribution, and marketing, and retail, consumption, and disposal—and where, within each of these sectors, opportunities exist for improvement.¹⁵

Production

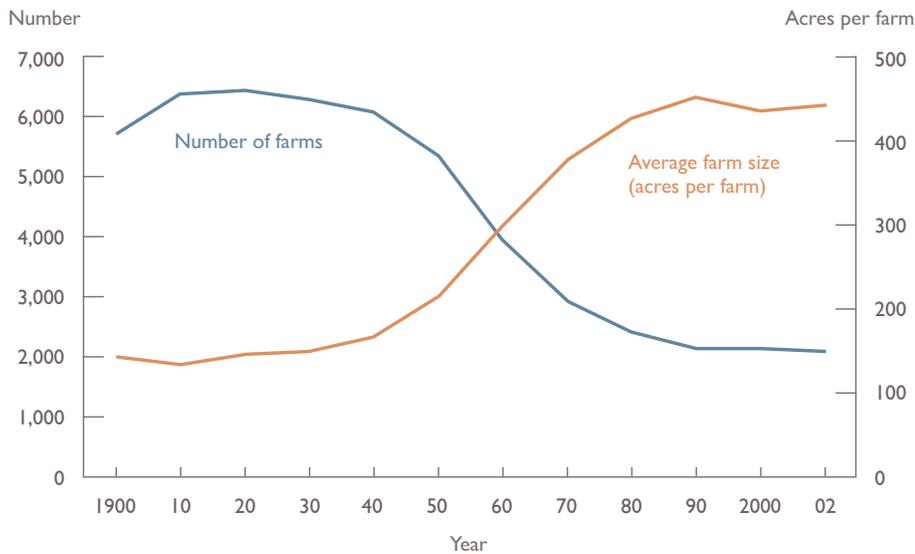
Agricultural production broadly refers to how food is grown, raised, or farmed. This terminology ranges from a backyard chicken coop to a salmon hatchery to a large, conventional farm.^{16,17} Over the past 100 years, the agricultural landscape has been transformed from numerous small- and mid-sized farms with highly diverse outputs to fewer, but larger-scale, capital-intensive farm operations. These larger farms that specialize in one or two commodity crops

are known as monocultures, while those that specialize in one or two food-producing animals are known as animal feeding operations (AFOs) or concentrated animal feeding operations (CAFOs).^{2,13,18} These shifts—aimed at increasing yields and creating a consistent food supply—were enabled by mechanization, crop variety advancements, and the introduction of agrochemicals to fertilize crops and control pests and weeds.^{1,18–20} Decades of policies with goals such as national security and preservation of rural communities also shaped which crops were selected for cultivation and how crops were grown.^{14,21}



Over decades, Industrialization has slowly transformed American society and its food system, including the mindsets of both consumers and producers.

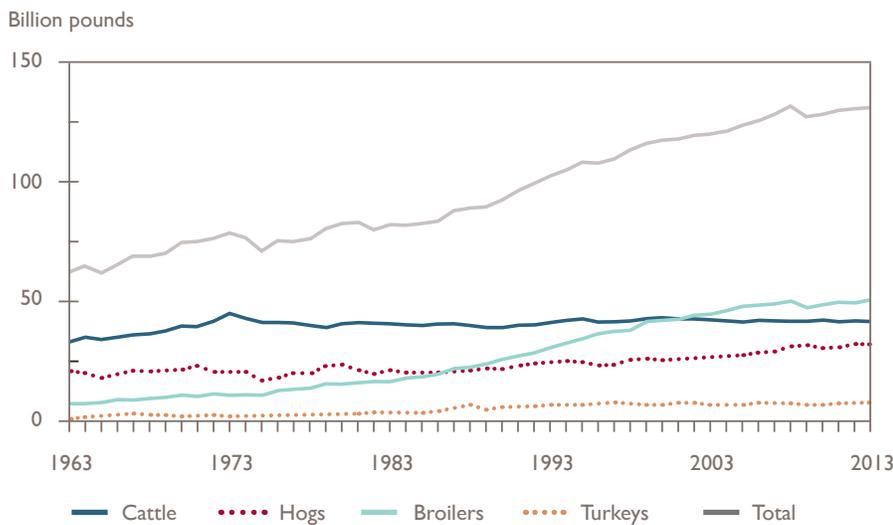
Figure 2. As the number of farms declined, their average size increased¹³



Source: Compiled by Economic Research Service, USDA, using data from *Census of Agriculture*, *Census of Population*, and *Census of the United States*.

The U.S. agricultural landscape has gone from many small- and mid-sized farms with diverse outputs to fewer, but larger-scale, capital-intensive farm operations.

Figure 3. Meat Animals: Pounds Produced 1963–2013³³



Source: USDA National Agricultural Statistics Service. Meat Animals: Production By Year, U.S.

