8 The Environment's Absence in Medicine: Mainstream Medical Coverage of Leukemia

Manuel Vallée

Introduction

Human health is inextricably intertwined with ecological health. This point has been repeatedly underscored by environmental health research that elucidates the close relationship between environmental pollution and disease. Whether we are discussing cancers, reproductive issues, birth defects, developmental disorders, musculo-skeletal problems, metabolic disorders, immunological problems or practically any other disease category, environmental health research shows that disease is invariably related to environmental pollution, in often subtle but intimate ways (CHE, 2018a; Schettler et al., 2000; Steingraber, 2009).

Curiously, however, environmental pollution's role is usually obscured or downplayed in mainstream medical information. For example, Brown and colleagues (2001) showed print media's coverage of breast cancer consistently downplays the role of toxicants, in favor of an individualizing frame that emphasizes genes and lifestyle choices. A similar pattern is found with information provided by the medical profession, as demonstrated by Steingraber's (2009) analysis of cancer educational materials distributed in clinics, hospitals, and waiting rooms. Vallée (2013) found the same to be true with the 2011 clinical practice guidelines for Attention Deficit/Hyperactivity Disorder, which failed to mention lead or other toxicants associated with the condition. Such information discrepancies matter because they conceal the significant role environmental pollution plays in producing disease, thereby making it more difficult for patients and families to protect themselves, as well as to advocate for stronger policy and regulations.

Although social scientists have extensively analyzed the medical information provided in mass media (Atkin et al., 2008; Brown et al., 2001; Lewison et al., 2008), the same cannot be said for online medical publishing websites, such as WebMD.com and Healthline.com. This lacuna is significant for three reasons. First, their information is more accessible than conventional print sources because most content is free, can be instantaneously accessed, and can be accessed at a distance. Second, lay audiences are likely to give more credibility to the websites, due to features suggesting a close association with the medical profession: 1) including "health," "medicine," "MD," or "Dr" in their website names; 2) clearly identifying medical doctors as content reviewers; and 3) including medical doctors on the

governing boards. Third, the medium has grown significantly in recent years, as indicated by the proliferation of websites, the followings many have developed, and that it has become a multi-billion dollar industry (Bray, 2017). The medium's growth means the websites now exert a greater capacity to influence how people understand and address disease.

To shed light on how medical issues are discussed on such websites, I examine WebMD's leukemia coverage. Leukemia is a bone marrow cancer that affects over 385,000 people in the United States and is the most common cancer in children under 15 (NCI, n.d.; NIH, n.d.). Although environmental health researchers have identified twenty-two toxicants associated with leukemia, WebMD's coverage systematically obscures the environmental causation perspective by failing to identify most toxicants and by emphasizing a genetic and lifestyle causation frame. Building on Brown et al.'s work (2001), I also illuminate rhetorical mechanisms through which dominant sources downplay the environmental causation perspective, including placing toxicant information in subordinate locations, surrounding the information with negating statements, and treatment discussions that fail to address toxicants. I also discuss how obscuring toxicant information places humans at greater risk and makes it more difficult for patients and families to protect themselves. Finally, to unearth the problem's sources, I consider WebMD's reliance on the medical profession, as well as the profession's financial motivations and ideological orientation.

Background: Environmental Pollution and Disease Framing

While industrialization accelerated environmental pollution during the nineteenth and early twentieth centuries, John Bellamy Foster (2009) argues the problem has worsened since World War II because societies have become increasingly reliant on plastics, chemical pesticides, and other non-biodegradable chemicals. The rampant use of these products, he argues, undermines the very life-support systems that make life possible on Earth. Moreover, the resulting pollution has impacted human bodies. Because we rely on the environment for the food we eat, the water we drink and the air we breathe, pollution has been building up in human tissues, which has been linked to cancer and numerous other medical conditions (CHE, 2018a; Schettler et al., 2000; Sexton et al., 2004).

However, the relationship between toxicants and disease is often difficult to discern in mainstream medical information, which tends to favor reductionist disease framings that emphasize genetics and lifestyle choices (such as smoking and alcohol consumption). For instance, Brown et al. (2001) found print media coverage of breast cancer seldom references environmental causation (i.e. chemicals, pollutants, and radiation), and focuses instead on genetics and personal lifestyle factors. Similarly, a follow-up study by Atkin et al. (2008) revealed that toxicant risk factors were only mentioned in 4 percent of breast cancer stories in print and television media. Additionally, Lewison et al. (2008) found that breast cancer stories on the BBC website typically emphasized an individualizing frame, where the cause was implicitly attributed to genetic factors and/or personal lifestyle choices. In short, the

research has repeatedly demonstrated that mainstream disease coverage invariably obscures the environmental causation perspective.

Consequences of Reductionist Disease Framings

Disease frames matter for several reasons. First, an individualizing frame encourages the public to adopt a disease understanding that ignores the causal role played by environmental pollution, focusing instead on genes and harmful personal choices (Brown et al., 2001; MacKendrik, 2010). In turn, this determines how we seek to address the symptoms. For example, if the dominant asthma framing emphasizes genetic causes, then doctors will steer patients towards symptom suppression, which will invariably be pursued, in twenty-first-century industrialized countries, through pharmaceutical medications. Moreover, they will ignore environmental factors (such as a moldy living environment or exposure to chromium, latex, plastic fumes, or the many other toxicants associated with the condition [CHE, 2018a]). Consequently, this ensures patients will continue to live in symptom-causing environments that undermine their ability to eliminate or, at least, minimize the symptoms. On the other hand, if asthma symptoms are attributed to external factors, then doctors will steer patients to environment-changing interventions, such as diet alteration, mold remediation, and/or cleaning up toxicant contamination in their home and workplace.

Disease framings also have important socio-economic implications. First, they significantly impact healthcare expenditures. If the prevailing frame obscures underlying causes of disease, society is far less likely to take steps to eliminate them. In turn, this maintains disease incidence rates, which drives up healthcare expenditures and further stresses our already overburdened healthcare systems. Second, because they steer patients towards using medical treatments, individualizing disease frames are a boon for treatment manufacturers (including pharmaceutical manufacturers) and the medical sub-disciplines who rely on those treatments for their medical authority.

