

Viewpoint

# Prevention Science Can't Wait: An Interview with Dr. Diana H. Fishbein

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**Abstract:** In an ongoing series of interviews, *Challenges* Advisory Board member and Nova Institute for Health Fellow Alan C. Logan meets with thought leaders, scientists, scholars, healthcare professionals, artisans, and visionaries concerned about health at the scale of persons, places, and the planet. Here, Dr. Diana H. Fishbein responds to a set of questions posed by *Challenges*. For over forty years, Dr. Fishbein, a neuroscientist and criminologist by training, has been at the forefront of research examining the intersections of biological, environmental, social, and physical factors as they relate to brain development, functioning, risky behavior, and life outcomes. Within this broad-ranging career, Dr. Fishbein was among the very first to conduct a dietary intervention study (eliminating refined carbohydrate foods) examining behavioral outcomes (i.e., nutritional psychiatry). This, combined with related research endeavors and experiences, led to a wider-lens view of prevention research, a desire to understand the physiological mechanisms that explain heterogeneity in positive and/or unfavorable outcomes in prevention programs, and a dynamic career devoted to the science of prevention. Here, Dr. Fishbein reflects on her career and its many twists and turns through a range of interdisciplinary work. She discusses prevention science through the lens of future possibilities and the need for scientists to lean toward advocacy and supporting evidence-based policy changes. Prevention science, as Dr. Fishbein explains, is at the heart of the many interconnected challenges of our time.



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## 1. Introduction

*Challenges* is a unique interdisciplinary journal dedicated to integrating diverse scholarly discourses related to the Grand challenges currently facing our societies and the planet-at-large. To that end, the journal maintains ongoing interviews that cut across disciplines, professions, and perspectives. In collaboration with the Nova Institute for Health, these interviews seek out individuals with remarkable experience and wisdom. The goal of the interview is to question outstanding individuals on their work, experiences, and ideas, and how those might help break down barriers to the promotion of health and flourishing at the scale of persons, places, and the planet.

In the context of some of the most enduring and sticky challenges of our time—including, but not limited to, mental disorders, delinquency, antisocial behavior, substance-use disorders, ultra-processed-food addiction, aggression, and violence—the term prevention science encompasses critical findings in both basic and applied research. The field, aided by the publication of critical research on evidence-based prevention, took formal shape in the 1990s [1]. Over time, the field has drawn from interdisciplinary expertise and

emerged as its own unique science, with dedicated journals [2], specific PhD programs [3], distinct university divisions [4], academic centers [5], and inclusion in university-based library resources [6].

Prevention science is distinct from the fields of treatment and rehabilitation. It moves beyond single-component interventions and, at its best, utilizes a comprehensive approach that targets multiple components of risk over time. For example, the interventions used in prevention science might simultaneously address parenting skills, social-cognitive skills in children, the positive development of peer relations, tutoring and other methods to improve academic skills, and attention to a social ecology that fosters healthy behavior among peers—for adolescents, this might include attention to topics such as adolescent development, alcohol, tobacco, drugs, and decision making [7]. Decades of research in prevention science show that early-life factors—both beneficial and detrimental—can determine later-life outcomes, including those considered behavioral and those that might lead to involvement with the criminal justice system. Despite this evidence, and the obvious benefits to all of society, prevention science remains underfunded and underappreciated.

The contemporary planetary-health movement underscores that the health of individuals, communities, and the planet cannot be uncoupled [8]. As such, discussions of health along the person, place, and planet continuum require a mindset that prioritizes the prevention of harms. Sidelining prevention contributes to the maintenance of unjust systems, such as a bloated prison-industrial complex that is used as a dumping ground for a mental health crisis that society seems unwilling to confront with vigor. The marginalization of prevention comes with a price tag that is virtually incalculable. Recent estimates indicate that the annual cost of crime in the United States, with all its related costs in terms of victim losses, healthcare, maintenance of courts, jails/prisons, police, parole, probation, and so on, is north of USD 5.76 trillion [9]. Of course, a large and overburdened healthcare system and a vastly overused criminal justice system add immensely to the carbon footprint [10–12]. Put simply, prevention science is a topic of high-level relevancy to planetary health. With the goal of exploring prevention science in more detail, *Challenges* Advisory Board member and Nova Institute for Health Fellow, Alan C. Logan, was honored that Dr. Diana H. Fishbein, a long-time leader in the field of prevention science, agreed to be the subject for the Nova Interview (Figure 1).



**Figure 1.** Dr. Diana H. Fishbein—“then and now”. (Left), Photographed with an EEG machine as a new graduate investigating criminology through the lens of neuroscience; (Right), in her current role as a senior research scientist at Pennsylvania State University and University of North Carolina (photographs used with permission).