Together, these changes impacted the food supply where commodity crops best suited for large-scale production, simple storage, and long-distance shipping—corn, soy, and wheat—were increasingly produced in vast quantities.^{1–2} In part, this expanded the availability of fats, sugars, and calories in the food supply. In 2002, USDA researchers attributed rising obesity rates from 1985 to 2000 to a 300-calorie spike in how many calories the U.S. food supply provided to the average eater.⁴ Of these extra calories, 46 percent came from grains (mostly refined), 24 percent from added fats, and 23 percent from added sugars.⁴ Simply, sweets and fats were more available at a lower cost than many healthier foods.^{22,23} For example, fruits and vegetables do not even meet production levels sufficient for recommended consumption for the population.^{24–27}

The adoption of vast monocultures also spurred rapid expansion of pesticide use to repel invasive pests, minimize spread, and preserve crop yield.²⁸ Highly publicized events over the last several decades related to toxic pesticide levels in specific foods has resulted in heightened public concern about use of pesticides and increased awareness about their potentially harmful effects. A study conducted by the USDA Economic Research Service (ERS) focusing on a selected 21 crops (accounting for 72 percent of pesticide use from 1980–2006) found that 516 million pounds of active-ingredient pesticides were used on crops in 2008, compared to 196 million pounds in 1960.¹⁹ Two additional studies have calculated that pesticide use results in \$1.1 billion per year in public health costs, based only on acute poisonings plus associated illness and cancer.^{20,29}



Figure 4.

Cows grazed on pastures have five times more of a fatty acid called conjugated linoleic acid (CLA) in their milk. The incidence of cancer in laboratory rats declines after they've consumed CLA.³⁴

Source: USDA.

The emphasis on production capacity, monocultures, and specialization also encouraged the creation of separate and large-scale food animal operations of limited species (AFOs, CAFOs).² Large-scale production of food animals often results in hundreds or thousands of hogs or poultry confined indoors in a single building and cattle tightly crowded on feedlots. This has given rise to two main human nutrition and health-related concerns: reduced nutrient content and increased antibiotic resistance. Due to the increased scale of production and focus on efficiency, animal husbandry efforts have drastically changed (see Figure 4).^{6,30,31} Cattle have transitioned from a diet largely composed of grasses to a diet of corn and soy. Poultry and hogs have less space to move around. These and other methods to increase egg, meat, and milk yields for food animals have resulted in changes to nutritional value in the final products.^{2,30,31}

To prevent disease spread in these crowded conditions, and also to treat infection and promote growth, low doses of antibiotics are often administered to these food animals.^{7,30} This has contributed to an increase in antibiotic resistance in humans.⁷ In September 2014, the President's Council of Advisors on Science and Technology delivered the *Report to the President on Combating Antibiotic Resistance*, which described the growing risk of antibiotic resistance in human health linked with use in animal agriculture. While the report acknowledged that the magnitude of this link must be better understood,

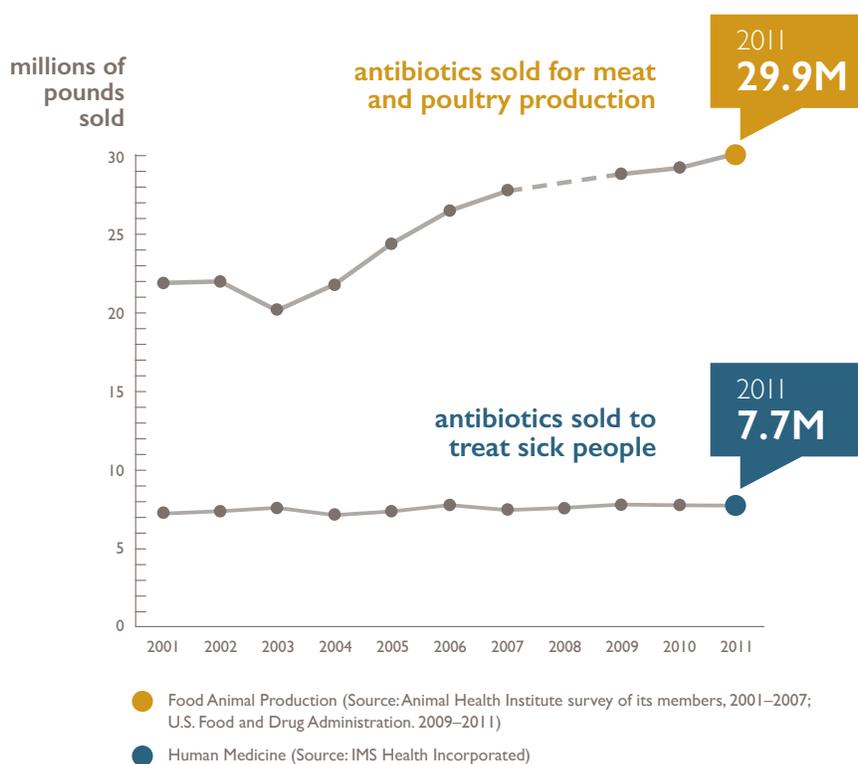
it indicated strong reasons to minimize the use of antibiotics in agriculture.³⁵ In response, the president issued an executive order to convene an interagency task force, including the secretaries of defense, agriculture, and health and human services to enhance surveillance and continue taking steps to eliminate the use of antibiotics for growth promotion purposes in food-producing animals.³⁶

