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COMMENTARY

Perspectives on the knowledge of asbestos disease in the United States – what was known, by whom, and when

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ABSTRACT

Historical research on asbestos disease can be traced back to the early twentieth Century. The majority, if not all of the early research was conducted outside the United States. There are a number of historical time-lines published that chronical these studies. However, what these time-lines do not address is how widespread this information was, who had access to it, and who may have been furthering this research here in the United States. To address these questions, we can look to the writings of early pioneers in occupational medicine like Alice Hamilton and Carey P. McCord from that era to determine the extent that asbestos disease was mentioned or being discussed. Based on the works of Dr. Hamilton and Dr. McCord, the dissemination and penetration of knowledge about asbestos within the medical and industrial hygiene communities during the first half of the twentieth Century in the United States were very limited or non-existent.

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Introduction

Over the years, there have been number of articles published that discuss the history and knowledge of asbestos-related lung disease (Corn M. 1986; Corn J. 1992; Martonik et al. 2001; Paustenbach et al. 2004; Castleman 2005; Hollins 2009; Barlow 2017). However, the 2017 Barlow et al. review published in Critical Reviews in Toxicology is the most throrough and well-researched review to date. Historical research on asbestos disease can be traced back to the early twentieth Century. Most of the reviews point to the seminal epidemiology study by Merewether and Price in 1930 as the article that brought attention to the potential hazards associated with workers mining and milling trades who handled raw asbestos fiber (Merewether 1930). While others point to a 1924 article in the British Medical Journal by William Cooke that identified asbestos factory workers who suffered from fibrosis of the lungs and tuberculosis (Cooke 1924). However, the studies conducted prior to 1930 were problematic because tuberculosis (TB) was often present, making it hard to determine whether the TB or the observed fibrosis was causing the pulmonary dysfunction (Franke and Paustenbach 2011). While these timelines focus on the dates the articles were written or published, they do not put into perspective who might have had access to the reports and/or how widespread the information penetrated the medical research community here in the United States. Because most of the initial studies about asbestos-related disease were carried out by researchers in Europe, dissemination of this information to a wider international audience did not occur for decades. To gain a better understanding of what medical researchers and toxicologist were focused on during the first half of the twentieth Century in the United States, one can look to the writings and publications by Dr. Alice Hamilton and Dr. Carey P. McCord. Both are recognized pioneers in the fields of Industrial Hygiene and Occupational Medicine.

Occupational health hazards in the United States from 1900 to 1940

Dr. Alice Hamilton describes the lack of occupational medicine and hygiene in the United States and the lack of access to research articles during the first half of the twentieth Century in her autobiography, *Exploring the Dangerous Trades*. Dr. Hamilton states in the introduction of her autobiography:

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> "American medical authorities had never taken industrial diseases seriously, the American Medical Association had never held a meeting on the subject, and while European journals were full of articles on industrial poisoning, the number published in American medical journals up to 1910 could be counted on one's fingers." (Hamilton 1943)

Dr. Hamilton was born in 1869 and received a degree in medicine from the University of Michigan in 1893. In 1897, she took a teaching position in Chicago and moved into Hull House. It was during this period that she developed a deep concern for people's welfare. In her autobiography, Hamilton stated:

> "I could not fail to hear tales of the dangers that workingmen faced, of cases of carbon-monoxide gassing in the great steel mills, of painters disabled by lead palsy, of pneumonia and rheumatism among the men in the stockyards." (Hamilton 1943)

Dr. Hamilton began her work in the field of industrial hygiene as part of the Illinois Commission on Occupational Disease. She later began working for the Bureau of Labor Statistics, where she conducted research and wrote toxicological profiles for the Bureau. Her investigations included aniline dyes, arsenic, benzene, brass, carbon monoxide, cyanides, lead, picric acid, toluene, turpentine, and benzene (Brock 1985; Rye 2017; Lawson 2018). In 1919, she accepted an appointment at Harvard Medical School. In 1935, Hamilton published *Industrial Toxicology*. This text did not contain any reference to asbestos as being a hazard of industrial importance in the United States. In addition, asbestos is not listed in the Bureau of Labor Statistics (BLS) reports on Occupational Hazards published in 1913, 1915, or 1922 (Statistics 1913; Bureau of Labor Statistics 1915; Dublin 1922). The first reference to asbestos included in any of the BLS reports is in the 1933 version of Occupational Hazards and Diagnostic Signs:

