

Assessing the Risk Factors of early onset Alzheimer's Disease

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Introduction

Alzheimer's Disease (AD) is a neurodegenerative disease characterized by progressive memory loss, starting with symptoms of forgetting important names and dates to loss of ability to carry out activities of daily life (e.g., dressing, eating, or even speaking). Alzheimer's is recognized as the most common form of dementia, dementia being an umbrella term for loss of memory or other cognitive abilities severe enough to interfere with daily life (National Institute on Aging, 2011). The disease presents in the brain by plaques and tangles; plaques being deposits present between nerve cells, composed of a protein called beta-amyloid, and tangles being twisted nerve fibers of a protein called tau (Scheltens et al., 2016). While it has been found that many people develop plaques and tangles as they age, those with Alzheimer's Disease acquire remarkably more and in a predictable pattern which begins in the areas of the brain involved in memory. While age is the most common risk factor for development of this disease, Alzheimer's is not a normal part of the aging process. It is because of this fact that abundant research is being done to evaluate the other risk factors of development of Alzheimer's disease.

Research has shown that common risk factors for AD are family history and genetics (i.e., presence of the e4 form of the apolipoprotein (APOE) E gene), biological sex, head trauma, air pollution, various lifestyle choices, sleep patterns, and more (Scheltens et al., 2016). Of these common risk factors, the current study focuses on assessing how various lifestyle choices may play a role in disease onset, as this is a risk factor over which an individual has the most control. Regarding lifestyle choices, the factors which have shown to have the most abundant contribution to the onset of AD are smoking habits, social life, health habits, and lifelong

learning (Scheltens et al., 2016). Those with health conditions also show a greater predisposition to the development of AD including high cholesterol, hypertension (elevated blood pressure), obesity, poorly controlled type two diabetes mellitus, and more (Mattson, 2004). Lack of exercise, lack of social engagement, untreated mental health conditions such as depression, and lack of mental stimulation are also lifestyle choices that may contribute to development of AD (Mattson, 2004). The research suggesting the risk factors of lifestyle habits with the development of AD are vast and continuing to grow. It is critical to continue to build an understanding of how certain lifestyle choices may impact the development and progression of AD later in life. This type of research may identify critical factors that can be behaviorally controlled to decrease the rates of AD and increase quality of life.

Methodology

Data for this research project was collected through a qualtrics survey distributed to family members of those with an Alzheimer's Disease diagnosis. The survey (see Appendix 1) was comprised of approximately 50 questions addressing the important factors of lifestyle habits encompassing the loved one's health history, sleeping patterns, social life, eating and dietary habits, educational and work history, and mental and physical fitness. The survey also considered their loved one's Alzheimer's disease stage and time of onset/diagnosis. The severity of the AD diagnosis and previous lifestyle choices are then analyzed to determine if there is a correlation between lifestyle habits and AD onset and progression and considered in light of published data sets. Participants included family members of residents of Spring Wind assisted living and those affiliated with the Wyoming Center on Aging. This study included 3 participants who completed the survey on their loved ones Alzheimer's disease diagnosis and lifestyle habits.

Once the data was collected, qualitative assessments of the individual's stage of dementia, when the onset occurred, and their health and lifestyle habit history were performed. The analyses were based on a general scale of the stages of AD and how symptoms and severity are commonly depicted by credible sources. The quantitative analysis of the individual's diagnosis, severity, and lifestyle were then correlated with qualitative analysis of credible sources statistically evaluating the same common risk factors.

Results

Participants

Data collection results include responses from three individuals who have a loved one with a diagnosis of AD. The diagnosed individuals were predominately male. Time of diagnosis for all individuals ranged from 3 to 6 years ago, and all cases were described as being quite severe. In this sample set, there were special cases such as one individual having a traumatic brain injury from a car accident. Otherwise, typical AD pathology was endorsed.

Mental Stimulation

Abundant research has been done addressing the role of mental stimulation and lifelong learning in progression of dementia. This research has shown that keeping the brain active, whether it be through reading, creating art, doing mentally stimulating activities such as sudoku, learning a new language, playing a musical instrument, board games, word puzzles, or reading, helps to build healthy reserves of brain cells and strengthen the connections between them (Mattson, 2004). It is believed that these healthy reserves may compensate for the eventual damage done by Alzheimer's Disease or dementia in general. The types of mental stimulation

should be reasonably complex, varied, interesting, and should be engaged in frequently for the greatest benefit (Mattson, 2004). Among mentally stimulating activities is also the factor of social habits and family support. It is believed that those who are more involved in social events, have a steady group of friends, and have prevalent traditions are less likely to experience significant cognitive decline (Dementia Australia, 2020). In the current study, all participants were not described as being especially social and did not have a continuous group of friends or social commitments (e.g., church, various traditions) throughout their life. Their loved ones did, however, endorse engagement in mentally stimulating activities such as listening to music, doing puzzles such as sudoku, and, for one individual, earning a high degree of education. These results are very interesting in that they suggest an instance in which social engagement is observed as playing a greater role than other forms of mental stimulation in being a protective factor for AD.