Processing

Food processing transforms ingredients from production, such as harvested crops or animal products, into new outputs for consumption. This can be as simple as washing and packaging fresh produce or as complex as making breakfast cereal.¹⁶ Similar to the production sector, industrialization of the food system impacts both the ingredients available for processing and the scale at which food is processed.^{1,11}

While often convenient and inexpensive, highly processed foods can come at a cost to nutrition. Processed refined and polished grains are milled to remove the bran and germ—the most nutrient-dense portions of the kernel—to give the grains a finer texture and enhance shelf life.²⁵ During this process, key nutrients such as dietary fiber, iron, and many B vitamins are lost. Most refined grains are enriched to restore certain B vitamins (thiamin, riboflavin, niacin, and folic acid,

Figure 5. Antibiotics sold for meat and poultry production as compared to those sold to treat sick people³⁷



Source: The Pew Charitable Trusts.

among others) and iron lost in processing. However, fiber, which is critical for digestive health and may help reduce the risk of cardiovascular disease, obesity, and type II diabetes, cannot be restored. Currently, Americans consume 200 percent of the recommended limit for refined grains.³⁸ Another highly processed ingredient abundant in the American diet is high-fructose corn syrup (HFCS). Almost 5 percent of the total corn crop is diverted to sugars in the form of HFCS contained in sweetened beverages, cereal, baked goods, and sweets.³⁸ Though mixed evidence exists regarding the impacts of different types of sugars on human health, high consumption of added sugars has been linked to adverse health effects such as weight gain, type II diabetes, and mortality from coronary heart disease.³⁸⁻⁴²

Highly processing foods can come at a cost to nutrition. Key nutrients such as dietary fiber, iron, and many B vitamins are lost in the refining of grains.

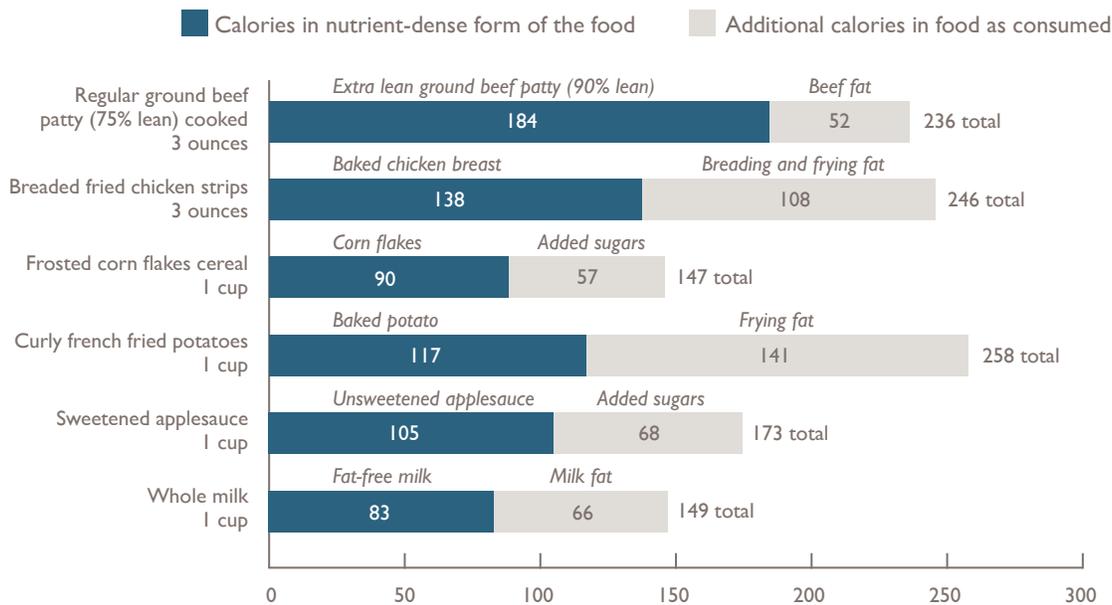
Currently, Americans consume 200 percent of the recommended limit for refined grains.



