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Corresponding Author: David P. Gilkey, Professor, Department of Safety, Health, and Industrial Hygiene, School of Mines and Engineering, Montana Technological University, 315 Science and Engineering Building, 1300 Park Street, Butte, MT 59701.
Email: dgilkey@mtech.edu.

Note. This supplemental file contains a background of the environmental health profession and was part of the manuscript submitted by the authors. Due to space limitations, editors of the *Journal of Environmental Health* have removed this information from the published article and have presented it as a supplemental file posted online at <https://www.neha.org/jeh-supplementals>.

Supplemental Text: Background of the Environmental Health Profession

The field of environmental health (EH) in the U.S. shares a common history with public health and medicine. As immigration to the early Americas was on the increase throughout the 1630s, the rapidly growing town of Boston passed the only sanitary ordinance that prohibited residents from depositing fish or garbage near common landings. Otherwise, general sanitary matters were left up to local residents, who were free to dig wells, construct privies, and make drains where feasible. By the end of the 1640s, the cleanliness of Boston could no longer be left to individuals, and beginning in 1652, a series of ordinances were passed to improve sanitary conditions (Duffy, 1992).

New York City was the first colonial town to regulate food staples. As early as 1653 it established a public weight house and storehouse. Approximately 3 years later, a public slaughterer was established and three official butchers were appointed to assure quality and consistency (Duffy, 1992). Two additional inspectors for beef and pork were appointed, which assured a measure of government control over all basic food supplies.

A major problem in all colonial towns at that time was the lack of adequate wastewater drainage. Individual residents usually took it on themselves to drain their own property, or groups of residents in proximity built a common sewer or drain (Duffy, 1992). In Boston, complaints about individuals digging up the streets to make drains led to an ordinance requiring them to get prior permission from the city. New York City had unique problems since its boundaries included many low-lying areas, particularly those in the vicinity of boat docks and slips, and the city reluctantly began constructing drains.

New York City formed a committee in 1751 that was charged to investigate the construction feasibility of an underground sewer in place of the existing Fly Market drain. They concluded, however, that it would be far too expensive and the project failed at that time (Duffy, 1992). As a result, the drains, or open sewers, became receptacles for filth, all of which drained into the slips in the harbor. The solid material was deposited on the bottom of the slip and when the tide was out, the stench, particularly in the summer, was almost unbearable. The situation worsened with the growth of New York City. Cartmen and scavengers were employed to empty privies and dump their loads of human waste either onto the docks or into the slips. Conditions

became acute by the end of the 18th century (Duffy, 1992). While health was a minor concern of those who led the fight for an adequate water supply, the dangers of fires also existed and was a priority in an age where open fires and candles were commonly used.

By 1753, New York City assumed full responsibility for maintaining and repairing all public wells and pumps. The city supported the construction of a reservoir and distribution system to convey water to residents and businesses. Even though the new conveyance system worked, it proved inadequate to meet all needs. While the project was later doomed by the start of the Revolutionary War, it led the way for a new water system some 25 years later (Duffy, 1992).

In the years following the Revolutionary War, cities such as Boston, New York, and Philadelphia continued to grow and enacted additional sanitation laws. In New York City, the growing demand for food also created profitable opportunities for aggressive businesses trying to monopolize industries, which led to the rising spirit of free enterprise but clashed with the traditional regulations designed to protect consumers (Duffy, 1990).

In April 1796, the New York legislature enacted a comprehensive health law. The first 10 provisions of this health law established a permanent health office to enforce ordinances and the quarantine system. The New York Health Office was to consist of several appointed health commissioners, one of whom (a practicing physician) was to serve as the official health officer who authorized the city to pass additional sanitary ordinances pertaining to streets, vacant lots, nuisances, and the obnoxious trades (Duffy, 1992). Members of the health committee supported the role of government in public health and recognized that the public good must come first over the profit of free enterprise (Duffy, 1992).

