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Epidemiology of Alzheimer's Disease with the Projection of Falls Among the Aged Population

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Additional information is available at the end of the chapter

1. Introduction

With aging, the loss of the ability to adapt to environmental factors in progressive decline occurs. Particularly in North European countries, the elderly population continues to gradually increase. Currently, in developing countries with a high youth population,it has been mentioned that the size of epidemiology in the aging population revealed a more realistic projection. The aging population is rapidly increasing. Of the 600 million elderly (60 years and over) that are living,the ratio will increase by 25% in the next 25 years, and the population of over 65 years old is expected to increase by 88% in the world. Most of the older population is found in developed countries than that are indicated. In this projection, the determination of health policies for the elderly necessarily becomes a first priority.

The old age period needs to be examined in physical, psychological, and social aspects. While physical changes occur in a chronological order, psychological perception changes are observed in learning, psychomotor, and personality characteristics. In the aspect of social perspective, the people live in many limitations [1]. The elderly population suffer with the following: approximately 8.0% have serious cognitive problems; 20% have chronic diseases, vision problems, and hearing loss; and 33% live with a limitation on movements [2].

Dementia is defined as one of the biggest problems faced by the elderly population. It is an overall term for diseases and conditions characterized by a decline in memory or other thinking skills that affects a person's ability to perform daily activities. According to DSM V criteria, dementia can be defined as a major and mild neurocognitive disorders. In epidemiological data, 24.2 million people live with dementia at that time, with 4.6 million new cases arising every year [3]. Dementia increases with age, especially over the age of 65 which are 1.5 times more often seen. Many conditions may cause dementia. However, the Alzheimer's disease (AD) is one of the reasons of the dementia that estimates 60-80%.

Alzheimer's disease is defined as a progressive loss of the cognitive function. This function loss history starts with the loss of memory and function, and eventually to all the intellectual activities of daily living and leads to premature death. Beta-amyloid plaques, neurofibrillary tangles, and neurodegeneration are the hallmark pathologic characteristics of AD [4]. To establish a diagnosis of AD with the onset of symptoms that can be done, in fact, already started the beginning of the 20 year before. Etiology has not been fully clarified, but the underlying causes are genetics, age, family history, the Apolipoprotein E-ε4 gene (APOE-ε4), mild cognitive impairment, education level, traumatic brain injury, and cardiovascular risk factors [5].

Alzheimer's disease causes slowly progressive irreversible cognitive destruction with the loss of performing even the daily activities. In particular, the most common problems encountered in this process is falling. Falls in patients have clinically more severe chronic process and present additional morbidity while mortality is increases. Alzheimer's disease has approximately 2 times higher risk for falling [6,7]. For patients with dementia, when they fall, they are three times more likely to have broken hips. Hip fracture further increase the death rate of AD patients [8]. In AD patients, increased risk of falling remains less understood. In studies, cerebral white matter lesions may relate to cognition and postural balance [9-10].

In this chapter, the epidemiology of Alzheimer's Disease with etiologic factors will be discussed, and with this projection, the risk and importance of falls in these patients will also be tackled.

2. The aging population

With aging, loss of the ability to adapt to environmental factors in progressive decline and aging population is rapidly increasing. Of 600 million elderly (60 years and over) that are living, the ratio will increase by 25% in the next 25 years, and the 65+ population is expected to increase by 88% in the world. Most of the older population is found in developed countries than that are indicated. In the year of 2056, 29.5% of Canadians, which is roughly 10.5 million people, are expected to be above 65 years of age [11]. Approximately 8% of the elderly population live with serious cognitive problems, while 20% have chronic diseases, vision problems, and hearing loss, while the another 33% live with limitation of movements [2,12].

While the geriatric population increases, the incidence of chronic diseases also increases. In particular, there are many physiological changes that occur in the geriatric period. The most prominent of these occur in the skeletal system. With aging, bone resorption decreases and senile osteoporosis occurs. In women, the menopause accelerated osteoporosis, and it threatens both male and female with aging. In addition to this change in the geriatric period, gastrointestinal system changes occur that reduce appetite and prevent the absorption of nutrients. This process in the geriatric period affects both the dementia process as well as increase the risk of co-morbidity.

There are also social aspects of geriatric patients with the same changes. The most prominent of these is related to the loss of spouse or loss of family members. Work situations, such as separation or lack of income increases, results to social problems in the elderly.

Today, in developed countries live alone in geriatric period stood out, with the rise of industrialization. In developing countries geriatrics are also dwindling along with family members. This facilitates the social isolation occuring in the aging population that live on their own.

One of the most significant changes experienced by the geriatric age group is also a change in mental health. Especially due to social isolation or existing health problems, mood disorders in the geriatric population is emerging. At the inital stage of dementia in people with mood changes, it is difficult to recognize the coexistence of disorder or delay.

3. The aging population and falls

In the elderly, physiologically changes and many chronic diseases occur, and the geriatric population also experience comorbidity problems. Falling is one of the major problems causing the increasing comorbidities and mortality rates. Falls, in the geriatric population, is the fifth leading cause of mortality [13]. Every year, geriatric patients aged 65 years and over is reduced by 30%, and for patients over 85 years of age, by 50%. Each year, 30-50% of falls are in nursing homes and 40% of those individuals fall again [14].

In the study from South Asia, it was found that the incidence of falls in China was 6-31%, while in Japan, it was 20% [15-17]. According to the WHO report, the rate of hospital admission caused by falls was found to be 1.6 to 3.0 per 10,000 population for people at the aged 60 years and over in Australia, Canada, the United Kingdom of Great Britain, and Northern Ireland (UK) [15]. Forty percent of all injury deaths are caused by falls [18]. Populations have various fall fatality rate for people aged 65 years and over: in the USA, 36.8 per 100,000 population; in Canada, 9.4; in Finland, 55.4 for people aged 50 and over [19-21]. Figure 1 indicates fatal falls by age group and gender [15,22]. Fatal fall rates increase with age for both gender, and the highest rate is seen at the age of 85 years and over. It has been found that men reported poorer health and a greater number of underlying conditions than women. These include increasing hip fracture and the risk of mortality [23].

