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PEER-REVIEWED ARTICLE

Food Protection Trends, Vol 35, No. 2, p.101–105

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Occupational Analysis of the Present and Future Food Safety Workforces

ABSTRACT

A general shortage of qualified food safety professionals has been observed in recent years. An occupational analysis was conducted by interviewing industry experts and summarizing employment and salary figures from recent U.S. Department of Labor reports. Common food safety occupations included agricultural and food scientists, technicians, food processing operators, microbiologists, chemists and materials scientists, dieticians and nutritionists, and epidemiologists. Many food safety occupations requiring higher education had higher mean salaries than the national average. Food safety employment was expected to increase through the years 2010–2020. Food scientists and technologists and food processing operators experienced the highest employment growth from 2010 to 2013 (43% and 57%, respectively). This analysis further emphasized the importance of outreach and recruitment efforts concerned with staffing the food industry with a qualified workforce and produced useful data for such efforts.

INTRODUCTION

Maintaining a staffing pipeline of qualified professionals with the appropriate technical skills and behaviors can be a barrier to establishing food safety programs *(11, 12)*. Unfortunately, there is a general shortage of qualified food safety professionals across all food sectors in the United States *(3, 6)*. Consideration of how to recruit and train more qualified food safety professionals is warranted, given the hazards to food safety that this human resources shortage poses. Workforce capacity building efforts may benefit from increased understanding of the variety of occupations in food safety.

The challenge of maintaining a staffing pipeline of qualified food safety professionals is complicated by the breadth of jobs, their education requirements and salary expectations. Although numerous food safety job task analyses have been conducted *(4)*, occupational analyses for this career field have not been reported in the literature. Unlike job analyses, occupational analyses determine how particular occupations are employed across industries/enterprises/organizations. The objective of this study was to conduct an occupational analysis of persons employed

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TABLE 1. Food safety occupations and education requirements *(8)*

Occupation	Description	Education Requirements
Agricultural and Food Scientists	Ensure productivity and safety of food processing and agricultural production. They mostly work in research universities, the private sector, or the federal government. They work in offices, laboratories, and in the field. Scientists in processing plants may occasionally work in unpleasant conditions. Most agricultural and food scientists work full time.	At least a bachelor's degree, and many have a doctoral degree. Common bachelor's degrees are in agricultural sciences, biology, chemistry, physics, or engineering. Ph.D. students may focus their programs on food science, genetics, animal reproduction, or biotechnology.
Agricultural and Food Science Technicians	Agricultural and food science technicians measure and analyze the quality of food and agricultural products, under the supervision of scientists. They work in offices, laboratories, and in processing plants.	Typically need an associate's degree in animal science or a related field. Technicians with only a high school diploma usually receive more on-the-job training than those with an associate's degree.
Food Processing Operators	Depending on their specific position, they set up, operate, and tend cooking equipment that mixes, blends, cooks, or otherwise processes ingredients in manufacturing food products. They work in food processing facilities. Facilities are usually loud and may be hot or cold, depending on the goods being produced. Most food processing operators worked full-time. This category includes food batch makers, equipment operators and tenders.	Most have at least a high school education. Due to the increasing complexity of the equipment, math and English skills may also be required. Physical stamina is needed, and some previous experience in manufacturing is preferred.
Microbiologists	Study the growth, development, and other characteristics of microscopic organisms such as bacteria, algae, and fungi. Microbiologists work in laboratories and offices where they conduct scientific experiments and analyze the results. Most microbiologists work full time and keep regular hours.	A bachelor's degree in microbiology or a closely related field is needed for entry-level jobs. A Ph.D. is frequently needed to carry out independent research and to work in colleges and universities.
Chemists and Materials Scientists	Study the molecular interactions of food ingredients. Their research has a wide range of applications, including food safety. These professionals mostly work full time and keep regular hours.	Need at least a bachelor's degree in chemistry or a related field. However, a master's degree or Ph.D. is required for many research jobs.
Dietitians and Nutritionists	Advise people on what to eat in order to lead a healthy lifestyle or achieve a specific health-related goal. They work in many settings, including hospitals, cafeterias, nursing homes, and schools. Some are self-employed and own their practice.	Most have a bachelor's degree and have previous supervised training. Also, many states require dietitians and nutritionists to be licensed.
Epidemiologists	Investigate the causes of disease and other public health problems to prevent them from spreading or creating another outbreak. They report their findings to public policy officials and to the general public and work in health departments, offices, universities, and laboratories. Some do fieldwork to conduct interviews and collect samples for analyses. Epidemiologists must use safety precautions to minimize their exposure when fieldwork requires interacting with sick patients.	Need at least a master's degree from an accredited postsecondary institution. Most epidemiologists have a master's in public health or a related field, and some have a Ph.D. in epidemiology.

in food safety that may be useful in recruiting the next generation of food safety professionals.