Dr. Fishbein graduated with an undergraduate, a master's, and a doctorate degree from Florida State University. Dr. Fishbein holds appointments at the University of North Carolina, where she is a senior research scientist at the Frank Porter Graham Child Development Institute, and at Pennsylvania State University, where she is a member of the part-time research faculty. In addition, Dr. Fishbein is the founder and president of the National Prevention Science Coalition to Improve Lives, a national association that promotes the transfer of scientific knowledge to communities and policymakers.

## 2. The Nova Interview

**Nova:** Your early academic pathway at the bachelor, master's, and doctorate levels all included dual studies in criminology and psychobiology. This was at a time when criminology was almost exclusively dominated by social theories. It was also a time when psychiatry/psychology was only just starting to brush off its rigid attachments to all manner of Freudian pseudoscience [13,14]. Can you tell us a little bit about your academic pathway and motivations to study criminology through the lens of neuroscience, with biological factors in mind?

**Dr Fishbein:** Thank you for your question. I was raised in a working-class neighborhood outside of Washington, DC. Crime, domestic violence, alcoholism, gangs, and child maltreatment were all pervasive, not to mention racism, including antisemitism (which I personally experienced). My interest in criminology and, subsequently, neuroscience stemmed from my fascination with the stark differences in outcomes amongst my friends raised in the same neighborhood and experiencing similar conditions, with some developing behavioral problems, and others were seemingly resilient. At the time, I figured the degree of family support was at the root of these disparities. I had loving parents and safety within the home while some others did not. But I later learned it was much more complicated than that!

Due to my interest in individual differences, when I started college, I chose criminology as my major. Criminology originally developed as a truly interdisciplinary field, including sociology, epidemiology, psychology, biology, and genetics, among others. However, in the years immediately around my entry into college, a great deal of damage was done to the field when a few rogue researchers proposed biologically based racist and discriminatory theories that alleged some groups in our society were inherently less intelligent and prone to criminality. Some esteemed criminologists were so concerned about these negative influences, there were heated arguments and even a fist fight at a conference between researchers proposing biologically based theories and those opposed to any inclusion of biological factors, even when scientifically and morally sound. The original interdisciplinary nature of criminology thus disintegrated and became myopic. Sociological theories were not of central interest to me, so I shifted my attention to neuroscience, although later in my career, it became clear that social conditions are key factors in physical and behavioral development and functioning. But at the time, I was disillusioned and dropped out of college for a short time to participate in community organizing for the United Farm Workers in Florida. When I returned, I found my career pathway.

It was then that my focus turned to the role of the brain in risky behaviors. I developed a joint program in graduate school to integrate neuroscience with criminology, setting my sights on brain and peripheral physiological underpinnings of risky behaviors. I was fortunate to have a professor of criminology—Dr. C. Ray Jeffrey—at Florida State University who was renowned for this work. Other professors in the department also contributed their disciplinary perspectives, which kept me grounded to systemic and institutional sources of discriminatory treatment of offenders and other matters. So, I feel my educational experiences were broad, diversified, and integrational, providing me with a foundation to address the question as to why children and teens exposed to similar conditions end up in such different places (Figure 2).



**Figure 2.** Coming “full circle” at Florida State University (FSU). (Left), Diana Fishbein as a student at FSU (Right), returning 40 years later when she was inducted into the Hall of Fame at the College of Criminology at FSU (with her old FSU college professors: from (Left) to (Right), Professor Theodore Chiricos, Diana, Professor and Dean Thomas Blomberg, and Professor Gordon Waldo. (photographs used with the permission of D.H.F).

**Nova:** Your PhD work involved spending time in Florida’s Lantana Correctional facility, studying the dietary patterns of inmates, and examining outcomes related to shifts away from high-carbohydrate, high-sugar diets. The study of nutrition and behavior has exploded in recent years, with the American Psychological Association conceding last year that early pioneers in the field were often dismissed with “skepticism and dismissiveness” [15]. Why were you motivated to study nutrition and behavior in a correctional setting?

**Dr. Fishbein:** After working in a daycare center while attending graduate school, I noticed two brothers whose mother would leave them with a giant Coke each day. When they arrived, they were well behaved but after drinking their sodas, they would become hyperactive and aggressive toward other children. I scoured the research to determine what might have contributed to their drastic behavioral change and discovered hypoglycemia, or low blood sugar, which can adversely affect some children’s behavior. Because I was interested in underlying conditions that may lead to problems with impulse control, aggression, and emotion dysregulation, as well as my familiarity with the prison environment, I decided to focus on correctional inmates. I hypothesized that dietary change may lead to improvements in behavior.