Disease frames also impact who is viewed as being responsible for the problem, and whether individual troubles come to be seen as public issues. As Brown et al. (2001) emphasize:

> If the media focus blame and responsibility on the individual, it is likely that the problem will not be considered a social problem that merits public or governmental attention. If, however, the problem is framed so that structural or institutional causes receive the blame, it becomes a social problem of concern to all members of a community. (p. 752)

In turn, disease frames can have major consequences for social policy. If the disease is seen as being caused by industry and/or government failure to regulate industry, the framing can galvanize public will towards pressuring political representatives to tighten regulations. If, on the other hand, the disease continues to be seen as a personal issue, little will be done towards generating a collective solution.

Given their social impact, dominant disease frames should not be taken for granted but rather should be interrogated, which includes identifying their social implications

and illuminating the actors and processes that enable those frames to become dominant.

Analyzing Online Medical Publishing Websites

Beyond print media, Brown et al. (2001) identify other entities that adjudicate which disease frames become dominant, including other private sector entities (such as think tanks, disease groups, activists, and social movements), government (including agencies and politicians), as well as the scientific field (including individual researchers, professional organizations, as well as journals and their editors).

Although much attention has been directed towards mass media, online medical publishing sites have been relatively underanalyzed. This matters for several reasons. First, the field of online medical publishing has grown significantly over the last two decades, and is populated by numerous competing websites, including WedMD.com, Medicine.Net, Healthline.com, Doctoroz.com, Mercola.com, and DrWeil.com, many of which have attained significant followings (Comscore, 2016). The medium's significant growth means it now has the capacity to significantly influence public perceptions about disease causes and attribution of responsibility.

To address this gap, I examine WebMD's leukemia coverage. WebMD is a strategic case because it is the largest online medical publisher: in 2015 its network of websites were visited by more unique visitors than any other private or government website dedicated to health matters (Comscore, 2016). In turn, this enabled the company to generate $705 million in 2016, which led it to be purchased the next year for $2 billion (Bray, 2017). WebMD is also closely affiliated with the medical profession, as indicated by the medical doctors who review the articles and sit on its board of directors. While it targets physicians through a professional portal, it also targets consumers through its webMD.com website and *WebMD The Magazine*, a patient-directed publication typically on display in physician waiting rooms (*The Write News*, 2005).

Environmental Health Scholarship on Leukemia

The environmental health community has three authoritative bodies that track the relationship between toxicant exposure and disease. The first is the International Agency for Research on Cancer (IARC), which is the World Health Organization's specialized cancer agency. It was founded in France in 1965 to "lighten humanity's ever-growing burden of cancer" (IARC, 2018) by promoting international collaboration in cancer research. It focuses on identifying how lifestyle and environmental risk factors interact with genetics to produce cancer. This focus implicitly recognizes that "most cancers are, directly or indirectly, linked to environmental factors and thus are preventable" (IARC, 2018). A key contribution has been the IARC Monograph Programme, where international working groups evaluate the carcinogenicity of toxicants and publicly disseminate their findings.

The second authoritative body is California's Office of Environmental Health Hazard Assessment (OEHHA), one of six agencies within the California Environmental Protection Agency (CalEPA). OEHHA's mission is to "protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances" (OEHHA, 2018a), which it pursues by evaluating the health and environmental risks posed by hazardous substances, including pesticides, air pollutants, carcinogens, reproductive toxins, chemical exposures in the workplace, and chemical contaminants in food and water. It also "implements the Safe Drinking Water and Toxic Enforcement Act of 1986, commonly known as Proposition 65, and compiles the state's list of substances that cause cancer or reproductive harm" (OEHHA, 2018b). Additionally, it establishes exposure limits for air, water, and soil contaminants, which guides the general public, NGOs, all boards and departments within CalEPA, as well as federal agencies, including the Department of Justice and Department of Public Health (OEHHA, 2018a; OEHHA, 2018b).

The third authoritative organization is The Collaborative on Health and the Environment (CHE), which was founded in 2002 to create an interdisciplinary research network on environmental health issues (CHE, 2018b). A significant contribution has been the "Toxicants and Disease" database (CHE, 2018a), which enables users to identify all toxicants associated with a disease and, conversely, all diseases associated with a particular toxicant. Additionally, if a toxicant is associated with a disease, the database will signal the evidence strength. CHE is the only authoritative body that addresses leukemia directly, as OEHHA and IARC only identify whether toxicants are carcinogenic. For this reason, the CHE database was my main reference point.

Over the last four decades, environmental health researchers have identified numerous toxicants related to leukemia's development. As seen in TABLE 8.1, the CHE database lists twenty-two toxicants or toxicant classes associated with the disease, including formaldehyde, benzene, ionizing radiation, ethylene oxide, and 1,3-butadiene, which are each classified as having a "strong" level of evidence. A "strong" classification means "a causal association with the disease has been verified" (CHE, 2018c) and the toxicity of the chemical is well accepted by the scientific research community. Additionally, the seventeen others are all considered to have a "good" level of evidence, which is the classification given to "toxicants associated with a disease through epidemiological studies (cross-sectional, case-series, or case-control studies) or for toxicants with some human evidence and strong corroborating animal evidence" (CHE, 2018c).

IARC has also flagged many of those chemicals as being harmful or potentially harmful to human health, with eleven listed as recognized carcinogens, including formaldehyde, benzene, ethylene oxide, ionizing radiation, TCDD, and 1,3-butadiene (see TABLE 8.1). Additionally, the evidence for two others (DDT/DDE, chlorinated solvents) was deemed sufficiently strong to warrant a "probable carcinogen" designation, with three others (carbon tetrachloride and 1,2-dichloroethane) classified as "possible carcinogens." OEHHA has also recognized the majority of the toxicants as carcinogens (see TABLE 8.1). While being classified as a carcinogen