METHODS

An environmental scan was conducted to review occupational demographics in the field of food safety. Food safety occupational employment and salary figures were gathered from 2010 and 2013 reports from the U.S. Bureau of Labor Statistics *(7, 8)*. Employment projections were gathered from the 10-year projection made in 2010 *(7)*. From an initial list of 40 industry experts within the food manufacturing community, six volunteered to participate in this study. Corporate philosophies and career paths were summarized after in-depth interviews with these six persons, whose job titles were director of global quality assurance, quality assurance manager, director of quality assurance, vice president of research and development or vice president for food safety and quality. This group of individuals represented the following companies: General Mills (Minneapolis, MN), Sanderson Farms (Laurel, MS), The Bama Companies (Tulsa, OK), Aseptia (Troy, NC), Cabot Creamery (Cabot, VT) and Mountaire Farms (Siler City, NC).

RESULTS AND DISCUSSION

Many different professions fell under the job category of food safety, the most common of which are listed in *Table 1*. Defining the "food safety professional" was difficult because of the multidisciplinary nature of the field and because many food safety professionals work in the broader category of public health *(3)*. Those that were easier to define were at the government and scientist levels.

The lack of clearly defined food safety career paths may result in many talented individuals leaving the profession and/or fewer students entering the profession *(3)*. Careers within the food industry often receive no consideration from students and young adults *(6)*. The shortage of qualified food safety professionals was acknowledged; for example, one opinion leader stated, "I have found that today and in the last several years there is a real shortage of qualified people for those upper level positions. I think that it's relatively straightforward to find a supervisor, but someone coming out of college with a bachelor's degree is probably qualified to be a supervisor but they don't really have the right expertise or are not getting the right education in the undergraduate programs, either in food science or biology or something like that. They are not getting the content or skill sets required to be an effective quality assurance manager coming out of college."

Most of the food safety professionals employed in the public sector work under the broader job category of public health. For example, 78% of local public health departments provide food service establishment inspections, and 88% of them provide food safety education. There were a total of 2,565 local public health departments in the U.S., with more than 100,000 state health agency employees, including environmental health professionals and technicians in food safety and professionals who work part-time in food safety and environmental health. Other common professions include nutritionists, food scientists, microbiologists, epidemiologists, public health nurses, and toxicologists, as well as academicians working as food safety consultants or government extension agents.

Within the food manufacturing fields, food safety fell under the responsibilities of all, but those most accountable are plant and line managers, as well as quality assurance professionals. Some corporate philosophies stated that all employees were responsible for food safety; however, the breadth of responsibility and ultimate accountability may lie with a few employee or occupational groups, such as plant or line managers, risk officers and quality control personnel, among others.

Some opinion leaders said that, while there are managers and leaders ultimately responsible for food safety, efforts are under way within their organizations to reinforce the philosophy that food safety is a company-wide responsibility and that all employees ranging from senior leadership to floor or frontline staff play a role in ensuring that the company's products are safe. One opinion leader said, "The one thing that I would say is that within [company name removed], we are starting to really imbed food safety as part of everyone's job." At least two opinion leaders stated the need for better critical thinking skills or basic workplace skills, such as communication, research design, laboratory skills or statistical process control, among others. For example, "In terms of skills the one thing that I see that is really lacking across the industry are professionals who can actually translate complex science into understandable messages for the non-scientist."

The mean salaries of epidemiologists, microbiologists, animal scientists, chemists, and material scientists were above the national average of $71,274 *(9)*. All but two of the food safety occupations (food scientists and soil/plant scientists) had a salary increase from May 2010 to May 2013 *(Table 2)*. Animal scientists and food cooking machine operators and tenders experienced the most salary growth in the three-year time period, increasing by 7% and 12%, respectively. Salary increases of all other food safety occupations were above the national average of 3%.