Although population ageing is a triumph of humanity related to the extension of life-span, it brings back some challenges for societies [24]. The absolute number of people aged 60 years and over is expected to increase from 688 million in 2006 to 2 billion by 2050. For the first time, the population of aged people will be greater than the population of children under the 14 years of age [15]. In addition, being predisposed to falls and its serious consequences is fastest growing at the age of 80 and over. Figure 2 shows the population pyramid in 2005 and 2025 [15]. This figure shows that the percentage of older population is growing in parallel with a decreasing percentage of the younger population. The triangular shape of the 2005 population pyramid will transform into the more cylinder-like form in 2025 [15].
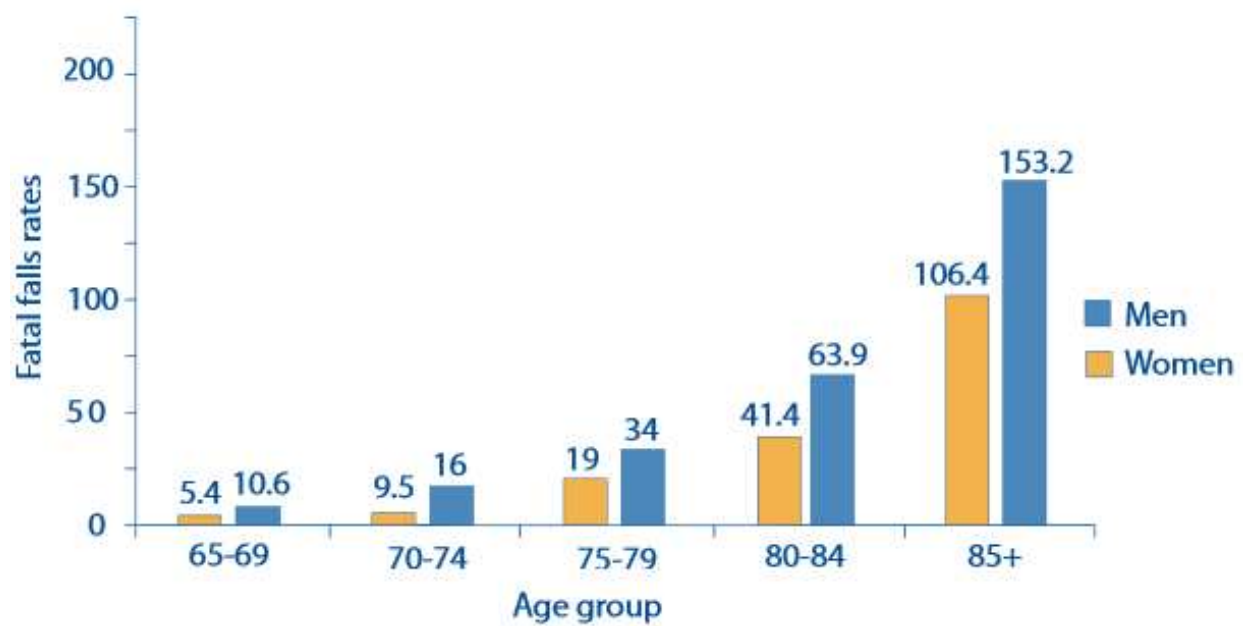
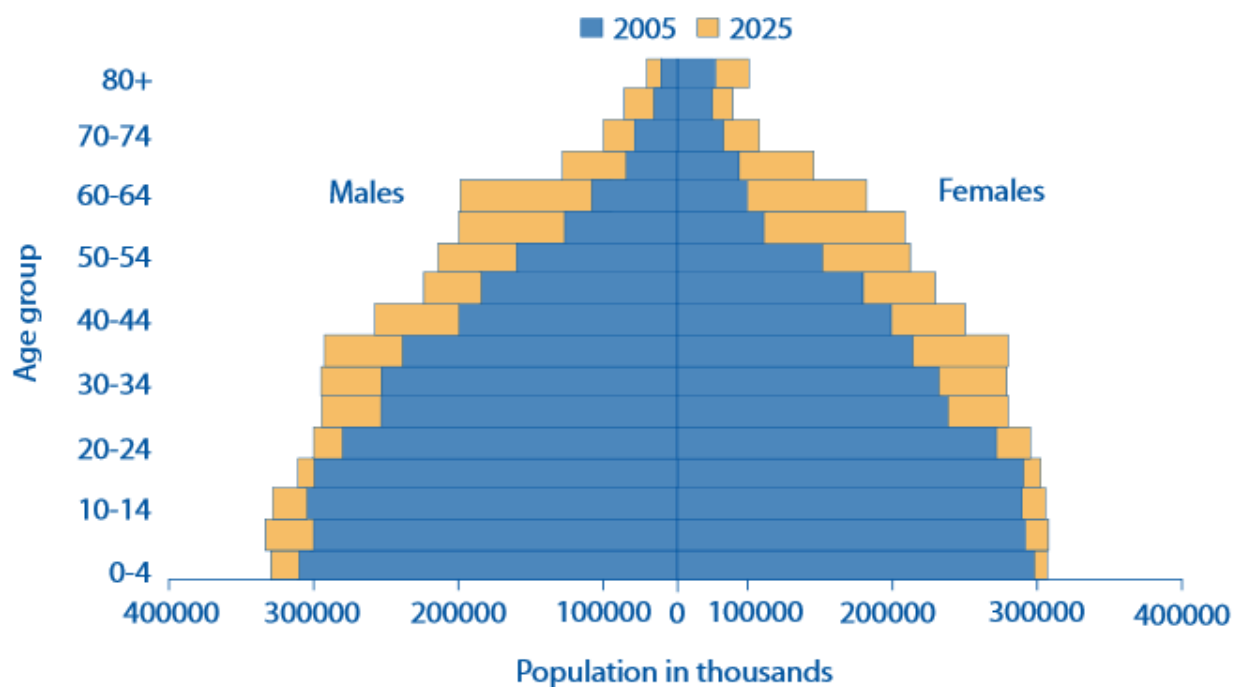**Figure 1.** Fatal fall rates by age and sex group[15,22].