> "Asbestos dust is another dust which, it has recently been definitely determined, produces a lung fibrosis under existing industrial conditions, although its action is apparently milder than that of free silica." (Dublin 1933)

If you were living in the first half of the twentieth Century, you would have experienced two world wars and the great depression. News traveled at a snail's pace. Important news was transmitted in short snippets using Morse code via a single transatlantic telegraph cable laid in 1866, which expanded to 40 cables by 1940. Larger items like magazines, technical reports, and research articles would have been delivered as print copies via currier. If a researcher in the United States wanted a copy of an article from someone in Europe, a letter requesting a copy would have been delivered to the European author via a Trans-Atlantic ship and mail currier, and a copy of the article would have been returned in the same way. The round-trip process took months to complete. There was no World Wide Web or the "Internet of Things," back then. It is difficult for those of us that grew-up in the information age to grasp the dearth of information that would have been available to the early medical researchers, industrial hygienist, and safety engineers. To think that works by Murray (1907), Cooke (1924), and Merewether (1930), were known to and/or discussed among the wider medical, industrial hygiene, or safety communities in the United States during this time period is absurd.

Dr. Hamilton was a prolific writer. Her body of work includes reports on industrial poisons, toxicological profiles, industrial toxicology text books, and hundreds of personal letters to colleagues, family, friends, and politicians. Through her works, we can gain a more accurate perspective of what information was known and being discussed by leaders within the U.S. Government, and among medical and toxicology researchers during the first half of the twentieth Century.

In 1908, Dr. Hamilton began her work exploring the dangerous trades. She set out to learn all that she could on the subject of industrial disease. She found that European literature was rich on information about "potters' consumption, on lead and mercury poisoning, among other illnesses, and on the efforts of several nations to control them" (Sicherman 1984). At the time, everyone she spoke to in the United States informed her that "the superiority of American working and living conditions made such diseases impossible" (Sicherman 1984). Dr. Hamilton was skeptical, which lead her to devote her career to industrial hygiene and industrial toxicology. At the turn of the Century, there was great focus on the subject of industrial accidents, and little on the topic of industrial diseases. Among the first to be investigated were phosphorus poisoning in the match industry and lead poisoning; which, Hamilton indicated was "the most widely used industrial poison, and the most insidious" (Hamilton 1913, 1914; Sicherman 1984). Hamilton also discovered benzene, a "new and highly volatile solvent used extensively in the rubber and canning industries and in quick-drying paints" (Hamilton 1921; Sicherman 1984). She was one of the first to investigate this new industrial poison. Through the investigations carried out by Dr. Hamilton while at the Bureau of Labor Statistics, she was able to document that the morbidity and mortality rates at factories in the United States were higher than similar factories in Europe, ultimately dispelling the belief that working conditions were superior in American industry (Hamilton 1913, 1914, 1921, 1910, 1915, 1917, 1940, 1949b).

During World War I, Dr. Hamilton shifted her attention to industrial poisons associated with the production of explosives. To support the war efforts, workers were being exposed to toxic chemicals not commonly used in the United States. These included "picric acid, smokeless powder, gun cotton powders, and mercury fulminate" (Hamilton 1917; Sicherman 1984).

In 1924, Dr. Hamilton attended a meeting of the Health Committee of the League of Nations. She was one of two U.S. delegates attending this meeting. In a letter to Julia C. Lathrop, she captured the essence of the topics covered at the meeting in Geneva:

> "I spent days listening to accounts of malaria in Italy, old Serbia, Albania, Dalmatia, Greece and Russia, of sleeping sickness and tuberculosis and equatorial Africa, and of Cholera in Persia." (Sicherman 1984)

This highlights the fact that the major issues being discussed among attendees at this world health meeting were serious and wide spread diseases of "non-occupational"

origin. This is where main-stream research and efforts were focused throughout the periods of the two World Wars and the Great Depression. The early industrial hygiene work related to asbestos disease in the United States began with the U.S. Public Health Service; but, was limited to industries with high exposures to raw asbestos fiber (Dreessen 1938).

