History of Public Health

Methods of preventing disease go back many centuries. Concepts of disease were crude and often based on anecdote. Some recommendations and practices were ineffective, if not even harmful to health such as bloodletting.

In the mid-1800's there was a hygiene movement, particularly in the UK, with focus of improvements of cleanness and well-being of the poor. Additionally, at the end of the 19th century germ theory became accepted.

Learning Objectives:

1. Explain the evolution of concepts about cause and prevention of disease
2. Understand the importance of studying the factors associated with outcomes in a systematic way in human populations.
3. Discuss some of the major historical figures and events that played a role in evolution of public health and epidemiology
4. Describe the overall structure of the public health system in the US today

Early Concepts of Disease

10,000 years ago when humans were hunter-gatherers and lived in small, nomadic groups accumulating waste and contamination wasn't a problem. Early concepts of disease revolved around superstition, myths and religion (bad spirits, Pandora's box, etc).

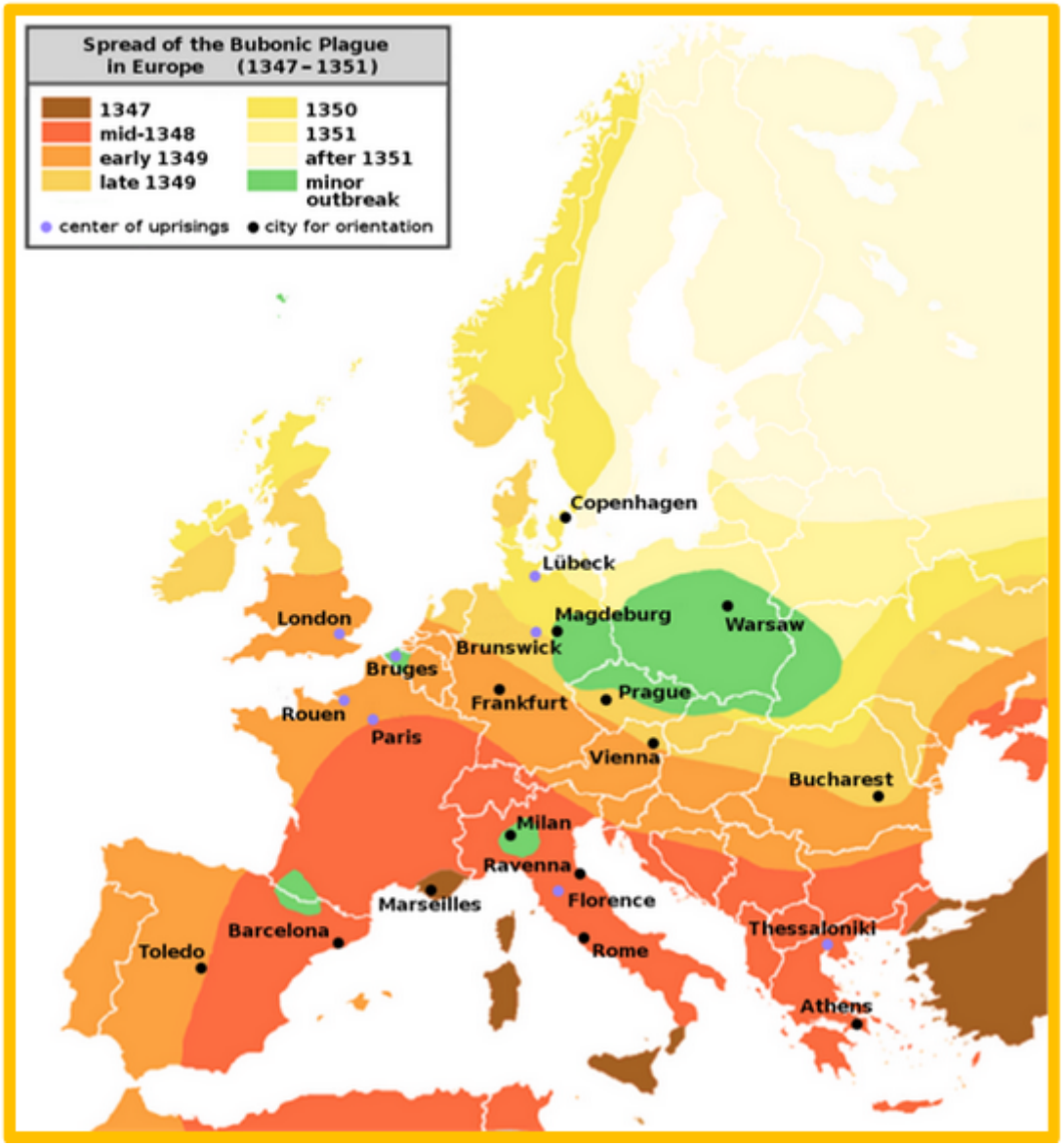
The agricultural revolution provided more secure supply of food and enable expansion of population. People often lived off one or two crops, often lacking protein and vitamins. The domesticated animals provided food and labor, but also carried diseases that could be transmitted to humans. Waste accumulation attracted rodents and insect vectors and with people living in larger groups there was a greater opportunity for transmission of diseases.