Figure 2. Global population pyramid in 2005 and 2025 [15,25].

The prevention of falls is a considerable challenge for the ageing population. The number of falls increase in magnitude as the number of aged people increase in many populations throughout the world [15]. Falls increase with age because of biological change. Consequently, the number of people aged 80 years and over will trigger a substantial increase of falls and

injuries at an anxious rate. Actually, incidence of fall injuries have increased by 131% in the last three decades. The number of injuries caused by falls is predicted to be 100% higher in the year 2030 [15,21].

This applies to developing countries where ageing population is rapidly occurring and where close to 70% of the elderly population lives. To add, "the developed world that became richer before getting older, developing countries are getting older before becoming richer" [26].

The Ontorio working group linked the cause of the high incidence of falls to extrinsic and intrinsic risk factors. The intrinsic risk factors are the physical characteristics, demographics, and general health status of elders; e.g. psychosocial-demographic risks, medical risks and considered as risk and degree of dependency with activity levels. While the extrinsic factors are thought to be related to the physical and socio-economic environment; e.g. balance, slip hazards and vision hazard. [27].

Most falls result from a person's environment. The causes are, especially, the predisposing and precipitating factors of the person's environment. In most studies, about 25 to 45 percent of falls occur because of environmental hazards [28]. The other common causes are gait disturbance and muscle weakness. The risk factors of falls are dizziness, vertigo, drop attacks, postural hypotension, visual impairment, and syncope in patients. Lower extremity muscle weakness is a significant risk factor for falls because it increases the odds of falling fourfold. The other risk factors of falls are having fall history and gait or balance deficits which increases the risk threefold. Other high-risk situations for falls are the use of an assistive device, visual deficit, arthritis, impaired activities of daily living, depression, cognitive impairment, and age over 80 years. Studies reported that, medication increases the risk of falls, especially the use of four or more medications, which have been strongly associated with an increased risk of falls. In particular, the use of psychotropic medications, cardiac drugs including class 1A antiarrhythmic agents, digoxin, diuretics, and anticonvulsants have been implicated in increasing the risk of falls [29,30]. In a social perspective, falls are one of the most common geriatric syndromes because of the threat to the independence of older persons. Between 30 to 40 percent of community-dwelling adults older than 65 years fall each year, and the rates are higher for nursing home residents. Falls are associated with increased morbidity, mortality, and nursing home placement [31,32]. The other risk factors of falls are arthritis, depression and activities of daily living [33,34].

Falling due to fractures is very common in the geriatric population. In Canada, it is stated that a large 23,631 people 59 years and older were hospitalized due to femoral neck fractures. The most frequent cause of hospitalization for 65 years old and older is hip fracture. Femoral neck fractures with dependence in daily activities in patients older than 85 years also increases [35-40].

The American Academy of Family Practice offers a clinical assessment to determine the risk of fractures in the elderly. The risk groups are defined as the conditions shown in Table 1 below.

Clinical Assessments and Interventions for Elderly at Risk for Falls*	
Assessment and risk factor	*Interventions*
Circumstances of previous falls	Changes in environment and activity to reduce the likelihood of recurrent falls
Medication use High-risk medications Four or more medications	Review and reduction of medications
Vision Acuity < 20/60 Decreased depth perception Decreased contrast sensitivity Cataracts	Ample lighting without glare; avoidance of multifocal glasses while walking; referral to an ophthalmologist
Postural blood pressure; ≥ 20 mm Hg drop in systolic pressure, with or without symptoms, repeat immediately or after two minutes of standing	Diagnosis and treatment of underlying cause, if possible; review and reduction of medications; modification of salt restriction; adequate hydration; compensatory strategies; pressure stockings; pharmacologic therapy if the above strategies fail
Balance and gait Patient's report or observation of unsteadiness Impairment on brief assessment	Diagnosis and treatment of underlying cause, if possible; reduction of medications that impair balance; environmental interventions; referral to physical therapist for assistive devices and for gait and progressive balance training
Targeted neurologic examination Impaired proprioception Impaired cognition Decreased muscle strength	Diagnosis and treatment of underlying cause, if possible; increase in proprioceptive input; reduction of medications that impede cognition; awareness on the part of caregivers of cognitive deficits; reduction of environmental risk factors; referral to physical therapist for gait, balance, and strength training
Targeted musculoskeletal examination: examination of legs and feet	Diagnosis and treatment of underlying cause, if possible; referral to physical therapist for strength, range-of-motion, and gait and balance training and for assistive devices; use of appropriate footwear; referral to podiatrist
Targeted cardiovascular examination Syncope Arrhythmia	Referral to cardiologist; carotid-sinus massage
Home hazard evaluation after hospital discharge	Removal of loose rugs and use of night lights, non-slip bath mats, and stair rails; other interventions as necessary

Table 1. Clinical Assessments and Interventions for Older Persons at Risk for Falls

Tinetti ME. Clinical practice. Preventing falls in elderly persons. N Engl J Med 2003;348:45.

