

Executive Summary



A dramatic increase in the aged population in the United States over the next few decades is expected to nearly double the number of people 65 and over by 2030. This “age wave,” fueled in the United States by the baby boomers, will soon reach shore and influence almost all aspects of our lives, including health care, economics, and social structure. Improved longevity is a success story and offers exciting opportunities, but at the same time it poses tremendous challenges. Among them are the growing threats of chronic diseases associated with aging and their changing patterns.

This report primarily examines the lifetime influences of environmental factors on Alzheimer’s and Parkinson’s diseases and their underlying pathologic mechanisms. Our close look at the science of these diseases shows they are related to a number of features of modern society and that Alzheimer’s disease especially is linked to other serious health problems of modern times, which we call the “Western disease cluster.”

By environment we mean the entire physical, biological, social, and cultural context in which we live, from conception to death. We take an ecological perspective since individuals do not live in isolation but as members of families, communities, and natural systems. Our findings show that a complex mixture of variables at each level influences the health of individuals and disease patterns in populations. If we do not confront them comprehensively, we risk overwhelming the health care system and weakening the social and economic fabric of families and communities.

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The pear is a symbol of hope and good health in many cultures. The Chinese associate the image with longevity, justice and good judgement.



A Multifactorial, Lifespan Perspective Points to Opportunities for Prevention

- Beginning in the womb and continuing throughout life, environmental factors are strong determinants of health decades later. The course of brain development follows an arc that begins soon after conception and progresses along some trajectory into

adulthood and older age. The shape of that trajectory—its features, length, and rate of change—can be profoundly influenced by many interacting genetic and environmental factors encountered throughout the lifespan. Early life events or circumstances can have enduring impacts on brain aging and function.

- Brain “reserve” or resilience can influence the timing of onset and progression of neurodegenerative conditions. They may be delayed in people with more reserve and accelerated in those with less. Brain reserve may be influenced by modifiable environmental variables, beginning with early development.
- Many “neurodegenerative” diseases might best be considered as existing along a continuum rather than as discrete, unrelated entities. A spectrum could better reflect the mix of symptoms and histopathologies seen in many cases that sometimes make it difficult to settle on a single diagnosis. A spectrum might also better accommodate diverse mechanistic biological pathways, influenced by interacting environmental and genetic variables, which may then converge into final common pathways and result in clinical disease. With respect to cognitive decline, disease severity can also be seen along a spectrum running from normal aging to dementia.
- It is highly likely that for many people, development of the two most common neurodegenerative diseases, Alzheimer’s and Parkinson’s, can be delayed or prevented altogether. In most cases these diseases result from the interaction of a number of different factors. They must be understood within a framework that includes biologic, social, economic, and cultural dimensions. These dimensions are represented, in turn, at all levels from the sub-cellular to society as a whole. The presence of certain genes may increase the risks of these diseases, but the actual pathologic processes leading to these conditions can also be highly influenced by environmental factors.

Underlying Dimensions of Neurodegenerative Disease

- Common mechanisms and pathways underlie many prevalent disease patterns. At the micro-level, inflammation and excessive oxidative stress play critical roles in the development and progression of Alzheimer’s and Parkinson’s diseases. Diabetes, obesity, hypertension, elevated blood lipids and metabolic syndrome are also often characterized by inflammation and excessive oxidative stress. They also tend to co-occur in individuals and in large populations, particularly as they undergo modern industrialization.

We refer to this group of chronic diseases as the “Western disease cluster.” Substantial evidence suggests that common forms of dementia—including Alzheimer’s and vascular dementia—are associated with this cluster as well.

- Recent scientific advances reveal connections among inflammation, oxidative stress, and disrupted insulin signaling pathways. The consequences of disrupted insulin signaling include insulin resistance, elevated glucose, vascular disease, and elevated blood lipids—key factors in the Western disease cluster. Environmental influences that may contribute to inflammatory disruption of insulin-signaling include toxicants, inflammatory nutrition patterns, inactivity, obesity, psychosocial stress, and various health conditions.