The first concept of disease not founded on superstition was the Hippocratic corpus; A Greek concept that disease is caused by an unbalance of the environment or natural forces, and Blood, Bile, Phlegm, and Melancholy must be kept equal within the body. Although the concept clearly incorrect by today's medical standards, Greek doctors would prescribe changes in diet and lifestyle. It also became the rational for bloodletting, which continued for many centuries despite lack of evidence.

The Bubonic Plague

The bubonic plague caused by a bacteria that lives in the intestines of fleas. Fleas were the vector and rats were a reservoir for the bacteria that could easily transmit the disease. Occasionally, an infected flea could jump to a human and infect them directly. Causing dark, tender, swollen nodules. Symptoms also included headache, and delirium and was fatal in about 60% of cases.

Starting in 1347 Europe experienced waves of the plague which lasted until the late 1700's. It was believed to have originated in Asia and traveled along trade routes to the black sea.



The most popular explanation was that it was caused by miasmas - invisible vapors which emanated from swamps or cesspools and floated around in the air where they could be inhaled. One pope kept fires burning on both sides of the room to counter miasmas. Plague doctors kept herbs and flowers in a beak-like mask to ward of miasmas. Of course these were all ineffective as it was spread by flea bites. In a sense the real cause of transmission was population density and waste stagnation, which attracted rats with the fleas that carried the plague. Later the pneumonic form of the plague caused people to cough up blood and could spread by inhalation.

One might blame the lack of preventative measures and knowledge about transmission on the primitive understanding of medicine, however this wasn't due to a lack of technology but the fact that humans had not come up with a structured way to think about disease. There were theories about how the plague spread and how to prevent it, but no tests were ever done through observation of large groups of people. The idea of studying groups of people to identify risk factors and disease outcomes had not yet evolved. **The lack of a systematic way of testing possible associated between exposures and outcomes was the major factor that prevented advances in understanding the causes of disease and development of effected treatment/prevention.**

The black plague still exists today, and kills a few thousand people every year due to anti-biotic resistant strains. However, when identified early it is curable.

Quarantine and Isolation

The concept of quarantine dates back to the early 1400's and the black death. In Italian Qaurintina means 40 days. Travelers and merchandise thought to have been exposed would isolate for a set period of time. This practice persisted until the 19th and 20th century. **Isolation** is separating someone who has the disease from the rest of the population, which was useful in cases like SARS where the infected is only contagious when symptoms are present. **Quarantine** is separating someone from the population who might have been exposed, e.g. COVID-19 since one could be contagious without symptoms.

Public Health in the US

Events in the US paralleled those of the UK as the population moved from an agricultural to an urban and industrial way of living.

Timeline 1800s

- 1798: Congress passes the Act for the Relief of Sick and Disabled Seaman and authorizes the formation of US Marine Hospital Service (MHS), a forerunner of the Public Health Service. Seamen were taxed 20 cents per month to fund physicians and support the network of hospitals. The tax was abolished in 1884 and replaced with a levy on merchant ships, then after 1906 funds were allocated by congress.
- 1799: Castle Island in Boston Harbor was chosen as the temporary site for the first marine hospital. Dr. Thomas Welsh was named physician in charge.
- 1799: Boston establishes the first board of health and the first health department in the US. Paul Revere is named as the first health officer.
- 1800: Dr. Ben Waterhouse introduced smallpox vaccination to the US