Table 8.1 *Toxicants associated with adult-onset leukemias*

Class of Toxicants	Toxicant	CHE Database Evidence Rating *	IARC Classification **	OEHHA – Health Ailment it associated with the toxicant (date added to Prop 65's List) ***	WebMD pages mentioning the toxicant
	1,3-Butadiene	strong	Category 1****	Cancer (04/01/1988)	0
	Ethylene Oxide	strong	Category 1	Cancer (07/01/1987)	0
	Formaldehyde	strong	Category 1	Cancer (01/01/1988)	1
	Ionizing Radiation	strong	Category 1	NA	7
	Benzene	strong	Category 1	Cancer (02/27/1987)	38
	1,2-Dichloroethane	good	Category 2B ††	Cancer (10/01/1987)	0
	Alachlor	good	NA	Cancer (01/01/1989)	0
Aromatic Amines	2-Naphthylamine	good	Category 1	Cancer (02/27/1987)	0
Aromatic Amines	4-Aminobiphenyl	good	Category 1	Cancer (02/27/1987)	0
Aromatic Amines	4,4'methyleneibis	good	Category 1	Cancer (01/01/1987)	0
Aromatic Amines	Auramine	good	Category 2B	Cancer (07/01/1987)	0
Aromatic Amines	Benzidine	good	Category 1	Cancer (02/27/1987)	0
	Arsenic	good	Category 1	Cancer (02/27/1987)	12
	Carbon Disulfide	good	NA	Reproduction & Developmental Problems (07/01/1989)	8
	Carbon Tetrachloride	good	Category 2B	Cancer (10/01/1987)	0
Chlorinated solvents		good	Category 2A†††	NA	1
	DDT/DDE	good	Category 2A	Cancer (10/01/1987)	0
Pesticides		good	NA	NA	20
Phenoxyacetic herbicides	2,4-Dichloro phenoxyacetic Acid	good	Category 2B	NA	0

Table 8.1 (*cont.*)

Class of Toxicants	Toxicant	CHE Database Evidence Rating *	IARC Classification **	OEHHA – Health Ailment it associated with the toxicant (date added to Prop 65's List) ***	WebMD pages mentioning the toxicant
Phenoxyacetic herbicides	Agent Orange †	good	Contains TCDD dioxin, which IARC classifies as Category 1 toxicant	NA	43
Dioxins	TCDD	good	Category 1	Cancer (01/01/1988)	0
Air Pollution	tobacco smoke (active smoking)	good	NA	Reproduction & Developmental Problems (04/01/1988)	72

*: all CHE data taken from their "Toxicant & Disease" database (CHE, 2018a)
**: all IARC data was obtained from the "IARC Monographs" website (IARC, 2018)
***: all OEHHA data was obtained from the "Chemicals" page on the OEHHA website (OEHHA, 2018c)
****: Category 1= Carcinogenic to humans
†: Agent Orange is a combination of 2,4-D and 2,4,5-T
††: Category 2B: Possibly carcinogenic to humans
†††: Category 2A: Probably carcinogenic to humans

does not necessarily link a toxicant to leukemia, it does underscore its capacity to contribute to cancer-producing processes.

WebMD's Coverage of Toxicants

Although environmental health researchers have identified many toxicants associated with leukemia, WebMD's leukemia coverage fails to cover most of them. Moreover, while some are mentioned, WebMD downplays their importance through several rhetorical strategies.

Obscuring Environmental Causation by Tokenistic Coverage of Toxicants

An October 2018 search for "leukemia" on WebMD's website yielded 1,213 results and the first step was identifying the coverage provided for each toxicant. TABLE 8.1 shows WebMD's coverage failed to mention fourteen of twenty-two toxicants linked to leukemia. Besides omitting most toxicants, the website ignored two of five strongly linked to

leukemia (1,3-Butadiene and ethylene oxide). Additionally, toxicants that were mentioned appeared on few pages. For instance, only five toxicants (benzene, pesticides, arsenic, agent orange and tobacco smoke) appeared on ten or more of the 1,213 pages addressing leukemia.[1] Moreover, even the best covered toxicants only appeared on a small fraction of leukemia pages. For example, agent orange was the chemical with the most coverage and it appeared on less than 3.5 percent of leukemia pages. Such spotty coverage effectively obscures the links between toxicant exposure and leukemia.

Tokenistic Coverage on Key Webpages

Another important issue is the coverage on pages viewers are more likely to see, such as initial search results. Initial results are particularly important because viewers are unlikely to read all 1,200 results and are likely to stop after reading results from the initial pages. The first page provided links to thirteen readings, but only two (i.e. "What is leukemia? What causes it?" and "Slideshow: Guide to Leukemia") mentioned toxicants (see TABLE 8.2). The second page was a bit better as five out of ten links mentioned toxicants. While toxicants were mentioned on seven of the first twenty-three results, this was woefully limited. Moreover, the problem was compounded by the fact none covered all toxicants linked to leukemia.

The "What is leukemia? What causes it?" (WebMD, 2017a) page is particularly important because it provides an overview of leukemia, which will strongly interest those who do not have prior knowledge about the condition. As well, its focus on "causes" makes it the most likely page to discuss environmental toxicants. However, its coverage was poor as it only mentioned tobacco smoke, high doses of radiation, and "some chemicals" (WebMD, 2017a). Although this covers two toxicants (smoking and radiation) from the CHE list, it leaves out twenty others, including four that have "strong" evidence (benzene, formaldehyde, ethylene oxide, and 1,3-butadiene). Even though the page mentions "some chemicals," this vague statement fails to alert readers to the specific chemicals that can prove harmful, how they might be exposed to them, or what they can do to protect themselves.

The "What is Acute Myeloid Leukemia?" page is also very important (WebMD, 2017b). Although it is the last result on the second page of search results, Acute Myeloid Leukemia (AML) is leukemia's most prevalent form and will therefore be sought out by many viewers. The coverage on this page was a bit better as it mentioned benzene, chemotherapy drugs, cleaning products, detergents, and paint strippers. Identifying these chemicals alerts readers to the harmfulness of chemicals in their environment, which supports the environmental causation perspective. However, the coverage suffers from vagueness, failing to identify chemicals that are either known culprits or for which there is growing evidence of harm. Moreover, while the page added a chemical with "strong" evidence (i.e. benzene), it failed to mention the four others with "strong" evidence (ethylene oxide, formaldehyde, ionizing radiation, and 1,3-Butadiene), as well as the seventeen others associated with leukemia.

1 For each toxicant, I conducted a search pairing the name of the toxicant and "leukemia." Then, each page was analyzed to verify that the mention related to the toxicant's disease-causing potential. Pages that did not meet that criteria were eliminated from the count.