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Environmental Risk Factors in the Development of Dementia/Alzheimer’s & Parkinson’s Diseases

- Modifiable lifetime environmental factors that influence aging and health include nutrition; exposure to environmental chemicals and infectious materials; physical activity; social interactions; education; socioeconomic circumstances; and active intellectual stimulation. These factors do not act in isolation. Rather, they interact and collectively, along with multiple genetic influences, create the conditions out of which health or disease emerge.
- Individual lifestyle choices can influence which environmental factors will affect disease risk. However, lifestyle factors are not simply matters of individual choice. They are highly influenced by availability, cost, advertising and cultural preferences among other factors. Consequently patterns of disease are not simply the product of individual choice but are also features of families, communities and societies. Indeed, drivers of excessive inflammation and oxidative stress are present at all levels of the eco-social environment. Disease prevention requires public health approaches as well as healthy lifestyle choices.
- An individual’s or community’s position on the socioeconomic gradient is one of the strongest determinants of health status. Lower socioeconomic circumstances are associated with increased risk of disease and premature mortality at every level of the gradient. All diseases of the Western disease cluster are over-represented in people of lower socioeconomic status.
- A coherent and growing body of evidence indicates that numerous nutritional factors—especially in combination—can increase the risk of neuroinflammation, excessive oxidative stress, and

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neurodegeneration. These nutritional factors include consumption of saturated and trans fats and refined carbohydrates, along with inadequate intake of omega-3 fatty acids, antioxidants, and micronutrients. This dietary pattern stimulates an inflammatory response in many tissues and organs, mediated in part by the innate immune system. It can also increase the risk of Western disease cluster illnesses as well as neurodegenerative disease.

- The dominance of this inflammatory nutrient pattern results, in significant degree, from trends in agriculture, food production and marketing over the past 50–100 years. These trends include the growth of factory farming and consumption of fast foods and highly processed foods. These trends in food production and distribution have also intensified dependence on fossil fuels. This adds to chemical and climate impacts, compounding risks to human and ecosystem health.
- Many environmental chemicals promote excessive oxidative stress and inflammation and contribute to the risk of neuroinflammation and neurodegeneration. Environmental chemicals can also modify gene expression and alter brain development through a variety of mechanisms, increasing the risk of neurodegenerative diseases later in life. Chemicals of concern include lead and other heavy metals, PCBs and other persistent organic pollutants, and pesticides. Endocrine disruptors to which the population is widely exposed also have inflammatory and metabolic effects. Bisphenol A, for example promotes insulin resistance and the accumulation of fat at relatively low levels of exposure. Exposures to PCBs, dioxin, and several pesticides also strongly correlate with the likelihood of having type 2 diabetes, insulin resistance, and the metabolic syndrome. Emerging evidence also suggests that air pollution contributes to brain inflammation and the risk of Alzheimer’s-type neurodegenerative disease.

Human and Ecological Health are Interdependent – Cross-Cutting Solutions are Possible

Changes in the natural, built, and social environments during the 20th century in the U.S. and many other countries strongly contributed to increased life expectancy and other indicators of human development. But many changes also altered system conditions so that large numbers of people are living close to or beyond

thresholds of chronic diseases that severely undermine quality of life. Upward age-adjusted trends in obesity, diabetes, hypertension, asthma, and some kinds of cancer are illustrative. Our task is not only to respond to the medical and social needs of individuals who are sick or at risk, but also to optimize conditions so that fewer people find themselves at risk in the first place.

As the evidence in this report demonstrates, key elements of healthy living include:

- Eating healthy and nutritious food;
- Staying active physically and mentally;
- Avoiding harmful toxicants and pollutants;
- Being socially engaged with family, friends, and community.

Individually and collectively these approaches can reduce excessive oxidative stress, inflammation, and other pathogenic biologic pathways, and help to reduce the risk of obesity, overweight, dementia and diseases of the Western disease cluster.