Health care services has provided the necessary preventive measures for fall-related fractures in the geriatric population. There are some precautions, in terms of extrinsic factors, that are also needed to be taken to prevent falls. In this regard, the US Preventive Task Force (USPSTF) offers suggestions to prevent fractures in elderly patients [41]. The USPSTF recommendations are given in Table 2 below.

Strength of Recommendations*	
Key clinic Recommendations	Label
Home hazard assessment and modification is recommended for patients with a history of falls.	A
Exercise and physical therapy are recommended to prevent falls and injury from falls.	A
Patients should receive a multifactorial risk assessment and intervention because it is the most consistently effective strategy to prevent falls.	A
Evaluation of medications and withdrawal of medications that increase the risk of falling is recommended.	B
Dual-chamber pacemaker placement is recommended for selected patients with carotid sinus syndrome and syncope.	B
Hip protectors are recommended for patients at high risk of falling in an institutional setting.	B
Patients with a history of falls or with risk factors for falling should undergo a formal evaluation.	C

* U.S. Preventive Services Task Force. Guide to clinical preventive services

Table 2. Recommendations and labels for preventing elderly people from falls

One of the most significant pathology in the geriatric age group is also dementia. The most common cause of dementia in the USA is Alzheimer's disease that has an annual health spending of 192 billion dollars. The cost for health expenditure has been based from a study but the social impact cannot be calculated [41].

4. Dementia in the aged population

The biggest problem is defined as dementia in the aged population. Dementia prevalence is estimated to amount to 24 million and predicted to quadruple by the year 2050 [41]. Dementia is defined as an overall term for diseases and conditions characterized by a decline in memory or other thinking skills that affects a person's ability to perform everyday activities. According to the DSM V criteria, dementia is defined in terms of major and mild neurocognitive disorders. In the epidemiological data, 24.2 million people lived with dementia at that time, with 4.6 million new cases arising every year [3]. In Canada; 2.0% of the population were diagnosed

with dementia [11]. Dementia, increases with age, especially over the age of 65 years where it has been often seen by 1.5 times more.

Previous definitions of dementia have often included the requirement of a progressive and irreversible impairment. Dementia related so many things and can occur before or after the age of 65 [42].

Alzheimer's disease (AD) has been one of the top reasons of the dementia which estimates 60-80%. The etiology of Alzheimer's disease shows many reasons, although the exact etiologic factor could not be determined. The early-onset AD is referred to the existence of genetic factors associated with the etiology of APOE. While with the late onset AD, the etiological factors could not be determined [4].

5. Alzheimer's disease epidemiology

Alzheimer's disease is defined as a progressive loss of cognitive function. This function loss history starts with the loss of memory and function, and eventually to all the intellectual activities of daily living, and leads to processes that causes premature death. Beta-amyloid plaques, neurofibrillary tangles, and neurodegeneration are the hallmark pathologic characteristics of AD [4]. In fact, since 20 years ago, there were already initial steps to establish the diagnosis of AD with the onset of symptoms. Etiology has not been fully clarified, but the underlying causes are genetics, age, family history, the Apolipoprotein E-ε4 gene (APOE-ε4), mild cognitive impairment, education level, traumatic brain injury, and cardiovascular risk factors [5].

The prevalence of Alzheimer's disease, according to the countries' health-related database information from Holland, France, Italy, England and USA, is estimated at 3-7% [43].

Memory loss is the most pronounced behavioural abnormality, and is usually the first symptom in Alzheimer's disease. Memory is impaired for recent events, with relative preservation of remote memory. In the early stages of the disease, memory impairment may be an isolated dysfunction, followed in time by the development of impairments of attention, language function (defective word finding with otherwise fluent speech), visuospatial abilities (drawing, route finding), praxis (purposeful movements), calculations, visual, auditory and olfactory perception, problem-solving ability, and judgement. Patients with Alzheimer's disease have difficulty shifting their mental set from one task to another. Depression, personality changes, apathy, and irritability are also common features of the disease. Language abilities and social skills may be remarkably preserved, even in the later stages, and patients with well-established dementia may be able to maintain polite conversations with remarkable skill and thus appear to be intact to the casual observer. Paranoid delusions, illusions, and hallucinations are seen in a minority of patients, usually in the later stages. Up to half of the patients with Alzheimer's disease have limited awareness of their behavioural deficits. It should be emphasized that the behavioural features of this disease are highly variable from patient to patient: some patients may have preserved language function with impaired

visuospatial abilities, while other patients at a similar stage in the overall disease process may show the reverse pattern of deficits. Motor function and urinary continence are usually not affected until later. This variability, or heterogeneity, in the behavioural manifestations of the disease is due to variations in the distribution of disease severity in brain regions. For example, patients with severe involvement of the left temporal and parietal cortex will have relatively more marked language dysfunction. The disease is progressive, with survival rates after an onset of 5 to 12 years duration [42,43].

As the elderly population in developed countries increases, it also can not be prevented to have an increase in the prevalence of Alzheimer's disease. This is due to the change in the direction of health policies. The unknown cause and limited treatment cause higher health expenditures and quite large losses in every perspective.

Alzheimer's Disease, has two types of progressive diseases. If the AD starts before 65 years of age, it is defined as early clinical onset. If it starts after 65 years of age, it is defined as late onset AD. Early-onset AD starts in middle age and is implicated in the etiology of genetic predisposition. Late-onset AD is the most commonly seen in the 70-80 age range, and after 65 years, there is a 2-fold increased risk of AD.

Some factors considered to be the etiology of Alzheimer's disease: age, genetics, family history, the Apolipoprotein E-ε4 gene (APOE-ε4), mild cognitive impairment, education level, traumatic brain injury, and cardiovascular risk factors.

Age: Age is associated with the increase in the prevalence of AD. After 65 years of age, it is known that a 2-fold increase likelihood of AD occurs every 5 years. When a person isover 85 years of age, the increased risk becomes 16-fold.