Table 8.2 *WebMD articles on leukemia*

Position in the search	Page Location	Title of Result	Name of WebMD Reviewer	Toxicants Mentioned
1	First	Non-Hodgkin's Lymphoma	NA	none
2	First	Slideshow: Chronic Myelogenous Leukemia Phases and Treatment	Laura J. Martin, MD (Jan. 2018)	none
3	First	Video on the Stages of Multiple Myeloma	Neha Pathak, MD (May 2017)	none
4	First	Vitamin and Supplement results for Leukemia	NA	none
5	First	What is leukemia? What causes it?	Melinda Ratini, DO, MS (Sept. 2017)	radiation, tobacco smoke, and certain chemicals
6	First	Leukemia (Directory)	NA	none
7	First	Blood Cancer (Directory)	NA	none
8	First	What is leukemia?	William Blahd, MD (Dec. 2016)	none
9	First	What is bone marrow cancer?	Louise Chang, MD (Feb. 2017)	none
10	First	What is leukemia?	William Blahd, MD (Dec. 2016)	none
11	First	Childhood Leukemia: Symptoms, Treatments, Risk Factors, Tests	Neha Pathak, MD (Sept. 2017)	none
12	First	Childhood Leukemia Directory	NA	none
13	First	Slideshow: Guide to Leukemia	Laura J. Martin, MD (April 2018)	smoking, tobacco, and very high levels of radiation
14	Second	How is leukemia grouped?	Melinda Ratini, DO, MS (Sept. 2017)	none
15	Second	What causes leukemia?	Melinda Ratini, DO, MS (Sept. 2017)	smoking, high radiation exposure, and certain chemicals
16	Second	How is leukemia treated?	Melinda Ratini, DO, MS (Sept. 2017)	none

Table 8.2 (*cont.*)

Position in the search	Page Location	Title of Result	Name of WebMD Reviewer	Toxicants Mentioned
17	Second	How is bone marrow diagnosed?	Louise Chang, MD (Feb. 2017)	none
18	Second	What is childhood leukemia?	Louise Chang, MD (Feb. 2017)	none
19	Second	What are treatments for bone marrow cancer	Louise Chang, MD (Feb. 2017)	none
20	Second	What is childhood leukemia?	Neha Pathak, MD (Sept. 2017)	"exposure to chemotherapy or chemicals such as benzene (a solvent)"
21	Second	Juvenile Myelomonocytic leukemia	William Blahd, MD (March 2017)	"some theories are that having a virus or being around toxic chemicals or radiation can cause this to happen"
22	Second	Chronic Myeloproliferative Neoplasms Treatment (PDQ): Treatment-Health Professional Information [NCI]- Chronic Neutrophilic Leukemia	William Blahd, MD (March 2017)	"some theories are that having a virus or being around toxic chemicals or radiation can cause this to happen"
23	Second	What is Acute Myeloid Leukemia? What Causes it?	Laura J. Martin, MD (Nov. 2017)	smoking, benzene, certain cleaning products, detergents, paint strippers, high doses of radiation, chemotherapy drugs

Emphasizing a Reductionist Framework

Even when toxicants are mentioned, the environmental causation perspective can be downplayed by the surrounding context. As argued by Brown et al. (2001), "the context within which environmental causation is mentioned says much about the way it is legitimized or delegitimized" (p. 764). In particular, they found it can be undermined by an article's focus on other causal factors, such as genes, medical treatments and lifestyle factors (such as smoking).

Similarly, WebMD's leukemia coverage also emphasizes genes, as underscored by the second paragraph of the "What is leukemia? What causes it?" page:

> There's really nothing you can do to prevent leukemia. It's cancer of your blood cells caused by a rise in the number of white blood cells in your body. They crowd out the red blood cells and platelets your body needs to be healthy. All those extra white blood cells don't work right, and that causes problems.

This statement clearly situates leukemia in the body and obscures the role of environmental pollutants. The first sentence is particularly problematic as it suggests that even if we know certain toxicants contribute to leukemia, such knowledge can not stop leukemia's development. It is a subtle nod to a gene-based explanation, where genetic programming runs its course regardless of environmental context.

This causal framework is reinforced by the next sub-section ("How does it happen?"), which provides additional information about the physiological process through which leukemia happens, with no information about how environmental factors mediates that process. Reductionist disease framings are deficient because they fly in the face of environmental health research, which shows that while individuals may have genetic susceptibilities to developing disease, those susceptibilities are invariably triggered by the environmental context, not the genes (Steingraber, 2009). Moreover, Steingraber (2009) argues "shining the spotlight on inheritance focuses us on the one piece of the puzzle we can do absolutely nothing about" (p. 291).

The genetic framework is further emphasized at the section's end, which points to family history as a leukemia risk factor: "if an identical twin gets a certain type of leukemia, there is a 20% chance the other twin will have it within a year." This support for the genetic frame assumes that any similarities between twins will be due to genetics. However, the assumption ignores that fetuses can be significantly exposed to toxicants in the womb, and this is particularly true in underprivileged communities. For instance, Goodman (2009) found an average of 200 chemicals in newborn umbilical cord blood. Thus, if disease similarities are found between twins, toxicant exposures have to be considered as a potential contributing factor. At the very least, it is a factor twin studies should control for.

Contextual Factors that Undermine the Environmental Causation Perspective

Besides emphasizing a reductionist framework, there are three other ways WebMD's coverage undermines the environmental causation perspective: 1) placing toxicant information in subordinate positions; 2) surrounding the toxicant information with

negating statements; and 3) providing treatment discussions that ignore environmental remediation.

Regarding the first, when toxicants are mentioned, it tends to be deep within the text, after readers get substantial exposure to the reductionist paradigm. For instance, "What is leukemia? What causes it?" does not address toxicants until the article's fourth section ("Causes"), where the authors finally state:

> It may be possible that certain things in your environment could trigger the development of it. For example, if you are a tobacco smoker, you are more prone to some types of leukemia than a nonsmoker. It's also associated with a high amount of radiation exposure and certain chemicals.

That statement is preceded by three sections, with the first telling readers: 1) who is most likely to get leukemia (adult men); 2) "there's nothing you can do to prevent leukemia"; and 3) the key role played by defective white blood cells. The second section describes how blood cells work and what happens when white blood cells act abnormally, while the third discusses different types of leukemia. By the time the reader reads the statement about toxicants, they have been repeatedly exposed to statements that individualize leukemia. Moreover, when toxicants are finally addressed, it is a statement that suffers from the sins of omission and vagueness (i.e. "certain chemicals").

Toxicant information can also be downplayed by surrounding it with negating statements. For instance, the "Causes" section opens with "No one knows exactly what causes leukemia," which erroneously suggests there is a dearth of solid research linking the condition to environmental factors. The subsequent sentence reinforces the reductionist frame by stating "people who have it have certain abnormal chromosomes," while failing to identify the environmental factors that can alter those chromosomes. And the third sentence begins with "You can't really prevent leukemia," which reinforces the notion that knowledge about toxicants will not help people avoid the condition.