As cities in the east continued to grow, so did the desire for clean and reliable water from the public. Cities began to dig public wells with Pittsburgh authorizing their first in 1802, agreeing to contribute to the cost of private wells if owners made them available to the public. In 1828, an 84-horsepower steam engine raised water from the Allegheny River to a reservoir 116 ft above the river and by 1832 Pittsburgh was adequately supplied with good water. None of the early water systems provided filtered or disinfected water. The quality of the water depended on its source, and while only the well-to-do could afford to have water piped into their homes, most residents relied on standing pipes or hydrants located at intervals on street corners (Duffy, 1992). The role of sanitarians in public health continued to evolve as the U.S. prospered and grew. The U.S. Sanitary Commission was formed in 1861 (Powitz, n.d.). The civilian-based organization provided services to the armed forces of the U.S. Civil War. The Commission ended in 1866 and was credited for bringing standards and practices for cleanliness to homes and communities after the war ended (U.S. Army, 2022).

By the early 1900s, there was a significant shift in public health reform within the U.S. The federal government expanded its hygienic laboratory to include not only pathology and bacteriology but also chemistry and zoology to address the broader range of health challenges (Duffy, 1992). In 1912 the U.S. Public Health Service (USPHS) was created to systematically carry out health inspections to identify problems with sanitation, sewage, and pollution. World War I further expanded health mandates to include the responsibility for EH around military camps. Initiatives were developed to control widespread sanitation measures and reduce mosquito-borne illness to lessen the burden of malaria in the U.S. (Duffy, 1992).

The Pandemic of 1918–1919 added great stress to the public health system. Influenza cases exploded in New York and spread across the U.S., ultimately killing an estimated 550,000 people (Duffy, 1992). USPHS began to collect case data from states to centralize information

and create prevention campaigns. They were charged with assigning quarantine officers across the country to limit the spread of disease (Duffy, 1992).

In Montana, the disease spread rapidly, and city leaders discouraged public meetings and advocated for social distancing and wearing masks (Mullen & Nelson, 1987). The Montana Board of Health was adamant about stopping the spread of influenza and closed high-risk businesses. Election halls were fumigated to prevent the spread of illness. Quarantine wardens enforced health ordinances, identified cases, posted notices, and levied fines for violations (Mullen & Nelson, 1987). The shortage of public health professionals resulted in significant loss of life for those in rural locations. USPHS stepped in and provided additional medical personnel to help locally. The state epidemiologist estimated over one third of the population in Montana had contracted the disease with a fatality rate of 8.6 per 1,000 population (Mullen & Nelson, 1987).

Nationally, progressives continue to push for improved public health with opposition from several sectors including physicians and business. In 1922, the Sheppard-Tower Act was passed to address high infant mortality. A survey of 86 cities across the U.S. revealed that nearly one half of the cities surveyed had no full-time health officers or adequate birth or death record systems. Furthermore, only 56% of children living in the U.S. were reported as vaccinated against smallpox (Duffy, 1992).

There remained a strong interest in personal and public hygiene and the adaptation of innovative technology. Philanthropy funded a new wave of sanitarians who specialized in food safety and air, soil, and water quality. This era institutionalized and professionalized public health workers including sanitarians (Duffy, 1992). In 1937, the National Association of Sanitarians was formed, which later became the National Environmental Health Association (NEHA; Powitz, n.d.). The first issue of *The Sanitarian* was published in 1938 and renamed the *Journal of Environmental Health* in 1962 and currently remains in press.

The progressive era also promoted new and standardized curriculums for both medicine and public health. Improved education led to increased numbers of sanitarians graduating and practicing in the U.S. (Duffy, 1992). Between 1900 and 1930, the average lifespan increased from 47 years to 60 years. President Franklin Roosevelt signed the Social Security Act in 1935, which provided funds to meet rising health and sanitation needs. World War II (1939–1945) raised the standard of living for most people and included more aggressive activities by USPHS such as inspecting restaurants and food processors, and enforcing general sanitary standards for businesses and facilities (Duffy, 1992). The National Sanitation Foundation (NSF) was formed in 1944 to establish new technology standards for products used in producing and managing food and water, as well as for other consumer goods used by the general population (Powitz, n.d.).