Genetics: There are many studies on this subject. There are some genes and polymorphisms that are genetically determined. These genes and polymorphisms are associated with the pathophysiology of white plaque in AD. Alzheimer's disease pathology in the brain is characterised by the presence of plaques of amyloid β peptides and intraneuronal tangles of hyperphosphorylated forms of microtubule-associated protein tau (MAPT) [44]. It is stated that in the studies of both componentscarry genetic forms of AD. Casual mutations in three genes have been identified in early-onset forms, establishing the central role of amyloid in Alzheimer's disease, which has become to be the most widely studied pathway since these discoveries [45-49]. Twin studies have observed that the transition rate is 80% [50].

In the absence of transitions in all AD patients with the same genes, it has been suggested that the environmental factors are related in the development of the disease. It has been genetically implicated, especially in the early onset of Alzheimer's disease with APOE ε4 allele presence. At the molecular level, especially in transition, Mendelian APP, PSEN1, and PSEN2 mutations were studied [45-49].

Mutations in PSEN1 and PSEN2 are also directly related to amyloid production; they impair the γ-secretase-mediated cleavage of APP, resulting in an increased ratio of amyloid β to amyloid β [51].

The results of the studies that show autosomal dominant Mendelian characteristics found that some genes were involved in the pathology of AD. The late-onset AD is also guilty of the changes in these genes. The genome-wide association and replication of these genes, additionally, have been reported for single nucleotide polymorphisms in or near CR1, PICALM, and BIN1[52]. Continued concerted efforts identified the association with single nucleotide polymorphisms especially in MS4A cluster, CD2AP, CD33, EPHA1, and ABCA7 [52-56].

Apolipoprotein-ε4 (APOE ε4)

Apolipoprotein-ε4 allele is the best known factor for the late-onset and early-onset forms. The Alzheimer's disease risk is increased with having one ε4 allele roughly three-times and those with two ε4 alleles have a roughly 15-times-increased risk, compared with the most common genotype, APOE ε3ε3 [57].

Results of early studies suggested that this risk was greatest in patients who were 60–79 years of age at the onset, a notion confirmed by a study of more than 17,000 individuals with whom the risk of disease in APOE ε4ε4 carriers aged 60–69 years was as much as 35 times higher than that noted in APOE ε3ε3 carriers [58]. In APOE ε4 carriers, the lifetime risk of Alzheimer's disease (an estimate independent of APOE ε3ε3 and the actual probability of developing disease between birth and a given age) at age 85 years was estimated to be as high as 35% for female APOE ε3ε4 carriers and 68% for female APOE ε4ε4 carriers [59].

5.1. Cerebrovascular diseases

Hemorrhagic infarcts, vasculopathy or something which causes changes in white matter cause AD, however, the specific name for this cause or reason has not yet been identified. Infarcts can lead to losses in areas related to memory or due inflammation that occurs in AD [62,63].

5.2. Hypertension

In studies, the hypertension that especially occurs in middle aged people, could cause the onset AD. In many studies, vascular resistance of the resulting protein will lead to the extravasation of the blood-brain barrier and, thus, lead to damage in the cell structure, apoptosis, and damage in the brain. In addition, this may be considered as a cause of AD [62,63].

5.3. Type 2 Diabetes Mellitus

Type 2 DM is accused to be the cause of hyperinsulinemia in AD patients. Ensuring that the peripheral hyperinsulinemia down-regulates the insulin receptors in the brain, under physiological insulin needs provides a transition to the brain and leads to an increase in the IDE found mediated amyloid production [64,65].

5.4. Lipid disorders

Many studies considered cognitive impairment and AD are caused by lipid disorders, although there is no evidence to reveal exactly why. The reason for this is that genetics predisposition and apolipoprotein E, apolipoprotein J (APOJ, CLU), ATP-binding cassette

subfamily A member 7 (ABCA7), and sortilin-related receptor (SORL1) are responsible etiology of AD and lipid metabolism [66-68].

5.5. Head injury

In the meta-analysis, it is particularly prevalent in people who underwent a traumatic brain injury with dementia [69-71]. Especially the men are more affected than the women. However, there are inconsistent evidences for head injuries increasing the risk of AD.

6. Alzheimer disease and risk of falls

The prevalence of falls in patients with mild to moderate dementia is at 42% [44]. Cognitive destruction of dementia patients have a worse prognosis than when they fall. In studies, falls are more frequently seen in patients with AD [45]. In the world, the geriatric age population is increasing and consequently the number of patients with AD is also increasing too meaning falls happen in the people in this group, which is a serious problem [44-47].

According to the CDC, every year people aged 65 and over fall [48-49]. Falls can cause fatal and nonfatal injuries, and can increase the risk of early death [50]. In fact, we know that falls are a preventable public health problem, especially for aging communities. In aging societies, Alzheimer diseases is another serious health problem, which is largely seen in developed countries. The death and injury rates that result from falls among older men and women have risen sharply over the past decade (Table 3). Aged people with Alzheimer's Disease are at a particularly high risk of falling. Problems with vision, perception, and balance increase as the Alzheimer's Disease advances, making the risk of a fall more likely [51].

Deaths
In 2011, about 22,900 older adults died from unintentional fall injuries.
Men are more likely than women to die from a fall. After taking age into account, the fall death rate in 2011 was 41% higher for men than for women.
Older whites are 2.7 times more likely to die from falls as their black counterparts.
Rates also differ by ethnicity. Older non-Hispanics have higher fatal fall rates than Hispanics.
Injuries
People age 75 and older who fall are four to five times more likely to be admitted to a long-term care facility for a year or longer, than those age 65 to 74.
Rates of fall-related fractures among older women are more than twice than those for men.
Over 95% of hip fractures are caused by falls. In 2010, there were 258,000 hip fractures and the rate for women was almost twice the rate for men (15).
White women have significantly higher hip fracture rates than black women.

