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RESEARCH ARTICLE

ALZHEIMER'S DISEASE - CAUSES AND PREVENTIVE STRATEGIES

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ABSTRACT

This paper seeks to describe Alzheimer's disease (AD) with deep concentration on causes and preventive strategies. In Canada, more than 747,000 people are living with Alzheimer's or another type of dementia. (Alzheimer's society, 2018).It is estimated that about 5.5 million Americans are suffering from Alzheimer's disease. In the next half-century, the figure is expected to increase by 8.2 million – be 13.8 million. This would be as a result of the growing generation of baby boomers. According to Alzheimer's Association, 2015, after every 66 seconds, someone in the United States develops Alzheimer's dementia. This rate is expected to reduce by half – 33 seconds – by the year 2050. This would mean about 1 million cases of Alzheimer's dementia annually (Alzheimer's Association, 2016). The paper introduces the paper by explaining why the disease of great concern to not only the government but also the general Canadian and American Citizen. The condition is currently the sixth leading cause of death in the country. The paper discusses the causes of the Alzheimer's condition. It explains how genetic, health, environmental, and lifestyle leads to the development of AD. The paper finally discusses the possible preventive strategies. It looks at both the non-pharmacological and the pharmacological approaches that can be used in the prevention of the condition.

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INTRODUCTION

Alzheimer's disease is the commonest form of dementia known across the globe. Its frequency is constantly increasing as the population with advancing ages. It is currently estimated that the population suffering from Alzheimer's dementia stands at about 5.5 million (Alzheimer's Association, 2016). This number is expected to hit 13.8 million by the year 2040 – half century. This is expected to increase because of the high number of young people – baby boomers – aging. Reports indicate that someone in the United States develops the condition every 66 seconds and is sixth leading cause of deaths. This value is expected to half in the next 28 years – 33 seconds (Alzheimer's, 2015). Reports indicate that about 15.5 million family members and other caregivers (unpaid) provided about 18.5 billion hours of care in 2016 to the people with an AD and other forms of dementia (Alzheimer's Association, 2016). Monetarily, these hours were estimated to be equivalent to values above $230 billion. In 2017, the total payments for health care, long-term care and hospice care for the people suffering from AD – those of 65 years and above – was at $260 billion. This value is estimated to increase by about 5 billion by the end of the year 2018. This has forced the government to initiate and fasten the research about the condition, especially on diagnosis and prevention. It is important to note that there is no recorded cure for the Alzheimer's disease. Also, there are no scientifically proven ways to prevent the onset of an AD.There have been efforts to validate and validate Alzheimer's disease biomarkers. These efforts have mainly been directed towards developing and validating AD biomarkers detectable with brain imaging and cerebrospinal fluid (Vlachopoulos, Xaplanteris, Aboyans, Lekakis, 2015). This would help in the study of the condition; consequently assist in understanding and development of better medication and prevention methods. Currently, treatment of the condition solely depends on support and management of the symptoms. This is intended to increase functional ability and independence of the individual suffering from an AD. This paper seeks to discuss Alzheimer's disease with more concentration on causes and the preventive strategies.

Causes of AD: Scientifically, it known that Alzheimer's disease is a result of deterioration of the brain cells (Armstrong, 2013). Normally the body naturally tries to stop

this by producing a protein known as amyloid (Drachman, (2014). However, the increase in the amyloid results in the buildup in the brains which consequently leads to more deterioration. Selkoe, and Hardy (2016) and Armstrong (2013) say that deposits of amyloid, also known as plaques, cause the shriveling up of the brain cells. These shrivel forms tangles which restructure the brain structure consequently causing the death of the brain cells. The brain starts to shrinks. This prevents the production of some important brain chemicals responsible for neurotransmission, such as acetylcholine (Armstrong, 2013). Acetylcholine is the one responsible for the memory functionality of the brain.

Although there are no recorded causes of Alzheimer's disease, there are wide scope of researchers that directs towards some factors that plays an important role in development of the form of dementia: Genetic, environmental, and lifestyle factors (Legg, 2018: "*Alzheimer's disease - causes, symptoms, treatment, prevention*," 2017). Genetic factors involve the presence of certain genes; sometimes the change in particular genes. According to Imtiaz *et al*. (2014), environmental factors involve the exposure to some chemicals – environmental solvents – such as paints and pesticides. It also involves infection as a result of environments such as the attack by particular bacteria and viruses. Lifestyle factors involve lack of exercise, poor diet, and lack of enough sleep. According to Alzheimer's Association (2016), a combination of the mentioned factors – genetic, lifestyle, and environmental factors – triggers a biological process in the brain which is normally abnormal. Consequently, an AD is contracted.

