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Prevalence and Gender-Based Risk Factors of Alzheimer's Disease in District Nowshera, Pakistan: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Background: Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the leading cause of dementia worldwide. It primarily affects memory, cognition, and behavior, with increasing prevalence among aging populations. Limited data exist regarding its burden and risk factors in Pakistan. This study aimed to determine the prevalence and gender-based risk factors of Alzheimer's disease in District Nowshera. **Methods:** A hospital-based descriptive cross-sectional study was conducted at Qazi Hussain Ahmed Medical Complex, Nowshera, from August to October 2022. A total of 80 clinically diagnosed Alzheimer's patients aged 50 years and above were enrolled through purposive sampling. Data were collected using a structured questionnaire focusing on demographic variables, symptoms, and risk factors. The data were analyzed using Microsoft Excel to calculate frequencies and percentages. **Results:** Among 80 participants, 61 (76.25%) were female and 19 (23.75%) were male, indicating a higher prevalence in women. The majority of patients were aged 60–65 years. Common symptoms included memory loss (80%), confusion (95%), and forgetfulness (96%). Major risk factors were depression (95%), diabetes (75%), low education (80%), and psychosocial stress (84%). Smoking was predominant among males (84%). Family history was reported in 68% of females and 89% of males. **Conclusion:** Alzheimer's disease is increasingly prevalent among elderly individuals in Nowshera, with a higher burden in females. Depression, diabetes, smoking, and low education were significant risk factors. Early detection, mental health support, and public awareness are essential to reduce the disease burden in Pakistan.

INTRODUCTION

Alzheimer's disease (AD) is a progressive neurodegenerative disorder primarily associated with aging and characterized by cognitive decline, memory loss, and impaired daily functioning. It represents the most common cause of dementia globally, accounting for 60–70% of all dementia cases (Braak et al., 1996). The disease is linked with neuronal degeneration and cytoskeletal abnormalities, particularly the accumulation of neurofibrillary tangles and amyloid plaques within the brain. These pathological changes lead to a gradual loss of neurons, synaptic dysfunction, and ultimately, irreversible cognitive impairment (D. Roses, 1995).

Historically, Alzheimer's disease was first described by the German psychiatrist and neuropathologist Alois Alzheimer in 1906 during a meeting of the Southwest German Society for Psychiatry, where he presented the case of Auguste Deter—a 55-year-old woman who exhibited memory loss, confusion, and behavioral changes. The term "Alzheimer's disease" was later introduced by Emil Kraepelin in 1910 and has since become a defining concept in neurodegenerative disease research (Cipriani

et al., 2011). Every year, September 21st is observed as World Alzheimer's Day to raise awareness of this debilitating condition.

Clinically, Alzheimer's disease manifests with symptoms such as progressive memory loss, mood changes, irritability, and loss of cognitive and functional abilities (James & Mack, 1994). Behavioral disturbances, including delusions, agitation, and sleep disturbances, are also frequent and often require pharmacological management such as thioridazine or other antipsychotic medications (Barry, 1987). The use of neuroimaging tools, particularly magnetic resonance imaging (MRI), has proven essential for diagnosing AD by revealing structural brain abnormalities, hippocampal atrophy, and cortical thinning (Faturrahman et al., 2017).

In recent years, various treatment approaches have been explored to mitigate the progression of AD. One promising therapeutic strategy involves β-amyloid peptide immunization, which aims to reduce amyloid pathology and stimulate an immune response against amyloid plaques (Schenk et al., 2000). Pharmacological treatments currently focus on symptomatic relief through

cholinesterase inhibitors and NMDA receptor antagonists such as memantine. Although these medications offer modest cognitive and behavioral improvements, they do not halt disease progression (Winslow et al., 2011; Massoud, 2011).

The etiology of Alzheimer's disease is multifactorial, involving a combination of genetic, lifestyle, and environmental factors. Major modifiable risk factors include smoking, hypertension, diabetes mellitus, obesity, and depression (Norton et al., 2014; Usman et al., 2010). Cardiovascular health plays a particularly important role, as elevated blood pressure, high cholesterol levels, and insulin resistance have been linked with increased AD risk (Kivipelto et al., 2001; Luchsinger & Mayeux, 2004). In addition, psychosocial stress, low education level, and social isolation contribute significantly to disease development, particularly in older adults and females, who show a higher prevalence compared to males (Usman et al., 2010).

Early-life factors may also influence susceptibility to Alzheimer's disease. Borenstein et al. (2006) identified several developmental and environmental exposures—such as prenatal conditions, early childhood nutrition, brain development, socioeconomic background, and educational stimulation—that shape cognitive reserve and resilience against neurodegeneration later in life.

In Pakistan, Alzheimer's disease and other dementias remain underdiagnosed and underreported due to a lack of awareness, limited diagnostic facilities, and sociocultural stigma. Depression and anxiety are common psychiatric comorbidities among AD patients, further worsening cognitive decline and quality of life (Usman et al., 2010). Given Pakistan's rapidly aging population, low literacy rate, and high prevalence of cardiovascular and metabolic disorders, Alzheimer's disease poses a growing public health challenge.