Third, the environmental causation perspective can be undermined by treatment discussions that completely ignore the importance of assessing and remediating, if necessary, the patient's living and working environments. On this point, the "What is leukemia? What causes it?" article discusses numerous treatments (including chemotherapy, radiation therapy, stem cell therapy, and even surgery) without mentioning the benefits to be gained from ensuring that the patient's environments are not re-exposing them to harmful toxicants.

Social Consequences

WebMD's leukemia coverage has important public health implications. First, obscuring the toxicants shields chemical manufacturers from blame, thereby reducing their likelihood of: 1) being penalized for their pollution; 2) being held responsible for cleaning it up; 3) having to face tougher regulations; and/or 4) risk profit-harming consumer boycotts. In turn, this means many polluted environments

will remain unremediated, manufacturers will continue to pollute, and more humans will be exposed to harmful substances.

Second, the coverage shields politicians from the political repercussions of weak and ineffective toxicant regulations, which weakens pressure to enact tougher policy and regulations. In turn, this also helps maintain a situation where more and more people will be exposed to harmful substances.

Third, the disease framing makes it harder for citizens to protect themselves and their families. WebMD's poor toxicant coverage maintains peoples' ignorance about carcinogenic substances in their living and work sites, which decreases their chances of addressing the problem. This is particularly important for those routinely exposed to toxicants, such as farm workers, families living near farms, and the surprisingly large numbers exposed to carcinogens in the workplace (Fritschi & Driscoll, 2006; Harrison, 2011). The problem is also vitally important for recovering patients. If they survive, their ignorance about toxicants will return them to potentially polluted and disease-exacerbating homes and workplaces. Sandra Steingraber (2009) argues all cancers have "ecological roots" and we have a *human right* to knowledge that will help us uncover those roots. However, that task is made much more difficult when medical information fails to identify known toxicant culprits.

Fourth, obscuring toxicants perpetuates an individualizing understanding of disease, which leads patients to pursue symptom-suppressing treatments, which are themselves toxic and laden with side effects that require further medical attention and medical expenditures (Lazarou et al., 1996). In leukemia's case, it is estimated 5 to 20 percent of AML cases, which are leukemia's most prevalent form, can be attributed to previous cancer treatments. Moreover, the figure is even higher for those treated for breast cancer, gynecologic cancers, and lymphomas, which tend to be treated with particularly toxic medications (O'Donnell et al., 2012).

Accounting for WebMD's Coverage

In trying to account for mainstream disease framings one should consider the surrounding political economy. Brown et al. (2001) argued that print media's individualization of breast cancer is related to the fact "it is easier to press individual responsibility than corporate and/or governmental responsibility" (p. 771). Their statement underscores that disease framings have significant economic and political consequences, and that they need to be related to the dominant political economy. As this pertains to WebMD's leukemia coverage, chemical manufacturers benefit significantly because the individualizing disease framing shields them from blame. Politicians are also protected from the political consequences of weak and ineffective regulations, which could: 1) damage to their reputation; 2) weaken their reelection campaigns; and 3) force them to pass legislation that could sever their relations with industry. The latter is significant as many, if not most, politicians rely on industry election contributions. This is particularly true in the United States, where it is so costly to run for office (Scherer, Rebala & Wilson, 2014). Beyond campaign funding, many politicians benefit from the revolving door with industry, whereby they pass

industry-friendly legislation while in office and get rewarded with lucrative industry appointments when they leave office (Faber, 2008).

While a political economy approach provides important context, it does not provide a sufficient explanation. To shed more light on WebMD's coverage we also need an institutional analysis that considers the organization's primary objectives and that relates its knowledge production to its primary social relationships. Although WebMD provides medical information and presents itself as an extension of the medical profession, it is in fact a for-profit entity, whose primary objective is profit accumulation. Their provision of medical information is a means to the end of drawing viewers to their website, in order to generate advertising revenue.

This business model makes them particularly dependent on advertising revenue. As others have shown, such dependence inevitably leads to editorial content being altered to suit the advertisers' interests (Campbell, 2009; Steinem, 2011). In WebMD's case, pharmaceutical companies are major advertisers and they benefit significantly from an individualizing disease framing. Specifically, maintaining the social ignorance about toxicants and disease decreases the likelihood that environmental pollution will be effectively addressed, which means people will continue to be exposed to toxicants, become sick, and create demand for pharmaceutical products.

Although advertiser influence is an important consideration, WebMD's business model makes it even more reliant upon the medical profession. Not only does medical research provide the basis for website content, the development of website articles is itself overseen by medical professionals, as exemplified by the fact its "What is leukemia?" page was reviewed by William Blahd, MD (WebMD, 2017a). WebMD's content is a reflection of mainstream medicine's tendency to reproduce individualizing disease frames that obscure the role of toxicants. Consequently, it behooves us to better understand the social dynamics that contribute to the production of such medical knowledge, including financial motivations and ideological tendencies.

Prioritizing Financial Interests Over Public Health

Even though the medical profession is often portrayed as nobly fighting disease and helping patients overcome illness, research suggests the profession has consistently prioritized financial interests. Paul Starr (1982), in particular, argues the American Medical Association (AMA) has, since its 1847 inception, consistently prioritized protecting and expanding the physicians' financial interests, which it has done by increasing its professional standards, embracing biomedical approaches, and working to undermine its healthcare competitors. An example of the latter is the profession's steadfast opposition to public health's prevention initiatives. For instance, in the 1920s the AMA and its lobbyists thwarted initiatives to establish neighborhood public health centers, due to their fear the centers would provide free care to people who would otherwise pay for medical care (Brandt & Gardner, 2000). Similarly, in 1921 the profession derailed public health's initiative to provide pre and postnatal care for infants and their mothers (Brandt & Gardner, 2000). Moreover, while public

health professionals have consistently supported proposals to provide universal healthcare to all United States citizens, such initiatives have been consistently opposed by the American medical profession, including in the late 1950s, when they used red-scare tactics to reduce public support from 75 percent to 25 percent (Quadagno, 2004).

The profession's financial orientation is also manifested by the "medical politicking" (Conrad & Schneider, 1994) the AMA has pursued vis-a-vis other medical practitioners, where they have sought to weaken their competition by stigmatizing and delegitimizing their services. An example is the AMA's nineteenth-century moral crusade to stigmatize abortion, which led to abortion being criminalized in many states in 1866 and eventually the rest of the country. Although physicians did not provide abortions at that time, many competing disciplines did, with many practitioners having lucrative practices that suffered significantly with abortion's criminalization (Conrad & Schneider, 1994). Similarly, during the 1960s and 1970s American medicine used similar tactics against chiropractic, which had emerged as an economic threat (Winnick, 2009). Such tactics have also been used against midwives, acupuncturists and, in more recent decades, against naturopathy (Baer, 2001; Winnick, 2009).