- 1804: The Boston Marine Hospital is established in Charlestown, Boston. Dr. Ben Waterhouse was appointed physician in charge from 1807-1809
- 1842: MA Legislator Lemuel Shattuck established the first US system for recording births, deaths and marriages. This became the model for states across the Union. Among his contributions were a standard nomenclature for disease; establishment of a system for recording mortality data by age, sex, occupation, socioeconomic level, smoking, and drinking.
- 1849: The MA legislature appointed a Sanitary Commission to prepare a plan for reporting a 'Sanitary Survey of the State' with Shattuck as Chief Commissioner and author. While well-received by the New England Journal of Medicine, the 50 recommendations in the report went ignored. 20 years later the Board of Health based their plans on Shattuck's recommendations.
- 1870: The Marine Hospital Service was reorganized to change the general character of the service. Medical officers, called surgeons, were required to pass entrance examinations and wear uniforms. In 1889 the medical officers were given titles and pay corresponding to the Army and Navy grades. The goal was to create a professional, mobile health corps free from political favoritism to deal with health needs of a growing nation.
- 1874: MA State Board of Health instituted a voluntary plan for weekly reporting of disease by physicians.
- 1884: MA passes legislation requiring the reporting of "diseases dangerous to the public health" and imposes fines for not reporting.
- 1887: A "Hygienic Lab" was established at the marine hospital on Staten Island to aid in the diagnosis of infectious disease among passengers of incoming ships. It eventually moved to Washington DC and became the National Institutes of Health.
- 1891: The Immigration Act of 1891 required all immigrants entering US be given health examination by PHS physicians. All "idiots, insane persons, paupers or people suffering from disease and criminals" were excluded. Ellis island in New York Harbor was the largest inspection site.
- 1894: The first epidemic of polio strikes the US.

Timeline 1900s

- 1900: Estimates suggest HIV was transmitted from monkeys to humans as early as 1884-1924 but was either unrecognized or failed to initiate human to human transmission.
- 1902: US Congress expanded scientific research at Hygienic Laboratory and gave it a definite budget. Marine Hospital Services were renamed Public Health and Marine Hospital Services (PHMHS).
- 1906: Congress passed the Federal Meat Inspection Act requiring the Department of Agriculture to inspect mean entering interstate commerce. They also passed the Food and Drugs Act that forbade adulteration and misbranding of foods, drinks, and drugs, but contained few requirements to insure compliance.
- 1910-16: The working environment and effect on worker's health became a major area of study for the Public Health Service

- 1918: The influenza pandemic of 1918 is believed to caused 25-50 million deaths worldwide.
- 1925: All states begin participating in national reporting of disease
- 1938: Congress passes Federal Food, Drug, and Cosmetic Act of 1938, and major changes were made in 1954, 58, and 60. Today the law requires manufacturers to provide scientific proof of a drug's safety and prevents mislabelling of products. Enforcement of these laws is the mission of the FDA.
- 1952: Polio cases surge in the US. Early testing of Jonas Salk's vaccine is encouraging
- 1953: Under President Eisenhower Congress created the Department of Health, Education and Welfare (HEW)
- 1954: A large scale clinical trial of the Salk vaccine begins.
- 1964: Sugeon General Luther Terry concerned a panel of experts to review the impact of smoking on health.
- 1970: The Occupational Safety and Health Act was passed by Congress and OSHA was founded in 1971
- 1970: EPA established
- 1979: HEW's educational tasks were transferred to the new Department of Education and health tasks to the new Department of Health and Human Services (HHS)
- 1979: Smallpox is declared eradicated by the World Health Organization. Last known case was 1977 in Somalia
- 1980: President Jimmy Carter signed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) to give the EPA authority to clean up hazardous waste spills
- 1981: Dr. Michael Gottlieb and his associates reported on four previously healthy young men who developed Pnewmoncystis carinil pneamonia. This was monumental in bringing attention to the HIV/AIDS epidemic.

Ideas About Health

Examples of a few key players who influenced how we think about health and disease and it's determinites:

- Girolamo Fracastoro (1546) - Italian physician, poet and astronomer who wrote about "disease seeds" carried by wind. In a way he was proposing germ theory 300 years before its formal discovery, though similar speculation had been made by Roman scholar Marcus Varro had been made in 1st century BC.
- John Graunt (1662) - Around 1592 parish clerks in London began recording deaths. In 1662 Graunt, as a member of the Royal Society of London, summarized the data from the Bills of Mortality in a publication called "Natural and Political Observations Mentioned in a Following Index, and Made Upon the Bills of Mortality". This publication made a variety of observations regarding common causes of death, higher death rates in men, season variation and the fact some diseases had constant death rates. He also estimated population size and growth and was the first to construct a "life table".