This study was therefore designed to evaluate the prevalence and gender-based risk factors of Alzheimer's disease among patients in District Nowshera, Khyber Pakhtunkhwa, Pakistan. Understanding the demographic distribution, major risk factors, and symptom patterns will help inform public health interventions, improve early diagnosis, and promote preventive strategies to reduce the burden of Alzheimer's disease in local communities.

MATERIALS AND METHODS

Study Area
This research was conducted at Qazi Hussain Ahmed Medical Complex, Nowshera, Khyber Pakhtunkhwa, Pakistan. The hospital serves as a major tertiary care center in the region, catering to both urban and rural populations. The study site was chosen due to its accessibility to patients from diverse socioeconomic backgrounds and its diagnostic capacity to identify neurological and psychiatric disorders, including Alzheimer's disease.

Study Duration
The study was carried out over a period of three months, from August to October 2022. This duration was sufficient to collect and analyze data from a representative number of Alzheimer's disease patients visiting the facility during the study period.

Study Population

The study population consisted of male and female patients aged 50 years and above who were diagnosed with Alzheimer's disease and attended the outpatient or inpatient departments of Qazi Hussain Ahmed Medical Complex. Inclusion of both genders allowed for comparison of gender-based variations in prevalence and associated risk factors.

A total of 80 patients were enrolled in the study. Among them, 61 (76.25%) were female and 19 (23.75%) were male. For analytical purposes, patients were categorized into three age groups:
• Group I: 50–60 years
• Group II: 60–65 years
• Group III: Above 65 years

In Group I, 19 females (23%) and 6 males (7%) were included.

In Group II, 21 females (26%) and 11 males (13%) participated.

In Group III, 17 females (21%) and 6 males (7%) were included.

Study Design
This was a hospital-based, descriptive cross-sectional study designed to determine the prevalence and gender-based risk factors associated with Alzheimer's disease. Data were collected using a structured questionnaire and interview method, which provided comprehensive information about the patients' demographic characteristics, symptoms, and risk factors. The cross-sectional design allowed assessment of disease distribution and associated factors at a single point in time.

Sample Size
A total of 80 patients diagnosed with Alzheimer's disease were selected using a non-probability purposive sampling technique. This sample size was deemed appropriate for descriptive statistical analysis, considering the limited number of Alzheimer's patients visiting the study site within the specified period.

Inclusion Criteria:
• Patients aged 50 years and above diagnosed with Alzheimer's disease.
• Both male and female patients attending the hospital during the study period.
• Patients or their caregivers willing to provide informed consent and participate in the interview.

Exclusion Criteria:
• Patients with other neurodegenerative diseases (e.g., Parkinson's disease, vascular dementia).
• Patients below 50 years of age.
• Individuals unable to communicate or complete the questionnaire due to severe cognitive impairment without a caregiver's assistance.

Data Collection Tool (Questionnaire Method)
Data were collected through a structured questionnaire comprising 20 close-ended questions. The questionnaire included sections related to:
• Demographic information (age, gender, education, and occupation)
• Clinical symptoms (memory loss, confusion, difficulty in performing tasks, sleep disturbances, and language problems)
• Risk factors (stress, diabetes, smoking, obesity, hypertension, family history)

•Treatment history and lifestyle patterns (exercise, diet, and medical management)

Questionnaires were filled through face-to-face interviews with the patients and, where necessary, with their caregivers to ensure accurate reporting of symptoms and background information.

Ethical Considerations

Ethical approval for the study was obtained from the Ethical Review Committee of Qazi Hussain Ahmed Medical Complex, Nowshera. Informed consent was taken from all participants or their legal guardians prior to inclusion in the study. Confidentiality and anonymity of all patient data were strictly maintained throughout the research process.

Data Analysis

Collected data were first checked for completeness and accuracy, then entered and analyzed using Microsoft Excel (Version 2022). Descriptive statistics such as frequency and percentage were used to present data related to demographic variables, prevalence rates, symptoms, and risk factors. Graphical representations including bar charts and pie diagrams were used to illustrate the results for clarity and comparison between male and female participants.

Limitations of the Study

The study was limited by its small sample size and single-center design, which may not fully represent the entire population of District Nowshera. Additionally, due to the cross-sectional nature of the study, causal relationships between risk factors and Alzheimer's disease could not be established.

RESULTS

A total of 80 patients clinically diagnosed with Alzheimer's disease were included in this study at Qazi Hussain Ahmed Medical Complex, Nowshera. Data were collected using a structured questionnaire and verified through MRI and clinical examination. The results are summarized below.

Gender-wise Distribution of Alzheimer's Disease

Out of 80 patients, 61 (76.25%) were female and 19 (23.75%) were male, indicating that Alzheimer's disease was more prevalent among females in the study population.