Compared with other industries, the food industry, while growing slightly, is one where profit margins tend to be smaller. Opinion leaders operating in the food industry cited highly competitive conditions and thus lower margins as reasons for the workers within the industry having lower salaries. Given this, highly specialized occupations in food safety are rare.

Employment projections expect all of these food safety occupations to grow from 2010 to 2020 *(Table 2)*. Most of these projections are below the expected employment growth

TABLE 2. Median salaries and employment projections of food safety professions *(7, 8)*. Some data were not available (N/A)

	Mean Salary		Salary Change	Employment Numbers		Employment Change	Projected Employment	Projected Increase in Employment 2010–2020	
Occupation	May 2010	May 2013	2010–2013	May 2010	May 2013	2010–2013	2020	Number	Percent
Agricultural & Food Scientists	N/A	$64,830	N/A	33,500	30,490	-9%	42,100	3,500	10
• Animal Scientists	$68,170	$72,930	7%	2,440	2,320	-5%	3,800	400	13
• Food Scientists & Technologists	$65,380	$65,340	0%	10,480	15,010	43%	15,000	1,100	8
• Soil & Plant Scientists	$62,600	$62,830	0%	12,120	13,160	9%	15,000	1,100	8
Agricultural & Food Science Technicians	$35,140	$37,010	5%	16,890	19,390	15%	26,700	1,500	7
Chemists & Materials Scientists	N/A	$78,780	N/A	90,900	94,950	4%	94,900	4,000	4
• Chemists	$73,240	$77,740	6%	80,180	87,560	9%	85,400	3,200	4
• Materials Scientists	$86,300	$91,160	6%	8,390	7,400	-12%	9,500	900	10
Dieticians & Nutritionists	$54,350	$56,300	4%	53,500	59,530	11%	77,100	12,700	20
Epidemiologists	$69,280	$73,040	5%	4,710	5,350	14%	6,100	1,200	24
Food Processing Operators	N/A	$27,890	N/A	131,000	205,860	57%	133,400	2,300	2
• Food Batch-makers	$26,820	$28,560	6%	97,220	109,660	13%	99,400	700	1
• Machine Operators & Tenders	$25,360	$28,410	12%	32,220	34,040	6%	34,000	1,600	5
Microbiologists	$72,030	$75,230	4%	18,330	19,880	8%	22,900	2,700	13

of 14% for all occupations in the U.S. The employment of epidemiologists was predicted to grow the fastest of all occupations (24%), whereas employment of food batch makers is predicted to grow the least, at only 1%. The 3-year period of 2010–2013, however, showed the most employment growth for food scientists and technologists (43%) and food processing operators (57%) and a 12% employment decrease for material scientists. Thus, employment projections of food safety occupations appear difficult to predict. The consistent employment growth in recent years and the expected growth in future years highlight the importance of ensuring that individuals employed in these occupations possess the appropriate qualifications and food safety competencies.

To build upon this study, future work should review the literature and investigate effective recruitment and retention activities. College students are generally ignorant about food safety careers and curricular offerings at their institutions *(10)*; thus, there is an opportunity to better inform and attract young people to consider food safety careers. Empirical evidence suggests that young people who have previous work experience in the food industry are more likely to consider careers in food safety than those without such experience, but minorities and female students are less likely to consider food safety careers than their counterparts *(5)*. Institutions wishing to expand human diversity within their food safety programs should engage persons of like diversity to perform their recruitment efforts, since empirical evidence suggests this is an effective method *(1)*. Similarly, companies wishing to recruit shift supervisors, for example, should send their shift supervisors to conduct recruitment activities, instead of sending upper management *(2)*.

CONCLUSIONS

Occupations in the field of food safety were analyzed in this regional study. Seven broad categories of occupations were identified, and described, and their education requirements were briefly summarized. The mean salaries of many occupations that require higher education were above the national average. Career opportunities in all of these occupations are expected to increase through the year 2020, especially for the occupation of food safety epidemiologists. Significant increases in the numbers of employed food scientists and food processing operators recently occurred between 2010 and 2013. This analysis produced useful data for outreach and recruitment efforts concerned with staffing the food industry with a qualified workforce.

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