I honestly think the reason this topic has received limited research attention is due to the great complexity of the field of nutrition. This complexity may also explain why medical schools have historically not delved into the topic with the depth it deserves, especially given how directly our diets are related to a range of behavioral health issues.

**Nova:** Although the Lantana study was relatively small, you observed an important phenomenon that is now the subject of intense scrutiny by researchers examining ultra-processed-food addiction—withdrawal-like symptoms [16,17]. During the first two weeks of the experimental diet, which is to say, a healthier low-sugar diet, you noted symptoms that were commonly mentioned, including “exhaustion, dizziness, extreme hunger, irritability, and nervousness” [18,19]. Can you tell us more about the outcomes?

**Dr. Fishbein:** My experience at the Lantana Correctional Institution is one I will never forget. I was able to gain entrance and actually change the diets of half of the prison and retain the normal diet for the other half. I collected self-report behavioral and psychological data from the inmates and ran difference tests to determine whether it made any difference. I also interviewed staff. According to both sources, it did. As an exploratory study, it was

not a well-controlled design, but offered some preliminary evidence for the importance of nutrition for the psychological and behavioral well-being of correctional inmates. And that precept certainly applies to all of us!

**Nova:** Your work inspired other dietary intervention studies in various correctional facilities in the 1980s [20,21]. Notwithstanding the limitations and quasi-experimental designs, the results certainly suggested that it was a topic to be taken seriously. It wasn't though. It sort of fizzled out. Sadly, a recent report from Impact Justice demonstrates that correctional facilities in the United States continue to serve high-carbohydrate ultra-processed foods that, while meeting check-marks for mandated vitamins and minerals, barely fit the description of food [22]. Given the massive rise in research that is tangential to "nutritional criminology", including better designed intervention studies, supported by increased illumination of mechanistic pathways [23], is it past time to revisit dietary intervention studies in correctional facilities?

**Dr. Fishbein:** Oh my, yes! I've consumed meals in a variety of jails and prisons. It is highly processed, lacking in nutrients, full of fat and sugar, and, when eaten routinely, substantially increases the risk for a host of serious chronic diseases. And as you pointed out, poorly regulated blood glucose can also contribute to irritability, cognitive problems, and other behavioral issues. The issue, as you point out, is not well studied in correctional settings, however, and deserves more attention. Given that most inmates will eventually be released (and even if not), it literally pays to offer a healthier diet; to prevent physical and behavioral health problems and reduce the strain on our healthcare systems.

**Nova:** After graduating with your PhD, you moved to the University of Maryland with a National Institutes of Health post-doc fellowship. It wasn't long before your work in biological criminology was making headlines in syndicated newspaper columns [24–26]. You argued that if research in the neurosciences, nutrition, and biological aspects of behavior continued to mature, then "changes must be made within the criminal justice system" [24]. You were not looking at these factors in isolation and emphasized that single biological factors were not proven to be causative. Rather, you argued that they were cumulative risk factors, intersecting with well-known developmental risk factors, such as abuse and childhood adversity. Can you tell us a bit about how that early work shaped your current thinking on prevention science?

**Dr. Fishbein:** Throughout college and during the early years of my career, I was exposed to several disciplines, not just one, which broadened my thinking. I always recognized the multidimensionality and interactivity of causal factors in contributing to human behavior. What had been left out of the equation when studying "criminality" for so long was the brain, a primary driver of behavior. Note, I'm placing criminality in quotation marks because it is, actually, a legal abstraction, indicative of how the system responds to behavior that crosses legal lines, and not reflective of the actual behavior. I focus on the latter. Credited to all those who took part in my training, my career trajectory became increasingly focused on the effects of the social (e.g., child maltreatment, poverty) and physical (e.g., heavy metals, head trauma) environment on brain development and functioning. Influential factors that affect us all, especially children, also emanate from some of our systems and institutions in our society, such as policies followed by the child welfare and justice systems, as well as discriminatory and racist practices, both abject and implicit. And I was particularly interested in how evidence-based preventive and treatment interventions had potential to impact the brain and improve overall outcomes. Because of what I witnessed and experienced myself in my neighborhood, I knew the pain and suffering of children who were mistreated—for me, primarily revolving around my Jewish ethnicity as well as being the victim of criminal acts. I knew that I wanted to spend my life understanding the sources of adversity, the impacts on development, and preventing children from experiencing the same. So, my thoughts and actions turned toward prevention science; a field that has amassed an enormous body of knowledge and practice over the past 40 years (Figure 3).