Other processing techniques, such as freezing, extend shelf life and preserve the nutrient content of certain fruits and vegetables at peak ripeness.^{11,12} Once frozen, these foods can last up to 6–12 months and have higher nutrient content than their “fresh” counterparts that may have been shipped thousands of miles over 7–10 days.¹²

Depending on the season and type of fruit or vegetable purchased, frozen produce may also be more affordable than fresh or canned.³⁹ While prices vary, so do time and preparation methods: most whole or cut fruits and vegetables are typically consumed raw while frozen foods may require additional thawing or preparation.

Figure 6. Examples of the Calories in Food Choices That Are Not in Nutrient Dense Forms and the Calories in Nutrient Dense Forms of These Foods²⁵



Based on data from the U.S. Department of Agriculture, Agricultural Research Service, Food and Nutrient Database for Dietary Studies 4.1 www.ars.usda.gov/Services/docs.htm?docid=20511 and USDA National Nutrient Database for Standard Reference, Release 23. www.nal.usda.gov/fnic/foodcomp/search/.

Aside from nutrient content, a growing concern among the public is the rise of additives in the food supply which enter during the food processing stage. There are over 10,000 additives currently allowed in food, of which some have the potential to reach toxic levels. Increased consumption of processed foods leads to a concurrent rise in chemical additives consumed by the general public.⁴⁴ The Food and Drug Administration (FDA) is responsible for overseeing premarket approval of food additives, excluding foods that are Generally Recognizable as Safe (GRAS).⁴⁵ Companies themselves determine if a food additive used in food processing meets GRAS standards, which has raised public concern that the FDA is not adequately involved in oversight for public safety.^{45,46} A recent analysis of data reported by the FDA, the National Institutes of Health (NIH), and other leading toxicology databases found that only one in five chemicals has been evaluated using the simplest lab animal test recommended by the FDA to evaluate safety.⁴⁴ This analysis, paired with a partial list of all food ingredients lawfully added to food, suggests potentially unknown health risks to the millions of Americans who eat food with untested additives.⁴⁷

Like chemical additives, foodborne pathogens also enter the food supply chain, though often involuntarily. Larger processing plants frequently practice composite processing; a burger patty purchased at the supermarket can be a blend of hundreds to thousands of animals.⁴⁸ If one animal is infected, it can spread throughout the plant. The same is true for many fruits and vegetables purchased at a typical grocery store. A leading approach to managing foodborne illness risks is Hazard Analysis and Critical Control Points (HACCP), designed to prevent the occurrence of problems by assuring the controls are applied at any point in a food production system where hazardous or critical situations could occur.⁴⁹ Still, foodborne illness is a significant problem; about 48 million (1 in 6) Americans get sick, 128,000 are hospitalized, and 3,000 die each year from foodborne diseases, according to recent data from the Centers for Disease Control and Prevention (CDC).⁵⁰

Distribution and Marketing

The *Dietary Guidelines for Americans, 2010*, emphasize that our food behavior is influenced by the situation around us.²⁵ Food distribution, marketing, and retail encompass the transportation of food from one place to another as well as the storage, marketing, and sale of those food products.¹⁶

The United States has a strong distribution network enabling consistent access to healthy food year round. However, with an average travel distance of 1,500 miles from harvest site to consumer plate and frequently long periods spent in storage or on-shelf, produce is subject to decreased nutrient content, quality, and freshness.⁵¹ Many nutrients, most notably vitamin C, break down immediately after harvest.⁵² Travel times may also affect taste, which can have negative impacts on consumption.⁵³ New refrigeration technologies and improved transportation systems aim to enhance nutrient quality and maintain freshness of food products traveling long distances.

Where Americans purchase food has also transformed greatly over the past 100 years. The first U.S. supermarkets opened in the early 1900s and revolutionized the food retail sector.^{12,55,56} It was not long after the introduction of supermarkets that Americans were welcomed into big-box stores, where the number of food choices increased exponentially and foods were often available in bulk. Nutrition experts suggest that

inflated package sizes and bulk deals may contribute to overconsumption.^{55,58} The rapid explosion in food choice and convenience presented new challenges for informing the consumer.

Food labels and regulations can be even more puzzling when it comes to learning how food was grown and produced, and what was added during various points of processing. For example, the USDA and FDA in many cases have different labeling requirements and definitions for communicating how food was raised and what was added during various processing points.^{59,60} Terms like “natural” and “hormone free” vary in their meaning, depending on the monitoring agency.¹² The USDA allows producers of conventionally raised food animals to label their meat as “natural” so long as this term is used truthfully, while FDA does not object to the use of the term if the food does not contain added color, artificial flavors, or synthetic substances.^{61,62} Labels on meat packages, such as “no hormones added,” can be confusing and often misleading to consumers who are unaware that hormones are only a routine husbandry practice for certain food animals (e.g., routinely used in cattle, but not routinely used in poultry and hogs).⁶²