Genetic factors: Normally some diseases are caused by genetic mutation or change in some specific genes, commonly permanent. These genetic mutations or change in the genes is passed to an offspring. Consequently, if an individual inherits the genetic mutation or change in particular genes which causes a certain disease, he or she develops the condition eventually (Legg, 2018). Some of the common diseases that are as a result of inherited genetic disorders include cystic fibrosis, early familial Alzheimer's disease, and sickle cell anemia. Alzheimer disease genetics exists in two types – early-onset and late-onset (Cacace *et al*., 2016).

Early-onset alzheimer's disease (AD): This is one of the rarest forms of an AD at about 10% and fewer cases of the condition globally. It occurs in persons between the ages of 30 and 60 years. In some cases, early-onset familial Alzheimer's disease occurs as a result of inheritance of the change in one of three genes. Some researchers, however, indicated that in some situations some factors of the genetic component other than the genes themselves could because of the disease(Cacace, Sleegers, & Van Broeckhoven, 2016). Nonetheless, a child who'sboth or either parent carry the genetic mutation for early-onset familial Alzheimer's disease has 50% chance of contracting the mutation. However, if the child inherits the mutation, there is higher chance that he or she will develop the early-onset familial AD. Early-onset Familial Alzheimer's Disease (FAD) can be caused by genetic mutations from any one of three chromosomes – 21, 14, and 1 (Cacace *et al*., 2016). Individually, the mutation son each of the chromosomes results in abnormal formation of proteins in the brain. Abnormal amyloid precursor protein (APP) formation is caused by mutations on chromosome 21 (Selkoe *et al*., 2016: Drachman, 2014). Abnormal presenilin 1 and presenilin 2 formations is caused by mutations of chromosomes 14 and 1 respectively. These three mutations play a role in the breakdown of APP. However, it must be understood that protein APP functions have never been clearly stipulated. Nonetheless, the process of its breakdown has been realized to the amyloid plaques, something is known to cause Alzheimer's disease.

Late-Onset alzheimer's Disease (AD): This the commonest type of Alzheimer's disease. Most of the people who have late-onset type of Alzheimer's disease the symptoms start appearing or common in the mid-60s. Despite the fact that researchers and scientist have not found a specific gene that causes the late-ons*et al*zheimer's disease, some genetic risk factor has been found to be associated with the condition. Van der Lee, Wolters, Ikram, Hofman, Ikram, Amin, and van Duijn, (2018) indicates that presence of apolipoprotein E (APOE) gene on chromosome 19 has been found to increase the risk of contracting late-ons*et al*zheimer's disease. The apolipoprotein (APOE) comes in various alleles - APOE ε2, APOE ε3, and APOE ε4 (van der Lee *et al*. 2018). APOE ε2 is the rarest allele. In fact, in case an AD occurs in an individual with APOE ε2, it is common that the condition develops in the later stages in life as compared to a person with APOE ε4 gene. APOE ε3, on the other hand, is the commonest allele. It neither increases nor decreases the risk of having the Alzheimer's dementia. APOE ε4 is known for increasing the risk of developing AD. In fact, it is associated with earlier development of Alzheimer's disease onset. Normally a person has one, two, or three of this allele. In cases where a person has more than three of the APOE ε4, he or she has higher chances of developing AD. Despite the fact that APOE ε4 increases the chances of developing the Alzheimer's disease condition, inheriting the gene does not mean that the person will contract AD (Lim, Williamson, Laws,... & Masters, 2017). In fact, there are people who have the APOE ε4 and never develop the Alzheimer's dementia.

Environmental, Lifestyle, and Health Factors: Beyond genetics, research points to health, environment, and lifestyle factors. These factors have been noted to equally cause the development of Alzheimer's disease. Vascular conditions have been some of the greatest concern to be factors that lead to the development of the AD. Some of the cardiovascular conditions such as heart disease, HBP, and strokes have been noted to play a role in the development of Alzheimer's dementia. Some metabolic conditions such as obesity and diabetes have equally been noted to lead to the condition. These conditions normally depend on the environment, health, and lifestyle. For example, lack of exercises, poor diet, and poor sleeping habits. Proper diet, physical activities, mental stimulation activities have all been proven by health practitioners to have an impact on the health of an aged individual (Imtiaz *et al*. 2014). According to some researchers, these factors play an important role in improving cognitive ability consequently reducing the chances of developing Alzheimer's disease (Alzheimer's Association, 2016).