**Figure 3.** Dr. Diana H. Fishbein testifying at a United States congressional briefing on child poverty, Washington, D.C., 2017 (with permission of the author, D.H.F.).

**Nova:** During those early days you also acted as a consultant in prison reform and for groups such as Forensic Habilitation, the latter a Fairfax, Virginia-based, organization that emphasized biomedical assessments of justice-involved persons with behavioral disorders. Forensic Habilitation was founded by attorney Blaine Friedlander and psychologist Walter J. Moretz of George Mason University. At a time before the term *neurolaw* was even coined, Friedlander was convinced that biomedical factors played a role in criminal behaviors. The prosecutor for Fairfax County, attorney Robert Horan, was no fan of Friedlander; Horan referred to Friedlander as a “witch doctor” who spoke “mumbo jumbo” [27]. Horan argued that drug users, not just the dealers, deserved strict punishment: “It’s crucial that the convicted drug abuser serve jail time. Send them down the road” [28]. The “road” Horan was referring to was a path to the county jail. What do you recall about Forensic Habilitation? Looking back with 2024 scientific advances in hand, it seemed to be a progressive group now proven to be on the right side of history. Yet, was the cart before the horse?

**Dr. Fishbein:** I haven’t thought about Forensic Habilitation in decades, probably because I wasn’t there very long and it was tangential to my larger academic work. Thanks for the reminder. Blaine was ahead of the field in his thinking. Only much later did the research and accumulation of evidence catch up with the theories he espoused. So yes, the expression that cart was before the horse is apt! I do remember Horan, though. We were on a talk show together once and he attacked me, almost literally, while I was speaking. Definitely a man with an agenda.

**Nova:** Forty years on from your initial work in Baltimore, the celebrated biologist Robert Sapolsky has argued that given everything we know at the intersection of biopsychosocial risk, including advances in neuroscience, genetics, microbiome, findings in the exposome study of life-course experiences—both positive and detrimental—the criminal justice system needs to rebuilt [29,30]. The short version of Sapolsky’s position is that, taken as a whole, these scientific advances demonstrate that the current criminal justice system—especially the perceptions of prosecutors, judges, and juries—grossly overinflates the extent to which a justice-involved person has free will. For Sapolsky, free will is mostly an illusion. Actions, such as pulling a trigger, are, in Sapolsky’s view, “embedded in what came before” [31]. Since you were the pioneer in this realm, and are one of the very few scientists who has spent decades within both neuropsychology and criminology, you have a unique vantage point. What are your thoughts?

**Dr. Fishbein:** Free will is a tricky and actually quite heavy subject that I have grappled with for my entire career. The structure of our society and the prevailing mindset of people in this country accept the notion of free will. And the activities carried out by our criminal justice system—from law enforcement to court procedures to incarceration—are particularly steeped in the free-will doctrine. There is a myriad of questions that arise in response to the science demonstrating that genetics and environmental experiences and exposures profoundly influence brain function and behavior. What is not clear is where the separation lies between these influences. How are they assimilated and voluntarily acted upon by the individual? If a person with bipolar disorder commits a crime, should s/he be held accountable? Or what if that person experienced horrific acts of violence as a child that increased his/her own risk for violence? Can we legitimately say the person would not have done it if not for these influences? Even in the absence of a problematic history, all the various experiences and exposures certainly contribute to who we are and how we behave. But is there a linear cause and effect? Can't people overcome their past and choose their course? And what about the danger they pose to our public safety—do we allow them to roam the streets because they are a product of their genes and environment?

Rather than engage in these philosophical discussions, which I don't think really move us forward as a society or solve any problems, I prefer another tact: *prevention*. First, let's focus on those prevailing conditions that adversely affect human development and functioning and strengthen conditions that promote good health and wellbeing. Second, we should systematically deliver science-informed, health-promotive programs on an individual, family, and community level, as indicated, and ensure our policies support population-level healthy outcomes. And third, we need to construct carceral environments, when they are necessary, that are humane and conducive to positive behavioral change. It is evidence we have a long way to go, but progress is being made.

