

INTRODUCTION

Thousands of chemicals are negatively affecting our brains, bodies, and environment each and every day. Substances invisible to the naked eye are not only disrupting the most important hormones of our body and brain but also laying down multiple paths of disease that will impact our children and their children decades into the future. These are challenging and uncomfortable ideas to accept. You might want to throw up your hands when you hear that these chemicals are produced and distributed on a massive scale, are minimally regulated, and will continue to wreak havoc on our lives, generation after generation.

As mind-boggling as it is, this dire scenario is all too real.

I trust that you know someone who has attention-deficit/hyperactivity disorder (ADHD) or whose child or grandchild has been diagnosed with autism. You may have wondered about the dramatic increase in obesity and diabetes across American society over the past couple of decades. Study after study has shown that these increases can be directly tied to chemicals in our food supply, environment, and household and personal care products. You may not yet be aware of the slow yet steady rise in fertility issues experienced by both women and men. You may not be tuned in to the documented drop in sperm count for men as young as in their 20s. You may not yet appreciate the long-term economic costs

to society when young children are born with an already-diminished IQ. These, too, are some of the frightening and real outcomes of endocrine disruption.

One of the first major public disclosures that the widespread use of synthetic chemicals can do harm—not just provide benefits—occurred when Rachel Carson's *Silent Spring* was published in 1962. Though scientists had been questioning and investigating the deleterious effects of man-made or synthetic chemicals since World War I, the wider world was just beginning to wake up to the dangers of chemicals such as DDT, sprayed over farmland, wetlands, and in our neighborhoods, to our natural habitat. Half a century later, Carson's deeply felt exploration of the harms of pesticides is not only still relevant but also serves as a dramatic reminder that we have not fully resolved the issues that she raised more than five decades ago. Indeed, our environment and human health and survival are more endangered now than ever before.

Like many of us, I am deeply concerned about the degree to which chemicals are still infiltrating our world, our bodies, and our brains. I am as much an environmentalist as any sane person troubled by the state of the air we breathe, the water we drink, and the land from which we harvest our food. But I am first and foremost a pediatrician—and the father of two young children. My education and training began at Harvard College and then Harvard Medical School. During medical school interviews, I recall frequently being asked for my opinion about President Clinton's proposal for universal health care. Everyone seemed to have an opinion one way or another, but I wasn't sure I had the proper training to answer this important policy question.

I began to ask whether students were taught how health care policy is made and how doctors could shape the process. I soon realized how little room there was in the medical school curriculum to focus on the political and economic forces that

shape medicine. Indeed, to this day, very little about health policy is included in the typical medical school curriculum, especially policy that is related to environmental health and the impact of chemicals. In order to gain a more informed perspective, I enrolled at the Harvard Kennedy School of Government, where I dived deep into health policy and its economics. This experience fundamentally transformed the way I thought about medical care. I realized that I had the opportunity to help many more people if I could bring my knowledge of medicine to the process of shaping decisions that could affect thousands if not millions of people.

Soon after I completed my pediatric residency at Boston Children's Hospital and Boston Medical Center, I was accepted into a fellowship program with then-Senator Hillary Clinton's office. I was asked to focus on two areas—children's health and environmental health—and was excited to work on child health policy. I cared about the environment but had not yet connected it to the health of children in a very deep way.

My time working for then-senator Clinton was another transformative experience. I came to more fully appreciate the enormous and growing impact of chemicals and other environmental factors on human health and the role of regulation in eliminating or reducing the most harmful exposures. I finished my fellowship with a new and energized career focus: to study the impact of environmental exposures on children and to document the benefits of prevention to society at large.

After additional training in environmental medicine, I embarked on a career at the intersection of environmental science, medicine, and policy. Currently, my research focuses on identifying preventable and environmental factors that contribute to obesity and other chronic conditions in children, as well as measuring and documenting the economic costs of failing to prevent environmental hazards. I now serve as an

associate professor of pediatrics at the NYU School of Medicine, of health policy at the NYU Wagner School of Public Service and at the NYU College of Global Public Health. I serve on several national and international committees that study the impact of chemicals on children. I have been working in environmental health for close to 20 years.