These examples underscore that the medical profession prioritizes financial considerations even when it threatens the public's health. In turn, this provides a frame through which to understand why the profession would produce medical knowledge that obscures the role of toxicants. Producing such knowledge financially benefits the profession in three ways. First, it helps maintain public ignorance about the dangers of toxicants, which reduces public pressure on politicians to enact tougher regulations, guarantees people will continue to be exposed to dangerous products, and maintains a steady flow of new patients. Second, it preserves the profession's market share. While mainstream medicine offers little to undo the health effects of toxicant exposure, there are other practitioners (including osteopaths, naturopaths, doctors of Chinese medicine, and doctors of environmental medicine) who claim that ability. However, patients are less likely to seek them out if they are unaware of the relationship between toxicants and disease.

Third, obscuring the role of toxicants enables medical organizations (like the AMA and other professional societies) to maintain lucrative partnerships with industry, such as pharmaceutical manufacturers, which benefit significantly from concealing the environmental sources of disease. However, medical organizations also form partnerships with environmental polluters, who benefit mightily from obscuring the relationship between toxicants and disease. For example, the National Comprehensive Cancer Network (NCCN) (i.e. the producer of the clinical practice guidelines for leukemia) website lists General Electric (GE) as one of their sponsors, in addition to numerous pharmaceutical companies. GE has a lengthy track record of polluting the environment, including with PCBs and other carcinogens, as well as deliberately exposing citizens to nuclear radiation (Multinational Monitor, 2001). By 2001 they were deemed wholly or partially liable for at least 78 federal Superfund sites, had paid hundreds of thousands of dollars in fines, and was forced to pay a $200 million settlement for its pollution of the Housatonic River in

Massachusetts (Multinational Monitor, 2001). Sponsorship from such companies undoubtedly comes with an implicit, if not explicit, understanding that disease coverage will downplay the role of toxicants.

Ideological Opposition to Preventive Approaches

Beyond material interests, the omission of environmental pollutants can also be attributed to a worldview that is hostile to public health and its prevention initiatives. Although Brandt & Gardner (2000) identify many ways organized medicine has opposed public health over the twentieth century, they caution against solely attributing this to financial self-interest, arguing it can also be traced to medicine's deep ideological adherence to the reductionist biomedical paradigm.

When the AMA was founded the profession suffered from a poor reputation, low scientific credibility and low moral authority. To some extent, this was due to the profession's low level of professionalization and standardization (Starr, 1982). However, it was also due its reliance on "heroic medicine," which relied heavily on bloodletting, blistering, vomiting, and purging (Starr, 1982). The potential harmfulness of such practices stoked public opposition and contempt for the profession. The AMA addressed the issue by steering physicians away from such practices and towards bio-medicine, which included a growing reliance on diagnostic technologies (including x-rays and stethoscopes), a firm adherence to bacteriology and the germ theory of disease, which located disease in the individual (Starr, 1982).

The reductionist paradigm gave physicians an understanding of disease and approach that enabled them to decouple disease from its social roots, thereby making public health's broad social and environmental agenda appear unnecessary. In particular, physicians were attracted to the paradigm's "science-based objectivity and technique," which "contrasted with the tumultuous world of public health" (Brandt & Gardner, 2000, p. 711). Physicians were suspicious of public health endeavors, as they believed it was difficult to address disease-causing social conditions and such efforts were rendered even more difficult because they were tainted by "politics, advocacy, individual noncompliance, and social diversity" (ibid). The physician worldview dictated that "medicine could not solve the problems of poverty, illiteracy, and inequity–but it could, at least potentially, cure the diseases that these social forces produced" (ibid). As well, many medical advocates argued that improving health and life expectancy through medical interventions would eventually lead to reductions in poverty and social inequities (ibid).

In turn, this worldview strongly influenced medical training and medical practice, orienting both toward disease-focused reductionism and away from a concern about contextual sources of disease (Brandt & Gardner, 2000). In the 1920s there were many physicians who recognized the importance of prevention-oriented research and teaching. However, this objective was overshadowed by the medical schools' focus on intensive scientific and clinical training (Brandt & Gardner, 2000). This was also true in the 1930s and 1940s, where attempts to introduce preventive medicine failed to alter the dominance of the reductionist paradigm (Brandt & Gardner, 2000).

In the 1990s the problem was still present as 25 percent of medical schools offered no instruction in environmental medicine and those that did averaged less than ten hours of instruction over four years (Schenk et al., 1996). Relatedly, two thirds of medical school deans reported their schools offered minimal coverage of environmental issues (Graber et al., 1995), with similar results being reported for residency training (Musham et al., 1996; Lees, 1996). While the issue has garnered attention in recent decades, the problem continues to persist. For instance, in 2010 35 percent of graduating medical students reported being under-educated in environmental health (AAMC, 2010). Moreover, surveys find that while physicians acknowledge the importance of environmental factors, few receive the training to conduct a proper environmental history. For instance, Kilpatrick et al. (2002) found only 21 percent of Georgia pediatricians had received such training, while Zachek et al. (2015) found the same was true for only 7 percent of pediatric hematologists and oncologists.

These problems significantly impact medical practice as physicians lack the competence and confidence to engage with environmental issues, and invariably ignore these issues in the clinical encounter (Kilpatrick, 2002; Trasande et al., 2010; Zachek et al., 2015). For example, 73 percent of pediatric hematologists and oncologists reported rarely or never seeing a case they suspected was related to the patient's environment (Zachek et al., 2015). Moreover, 44 percent reported discomfort with having conversations with patients and their families about potential environmental causes of disease (Zachek et al., 2015). Additionally, Trasande et al. (2010) found that while Michigan pediatricians voiced high self-efficacy with addressing problems related to lead and second-hand smoke, they were far less confidant when dealing with pesticides, air pollution, PCBs, mercury, and mold exposures. Moreover, while pediatricians routinely refer patients to lead/toxicology clinics, they typically do not refer patients to regional pediatric environmental health specialty units, which could help patients address exposures to other toxicants (Trasande et al., 2010).