*Centers for Disease Control and Prevention, the National Center for Injury Prevention and Control.

Table 3. Fall-related deaths and injuries*

The annual incidence of Alzheimer's disease patients that experience a fall in their age group is 60-80% of non-AD. Also AD patients are 3 times more likely to carry the risk of fall-related developments fraction [52-55].

Although not proven, there are already studies about the increasing frequency of falls in patients by De Groot et al., [9] and Maruyama et al., [10] that cerebral white matter lesions may relate to cognition and postural balance.

There is not known relation between falls and AD. But, changes in motor movements are thought to be related to the recently impaired cognitive function. It is not known whether changes in motor movement, or cognitive loss in AD and mild cognitive impairment had previously occurred [46-57]. Stark SL et al., [58] considered that motor movements are affected before than the cognitive impairment and is argued that the increase of brain amyloid levels increase the risk of falling.

Ogama N et al., [59] declared that AD patients with falls have higher white matter lesions (WML) than patients without falls. The posture and gait performance of the AD patients with falls were lower than patients without falls. It has been found that, the periventricular hyperintensity in frontal caps and occipital WMLs were strong predictors for falls, even after potential risk factors were considered. About the risk of dementia and AD patients, regional WMLs visualisation by the the brain magnetic resonance may greatly help to diagnose dementia in the elderly with a higher risk of falls. Regional white matter burden, independent of cognitive decline, correlates with balance/gait disturbance and predicts falls in elderly with aMCI and AD [59].

In dementia, many risk factors were studied. The most common risk factors for falls in patients with AD that are related to cognitive impairment and dementia are: gait and balance disturbances, behavioral disorders, visual problems, malnutrition, adverse effects of drugs, fear of falling, neurocardiovascular instability (particularly orthostatic hypotension), and environmental hazards.

Based on data from studies, a multifaceted intervention, including a physical exercise programme, and a modification of the risk factors may prevent falls in older people with cognitive impairment and dementia. Lorbach ER et al., considered [60] that age, history of falls, motor impairment, visual disturbance, cognitive disfunction, behavioral disturbance, side effects of prescription drugs, and the presence of risky behaviors are risk factors of falls. NutriAlz' study declared that the risk of falls are related with the history of falls, nutritional status and arthritis [61]. Walking is an automatic process until it is necessary to deviate from the learned program. Most of the locomotion involves intention and therefore, there are cognitive inputs of various degrees.

In AD and the other dementia diseases, cognitive impairment will have a negative effect on all aspects of gait performance and progressive decline in cognition. This may cause a concomitant disorganization of the network that controls locomotion, leading to an impaired gait timing and postural control.

A disintegration of a higher cortical sensory function and a particularly involving perceptual-motor integration may represent in AD patients. Because of this disintegration of the

various components, previously learned routine motor functions "breaks down" due to visuo-spatial integration and other functions of higher cortical perception, an unconscious component in the network of motor control. In AD patients, both constructional and ideomotor apraxia at all stages of the disease occur. Alternatively, as a result of trying to compensate for an impaired higher cortical sensory integration and competition for attentional resources, the control of timing in the cerebellum executes programs with variable output, leading to the variability of stepping during the stride with subsequent gait unsteadiness and ultimately leads to falling [62].

Dementia and AD with frontal cognitive impairment is reported to cause deterioration of walking in patients [63]. In the study Coelho et al., [64] AD's mild/moderate stages indicate that the difference between the kinematic parameters is walking. Moderate stages of AD patients had shorter stride lengths and walked more slowly than patients who were in the mild stage. In the study of Maggio et al., [65] the caregivers are the risk factor of AD because of caregiver stress.

7. Other risk factors of falls in Alzheimer disease

Physiological and cognitive changes and other functional disabilities occur in patients with AD. The experimental or epidemiological studies show that there is more than one etiologic factor that may be responsible for the risk of falls.

Age: Age is seen as the most important etiologic factor. Both AD prevalence and falls increase with ageing. In Nutrialz study, the prevalence increase by 10% with ageing and is increases every 5 years [61]. It is known that, with ageing, dementia, AD, and falls increase. The loss of abilities is related to ageing.

Education level: In the study of Ott et al., [66] high education level is stated to be related to AD. It was especially noted that increased levels of education delay the onset of AD. With a higher education level, neural reserve and neural network capacities are higher, and this delayed the neurodegeneration [67,68]. The effects of education, job and entertainment experiences lead to the efficiency of neural reserves.

Functional Ability and Falls: Normal ageing involves vision, hearing, vestibular, and somatosensory changes in the primary sensory areas. Thus, a more cognitive effort may be required to accommodate these systemic changes. The progressive decline in cognitive functions may lead to the disorganization of the network that controls locomotion, leading to impaired gait speed, timing, and poor postural control [70].

Recent Falling History: The risk of falls is increasing with AD patients that have a previous falling history. This is influenced by, because of recent experiences, fear of falling. Fear of falling are influenced by spatial and temporal parameters [71-72]. In this subject, there are many evidences. Especially, the history of falling is the main risk factor in elderly people and in patients with AD.

Gait: In AD patients, stride length variability at all walking speeds may contribute to the increased incidence of falls [73].

Global Brain Atrophy: White matter lesions in older adults are also associated with gait and balance impairment, cognitive impairment, and frequent falling. Yamaha et al., [74]. stated that patients with cognitive disorders, global brain atrophy is an independent factor for falling in AD patients.

Medication: In AD patients, one of the risk factors for falls is the medication. In the study of Epstein et al., [75] the medication increases the falls. Even after the medication has been changed, medication side effects are still thought to be the cause of the vast majority of falls.

7.1. Preventing falls

Older adults can keep on their independence for their daily life activities and reduce their experience of falling through exercising regularly, asking their doctor to revise their medicine use due to dizziness, having their eyes checked, and making their homes safer [50,77,78].