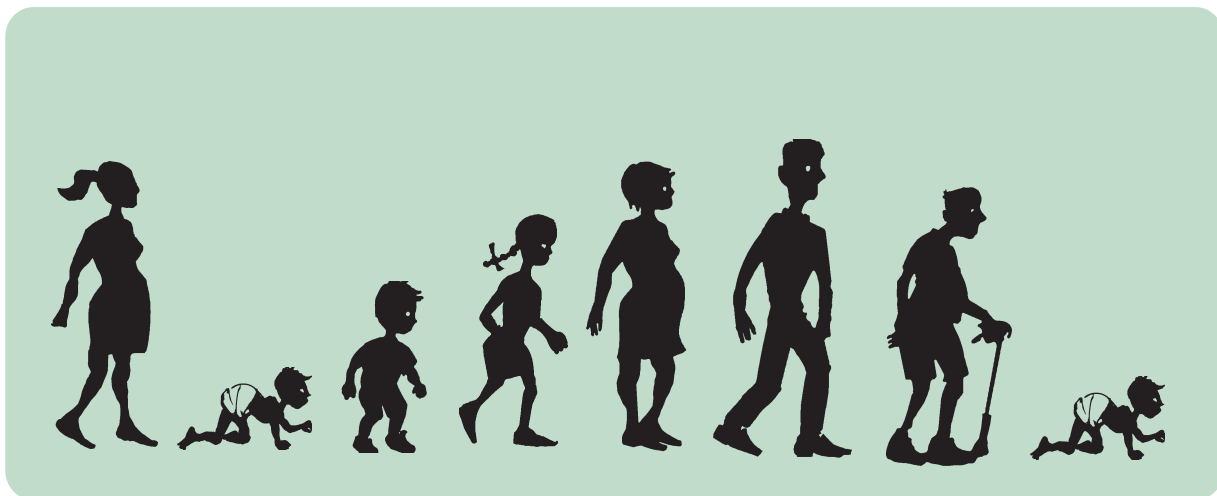
Individual actions are not enough. In multifactorial diseases, policy interventions at many levels are necessary and can have profound influences on individual and population health. Some policy interventions are cross-cutting, addressing multiple risk factors simultaneously. For example:

- Encouraging more localized, diversified and sustainable food production rather than factory farming would enhance nutrition, decrease the environmental impacts of agriculture, and strengthen local economies. It would reduce reliance on pesticides and minimize the use of fossil fuels for long distance transport. This in turn would reduce air and water pollution as well as greenhouse gas emissions.
- Transitioning to clean, renewable energy and reducing fossil fuel consumption in general would drastically reduce air pollution, which is increasingly recognized as pro-inflammatory, neurotoxic, and contributing to cardiovascular disease. It would also undercut a host of harmful chemical exposures related to production, transport, and use of fossil fuels. Prioritizing the development of energy-efficient mass transit systems that interface with bike paths and sidewalk networks would save energy while minimizing air pollution and combating obesity.



- Reducing use of toxic substances in the home, workplace, and community through “safer substitute” programs and green product design can reduce exposures that contribute to neurodegeneration and many other chronic diseases, reduce ecosystem and wildlife contamination, and create new jobs.
- Reducing socioeconomic disparities and making certain that all people have access to affordable health care, as a right and a matter of decency, will reduce the general chronic disease burden and help to alleviate its consequences for individuals and society.

Much of the chronic disease burden could be reduced by addressing the broad environmental-context of health, and prioritizing primary prevention at many levels—from the individual to the family, community, society, and ecosystem. Throughout the lifecycle our health is deeply connected to other stages of life, and to the ecosystems around us that are literally our lifeblood. Fortunately, we have innumerable opportunities to jointly improve health throughout the lifecycle and to restore degraded ecosystems. In so doing we can achieve human and ecological health that are interdependent, urgently needed, and within our reach.



Aging begins at conception.