Thus, while medicine has financial interests for producing medical information that obfuscates the role of environmental pollutants, such knowledge production has deep ideological roots, which have created an education system that encourages doctors to ignore environmental pollution and deprives them of the tools to address it. If environmental medicine was more emphasized in medical school, we would have physicians who demand and produce medical information that better acknowledges the relationship between environmental pollution and disease.

Conclusion

Environmental pollution is an important source of disease. However, this information tends to be obscured by mainstream medical information, which fails to identify most toxicants related to disease and presents toxicant information in ways that systematically downplays its importance. This reinforces the dominance of the reductionist medical paradigm, which attributes disease to genes and personal choices. In turn, this makes it harder for individuals to protect themselves and their

families from polluted contexts and the industries who produce them. Moreover, while polluting industries and politicians are shielded from public scorn, pharmaceutical manufacturers and the medical profession benefit from a steadily growing flow of patients.

Although mainstream sources obscure the environmental causation frame, many are working to change the situation. Besides the environmental health researchers who document and publicize the links between disease and pollution, there are scientific organizations (such as Silent Spring Institute and The Collaborative on Health and the Environment) that work to educate the public (Brown et al., 2009). Additionally, environmental justice activists are publicizing the links between environmental pollution and disease in local communities, as well as organizing the communities to eliminate those problems (Brown et al., 2009). In the medical field, individual healthcare practitioners, such as functional medicine doctors, have pursued training in environmental health and have incorporated the knowledge into their clinical practice. Moreover, some practitioners (such as Dr. Mercola, Dr. Weil, and Dr. Oz) have sought to educate the public by integrating toxicant information into their website content.

While these efforts are important, their capacity to bring about change is limited because they are not tackling the problem's roots. One root cause is medical curricula that obscure or marginalize the role of toxicants. We need research that illuminates how such deficiencies are socially constructed and reproduced, which includes identifying: 1) the process through which school curricula are revised; 2) the people who make key decisions; 3) the values in their calculus; and 4) the social forces that shape that value system.

Another root cause is the public's general ignorance about toxicant harmfulness to humans and ecosystems, which can also be traced to educational shortcomings. In particular, Woodhouse & Howard (2009) argue North American universities are failing to educate most, let alone all, students about the ecological and human harms associated with the production, use, and disposal of common toxicants. This is another area that should be tackled by future research. Key in this regard would be to analyze places in academia were such information would be most expected (such as chemistry courses) and to explore why those sites are failing to provide it. In turn, this knowledge would enable us to correct these major educational failings and, in the process, create a populace that is more aware of toxicant harmfulness, better able to protect themselves and their families, as well as more demanding of tighter regulations and medical information that accurately conveys the disease-causing effects of environmental pollution.

References

Association of American Medical Colleges (AAMC). (2010). *Medical School Graduation Questionnaire: All Schools Summary Report: Final*. Retrieved from http://docplayer.net/7369062-Gq-medical-school-graduation-questionnaire-all-schools-summary-report-final.html.

Atkin, C., Smith, S., McFeters, C., & Ferguson, V. (2008). A Comprehensive Analysis of Breast Cancer News Coverage in Leading Media Outlets Focusing on Environmental Risks and Prevention. *Journal of Health Communication*, 13(1), 3–9.

Baer, H. (2001). The Sociopolitical Status of U.S. Naturopathy at the Dawn of the 21st Century. *Medical Anthropology Quarterly*, 15(3), 339–346.

Brandt, A., & Gardner, M. (2000). Antagonism and Accommodation: Interpreting the Relationship Between Public Health and Medicine in the United States During the 20th Century. *American Journal of Public Health*, 90, 707–715.

Bray, C. (2017, July 24). K.K.R. to Buy WebMD and Take Majority Stake in Nature's Bounty. *The New York Times*, p. B7. Retrieved from www.nytimes.com/2017/07/24/business/dealbook/kkr-webmd-natures-bounty.html

Brown, P., Zavestoski, S., McCormick, S., Mandelbaum, J., & Luebke, T. (2001). Print Media Coverage of Environmental Causation of Breast Cancer. *Sociology of Health & Illness*, 23(6), 747–775.

Brown, P., Zavestoski, S., McCormick, S. et al. (2009). Embodied Health Movements: New Approaches to Social Movements in Health. In Peter Conrad (ed.), *The Sociology of Health & Illness: Critical Perspectives* (pp. 592–604). New York: Worth Publishers.

Campbell, E. (2009). Corporate Power: The Role of the Global Media in Shaping What We Know About the Environment. In Kenneth Gould and Tammy Lewis (eds.), *Twenty Lessons in Environmental Sociology* (pp. 68–84). New York: Oxford University Press.

Collaborative on Health and the Environment (CHE). (2018a). Toxicant and Disease Database. *Collaborative on Health and the Environment*. Retrieved from www.healthandenvironment.org/our-work/toxicant-and-disease-database/

Collaborative on Health and the Environment (CHE). (2018b). A Brief History of CHE. *Collaborative on Health and the Environment*. Retrieved from www.healthandenvironment.org/about/a-brief-history

Collaborative on Health and the Environment (CHE). (2018c). About the Toxicant and Disease Database. *Collaborative on Health and the Environment*. Retrieved from www.healthandenvironment.org/our-work/toxicant-and-disease-database/about-the-toxicant-and-disease-database

Comscore. (2016, January 21). Comscore Ranks the Top 50 U.S. Digital Media Properties for December 2015. Retrieved from www.comscore.com/Insights/Market-Rankings/comscore-Ranks-the-Top-50-US-Digital-Media-Properties-for-December–2015/

Conrad, P., & Schneider, J. (1994). Professionalization, Monopoly, and the Structure of Medical Practice. In Peter Conrad and Rochelle Kern (eds.), *The Sociology of Health & Illness: Critical Perspectives* (4th ed.) (pp. 167–173). New York: St. Martin's Press.

Faber, D. (2008). *Capitalizing on Environmental Injustice: The Polluter-Industrial Complex in the Age of Globalization*. Lanham: Rowman & Littlefield.

Foster, John Bellamy. (1999). *The Vulnerable Planet: A Short Economic History of the Environment*. New York: Monthly Review Press.

Fritschi, L., & Driscoll, T. (2006). Cancer Due to Occupation in Australia. *Australian and New Zealand Journal of Public Health*, 30(3), 213–219.

Goodman, S. (2009, December 02). Tests Find More than 200 Chemicals in Newborn Umbilical Cord Blood. *Scientific American*. Retrieved from www.scientificamerican.com/article/newborn-babies-chemicals-exposure-bpa/

Graber, D., Musham, C., Bellack, J., & Holmes, D. (1995). Environmental Health in Medical School Curricula: Views of Academic Deans. *Journal of Occupational and Environmental Medicine*, 37(7), 807–811.