Prevention Strategies: Gauthier, WuRosa-Neto, and Jia, (2012) indicate that there are no proven approaches to the prevention of the Alzheimer's disease. This is because of various factors. There are various difficulties in conduction prevention trial for an AD. This is because of the not known pathophysiological mechanism of Alzheimer's dementia. Also, there has been difficulty in selection of target population to conduct trial since most of the affected are the aged.

Table 1. Preventive Drugs

Pathophysiology factors	Possible drug Treatments/Medication
1. Amyloid deposition	Treatment using the beta and gamma-secretase inhibitors. Also, active and passive immunotherapy.
2. Insufficient synaptic plasticity/synapse lapse	Treatment using probuchol
3. Microglial activation	Treatment using naproxen
4. Tau hyperphosphorylation	Treatment using methylene blue, lithium, or memantine. Sometimes a combination of the three.

Other factors include the need for large sample population size, high costs involved, related ethical issues, long period involved in the follow-ups, and the events of studies prevention drugs (Gauthier *et al*., 2012). There are otherwise epidemiological pieces of evidence that suggest changes in lifestyles could be the solution to the Alzheimer's condition. Gauthier *et al*. (2012) say that these can either be non-pharmacological or pharmacological interventions.

Non-Pharmacological interventions: Modification of lifestyle is one of the non-pharmacological interventions that are greatly considered in preventing the development of AD. A lifestyle change that aims at reducing risk factors, for instance, the vascular conditions and improves protective factors – physical activities and exercises, healthy eating/diet, and cognitive improvement – help in reducing the chances of Alzheimer's dementia condition. Researchers indicate that regular physical activities and exercises have a direct influence on the positive health of the brain cells which consequently reduced the development of AD. Healthy diets and healthy eating also help in reduction of the development of the disease. Although there is no specific diet that has been indicated to reduce the development of Alzheimer's disease, the Mediterranean diet has been suggested by various dietitians. This diet included food such as fish, beans, nuts, whole grains, vegetables, fruits, olive, eggs, and poultry. Iturria-Medina, Sotero, Toussaint, Mateos-Pérez, Evans, Weiner, and Trojanowki (2016) explains that these foods play an important role in reducing or lowering the cases of cardiovascular conditions and diabetes disease which are some of the influencers of AD condition. Some studies such as the Multidomain Alzheimer Prevention Trial (MAPT) have suggested supplementing these non-pharmacological interventions with omega-3 (Iturria-Medina, *et al*. 2016).

Pharmacological Interventions: Alzheimer's disease has been associated with protective factors and different risks, especially in the mid-life of an individual who is acquiescent to the preventive approaches. Most of the preventive measures that are more concerned with cardiovascular and vascular factors have been realized to reduce the prevalence of dementia (Iturria-Medina *et al*., 2016). Some of these risk factors include systolic hypertension. Partly this could be explained by the various effects of the antihypertensive drugs on the pathways that are associated with Alzheimer's dementia. However, these drugs have failed to meet the standards to be allowed and be endorsed by the United States task force to be used in the control of systolic hypertension or in any other lifestyle change as an approach to prevent Alzheimer's dementia. Another pharmacological intervention strategy involves targeting the pathophysiology of Alzheimer'sdisease directly in the pre-clinical stages (Kumar, & Singh, 2015).Various possible pathophysiological exists to be used in the prevention of the Alzheimer's dementia. The duo indicates that they can be divided insoluble amyloid, loss of neurotransmitters, inflammation, oxidative stress, synapse loss, amyloid plaques, and neurofibrillary tangles preventions (Drachman, 2014).

Some of the pathophysiological factors and their drug treatments include;

CONCLUSION

It is estimated that about 5.5 million Americans are suffering from Alzheimer's disease. In the next half-century, the figure is expected to increase by 8.2 million – be 13.8 million. This calls for understanding the causes of the condition and the possible preventative interventions. Various researchers indicate that there are no recorded causes of Alzheimer's disease, there is the wide scope of researchers that directs towards some factors that play an important role in the development of the form of dementia: Genetic, environmental, and lifestyle factors (Imtiaz, Tolppanen, Kivipelto, &Soininen, 2014). There are two types of Alzheimer's disease – early-onset and late-onset FAD – which are influenced by gene mutation or permanent change in genes. There are no proven approaches to the prevention of the Alzheimer's disease. However, some non-pharmacological and pharmacological interventions can be utilized.

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