**Nova:** **The history of biological criminology has, to put it kindly, a checkered past. The ancient coin of the realm is stamped with the face of Ezechia Marco "Cesare" Lombroso, a nineteenth-century criminologist. Lombroso postulated that criminals could be identified by, among other things, anatomical traits such as sloping foreheads, protruding jaws, large ears, thick eyebrows, and asymmetrical skulls. Lombroso's theories were rooted in white supremacy; multiple authors have drawn lines between his influential publications and eugenics, and later, the pseudoscience that attempted to justify World War II genocide and other atrocities [32]. There seems little doubt that the recoil from Lombroso-esque theories acted as a barrier to advances in late-20th century and early 21st century biopsychosocial criminology. That is changing now, especially as it has become patently obvious that criminology is a transdisciplinary enterprise deeply connected to countless branches of scientific inquiry [33,34]. The increased acceptance seems to have been a painful process. For example, in 1995, one of the major criminology events at the University of Maryland, focusing on genetics and crime, was met with protesters claiming the event was "pushing genocide" [35]. What was it like to witness this transition over time?**

**Dr. Fishbein:** I think this takes us back to my views articulated above, and the enduring need to emphasize prevention through approaches that are scientifically and morally sound. I gave the opening and closing remarks during that conference at the University of Maryland. And while sitting in the audience when the protestors came in charging, one of them broke my foot! But more on point, to this day, there is still widespread rejection of the role of biology in human behavior amongst criminologists. My mid-career colleagues who studied the field in the interdisciplinary manner in which it was intended are unable to obtain funding or publish in key criminological journals as a result.

**Nova:** **In 1989, a *Dallas Morning News* article promoted the topic of biological criminology, and the article was picked up for national syndication. It even appeared in Canadian newspapers [36]. The *Chicago Tribune* reprinted it with the headline "Killer Chemistry" [37]. This was about ten years after your initial work in the field. It seemed that you were the voice that was trying to provide some caution against over-hyping the**

field that you helped to pioneer. The article contains a quote from you: *“None of this is cause and effect,” cautioned Dr. Diana Fishbein, a professor of criminal justice at the University of Baltimore. “It places you at risk. Biology is not completely responsible”* [36]. **Engaging with media and policymakers can be difficult for scientists. In recent years, you have spent considerable time developing science advocacy training so that scientists and other experts can effectively engage with policymakers and media in ways that help to understand prevention science. Since prevention science involves complexity and non-linear thinking, this is not an easy task. Can you talk about this?**

**Dr. Fishbein:** My initial training was in both criminology and neuroscience, but given the limitations I cited in the breadth of criminological inquiry, I focused most of the remainder of my career on the impacts of the social environment on brain and psychophysiological development and functioning, with direct implications for mental and behavioral health. Because of my determination not just to study behavior but to change our environment to be more responsive to human needs and nurturing of healthy behavioral outcomes, I gravitated toward the discipline of prevention science, which has exerted significant social impacts on individuals, families, and communities over the past 40 years. We have learned how to prevent/reduce academic failure, tobacco use, teen pregnancy, addiction, violence, mental health problems, and many other negative outcomes. And we have learned how to promote healthy development, well-being, supportive parenting, and community cohesion. However, despite these truly remarkable successes, prevention strategies are chronically underutilized and underfunded, and as a result, there are few governance policies to institutionalize these programs that the research suggests is warranted. In large part, this reality is due to the global lack of awareness on the part of the public and policymakers of the wealth of rigorous research findings from prevention science.

Scientists can speak to these issues with authority to exert an influence and impact the social determinants of health by engaging in the active translation of our work. However, scientists rarely engage in advocacy due to fear of restrictions on lobbying imposed by their affiliations (universities and research corporations). Although all lobbying is advocacy, all advocacy is not lobbying, and I sought to inform researchers of these distinctions and encourage them to engage in the policy process. If they do not, then policies will be influenced more by lobbyists and vested interests than behavioral scientists who are infinitely more knowledgeable about human behavior and the conditions under which we can thrive. So, I founded and continue to co-direct the National Prevention Science Coalition to Improve Lives, now a large professional association of researchers, practitioners, clinicians, educators, advocates, policymakers, and national and community organizations, all dedicated to translating science to public health policy. Basically, my research has enabled me to address what we don't know. But my Coalition work positions me to disseminate what we do know.

**Nova:** **For a while, it seemed that genome-wide association studies, in the context of mental health and psychiatry, were not going to live up to their initial promise [38,39]. Maybe hype is a better word than promise. More recently, though, when combined with the exposome—study of the entirety of environmental exposures (i.e., total lived experiences, the nongenetic component) over time—genetics appear to be more meaningful [40]. Essentially, the exposome describes the lens through which you were operating decades before it became a popular term [41,42]. In terms of prevention science in the behavioral arena, how important is information concerning genetic factors?**

**Dr. Fishbein:** There is a scientific consensus around the understanding that individual differences in risk for adverse behavioral outcomes can only be truly understood by holistically recognizing that human behavior emanates from genetic and neurobiological factors—those that are sculpted and influenced over time by social environmental experiences and exposures. So, while our genetic composition may predispose us toward a particular temperament, likes and dislikes, cognitive functioning, and behaviors, it is not determinative. Also, epigenetic changes—modifications in the way genes are expressed—

occur in response to our experiences and can alter those predispositions quite profoundly, for better or for worse.

