



Social Determinants of Health and Dementia Risk: The Environment

What Is Already Known

Theoretical frameworks and health disparities models have been used to study intersections between the environment and brain health, particularly with aging. Recently, these models have begun to view the effects of the environment on an individual as multifactorial – from both episodic exposure to cumulative exposure over the life course.

Background and Evidence Base

The environment encompasses both built and natural elements. The built environment includes population density, green spaces, public resources (such as community centers and parks), food and nutrition options, transportation options, pollutants, and community cohesion. Features of the natural environment include all things naturally occurring on Earth, including ecosystems, all living species, climate, weather, and natural resources. The different ways in which populations interact with the environment can produce both positive and negative outcomes, including with respect to cognitive decline and dementia.

There is growing evidence that aspects of the environment may increase risk of developing dementia, and may particularly increase risk for disproportionately affected populations. However, it is important to remember that the environment affects several other factors that, in turn, may affect dementia risk. For example, the environment affects socioeconomic factors, such as education, job status, family/social support, income, and community safety. The environment is also related to individual health behaviors, such as tobacco use, diet and exercise, and alcohol use – meaning it could have a bigger impact on dementia risk than the direct effect.

Air Pollution: Outdoor

Several systematic reviews have examined the association between outside pollution (i.e., noise and air) and the risk for Alzheimer's disease and other dementias. The most reported relationship is an association between cognitive decline and particulate matter 2.5, with less clear findings for nitrous oxide, noise pollution, and ozone. The hypothesis to explain the mechanism underlying this relationship is that inhalation of gas

particles catalyzes an inflammatory response, followed by microglial activation, which increases the productivity of reactive oxygen species, ultimately resulting in accumulation of amyloid deposition in the brain.

In a study of exposure to primary and secondary sources of particulate matter by race, ethnicity, and residential location (i.e., urban and rural), researchers found that, compared with White Americans, people of color were disproportionately exposed to pollutants and from a wider variety of sources, including industry, utility companies, construction activities, and living close to a highway. This relationship was the same for both rural and urban areas. These findings highlight the systemic issue of environmental racism, a concept developed in the 1980s that describes the disproportionate burden that environmental hazards, such as air pollutants, have placed on communities that are historically underserved. Redlining, zoning regulations, industrial and corporate development, and other policies and practices disproportionately expose these communities to pollutants, which may place them at higher risk for dementia.

Air Pollution: Indoor

According to data from the World Health Organization, 2.6 billion people worldwide use heating or cooking sources (e.g. open fires, simple stoves) that cause indoor pollution due to a poor fuel source such as biowaste or kerosene. There are about 4 million deaths each year related to these heating or cooking sources, with most causes of death being respiratory, cerebrovascular, or cardiovascular in nature. The majority of the people exposed to the byproducts of these fuel sources are women and children, who also comprise the majority of the deaths. Conditions associated with poor indoor air quality include allergies, asthma, and lung cancer. The relationship of these exposures to the development of dementia remains uncertain.

Green Space

Emerging studies have examined the relationship between green space and brain health. Using data from the Nurses' Health Study II, researchers found that increased residential green space was associated with better performance on processing speed and attention tasks as well as on better overall cognition, equating to



being about 1.2 years younger, cognitively, than study participants who did not live near residential green space. This relationship remained after adjusting for levels of air pollution, depression, and physical activity.

Neighborhoods

Several studies have examined the association between brain health and cognitive decline and neighborhood cohesion, density, and resources. Research has shown that those who live in medium to high density communities perform better on cognitive measures than those who live in rural areas, likely due to differences in educational attainment, prevalence of chronic disease, access to health care, and income.

Increasing availability and accessibility of various neighborhood resources including recreational centers, walking paths, and parks has also been linked to higher overall cognitive functioning.

Neighborhood social cohesion and perceived quality may also affect cognitive functioning. One study found that increased physical disorder of a neighborhood and decreased social cohesion is associated with poorer cognitive functioning. Another study indicated that adults who reported greater social cohesion, despite living in a more violent neighborhood, had higher cognitive functioning.

Several studies have also highlighted the association between neighborhoods and an individual's sleep quality, which is associated with risk for dementia. A review of such studies concluded that neighborhood factors such as high environmental noise, lack of social cohesion, and inability to trust one's neighbors were associated with negative sleep outcomes.

Implications for Public Health

The built and natural environment may affect not only cognitive functioning but also health behaviors including diet and exercise, as well as socioeconomic factors such as education, job status, and community safety, making it an important priority area for public health. Efforts to improve the environment, including promoting the use of renewable energy sources, developing more green spaces and walking paths, supporting the expansion of public transit, and planting more trees, may help to improve later life cognition. Additionally, promoting policy changes that address and mitigate the long-standing effects of redlining and other discriminatory practices can help combat environmental racism.

Discussion

The environment in which a person lives may affect dementia risk both directly and indirectly by increasing other risk factors for dementia. An emerging and important area of study is improving the understanding of the contribution of environmental risk factors to dementia risk and how these risk factors differentially affect subgroups of persons at risk for dementia, especially persons from poor and underrepresented communities.

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