Because half of all falls occur at home, below are some suggested steps that may be considered to make the home safer (Table 4) [51,79].

Remove things you can trip over, such as papers, books, clothes, and shoes, from stairs and places where you walk.
Remove small throw rugs or use double-sided tape to keep the rugs from slipping.
Keep the items you use often in cabinets you can reach easily without using a step stool.
Have grab bars put next to your toilet and in the tub or shower.
Use non-slip mats in the bathtub and on shower floors.
Improve the lighting in your home. As you get older, you need brighter lights to see well. Lamp shades or frosted bulbs can reduce glare.
Put handrails and lights in all staircases.
Wear shoes that give good support and have thin non-slip soles. Avoid wearing slippers and athletic shoes with deep treads.

Table 4. Safety tips for preventing falls at home

Fall prevention for people with Alzheimer's Disease and other types of dementia is vital. The key point for reducing falls in people with dementia is to understand why they fall and what causes the falls (Figure 3) [78]. Restlessness, discomfort or pain, hunger or thirst, a need to use the bathroom, boredom, and loneliness were other contributors to falls [78-81].

Some studies indicate that cognitive impairment is associated with Alzheimer disease and increase fall risk among older adults. Strategies including multifactorial assessment should be considered to prevent the risk of falling [24,25,82]. Falls are a prevalent health problem in the geriatric population and can result in severe somatic and psychological consequences. Fall risk assessment can provide knowledge to make and develop suitable interventions for identifing persons at risk [21,83].
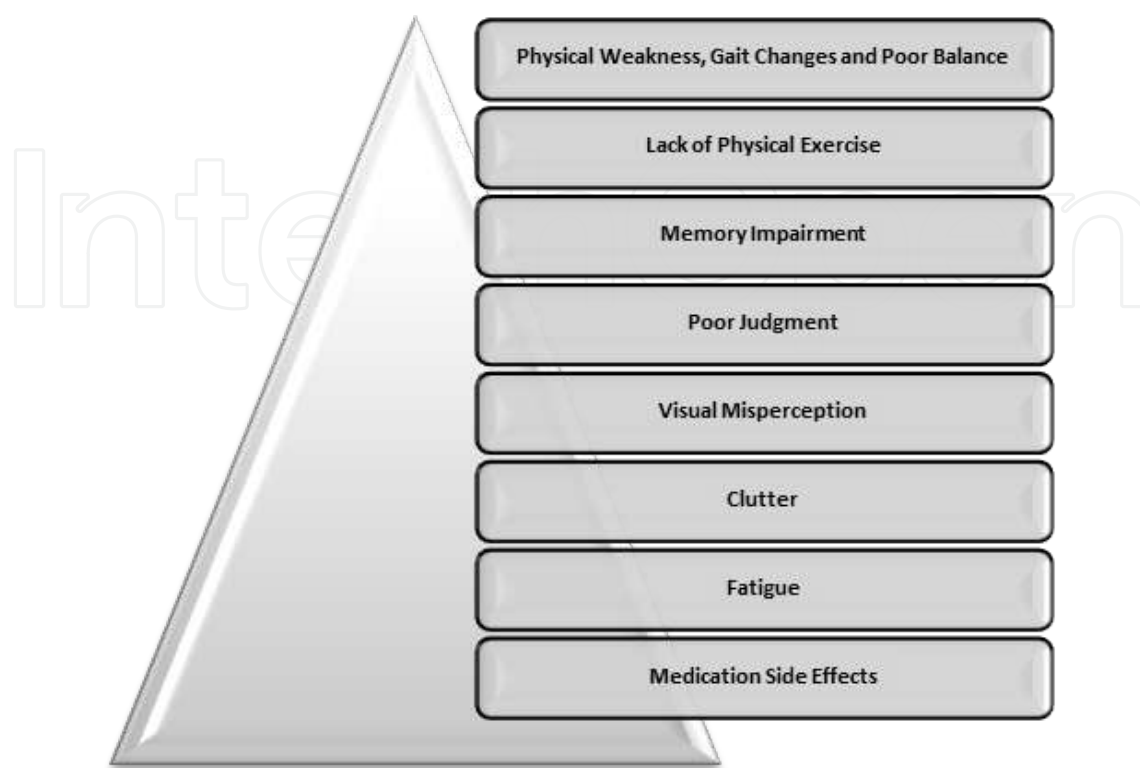
Figure 3. Causes of Falls among People with Alzheimer's Disease

8. How can we avoid accidents and reduce the risk of falls?

Aged people with dementia want to carry on their everyday life at home for as long as possible. However, it can be difficult managing everyday situations if you have dementia, particularly as the dementia progresses and as you get older. In conclusion, some people may not be as safe at home as they used to be. Some risk factors and suggested ways to manage them were mentioned below [84].

Occupational therapy provides practical support to help people do their day-to-day tasks, hobbies, interests, and activities (Figure 4 and 5). People who want to take an occupational therapy assessment can consult their local social services or their psychology experts related to occupational therapy [84].