For me, this book is an extension of my commitment to ensure that everyone has the opportunity to understand the long-term threat of synthetic chemicals and their relationship to endocrine disruption. I also hope to grow your appreciation that, though it's hard to measure the risks in the now, many chemicals have the power—and the tendency—to show up down the road, when it's often too late. In fact, that's why this book is both so timely and so pressing. The longer we wait to act, the longer we wait to truly take the power we do possess as citizens, to change our own habits and ultimately affect governmental policy, the more the danger grows. It can impact our own health and the long-term health of our children and grandchildren. Many health risks may not be crystal clear right now; however, the science itself is quite clear, pointing to illnesses, an increase in obesity, and shockingly the loss of IQ points that translates to a decrease in one's ability to earn money.

This may all sound dire and frightening. However, I want to assure you that there is hope in this message and in this book, especially in its concluding two chapters. There are actions you can take to protect yourself and your family, and there is a larger virtuous circle awaiting your participation.

MY STORY

In 2014, I was asked to organize the Endocrine Disrupting Chemical (EDC) Disease Burden Working Group, a group

of nearly 30 scientists from eight countries that advises their policymakers about the costs of conditions that can be linked to chemicals that can disrupt hormones in our bodies. (Throughout the book I will refer to this group of internationally regarded scientists, medical doctors, and other experts in endocrine disruption.) Our findings revealed that the chemicals referred to here are responsible for additional disease-related costs in Europe of €163 billion (which equates to \$209 billion) each year.^{1,2} How many chemicals did my group study? Fewer than 5% of all known hormone-disrupting chemicals. And yet the literal billions of euros (translated into even more US dollars) is likely a grave understatement of the overall problem. Because we had to restrict the number of chemicals in our study, our team could only begin to imagine the harmful effects of the thousands of other chemicals we have not yet had a chance to examine. For the sake of streamlining our studies, we chose not to include many conditions and diseases that are indirectly implicated by chemical exposure, including prostate cancer, osteoporosis, breast cancer, and certain immune conditions—adult diseases triggered as early as childhood, sometimes even *in utero*, after exposure to chemicals. Even the most sophisticated studies aimed at understanding these chemicals have only begun to scratch the surface of a much, much bigger problem.

In this book, I have chosen to focus on a few groups of chemicals because it's important to me to stay as closely aligned with the best scientific evidence possible. Though many other groups of chemicals may pose similar dangers, the scientific research is strongest and most current for the groups of chemicals described here. So in this book you will learn about how certain groups of chemicals disrupt our hormonal systems and damage our health in irreparable ways. You will come to learn about these chemicals and where they hide—in your home, workplace, the foods that you eat, and in

surprising areas of your everyday environment. You will also begin to gain an understanding of how these chemicals affect your and your family's brains and bodies and just how tricky they can be to trace. Unlike an infection, whose cause can be traced through microbiological analysis, chemicals can work almost invisibly. Routine clinical tests or exams may not detect exposures, or the traces of chemicals may disappear long before their effects emerge.

The book will describe

- how hormone-disrupting chemicals get into our bodies;
- how they can mimic our hormones and what happens when they do;
- how hormone disruption can contribute to a broad array of diseases, including brain disorders, metabolic disruptions such as type 2 diabetes and obesity, and reproductive illnesses;
- how the increased incidents of these diseases impact individuals and our society more broadly;
- how we can all limit our exposure to the chemicals of greatest concern while maintaining our urban, suburban, or rural lifestyles of choice;
- what the forces—political, economic, and policymaking—were that led to the epidemic we are facing today, how the regulatory framework is flawed, and how your consumer purchasing power holds promise in compensating for the absence of policy change, as it did with removing lead from paint, bisphenol A from baby bottles, Alar from apple juice, and many other examples.