One label in particular—USDA certified organic foods—does reliably guide consumers on food system methods.^{63,64} According to the USDA, organic is a

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Table I. Organic Labeling⁶⁵

Label Claim	Criteria	Principal Display ¹	Information Panel ²
100% Certified Organic	All ingredients must be certified organic. Any processing aids must be organic.	May include USDA organic seal and/or 100 percent organic claim.	Must identify organic ingredients (e.g., organic dill) or via asterisk or other mark.
Organic	All agricultural ingredients must be certified organic, except where specified on National List. Non-organic ingredients allowed per National List may be used, up to a combined total of five percent of non-organic content (excluding salt and water).	May include USDA organic seal and/or organic claim.	Must identify organic ingredients (e.g., organic dill) or via asterisk or other mark.
“Made with Organic”	At least 70 percent of the product must be certified organic ingredients (excluding salt and water). Any remaining agricultural products are not required to be organically produced but must be produced without excluded methods. Non-agricultural products must be specifically allowed on the National List.	May state “made with organic (insert up to three ingredients or ingredient categories).” Must not include USDA organic seal anywhere, represent finished product as organic, or state “made with organic ingredients.”	Must identify organic ingredients (e.g., organic dill) or via asterisk or other mark.
Specific Organic Ingredients	Multi-ingredient agricultural products that contain less than 70 percent certified organic content (excluding salt and water) don’t need to be certified.	Must not include USDA organic seal anywhere or the word “organic” on principal display panel.	May only list certified organic ingredients as organic in the ingredient list and the percentage of organic ingredients. Remaining ingredients are not required to follow the USDA organic regulations.

¹ **Principal display panel:** portion of the package most likely to be seen by customers at the time of purchase. Your certifying agent will review and approve each of your product labels to ensure compliance.

² **Information panel:** includes ingredient statement (list of ingredients contained in a product, from highest to lowest percentage of final product) and other product information.⁶⁵

third-party certified label “that indicates that the food or other agricultural product has been produced through approved methods that integrate cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.” This definition prohibits the use of pesticides, synthetic fertilizers, sewage sludge, irradiation, and

genetic engineering in fruits and vegetables and antibiotics, and of growth hormones and non-organic feed in food animals, and ensures the consumer that the label is reliable.⁶⁴

Finally, food marketing to children is another part of the food system that has been shown to influence children’s food preferences, choices, consumption, and health.^{61–63}

Food and beverage companies throughout the United States spend nearly \$2 billion to market products to children, with the majority promoting less healthy food and beverages.^{67–70} At the request of Congress, the FTC released several reports on the state of food and beverage marketing to children illustrating that the vast majority of youth-directed ads promote unhealthy foods and

drinks including fast-food products, carbonated beverages, cereals, candies, and other products high in sugar and/or fat.^{71,72} When compared to food and drinks marketed to adults, those products marketed to children prove to be much less healthful overall.⁷³

Food Access and Consumption

Food access and consumption is often described as the consumer's point of contact with food. It encompasses a variety of meanings about where (e.g., at-home vs. away-from-home, store type), how (e.g., purchase, via food safety net program), and what people eat (e.g., culturally appropriate, high quality, low nutrient).¹⁶ This sector is strongly related to health outcomes and household food security.

Except for the lowest-income consumers, Americans are spending a smaller and smaller percent of household income on food, while overall consumption continues to rise.⁷⁴ According to the USDA, food consumption rose dramatically from 1970 to 2003. The total amount of food available to eat per person increased 16 percent from 1,675 pounds in 1970 to 1,950 pounds in 2003.⁵

At the same time, the percentage of the food budget spent on food away from home has steadily increased since the mid-1970s and is projected to continue to increase for everyone except the poorest 20 percent.⁷⁴ Cheaper calories in general, especially those composed of greater amounts of unhealthful added sugars and fats, as well as increased amounts of food eaten away-from-home, have been shown to lead to overconsumption and increase the risk of obesity and other diet-related chronic diseases.^{4,12}

Paired with increasing rates of overconsumption is the simultaneous escalation of food insecurity in the United States. Seemingly discordant, the problem of overconsumption and under consumption are rooted in the same food system problem of disparate access to healthful and affordable food. An estimated 14.3 percent of American households were food insecure at least some time during the year in 2013, meaning they lacked access to enough food for an active, healthy life.⁷⁵ Closely linked with poverty, food insecurity disproportionately affects populations that are low-resourced in other ways, such as geographic access and time. Food insecurity predisposes individuals and households to other negative health

outcomes. Children who are food insecure are more likely to face developmental consequences that may be both nutritional (e.g., weight gain, nutrient deficiencies) and non-nutritional (e.g., academic performance and social skills).⁷⁶