- Van Leeuwenhouk (1670s) - In 1665 Robert Hooke devised a compound microscope and discovered plant cells, coining the term "cells" in his book Micrographia. Leeuwenhouk of Holland was considered the father of microscopy. While working in a dry goods store and using magnifying glasses to inspect the quality of cloth he discovered new methods to achieve increased magnification up to x270. He was the first to see bacteria (1674), yeast, protozoa, sperm cells, and red blood cells.
- John Pringle (1740s) - A Scot who served as physician general to the British forces during the war of Austrian Succession. In 1752 he published "Observations on the Diseases of the Army" in which he proposed a number of measures to improve health of soldiers such as hospital ventilation and camp sanitation. He wrote extensively on the importance of preventing typhus, which he incorrectly believed was caused by filth (it is caused by bacteria and carried by lice). He also coined the term "Influenza".
- James Lind (1754) - A Scottish navel surgeon who studied Scurvy in sailors and conducted what may have been the first clinical trial in 1754, by treating Scurvy infected sailors with a variety of treatments and correctly finding that citrus fruits cured the illness. Although he was correct in the cure, he was wrong about the cause of the disease, which was caused by vit C deficiency.
- Broussais and Louis (1754) - Broussais was a prominent Parisian physician and a strong proponent of bloodletting. His vigorous use of leeches during a cholera epidemic in Paris substantially contributed to the mortality rate. Louis was a contemporary of Broussais who believed numerical methods to evaluate treatment and discovered bloodletting was ineffective. Since bloodletting was embedded in medical practice his findings were largely dismissed.
- Ignaz Semmelweis (1840s) - Hungerian physician who practiced in the maternity department in Vienna in the 1840s. Post-partum sepsis was a common occurrence nearly always fatal and of unknown cause at this point. There were two different maternity wards, one attended by midwives and one attended by medical students. The medical students often came directly from handling corpses without washing their hands. He was the first to suggested all students wash their hands with chlorinated water and as a result the mortality rate plummeted, though some still ignored the findings.

John Snow: Father of Epidemiology

In the 1800s there were large outbreaks of Cholera in America and Europe killing thousands of people. John Snow was a physician from London who studied Cholera for many years, and is credited with solving a outbreak in 1854. The theory on Cholera transmission was measimas or person to person contact. Snow began examining the victims and found symptoms were always related to the gastroinstestinal tract and reasoned that if it were spread by bad air there would by pulmonary symptoms so transmission was more likely to occur by food or water consumption.

Many Londoners received their water from hand pump wells that were located throughout the city and two private companies in particular pumped water from the Thames river to the areas primary effected by cholera. Of course, few people believed Snow since he couldn't actually prove there was something in the water. He ended the epidemic in 1854 by removing the handle to the

infected water pump himself. Cholera remains a problem in countries with underdeveloped sanitation and water routes, such as Haiti. In these locations it is more realistic to vaccinate for cholera than fix the entire system.

The Sanitary Idea

In a way modern public health, i.e. as a function of government, comes from France and Britian around 1850-1875 in the wake of the consequences industrial revolution. However the circumstances that propelled the development of public health as a discipline, such as the importance of the size of a population in measuring the influence and power of a state. This crude notion made the idea of "numbering the people" important. John Graunt's office was the first of it's kind to mandate the recording of births, marriages, deaths. William Farr was the first Chief Statistician. The General Registrar's Office established the importance of surveillance with respect to health.

Another contributing factor was the start of the enlightenment, which embraced democracy, citizenship, reason, rationality and the social value of intelligence. One theme was the reduction of mortality and improvements to health had an economic value to society, healthy workers were able to contribute more. Utilitarianism, or the idea that one can measure the amount of evil by the misery created or relieved by an action, provided underpinnings for public health.

Health and Class

In 1842 Sir Edwin Chadwick, a social reformer, published a report entitled "Report into the Sanitary Conditions of the Laboring Populations of Great Britain proving that life expectancy is much lower in towns than in the countryside. He argued that it was possible for government to improve people's lives through reform and a healthier population would work harder and cost less to support. He concluded what was really needed was not more doctors but civil engineers to provide drainage of the streets and more efficient ways of delivering clean water and removing sewage. These ideas contributed to the idea that public health was a legitimate concern of government and led to the creation of legislation and government offices.

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