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Examining our Environmental Exposures could turn the Tables on Chronic Diseases

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Abstract

The Human Exposome Project is an international, cross-disciplinary coalition of researchers, organizations and policymakers working to map the combined impact of environmental exposures on human health from conception to death. It builds on the insight that genetic information alone explains only a modest share of chronic disease risk, and that the greater burden is shaped by what we breathe, eat and encounter in daily life be it chemicals, pollutants, diet, lifestyle factors and social stressors; and how these interact with our biology over time. By mapping these exposures and linking them to health outcomes, the project offers major opportunities: clearer identification of preventable causes of disease, earlier intervention for at-risk groups, and more precise targeting of regulation and public health action. Crucially, it provides a practical mechanism for translating evidence into policy by generating actionable, comparable data that can guide decisions on transport, energy, product safety, housing and healthcare systems, shifting the focus from treating illness to preventing it. In a period of heightened geopolitical tension, the Human Exposome Project also offers a unifying agenda: chronic diseases and pollutants do not respect borders, and a shared commitment to protecting health can bring countries together around common standards, shared methods and mutual benefit. If backed by sustained political will, exposomic science can become a cornerstone of environmental justice and a new public health approach that protects people before they become sick.

Every hour, 799 people on our planet die as a result of pollution in the air that we breathe, with many more admitted to hospital, placing a huge additional burden on already overstretched and under-resourced health services.[1] Over the author's career as a Member of Parliament, he has been told on many occasions by older constituents that "there was no such thing as 'that' when we were growing up," when referring to conditions such as multiple sclerosis, Crohn's disease, or motor neurone disease, and the list goes on.

It begs the question: is it the case that these conditions arise only because people are living longer, because we have learned how to diagnose them, or because we are exposed to environmental factors that our grandparents were not exposed to? Is it our genes, where we live, or what we eat?

These questions have motivated experts from across the world to come together as part of a broad coalition called the Human Exposome Project. This is a coalition of individual researchers, organizations and policymakers with a unified goal: to "map the combined

impact of all environmental factors that affect human health from conception to death"[2] This is a colossal undertaking but one that presents immense opportunities.

Many chronic health challenges are complex, with significant impacts on individuals, their families, the health service, the economy and broader society.

Mapping the genes in the human body through the Human Genome Project revolutionized our understanding of the genetic factors behind medical conditions. However, this information provides only part of the answer, because our genes account for about 10% of chronic disease.[3] What is less understood is the interaction of our genes with chemicals, pollutants, diet, lifestyle factors and social stressors. These environmental exposures are linked to between 70% and 90% of chronic diseases, which are rising and are now among the leading causes of both death and disability across our planet.[4]

For example, during the author's ministerial tenure with responsibility for the Environment in Ireland, significant policy efforts focused on mitigating a critical public health crisis; six people die every day on the island of Ireland from air pollution, with many more admitted to hospital, placing a huge additional burden on health services.[5]

Human Exposome Project

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This is where the Human Exposome Project comes into its own. The exposome refers to all the physical, chemical, biological and social factors in our environment that influence our health throughout our lives.[6]

Researchers from a broad range of disciplines, supported by people like the author who understand how research feeds into policy, are coming together from across the planet, including those from low- and middle-income countries, to systematically map the environmental exposures affecting human health throughout life. This work brings people together, regardless of country, politics or religion, to address environmental health disparities and promote environmental justice.

This is a monumental task that will require not just the support of the global academic and medical community, but governments as well, to translate this groundbreaking effort into actionable public health and policy strategies for disease prevention, early intervention and the treatment of chronic illness.

Chronic diseases do not respect borders. Nor do pollutants. If we treat the Human Exposome Project as another technocratic exercise, we will have failed. But if we treat it as a collective promise to protect people before they get sick, then it could become the most important public health initiative of our time.

While this is an enormous challenge, particularly at a time of heightened geopolitical tension, it is also an opportune moment to bring our world together to make it a better place for all who live on it. Chronic illnesses are a major and rapidly increasing driver of healthcare costs worldwide that is projected to reach $47 trillion by 2030.[7] Diseases such as diabetes, Alzheimer's disease and heart disease are surging, devouring health budgets and stealing productive years from millions of lives.[8]

The project has the potential to ignite the greatest public health revolution of our time, merging medicine's healing power with environmental stewardship to save lives at scale.

The financial burden includes direct medical expenses, lost productivity, and significant impacts on families and economies. These costs are expected to continue rising due to aging populations, lifestyle factors, and increasing prevalence of chronic conditions. By reducing the prevalence of environmentally driven diseases, we can alleviate the financial burden on public health systems. A healthier population also means a more productive workforce and stronger economies.

The Human Exposome Project is a collective effort to ensure that science and technology benefit humanity; responsibly, inclusively and transparently. This is not just a worthy theoretical goal; this project can be a practical bridge between bold ideas and real-world impact, helping to overcome the isolationist approach of some countries today.

Imagine halving childhood asthma rates by cutting transport emissions. Imagine tracing chemicals in household products to autoimmune conditions and banning them. Imagine the billions saved in healthcare costs by preventing disease rather than treating it. These are not distant dreams; they are concrete outcomes that exposomic data could deliver if we back the science with political will.

This project has the potential to ignite the greatest public health revolution of our time, merging medicine's healing power with environmental stewardship to save lives at scale.[9] From consumer products that do not poison our water to hospitals that heal both patients and the planet, this global meeting of minds is working to develop the blueprint for a world in which healthcare protects tomorrow's children while curing today's diseases.

But this project is not just about curing diseases or cleaning our planet; it is about reshaping healthcare into a force that heals patients without bankrupting nations. By aligning medical breakthroughs with environmental stewardship, the global team is building a system in which every medical treatment, every AI diagnostic tool and every climate-smart building delivers dual returns; longer, healthier lives and trillions of dollars safeguarded for future generations.

For comprehensive information regarding this initiative, visit https://globalexposomeforum.org/.

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Notes

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