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## Environmental and Genetic Variables Converge: Regional Trends Determine Alzheimer's Disease Prevalence

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# Environmental and Genetic Variables Converge: Regional Trends

## Determine Alzheimer's Disease Prevalence

Ellen Korcovelos



### Why do we care?

As one of the most frequent causes of disability and morbidity (Fratiglioni, 1999), dementia affected an estimated 35.6 million people as of April of 2012 (WHO, 2012). In fact, of the many diseases that contribute to years with impaired living, dementia patients lived nearly 11.2% of their life with a disability (Ferri, 2006). Research has probed for accurate accounts of the epidemiology of the disease; however, due to the multifactorial manner of its largest impetus, Alzheimer's disease (AD), the etiology remains vague and greatly representative of both environmental and genetic factors alike (Gauthier, 2000). While some researchers debate either of these variables as the sole cause of the disease, a large number of studies have agreed that dementia, indeed, is affected by both components.

Simultaneously, studies are developing theories that are beginning to link demographic variation to the presence of dementia within said region. Different regions of the world are comprised of varying gene pools, policies on medicine, and rates of industrial development, and therefore demonstrate varying degrees of association between AD prevalence and each of these factors.

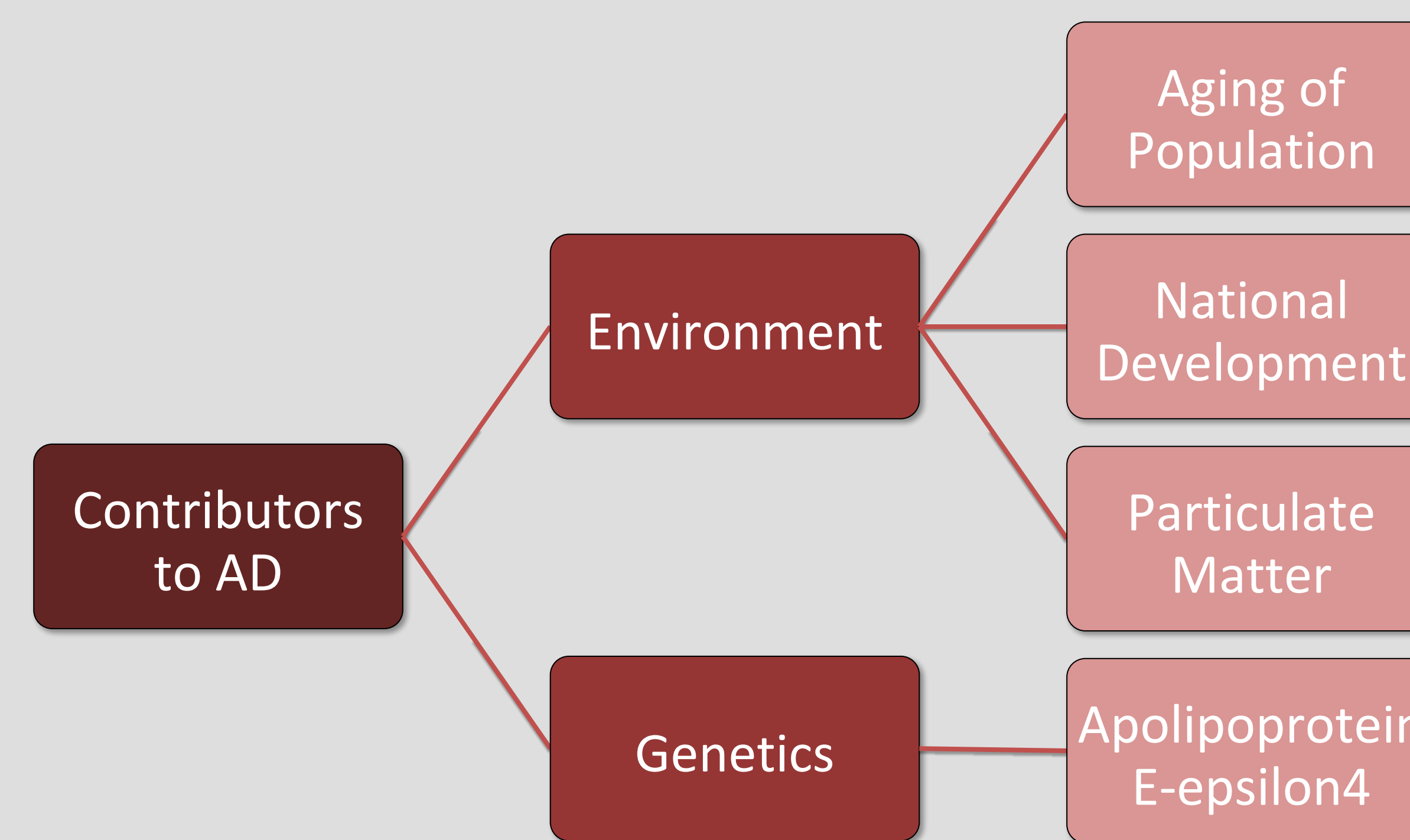
### How are dementia and Alzheimer's disease linked?