Physical Exercise

Participation in physical exercise has shown to be essential for delaying onset of AD. Exercise influences three areas of the brain (i.e., vascular physiology, hippocampal volumes, and neurogenesis), and aging causes altered blood flow to the brain which is related to impaired cognition (Meng et al., 2020). Engaging in physical exercise stimulates blood flow to the brain, thought to prevent or delay neuronal degradation, the most important area of the brain for memory capabilities being the hippocampus. Research has shown that engagement in mild-to-moderate physical exercise for over a year protects against degradation of hippocampal volume (Meng et al., 2020). The volume of the hippocampus is also associated with improved heart health, which is enhanced by physical exercise and healthy dietary choices (Meng et al., 2020). Previous research has found that exercise of a moderate intensity causes significant

augmentation of blood flow to the brain, with long term exercise habits slowing the aging process of the brain and the cognitive impairment that may accompany it (Meng et al., 2020). In the current study, each of the 3 participants engaged in regular, habitual exercise of some form; whether through aerobics classes, having a physically demanding job, or going on regular walks. Considering all individuals assessed had AD, exercise which they engaged in was not substantiated as being a protective factor for this sample set. These findings lead to very interesting further inquiry regarding whether there are forms of exercise which prove more effective in preventing neurodegeneration and associated cognitive decline.

Sleep Habits

A prevalent lifestyle risk factor undergoing abundant analysis is a person's sleep patterns throughout the middle stages of their life. It is believed that insufficient sleep and sleeping more or less than average may contribute to neurodegeneration later in life (Bryant, 2021). A longitudinal study by the National Institute of Health's National Institute on Aging found that, among 8,000 people 50 years of age followed from 1985 to 2016, those who regularly slept for less than six hours per night were at a 30% greater risk of developing dementia, compared to those who regularly got at least seven hours of sleep (Bryant, 2021). Another possible risk factor related to sleeping is sleep apnea. Sleep apnea is a condition in which one will have periodic cessation of breathing while they are sleeping, mainly during the REM cycle, a sleep cycle shown to be very important for neurodevelopment. Sleep apnea and AD commonly coexist, with research finding those with sleep apnea are at a greater risk of developing some form of cognitive impairment (Andrade et al., 2019). This research was substantiated by qualitative analysis of the data collected in this study, with all individuals being described as having irregular sleep patterns, and 66.67% reported as having both insomnia and sleep apnea, with no

endorsement of treatment for either. This data supports literature statements regarding the contribution to unhealthy sleep habits and conditions in that a majority of the individuals with AD assessed had irregular and/or unhealthy sleep habits throughout middle age.

Physical Health

A person's overall health habits have a major influence on the health of their brain as they endure the aging process. Sleep and exercise habits are encapsulated in this, yet there are chronic health conditions, such as hypertension and type two diabetes mellitus, that are suspected to be very significant risk factors in the development of AD. Specific diseases believed to be especially contributing risk factors to the onset and severity of AD are diabetes, cardiovascular disease, depression, and inflammatory bowel disease (Santiago & Potashkin, 2021). It is believed that the disruption in multiple shared biological systems causes the underlying pathology of AD progression. Qualitative analysis of the data in this study revealed that the only chronic health condition endorsed was hypertension, with a majority of the individuals not undergoing treatment for it.

Conclusion and Discussion

Quantitative analysis of prevalence of risk factors for AD from various literature, correlated with qualitative analysis of collected data, found supporting evidence that exercise, sleep habits, chronic health conditions, and mental stimulation are all prevalent risk factors in the onset and severity of AD. With 66.67% of diagnosed individuals having a diagnosis of sleep apnea and experiencing periodic insomnia and irregular sleep habits throughout middle age, we see a strong correlation between data collected and preliminary research which showed that those who regularly receive less than 6 or greater than 9 hours of sleep per night are at a greater risk of

cognitive decline. All of our individuals had regularly engaged in exercise of some form, yet were described as engaging in non-traditional forms of exercise such as having a physically demanding job or doing weekly aerobics classes. Seeing as they all have a diagnosis of AD, these findings do not entirely correlate with research findings which indicate exercise having a major impact on neurological health and hippocampal volume. These findings show that specific forms of exercise may have a greater impact than others, most likely exercise with a higher rate of cardiovascular output.

Our findings regarding mental stimulation also did not correlate entirely with literature findings, seeing that all individuals engaged in mentally stimulating activities of some kind, with the exception of regular social engagement. Similar to our conclusions regarding exercise, this could indicate that social engagement as a form of mental stimulation plays a more prevalent role in AD onset and severity than what was originally assumed. Lastly, the prevalence of chronic health conditions among the individuals we assessed were relatively low, with the only endorsed chronic health condition being hypertension, with 66.67% of individuals having a diagnosis with no current treatment. These findings were surprising considering the immense comorbid relationship between type two diabetes mellitus and AD. The presence of type two diabetes mellitus in individuals for this study is believed to have inevitably increased with a larger sample set. Despite some correlations between our data and the relevant literature not being as abundant as others, our findings further substantiate the notion that there are lifestyle habits commonly associated with the onset and progression of early onset Alzheimer's Disease. Our findings may lead to very interesting and substantial further investigation into how risk factors have different influences at differing capacities.

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