It was not until 1956 that the American Academy of Sanitarians (AAS, n.d.) was formed. The National Accreditation Council for Environmental Health Curricula was formed in 1967 to assure high-quality education for sanitarians and was renamed the National Environmental Health Science and Protection Accreditation Council (EHAC) in 1991. Today, EHAC-accredited schools graduate approximately 400 new EH students each year. Despite recruitment, training, and graduation numbers, there remains a paucity of well-trained EH professionals to meet the needs of today's workforce.

Compared to sanitarians in the prior centuries, EH professionals are core to the public health system of today. Within local and state public health departments, EH programs comprise a sizable service division that provides consumer safety for commercial food consumption, water and air quality monitoring, solid and hazardous waste management, emergency management

coordination, vectorborne illness prevention, and more. The estimated 100,000 EH professionals in the workforce today (BLS, 2022) make up approximately 10% of local health department personnel and 7% of the state department workforce responsible for the delivery of essential services by that address environment-related threats and determinants of health (Brooks et al., 2019).

Most contemporary EH professionals are consistently engaged in multiple program areas and routinely respond to disasters and other emergencies like the recent COVID-19 pandemic. EH professionals are strategically positioned in public health to monitor and diagnose EH problems, evaluate alternative solutions, and work collaboratively with other public health and community professionals to develop and guide interventions that solve and/or prevent historic and emerging threats (Brooks et al., 2019).

EH professionals must develop and practice core competencies that were established through a consensus process and first published in 2001 (National Center for Environmental Health et al., 2001) and recently updated in 2020 (Martin & Latshaw, 2020). Core competencies include knowledge, skills, and abilities (KSAs) in assessment; information gathering; data analysis and interpretation; evaluation; management; problem-solving; economic and political issues; organizational knowledge and behavior; project management; computer and information technology; reporting, documentation, and recordkeeping; communication; collaboration; educating others; conflict resolution; and marketing (Martin & Latshaw, 2020). The EH practice is guided by the 10 Essential Public Health Services, which was released in 1994 and updated in 2021 by the Centers for Disease Control and Prevention (2023). Despite guiding principles and methods, there is no single uniform nationwide method for organizing and delivering EH services (DeSalvo et al., 2021; Tariq et al., 2019).

Variability also exists in the credentialing of EH professionals and is not standardized nationally. EH professionals credentialed by NEHA make up the largest portion of certified EH professionals in the U.S. Professionals that meet the requirements may take a comprehensive test and earn the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential offered by NEHA (2023a). Some states have chosen to grant reciprocity with specific provisions being met that relate to test performance scores, years of experience in practice, and when the test was originally taken (NEHA, 2023b). Many states also have licensing boards that credential EH professionals or sanitarians. The Environmental Health Workforce Act (2021) was introduced to standardize training and credentialing for EH professionals in the U.S. While there exists great support for this bill, it was not passed by the end of the 2021–2022 legislative session. Codification of core competencies and a uniform method for certification are major goals of the legislation.

Core competencies for public health practice have been developed by the Council on Linkages Between Academia and Public Health Practice (2021). The core competencies reflect foundational and crosscutting KSAs for professionals engaging in public health practice, education, or research. These competencies provide a framework for workforce development planning and action. Many organizations are encouraged to interpret and adapt the core competencies to meet their specific organizational and community needs. (Council on Linkages, 2021). The public health workforce has been classified into three major levels: 1) front line and program support responsibilities, 2) program management and supervisory responsibilities, and 3) senior management and executive leadership responsibilities. Needs assessments have been aimed at identifying the training and education needs of public health professionals at all three levels.

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