Dementia, defined as the degeneration of memory and cognitive functioning, is the prominent symptom of AD, where estimates indicate that as many as 70-80% of all demented individuals have developed memory loss as a result of AD (Stern, 2011). The acknowledgement must be made, however, that dementia is not simply AD. Instead, it is a word that has overtime replaced the term senility to "refer to cognitive changes with advanced age," –those changes that are most often caused by AD (Stern).

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### Regional Influences of Alzheimer's Disease Prevalence



### Conclusion

When assessed as a whole, this research leads to the notion that a singular factor contributes most to AD development: aging. As seen through the mentioned studies, researchers have pinpointed that a multitude of factors play a role in dementia prevalence; however, these aspects all have demonstrated the magnitude of aging on a population. With the development of a nation comes greater access to better medical technology, cleaner air supplies, and overall more effective methods of research and recording of data. Likewise, as the benefits of MDR allow the population to age, an influx of incidence rates of AD have been recorded.

What is of greatest importance is how to use this information to implement proper diagnoses of the disease. As seen in many of the studies of this research, methodological discrepancies were at fault for inconsistencies within the data. One way to utilize these findings would be to form an equation which takes into account the different environmental aspects of a patient's location as well as any known genetic predispositions. In studying the development of the individual's region, an awareness of one's proneness to AD could be calculated.

For instance, if an individual was to question his or her susceptibility to developing AD, an analysis of their living condition would be assessed. Furthermore, in testing said individual's genotype for the ApoE-ε4 allele, an estimate of one's probability of developing the disease could be made. Not only would this early detection allow for faster treatment of the patient, but it would also give families the opportunity to learn the signs and symptoms of the disease. Furthermore, with the advancement of technologies that is currently strengthening the medical world's field of knowledge, further research on cures and a uniform basis of diagnosis should be implemented; this way, epidemiological studies would embody less discrepancies and more validity.

Thus it stands that AD, while previously thought to only reflect either environmental or genetic contributors, is in fact spurred on by various amounts of each; and with this information, the world can fight the ongoing battle of increasing regional AD prevalence.

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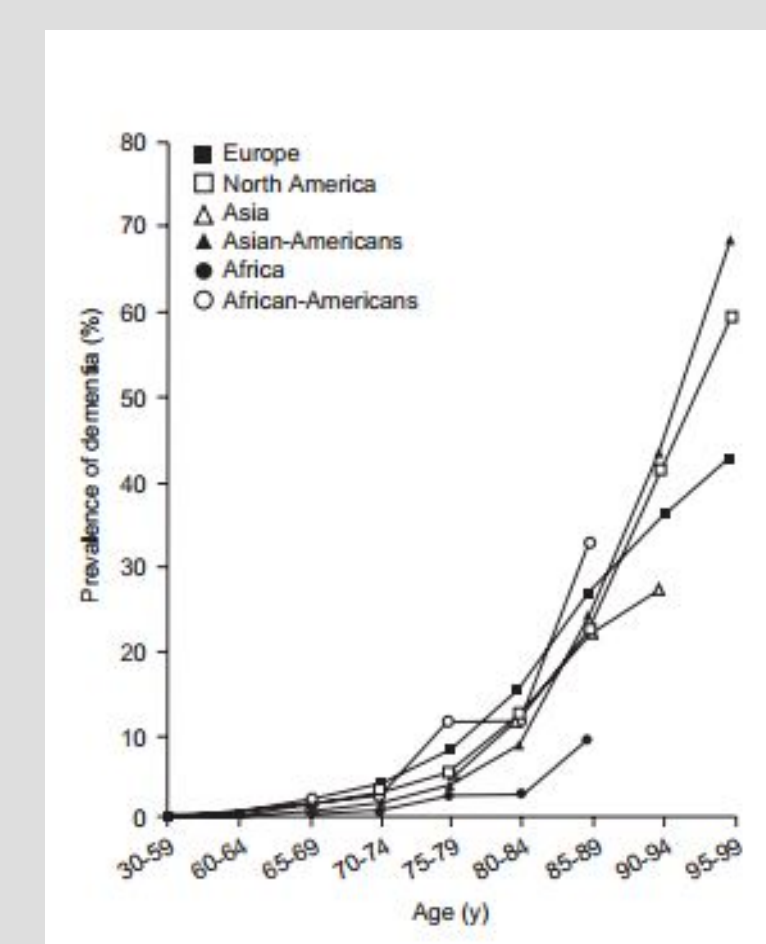
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### Aging Populations