You will come to know the products commonly used in your family's everyday lives that contain endocrine-disrupting chemicals (EDCs) and the simple, immediate steps you can take to lessen their danger. I've also included some case stud-

ies so that you can appreciate the toll these chemicals can take in real life. The case studies I describe are composites of multiple patients I've encountered throughout my career, with names and details intentionally modified to protect privacy and emphasize the key takeaways. Although many researchers step away from clinical care, to this day I still practice clinical pediatrics and work with patients and their families so that I can stay grounded in the real-life situations experienced by real people. As much as I am a policy wonk, staying close to children and their families informs the research I do and helps me better communicate the implications of my research to policymakers.

I have also incorporated the most important research studies so that you can appreciate why my colleagues in the field of endocrine disruption and I are so concerned and why you should be, too. There are prominent public figures who undermine the significance of these health issues and claim the science is wrong. There are some even within the medical community who attempt to minimize the impact of these chemicals, dismissing the studies that have shown clear, irrefutable results, studies that were carefully designed and replicated by independent scientists.

For that reason, though I don't ask you to dwell on the studies I have included here, I do want you to keep in mind that as corporate-led voices increase their attacks against those of us in the know and try to dissuade the public of these very real dangers of chemicals, it becomes even more important that you see how and where they mangle the science and misrepresent the research.

I don't intend to throw statistics, medical jargon, and scary facts at you. Instead, I want to unfold the dramatic story of endocrine-disrupting chemicals and the havoc they are wreaking on human health through an investigation into the state of our condition, as a species and as a planet, based on my access

to those at the forefront of discovery—the leading minds in the fields of endocrine disruption, obstetrics, toxicology, public health, pediatrics, and more.

Since one of my areas of research entails measuring the economic costs to society from EDC exposures, you will come across some dollar amounts. This discussion of economic burden is not in any way to diminish the health dangers. Quite the opposite, actually. Because chemical companies and manufacturers often argue about the apparent high costs of safer products, it's critical to measure the economic costs of inaction so we can make a fair and proper evaluation of the tradeoffs. You will soon discover that doing nothing costs more to the public than investing in safer products and new policy regulations.

Knowledge is power, and I hope knowledge will motivate you to participate in this opportunity for momentous change, taking real steps to protect yourself and those you love.

The strongest and earliest evidence has been documented for EDC effects on the brain, and so we will start our journey there. Next we'll explore what we know about EDCs and their effects on obesity and metabolic risks. Then we'll examine the role of EDCs in increasingly common reproductive conditions.

Along the way, you will hear about the economic costs associated with diseases due to EDCs because they are large and real. Finally, you will hear the stories of people I have met in my clinical career who suffer from conditions that may be related to EDC exposures. I choose my words carefully. Nearly all of these conditions have multiple origins and factors, arising from a collision of genetic predisposition, lifestyle habits, and environmental pollutants—which is why I say “may be related” to EDCs. Some industry representatives and their scientists use the fact of these multiple factors as a way to undermine or refute the connection between chemicals and disease.

Yet, much like the probability that human activity contributes to climate change, the science has accumulated to the point that scientists are nearly 100% certain that EDCs contribute to at least one, and likely many, of the metabolic, reproductive, and nervous system disorders you're about to discover.

I trust that by giving you the knowledge about these chemicals and arming you with real, first-hand understanding of the compounds at issue and their impact, you will feel inspired to continue to grow awareness and take action. If I have done my job, you will feel more empowered, more confident in your knowledge, and more emboldened to make your voice heard. We don't need to become political operatives—far from it. Indeed, my perspective is always grounded in the best science and common sense.

My work as a pediatrician, research scientist, and policy expert is entirely focused on helping parents and others connect the dots on these massive costs so that policymakers are finally swayed. Only when we understand the astronomical burden to society, government, and the economy itself when the connection between chemicals and their effects go unchecked will our society effect true, lasting change through regulation. But it's also really important that each of us makes his or her voice heard. All of us ordinary citizens have the power and the right to influence—with our hashtags and our checkbooks. Our choices and habits matter.

This is a lot of information to take in. But understand that these chemicals are real, they are dangerous, and they are deeply entrenched in the way most Americans live their lives. And, most urgently, these chemicals are not going away without strong action from all of us.