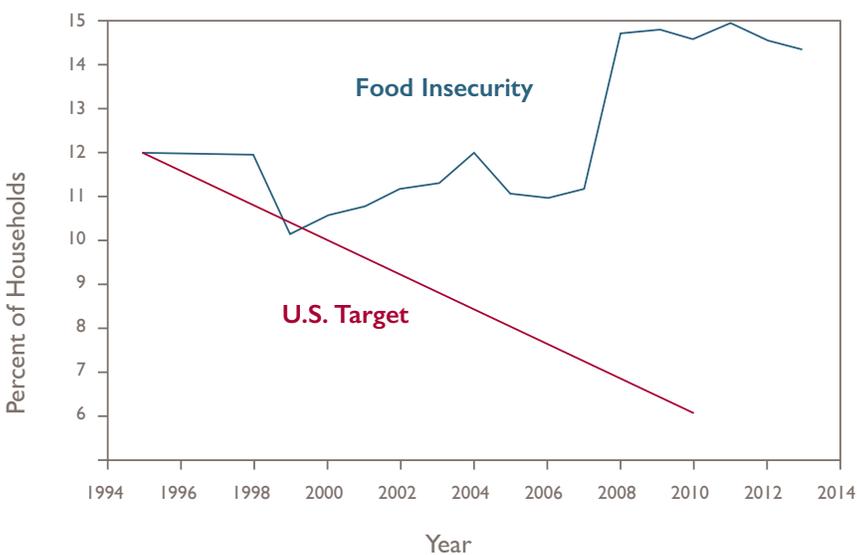
Despite these disconnects, notable efforts are emerging that link consumers with the sources and methods of food production. These include a consumer led movement for locally produced foods, an increased federal commitment to supporting local and regional food systems via programs such as the USDA's *Know Your Farmer, Know Your Food* (KYF2), encouraging consumers to better connect with their local farmers, and expansions in federal support for and purchases of organically grown food.⁷⁷⁻⁸¹

Disposal

Disposal, or post-consumption, encompasses all points of the food system—from growing, processing, packing, labeling, transportation, selling, purchasing, preparing, and consuming food—and the waste and packaging involved with each.¹⁶ More food reaches landfills and incinerators than any other single material in municipal solid waste. This has serious implications for fare available for food insecure populations as well as for environmental health concerns.⁸² Due to the challenging nature of quantifying food waste, limited research exists in this area.

The EPA reports that in 2012, more than 36 million tons of food waste were generated, with only 5 percent diverted from landfills and incinerators for composting. The majority of this waste comes directly from consumers. When food reaches a landfill, it rots and becomes a significant source of methane, a potent greenhouse gas with 21 times the global warming potential of carbon dioxide.⁸² The EPA's 2009 report *Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices* shows that approximately 13 percent of greenhouse gases in the United States are associated with growing, manufacturing, transporting, and disposing of food.⁸³

Figure 7. Food Insecurity Rates and Relation to U.S. Targets^{75,77}



Food waste also contributes to careless consumption of the natural resources used to produce it. This includes more than one-quarter of total freshwater consumption and approximately 300 million barrels of oil per year, which, along with methane and CO² emissions from decomposing food, impacts global climate change.^{84,85} One study suggests that U.S. per capita food waste has progressively increased by 50 percent since 1974, reaching more than 1,400 calories per person per day, or 150 trillion calories per year.^{85,86}

Moreover, food is often needlessly wasted for a variety of reasons, including being thrown out due to cosmetic blemishes, remaining unharvested due to the cost barriers or labor shortages associated with harvesting, and consumer/retailer misinterpretation of food labels related to “sell by” and “use by” dates (i.e., date labels). Date labels were designed to aid consumers in understanding freshness of products or when a product might taste its best, but consumers often misinterpret them as food safety messages that indicate a food has spoiled or may cause foodborne illness. In addition, the criteria for date labels are not uniform across the United States. This is because date labels are not defined at a federal level but instead are regulated by a mix of state and local laws.⁸² At a time when



nearly 17.9 million households are food insecure, this presents ample opportunity for farms and organizations to donate safe and healthy food to emergency food programs to both reduce food sent to landfills and feed those in need.^{83–88}

Conclusion: Cultivating a Food System that Aligns with Public Health Goals

Tremendous opportunities exist to improve food systems in ways that align with public health and nutrition goals. To realize these opportunities, the food system must be considered broadly and involve all food system sectors, stakeholders, and factors of influence.^{2–4,11–15}