The intersectionality between genes and environment is here, in epigenetic change, presenting substantial opportunities for prevention. For example, there is evidence that certain gene activities in the brain's reward system can increase risk for substance abuse, possibly by altering decision-making ability, novelty seeking, impulsivity, and other cognitive and behavioral functions implicated in substance abuse and other high-risk behaviors. Environmental factors—like past and present experiences of adversity, trauma, or stress—will affect these traits differently depending on the individual's constellation of genetic "variants" and epigenetic modifications and, in turn, contribute to the extent to which an individual is liable for a substance-use disorder. Because disadvantageous or dysregulated "neurogenetic" responses to environmental inputs often play a role in the advent and progression of behavioral problems, and because these brain dysfunctions can be improved through well-conceived programs and policies, there is potential to reverse course. Targeted psychosocial interventions shown to have an impact on these mechanisms work by strengthening or compensating for impaired or delayed cognitive and emotional regulatory processes that often accompany and precede the behavior we wish to prevent. These findings have direct implications for designing interventions to prevent negative behaviors and have extraordinary potential significance for mental and public health policies.

**Nova: You published a recent study on mindfulness as a school-based program to promote healthy development [43]. Why were you motivated to study mindfulness?**

**Dr. Fishbein:** I studied mindfulness because the results of my research and that of others consistently found emotion regulation, stress physiology, and lack of cognitive control in a variety of behavioral and mental health problems. One study in particular was of 15-year-olds living in very-low-income to impoverished areas with high rates of exposure to trauma. I wanted to identify the underlying mechanisms that might explain why some do not respond well to an evidence-based intervention to prevent violence. And in another study in a maximum-security prison, I also wanted to determine what characteristics may have impeded the male inmates from engaging in and responding favorably to a prison treatment program. In both studies, I found stress physiology and certain cognitive control deficits that may have contributed to their behavioral difficulties. Mindfulness programs have been shown to improve stress physiology, cognitive function, depression, anxiety, coping, and other constructs of interest in adults with mental health challenges in a variety of settings. And I was intrigued by Richie Davidson's work at the University of Wisconsin establishing measurable impacts of meditation, yoga, and other mindfulness practices on relevant measures of brain function. So, I wondered how that research might help children and adolescents develop better self-regulation and respond more favorably to prevention programs.

**Nova: Your basic research has focused in large part on biological and behavioral impacts of environmental exposures on child and adolescent development. And over time, you became interested in how preventive interventions have potential to improve brain and stress physiological functioning, leading to better outcomes for young people, particularly those who have experienced adversity. Your conceptual model for understanding why programs invariably do not work well for all recipients seems to have caught the attention of other prevention scientists. Where are you now with that work?**

**Dr. Fishbein:** For the first couple of decades of my career, I conducted basic science studies to better understand how certain environments can affect adolescent and adult functioning and behavior. I even went to Russia to isolate the effects of heroin on neurocognitive functioning relative to alcohol! The reason why Russia was appealing for this purpose is because early in adolescence, teens there identify a drug of choice and tend not to use other drugs. Here in the U.S., people who become addicted to heroin have used and continue to use a variety of other substances, making it impossible to determine what heroin alone is doing to the brain. We found specific aspects of decision-making ability that were uniquely affected by heroin relative to alcohol.

I've also conducted four longitudinal studies of adolescents in regions of the U.S. where particular substances are prevalent, e.g., inhalants in Cicero, Illinois; marijuana in Covington, Kentucky; and alcohol in the Washington, D.C., area, although alcohol use in adolescence is found everywhere. We then followed teens from early in adolescence through to late adolescence so we could compare those who began using substances with those who did not. We could identify neurocognitive, psychological, behavioral, and environmental predictors of use and also isolate the consequences of such use; most studies only assess teens after they initiate so we do not know what factors may have influenced substance-use onset and escalation. And now I have a longitudinal study of teens with symptoms of anxiety to determine the neurobiological mechanisms that explain adverse patterns of substance use and brain mechanisms that explain why some teens with anxiety do not use substances. These studies have huge clinical implications—if we treat them all as if they are alike, we are likely to miss the mark. Basic research and longitudinal studies in general help us to better target preventive interventions as well. That's why I began to study mechanisms underlying prevention program outcomes.