Harrison, J. (2011). *Pesticide Drift and the Pursuit of Environmental Justice*. Cambridge, MA: MIT Press.

IARC. (2018). IARC Monographs on the Evaluation of Carcinogenic Risk to Humans. Retrieved from http://monographs.iarc.fr/ENG/Monographs/vol77/index.php

Kilpatrick, N., Frumkin, H., Trowbridge, J. et al. (2002). The Environmental History in Pediatric Practice: A Study of Pediatricians' Attitudes and Practices. *Environmental Health Perspectives*, 110, 823–827.

Lazarou, J., Pomeranz, B., & Corey, P. (1996). Incidence of Adverse Drug Reactions in Hospitalized Patients. *Journal of the American Medical Association*, 279(15), 1200–1205.

Lees, R. (1996). Occupational and Environmental Health: Preparing Residents to Treat Related Illnesses. *Canadian Family Physician*, 42, 594–596.

Lewison, G., Tootell, S., Roe, P., & Sullivan, R. (2008). How Do the Media Report Cancer Research? A Study of the UK's BBC Website. *British Journal of Cancer*, 99, 569–576.

MacKendrik, N. (2010). Media Framing of Body Burdens: Precautionary Consumption and the Individualization of Risk. *Sociological Inquiry*, 80(1), 126–149.

Multinational Monitor. (2001, July/August). GE: Decades of Misdeeds and Wrongdoing. *The Multinational Monitor*, 22(7–8). Retrieved from www.multinationalmonitor.org /mm2001/01july-august/julyaug01corp4.html

Musham, C., Bellack, J., Graber, D., & Holmes, D. (1996). Environmental Health Training: A Survey of Family Practice Residence Program Directors. *Family Medicine*, 28(1), 29–32.

National Cancer Institute (NCI). (n.d). Leukemia – Patient Version. National Cancer Institute. Retrieved from www.cancer.gov/types/leukemia

National Institute of Health (NIH). (n.d). "Cancer Stat Facts: Leukemia. National Institute of Health. Retrieved from https://seer.cancer.gov/statfacts/html/leuks.html

O'Donnell, M., Abboud, C., Altman, J., Applebaum, R., Arber D. et al., (2012). Acute Myeloid Leukemia: Clinical Practice Guidelines in Oncology. *Journal of the National Comprehensive Cancer Network*, 10(8), 984–1021.

OEHHA. (2018a). About. Office of Environmental Health Hazard Assessment. Retrieved from https://oehha.ca.gov/about

OEHHA. (2018b). Risk Assessment. Office of Environmental Health Hazard Assessment. Retrieved from https://oehha.ca.gov/risk-assessment

OEHHA. (2018c). Chemicals. Office of Environmental Health Hazard Assessment. Retrieved from https://oehha.ca.gov/chemicals

Quadagno, J. (2004). Why the United States Has No National Health Insurance: Stakeholder Mobilization Against the Welfare State, 1945–1996. *Journal of Health and Social Behavior*, 45(extra issue), 25–44.

Schettler, T., Stein, J., Reich, F., Valenti, M. & Wallinga, D. (2000). *In Harm's Way: Toxic Threats to Child Development*. Greater Boston Physicians for Social Responsibility. Boston, MA: Red Sun Press.

Schenk, M., Popp, S., Neale, A.V., & Demers, R. (1996). Environmental Medicine Content in Medical School Curricula. *Academic Medicine*, 71(5), 499–501

Scherer, Michael, Pratheek Rebala, and Chris Wilson. (2014, October 23). The Incredible Rise in Campaign Spending; *Time*. Retrieved from http://time.com/3534117/the-incredible-rise-in-campaign-spending/

Sexton, K., Needham, L., & Pirkle, J. (2004). Human Biomonitoring of Environmental Chemicals: Measuring Chemicals in Human Tissues Is the "Gold" Standard for Assessing People's Exposure to Pollution. *American Scientist*, 92, 38–45.

Starr, P. (1982). *The Social Transformation of American Medicine*. New York: Basic Books.

Steinem, G. (2011). Sex, Lies, and Advertising. In Gail Dines and Jean Hurney (eds.), *Gender, Race, and Class in Media: A Critical Reader* (3rd edition) (pp. 235–242). Thousand Oaks, CA: Sage Press.

Steingraber, S. (2009). The Social Construction of Cancer: A Walk Upstream. In Leslie King and Deborah McCarthy (eds.), *Environmental Sociology: From Analysis to Action* (pp. 287–299). Lanham, MD: Rowman & Littlefield.

The Write News. (2005, April 22). WebMD Corporation Launches Print Magazine. Retrieved from www.writenews.com/webmd-corporation-launches-print-magazine–42220055

Trasande, L., Newman, N., Long, L., Howe, G., Kerwin, B. et al. (2010). Translating Knowledge About Environmental Health to Practitioners: Are We Doing Enough? *Mount Sinai Journal of Medicine*, 77, 114–123.

Vallée, M. (2013). Perpetuating a Reductionist Medical Worldview: The Absence of Environmental Medicine in the ADHD Clinical Practice Guidelines. *Advances in Medical Sociology*, 15, 241–264.

WebMD. (2017a). What Is Leukemia? Retrieved from www.webmd.com/cancer/lymphoma/understanding-leukemia-basics#1

WebMD. (2017b). What Is Acute Myeloid Leukemia (AML)? Retrieved from www.webmd.com/cancer/lymphoma/qa/what-is-acute-myeloid-leukemia-aml

Winnick, T. (2009). From Quackery to "Complementary" Medicine: The American Medical Profession Confronts Alternative Therapies. In Peter Conrad (ed.), *The Sociology of Health & Illness: Critical Perspectives* (pp. 261–275). New York: Worth Publishers.

Woodhouse, E., & Howard, J. (2009). Stealthy Killers and Governing Mentalities: Chemicals in Consumer Products. In Merrill Singer and Hans Baer (eds.), *Killer Commodities: Public Health and the Corporate Production of Harm* (pp. 35–66). Lanham, MD: Altamira Press.

Zachek, C., Miller, M., Hsu, C. et al. (2015). Children's Cancer and Environmental Exposures: Professional Attitudes and Practices. *Journal of Pediatric Hematology/Oncology*, 37(7), 491–497.