Improved coordination is necessary to continue efforts to align the food system with public health goals. The American Medical Association noted the disconnect between food policy, health, and sustainability and recommended better integration in its *2009 Sustainable Foods Report*.⁸⁹ Following that, in June 2010, the Academy of Nutrition and Dietetics, the American Nurses Association, the American Planning Association, and the American Public Health Association met to develop a set of shared food system principles: “a healthy, sustainable food system emphasizes, strengthens, and makes visible the interdependent and inseparable relationships between individual sectors (from production to waste disposal) and characteristics (health-promoting, sustainable, resilient, diverse, fair, economically balanced, and transparent) of the system.”⁹⁰ In 2013, the National Academy of Sciences formed an expert committee to develop a framework for assessing the environmental, social, and health effects (positive and negative) associated with the ways in which food is grown, processed, distributed, and marketed within the U.S. food system. The report is due in 2015.⁹¹ These efforts, along with the 2015 Dietary Guidelines Advisory Committee charge to outline evidence at the intersection of the food system as it relates to health and food security, demonstrate widespread approaches to lay the groundwork for a comprehensive food system that aligns with health goals.

Many concrete efforts are already under way. In 2010, the Department of Health and Human Services and the General Services Administration collaborated to create the *Health and Sustainability Guidelines for Federal Concessions and Vending Operations* to assist vendors at federal worksites in incorporating healthy foods and beverages with sustainable practices.⁹² The guidelines reflect the *2010 Dietary Guidelines for Americans* to support healthier choices, such as seasonal vegetables and fruits, freely available drinking water, and use of foods with less sodium. The guidelines also encourage more sustainable food service practices like offering incentives for reusable beverage containers; offering

Figure 8. Food Recovery Hierarchy⁸²

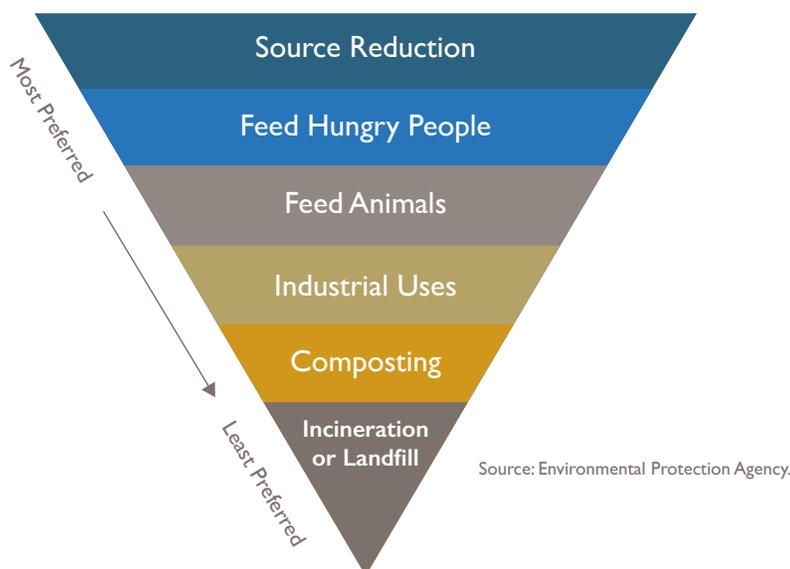


Figure 9. What can consumers do as we search more for answers?

As public health professionals, food systems experts, and decision makers search for answers, there are several steps consumers can take to support a healthier food system.

Know Your Farmer

Participate in programs that strengthen local and regional food systems. Whether you take an active role by always purchasing local, visiting your neighborhood market, or substituting a few ingredients here and there, increases in consumer demand for locally produced food are creating jobs and opportunity throughout the country.^{100,101} Farmers are discovering new opportunities to enter the market while you, as the consumer, learn more about where your food comes from, all the while gaining access to fresh, local foods.¹⁶

Eat Seasonally or Buy Frozen

For the highest nutrient content and often the best taste, choose foods that are in season in your region, or buy frozen options.¹¹ Become familiar with which foods are grown in your region throughout the year. Seasonal eating will provide you with food ingredients at their peak ripeness and nutrient content.^{52,102} In addition, the distance and duration these foods have traveled to your plate is likely to be shorter.¹⁰² When food ingredients are not in season, buy frozen produce with minimal ingredients listed to obtain foods frozen at peak ripeness and nutrient content.¹²

Pesticide Residue

Based on the USDA's Pesticide Data Program, the Environmental Working Group (EWG) reported that two-thirds of produce samples in recent government tests had pesticide residues.¹⁹ With increasing evidence to support the potentially harmful effects of pesticide use, EWG produced a resource for consumers to help identify which foods may increase exposure to pesticides and which foods had the lowest pesticide load. Nearly all of the data used took into account how people typically wash and prepare produce.^{19,103} The "Clean 15" foods had the lowest pesticide load, and consequently are the safest conventionally grown crops to consume from the standpoint of pesticide contamination. At the top of the list are avocados, sweet corn, pineapples, and cabbage. The "Dirty Dozen Plus" represents those foods with the highest pesticide load, making them most important to purchase or grow organically. The top offenders on this list are apples, strawberries, grapes, and celery. For a complete list, please visit EWG's website (www.ewg.org).¹⁹