- The worldwide population has followed a trend of increasing growth. With a decline in mortality rates, nations are seeing a rapid population growth and find their oldest population (individuals age 80 or older) increasing at the fastest rate of all other groups.
- Fratiglioni et al. (1999) suggest that there is a definite variation of AD prevalence among regions as well as among age groups (see figure below).

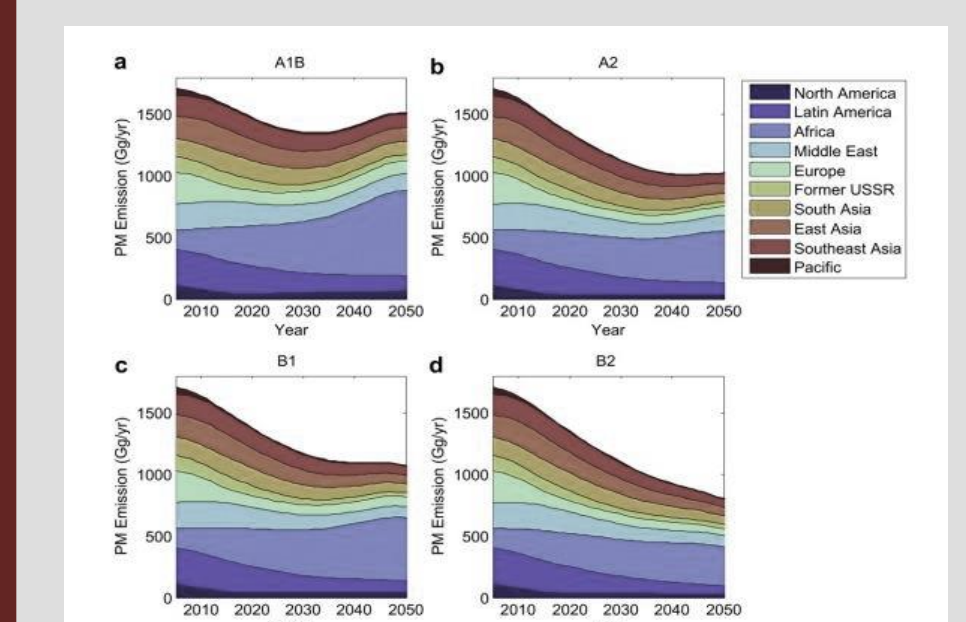


### National Development

- Ferri et al. (2006) found that the dementia prevalence in more developed regions (MDR) such as North America and Europe, will increase moderately from 2001 to 2040. This moderate growth rate stands only for countries that are currently developed.
- Less developed regions (LDR) such as Latin America and Africa currently have a low number of reported dementia cases. However, the outlook suggests that a rapid increase in dementia cases is expected.
- A third group referenced by the authors is that of countries such as China, India, and their south-Asian and western-Pacific counterparts. These countries have a high base of dementia cases and will continue to experience rapid growth.
- Wimo et al. (2003) claim like Ferri et al. that the proportion of AD cases living in LDR is staggeringly greater than those in MDR.

### Particulate Matter

- Research shows that higher concentrations of particulate matter (PM) lead to an increased presence of AD as the particles are dispersed within major organs of the body such as the brain.
- Yan et al. (2011) claim that while global emission intensities are projected to decrease, the overall regional distribution of PM is greatest in Asian regions; this results from lower concentrations of PM within MDR (see figure below).
- Wiseman and Zereini (2009) cite that one's susceptibility to developing AD rises with greater exposure to environmental metals.



### ApoE-ε4

- Gauthier et al. (2000) conclude that as age increases, the Apolipoprotein E-epsilon4 gene's characteristics grow more concentrated on the brain.
- Frisoni et al. (1998) confirm this trend as their results reflect AD's dependency on the age of onset. Data analysis demonstrates that patients who experience the onset of AD before age 60 and after age 75 less frequently possess the ApoE-ε4 allele.
- Instead, those who are 65-75 have the highest tendency of possessing the ApoE-ε4 allele.
- Frisoni et al. conclude that incidence rate of the ApoE-ε4 gene correlates with the prevalence of AD.