**Nova: An important part of your work has been focused on preventing substance use disorders, especially at the critical time of adolescence. Can you tell us about some of the research that is guiding best practices?**

**Dr. Fishbein:** There is no question that substance-use disorders (SUDs) are often preceded by psychological and behavioral problems; common predictors of SUD are academic failure, conduct problems, sensation seeking, impulsivity, anxiety, depression, and stress-related disorders. These problems can be traced back to adverse “social determinants of health” (e.g., poverty, family dysfunction, racism, economic insecurity) that affect the ability of young people to develop effective cognitive, coping, and prosocial skills. And in neighborhoods where these conditions are prevalent, there also tends to be less parental supervision, negative peer influences, marketing of harmful substances, and community violence, all of which present opportunities and influences to engage in risky behaviors. These conditions have a universal impact but are infinitely more impactful for individuals with a history of adverse childhood experiences (ACEs). In fact, individuals with four or more ACEs are over 1000% more likely to use intravenous drugs.

Over the past 40 years, prevention science has generated the knowledge and developed best practices that foster healthy childhood development and avert pathways away from substance use in the first place. Communities can take advantage of science-based programs that both reduce the risk factors and increase the presence of protective factors. These programs work to strengthen protective factors—such as warm and involved parenting, social competency and coping skills, school attachment, and supportive social and mental health services—which can reduce the risk of developing SUD. The benefits can be seen in teenagers who, earlier on, received prevention programming in their homes, schools, or neighborhoods; they are better able to successfully navigate adolescence and avoid risky behaviors. And in adulthood, they are more likely to be gainfully employed, involved in healthy relationships with others, and have fewer mental and physical health challenges. Through collaboration between policymakers, scientists, and communities, solutions to the SUD crisis can be implemented.

**Nova: In 2023, you co-authored a nationally syndicated editorial that appeared in major newspapers throughout North America [44]. The gist of the editorial was that the broad legalization of marijuana, while certainly overdue for adult populations, may be producing a variety of unintended, unhealthy, consequences for juveniles. In particular, you expressed concerns that adult legalization could increase perceptions that juvenile use is without risk and render adolescent use normative. Why should we be concerned about marijuana use and the developing brain?**

**Dr. Fishbein:** The trend across states to legalize marijuana for recreational purposes is very concerning for teenagers who are already at a high level of risk for experimenting with drugs in general. As states legalize, teens are increasingly under the impression that it can't be too bad—that there are not adverse consequences of using. And as the belief that it

is relatively “safe” increases, so does use among adolescents; even though it is not legal under a certain age, the availability has grown, and it is actually quite easy to obtain.

Using marijuana during adolescence is associated with a greater risk for eventual dependence and many people, including policymakers, don’t understand that marijuana, particularly in the concentrations currently available, is addictive. There is also concerning evidence that the regular use of marijuana during adolescence leads to abuse and dependence at higher rates than alcohol. The consequences of dependence appear to be most problematic in life functioning, including serious problems at home, work, or school.

The brain is rapidly developing during adolescence, making it very vulnerable to both positive and negative exposures that can alter the course of its development and functioning. For example, severe stress during adolescence has been shown to impair certain aspects of brain development and cognitive functioning. Thus, it is not surprising that regular marijuana use in adolescence has been associated with a number of developmental delays in neurological, cognitive, and psychological functioning. A number of studies of the developmental trajectories of heavy marijuana use in adolescence have shown deficits in cognitive function that, after chronic use, may follow them into adulthood. It’s critical that policymakers and the public understand how legalization—which is very different from decriminalization—can increase use in adolescents and what the consequences may be.

**Nova:** Vaccine pioneer Jonas Salk once lamented that there was very little investment in efforts to “immunize” against the development of prejudice, selfishness, violence, and aggression: *“The challenge of evoking the best in us may seem utterly forbidding but, surely, no more so than previously “impossible” challenges—heavier-than-air-flight, electricity, space travel. . . we talk of immunizing children. . . but what about immunizing, say, against the kind of behavior that leads to drug abuse? Or immunizing that leads to [youth being] more responsible for themselves and responsible to society?”* [45]. In the 1960s, as the military–industrial complex took hold, Salk proposed that any increases in spending directed at defense should be matched with distinct funding—dollar for dollar—to support health, education, and human well-being. He argued that this would support research to identify ways to reduce conflict, aggression, abuse, antisocial activity, and the same time, send a signal of mutualism that *“would remind the nation of its commitment to humanity”* [45]. In the years since, volumes of international research under the banner of the “developmental origins of health and disease” (DOHaD) and prevention science demonstrate that early-life experiences, even preconception and transgenerational factors, set the stage for long-term health outcomes. Yet, despite this vast knowledge, investment in prevention science seems paltry. What are the major barriers to the implementation of the existing evidence in the area of prevention science?