Other preventions to reduce the risk of falls are: store dangerous substances safely, improve home environment, manage daily activities such as cooking or bathing through adaptations, avoid fire including fitting smoke alarms and carbon monoxide detectors, stay safe outdoors, use support networks, arrange access especially for family member or care worker, and record contact names and numbers belong to carers, friends, or family members [84].
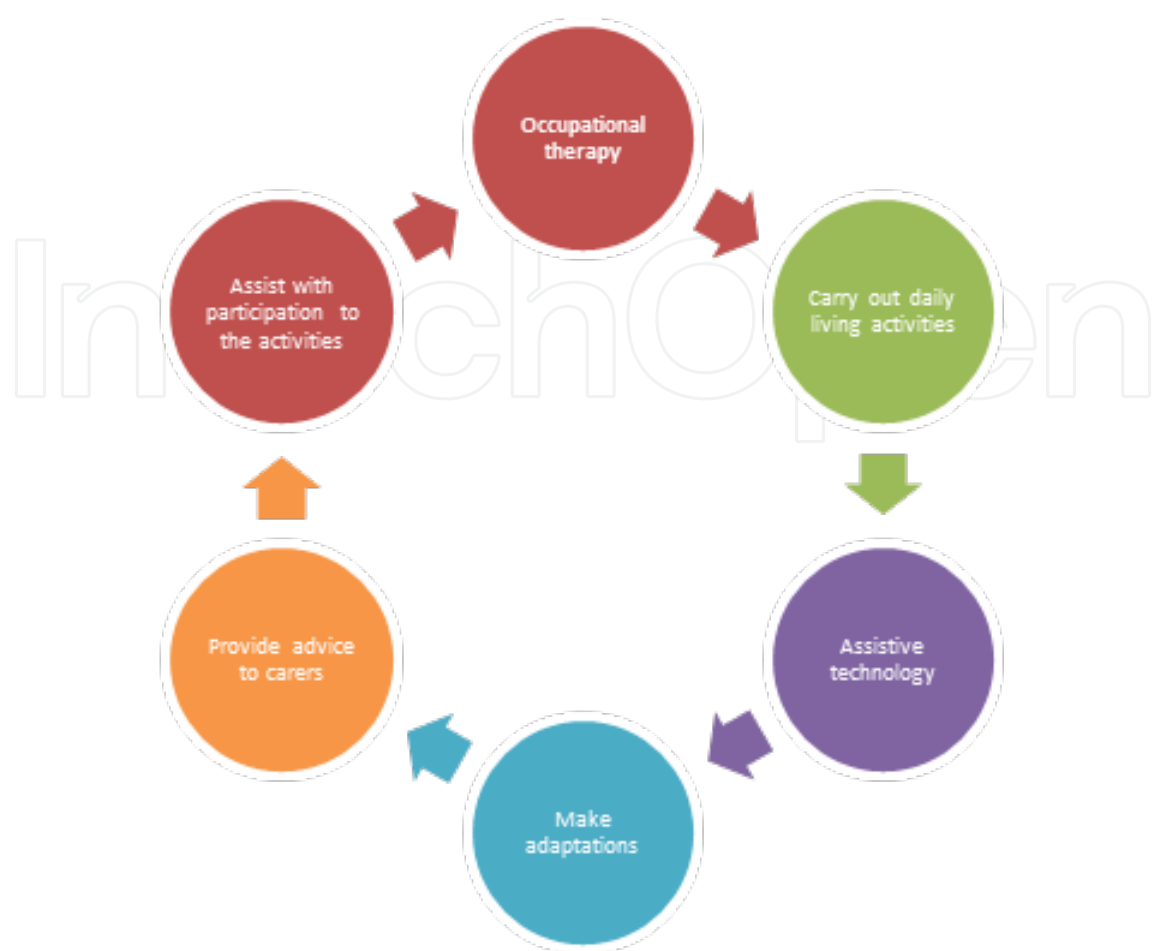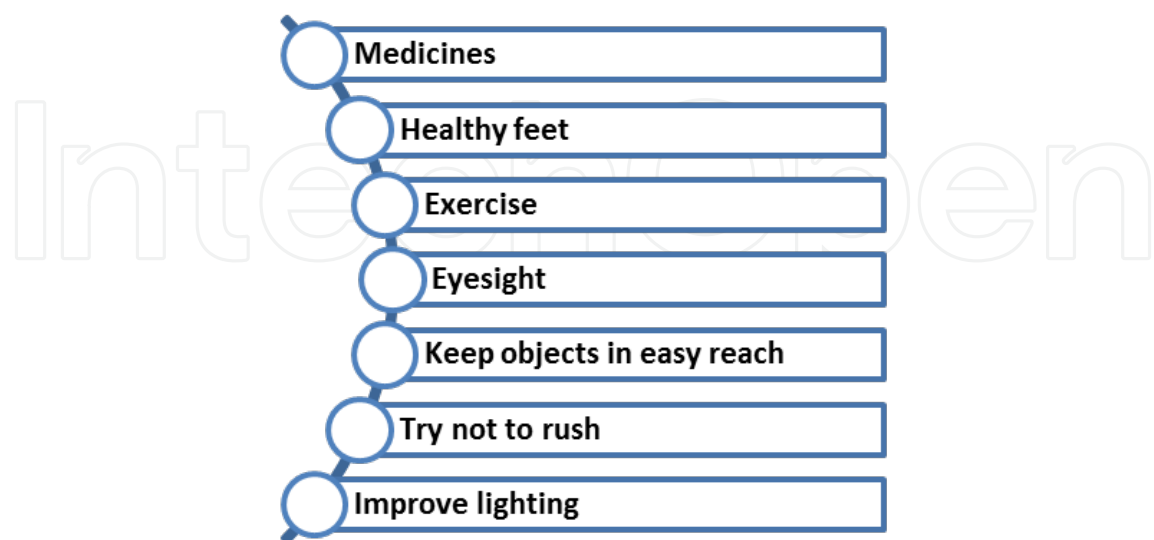
Figure 4. Seek advice from an occupational therapist.

Figure 5. Steps to reduce the risk of falling at home.

9. Conclusion

With ageing, the risk of dementia and falls prevalence increases. Falls are one of the important risks for comorbidity and mortality in the aged population. Preventing strategies must be performed and must be related with the individual as well as the health services and the politics area. Only the implementation of prevention services may be solve this problem because the dementia and AD have a progressive decline process and there is currently no known alternative treatment for these pathologic conditions.

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