Dr. Hamilton taught at Harvard from 1919 to 1934. Throughout this time, she investigated occupational disease and wrote toxicological reports for the Department of Labor. Dr. Hamilton published an update of her text *Industrial Toxicology* with Dr. Harriet Louise Hardy in 1945. Similar to the 1st edition in 1934, the 2nd edition did not include any reference to asbestos as an occupational health hazard (Hamilton 1934, 1949a). It was not until the 1974 edition of *Industrial Toxicology* was published, that Dr. Hamilton addressed asbestos in any significant way. In this edition, she wrote:

> "Another important problem far from settled is whether asbestos fibers acting as mechanical irritants deep in the lung are alone responsible for disease." (Hamilton 1974)

Dr. Hamilton highlighted the fact that there was still uncertainty in the scientific community about the mechanism by which asbestos causes disease in the mid '70 s.

Dr. Carey P. McCord's autobiography paints a very similar picture to that of Dr. Hamilton regarding what occupational medicine researchers and industrial hygienists were focused on here in the United States during the early twentieth Century (McCord 1945; Wilkins 1965). Dr. McCord was born in 1886 and received his medical degree from the University of Michigan in 1912, 19-years after Alice Hamilton. During World War I, Dr. McCord's work focused on controlling epidemics of dysentery and influenza among troops. Following WWI, Dr. McCord focused his attention on the "Hazardous Trades." In his autobiography, he wrote about investigating occupational diseases caused by gases, vapors, fumes, mists, solvents, dust, and thermal stress. On the hazards of dust, he writes:

> "Of the first-flight dust foes – there are not so many – lead, mercury, arsenic, manganese, fluorides, etc., silica is the archfiend. Among occupational diseases, silicosis (the lung disease produced by fine silica) is the grave-digger." (McCord 1945)

Similar to Dr. Hamilton, Dr. McCord's writings do not include any mention of asbestos as a potential occupational health hazard.

Conclusion

There is little question that widespread awareness among medical and industrial hygiene practitioners regarding the health hazards associated with asbestos did not begin until the mid '60 s following the New York Academy of Science meeting and subsequent work at Mount Sinai Hospital (Selikoff 1964). It is within the dozens of articles published by Selikoff and his team in the '60 s that the European articles (e.g. Cooke, Seller, Merewether & Price, Doll and Wagner), began to be cited by U.S. researchers. However, the debate about the mechanism of action, toxicity of fiber type, safe exposure levels, and resulting disease continued well into the '80 s. Following the publication of the Occupational Safety and Health Administration (OSHA) standard in 1972, awareness among the employers began to expand rapidly.

The aim of this commentary is to provide some perspective and context regarding who in the United States may have had knowledge about early asbestos studies carried out in Europe. Clearly, there was a dearth of knowledge and access to peer-reviewed works here in the United States prior to the '60 s. This is contrary to articles and trial testimony from some like Castleman (2005) and Egilman et al. (2014) who claim that this information was widespread and well known as far back as the '30 s.

Through the works of Dr. Alice Hamilton and Dr. Carey McCord, it is clear that medical researchers, toxicologist and industrial hygienists were focused on other highly toxic chemicals during the '30 s, '40 s, and '50 s. From the general public's perspective, asbestos was being touted as the "miracle mineral." Popular cartoons like Asbestos Lady in 1947, the "Little Devil" in 1957, and the "Human Torch" in 1963 depicted the positive attributes of asbestos. Commercials shown at the World's Fair, movie theaters, and early TV advertised the beauty, functionality, and safety of vinyl asbestos floor tile and exterior asbestos sidings for homes. Following the fire at Our Lady of Angels School in Chicago on 1 December 1958, where 92 students and 3 teachers lost their lives, an outraged public demanded the use of asbestos products in schools to prevent a similar tragedy from reoccurring (Maines 2005). During the '50 s and '60 s, asbestos was added to hundreds of consumer products. The general public's perception of asbestos through the '70 s was positive and consisted primarily of the image that asbestos was a safe and beneficial product. The general public's perception began to change in the late '70 s and early '80 s based on news reports of the dangers of asbestos. It was during this time that both OSHA and the Environmental Protection Agency promulgated rules to protect workers and the public from asbestos exposure.

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Declaration of interest

The author prepared this commentary as an independent consultant and did not receive any compensation. The author has appeared as an expert witness since 2008 in a number of cases concerned with potential injury from exposure to asbestos.

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