Reduce food waste

One step everyone can take is to reduce individual food waste. Approximately 46 percent of food goes uneaten.⁸³⁻⁸⁵ There are several steps consumers can take to reduce the environmental impacts and save money at the same time: plan ahead and only buy what you need; think before taking advantage of bulk deals and check expiration dates on food packaging; bring your own packaging; store food properly and rotate old food after purchasing new food; cook the right amount and leftovers for a later meal; recycle what you can't eat.⁸⁵ Individuals can also participate in and support local and national food recovery programs to help food insecure populations and to spread the word.¹⁰⁴



food that is organically, locally, or sustainably grown and labeled accordingly; and using compostable trays, flatware, plates, and bowls.⁹¹ Since their introduction, the *Health and Sustainability Guidelines* have inspired other agencies to follow suit, serving as a model for state and local governments, businesses, and non-governmental organizations in making the healthy choice the easy choice for their employees and customers.⁹³⁻⁹⁵

In addition to worksite procurement, the USDA supports farm-to-institution efforts in a variety of settings such as schools, childcare establishments, and hospitals. With an increasing percentage of people eating their meals outside of home, these settings offer an opportunity for U.S. farmers, ranchers, and food businesses to forge ties with local residents and improve healthy food access. The number of schools participating in farm-to-school programs and integrating agriculture into the classroom rose from 400 in 2004 to over 2,300 in 2011. Schools are discovering that when children are taught about where their food comes from, their attitudes toward consuming vegetables improve.⁹⁶

A number of incentive programs also exist to promote access to fresh produce for food insecure households. The Supplemental Nutrition Assistance Program (SNAP) launched several pilot programs to determine if incentives provided to SNAP recipients at the point-of-sale increased the purchase of fruits, vegetables, or other healthy foods.⁹⁷

The Healthy Incentives Pilot, conducted at the retail level by the USDA's Food and Nutrition Service, found that incentivized participants consumed 25 percent more daily of targeted fruits and vegetables than non-incentivized participants.⁹⁸ Similarly, preliminary evaluation results on incentive programs at farmers markets suggests positive outcomes in both food access and consumption.⁹⁹

These are abbreviated examples of the wide-ranging efforts to form a more connected and healthful food system. Many rich opportunities exist to improve our food system in support of human health and nutrition.

The number of farmers' markets in the United States has tripled since 2000. New York City alone has more than 135 farmers' markets, and at the height of the harvest, more than a quarter million people are frequenting the markets every week.



Scientific Summary

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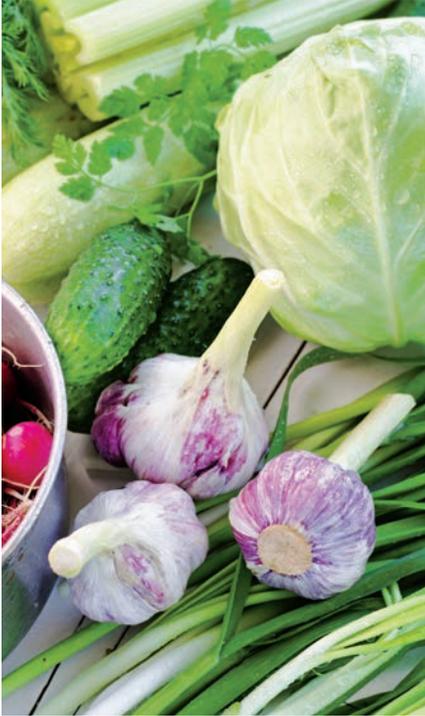
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The coexistence of obesity and food insecurity in America presents a tremendous challenge to public health, given the conundrum that both problems share a common food system. In their article, Bauchus and Otten highlight the impact of industrialization on the transformation of America's food system. The authors extend selected aspects of this structure to the potential development of public health policies aimed at improving health subsequent to consuming nutritious and, whenever possible, unadulterated foods. By describing the components of the food system, from production to consumption and disposal, in the context of consumer perceptions, fears, choices, and potential health outcomes, the authors present a sound rationale for coordination between all segments of the food system. They encourage interplay among health professionals to promote better nutrition and public health.

At the root of this discussion is the current farm-to-fork movement, which embraces the stages of food production—harvesting, storage, processing, packaging, sales, and consumption—in a more traditional way. Bauchus and Otten explain how concerns and attitudes about food safety and food freshness, coupled with skepticism of selected production and processing methods, provide a platform for a movement that is associated with organic farming initiatives, sustainable agriculture, and community-supported farming. The article concludes with realistic recommendations for consumers and an amicable challenge for crosstalk between health professionals, policy makers, and producers to advance public health initiatives through better nutrition.

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