**Dr. Fishbein:** There are numerous barriers to the uptake of evidence from prevention science, such as insufficient funding, ineffective messaging, lack of public support and political will, absence of governance policies to institutionalize and provide infrastructure for prevention, workforce inadequacies, and more. These barriers all exist because a general understanding of what prevention represents has lagged well behind the science. In fact, very few outside the field recognize that there is actually a significant body of research that establishes the value of implementing preventative practices, programs, and policies. Scientists can speak to these issues with authority to influence the social determinants of health by actively communicating this information to policymakers and the public. Doing so will reduce the burden of social problems we want to prevent, minimize errors, lower costs, narrow disparities, and improve outcomes for everybody. To reduce this communication barrier, we need a well-tested protocol for experts, practitioners, and advocates across fields and sectors to increase public understanding of prevention. We also need to motivate people to demand systems and a “culture of prevention” that supports its principles. It is essential that scientists are comfortable in this translational role, so a process and vehicle was needed to allow for clear articulation in lay terms of how research can be used to create and demonstrate practical prevention strategies and their

cost effectiveness. This is precisely what the National Prevention Science Coalition to Improve Lives ([www.npscoalition.org](http://www.npscoalition.org)) does.

**Nova: Some argue that industry acts as a primary barrier. When considering unhealthy products that find their way to adolescents, such as tobacco, ultra-processed foods, alcohol, and illicit drug diversion [46,47], what responsibility does industry have in maintaining an unhealthy status quo?**

**Dr. Fishbein:** Our laws have failed to prevent the many ways that corporate practices have contributed to toxic conditions across our communities. One of the central tenets of the free market in our society is that regulation of business is harmful. Ascribing to this view assumes regulations increase the costs of goods and services, reduces economic growth, and lowers income among the population. Limiting regulations has been an objective of policymakers even though our failure to regulate the marketing of tobacco, alcohol, guns, unhealthy food, internet gambling, and other engagements in digital environments by children and young people is demonstrably responsible for hundreds of thousands of premature deaths and other consequences. I would venture to say that all marketing should be regulated on the basis of its impact on public health. In other words, if a marketing practice can be shown to contribute to health problems (including behavioral and mental) or death for many people, that practice(s) would be prohibited and *all* profits from the practice would be confiscated. This contingency would mean that fines for harmful practices could no longer function as simply a cost of doing business. Regulating such sales by considering their impact on health should be a public health goal. No company should be able to profit from practices that harm the public.

**Nova: Even though there is so much more work to do to promote prevention science, do you ever reflect back on your own academic journey, with all of its twists and turns? Looking back at your career to this point, is it satisfying to see your early ideas in nutrition and behavior, the biopsychosocial aspects of behavioral problems, a model to better understand variability in preventive intervention outcomes, and policy approaches to reducing childhood adversity gain so much traction?**

**Dr. Fishbein:** If you were to look at my CV, you'd think I didn't know what path I was on. But it was all intentional, designed to gain a broad range of experience from basic research to the more applied and then, finally, to the policy work that's necessary to actually make a difference. It has been a heck of a journey, and I wouldn't have it any other way. On the other hand, there is always that lingering regret that there is much yet to be done. I feel that this is the dawning of the "decade of prevention" when it will finally begin to take hold, thanks to people much smarter than I.

**Nova: In 1988, OMNI magazine asked well-known personalities, some in science and medicine, about their own utopian thinking, or the world they would like to live in. Contemporary research on utopian thinking indicates that it can be a healthy process, increasing both personal and social hope, yielding an abstract mindset that bridges the psychological distance between the status quo ("here and now") and a better possible future [48,49]. What type of world would you like to live in?**

**Dr. Fishbein:** I want to live in a world where our economic systems ensure that all members of society have an opportunity to thrive and succeed. Where billionaires do not hoard their fortune but rather invest it in our children and families. Where politics is not polarized, self-serving, and counterproductive, but rather is responsive to the needs of constituent groups across our nation, without fear, favor, or prejudice. Where all members of society understand the impacts of adversity on child development and work in concert to eradicate it at all levels. Where all human services are structured to serve rather than further traumatize. Where our schools are equitably resourced and welcoming of ongoing innovations to provide the highest quality education imaginable. Where there is no racism or discrimination. Where everyone treats the earth with the same care and respect as we would a treasured friend, recognizing that humanity and nature are part of the same living system. Where no child suffers. Only then will my heart stop aching, and I will eventually pass gracefully without regrets (Figure 4).



**Figure 4.** Dr Fishbein at home and in nature: **(Left)**, with her dog Murphy and **(Right)**, on the trails in the Pocono Mountains (photographs used with the permission of the author, D.H.F).

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