Gender	Number of Patients (n = 80)	Percentage (%)
Female	61	76.25%
Male	19	23.75%

Interpretation:

The results show that the prevalence of Alzheimer's disease was significantly higher among females compared to males, suggesting possible hormonal, social, and lifestyle influences that may increase vulnerability among women.

Age-wise Distribution of Patients

Patients were divided into three age categories: 50–60 years, 60–65 years, and above 65 years. The distribution by gender is shown below.

| Age Group (years)	Female (n)	Male (n)	Female (%)	Male (%)
50–60	19	6	23%	7%
60–65	21	11	26%	13%
>65	17	6	21%	7%
Total	**57**	**23**	**70%**	**27%**

Interpretation:

The highest number of Alzheimer's cases was recorded in the 60–65 years age group, followed by the 50–60 years and above 65 years categories. The disease was observed to increase with age, with females showing higher representation in all groups.

Common Symptoms Among Patients

The most frequent symptoms reported by both male and female patients included memory loss, confusion, difficulty in performing familiar tasks, learning problems, sleep disturbance, and forgetfulness during conversation

Symptoms	Male (%)	Female (%)
Memory loss	68%	80%
Confusing personality	63%	95%
Difficulty in learning	89%	86%
Sleep disturbance (insomnia)	10%	18%
Forgetting words during speech	94%	96%

Figure.1.3. Symptoms of Alzheimer disease in male and female patients of districtNowshera.
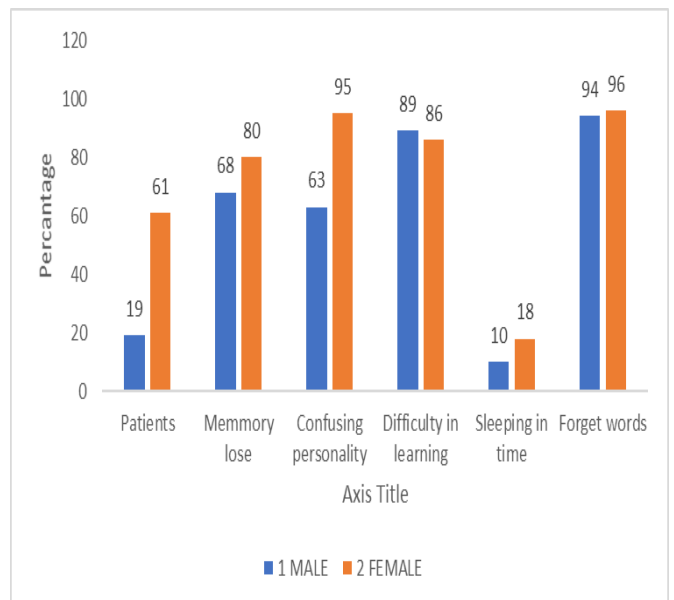
Interpretation:

Memory loss and confusion were the most prevalent symptoms among all patients. The frequency of cognitive and behavioral symptoms was consistently higher in females than in males.

Risk Factors Associated with Alzheimer's Disease

Several potential risk factors were identified among the study population, including depression, diabetes, smoking, low education, and social problems.

Risk Factor	Male (%)	Female (%)
Depression	78%	95%
Social problems	84%	93%
Diabetes	73%	75%
Smoking	84%	0%
Low education level	89%	80%
Family incidents/stress	84%	62%

Interpretation:

Depression, low educational attainment, and social problems were the most significant risk factors, especially among females. Smoking was a dominant risk factor among males, while psychosocial stress was common across both genders

Treatment History

Treatment responses were divided into three categories: **no treatment (nil)**, **surgery**, and **medication**. Most participants reported reliance on medication as the primary management strategy.

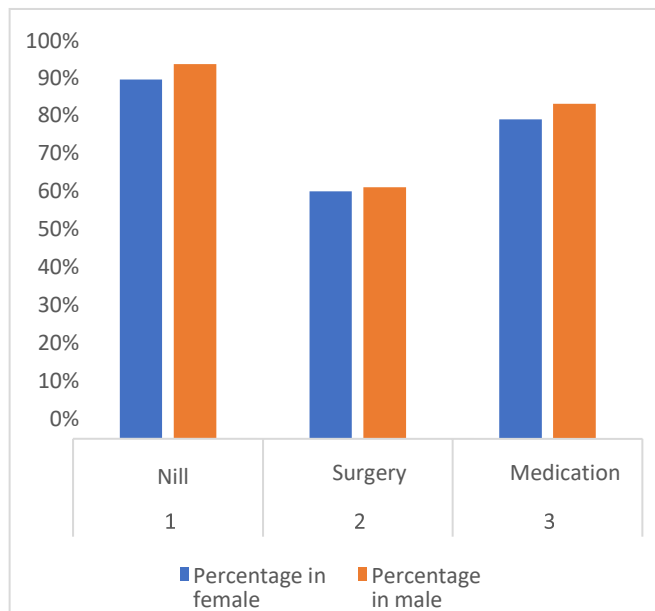| Treatment Type	Male (%)	Female (%)
Nil (no treatment)	94%	96%
Surgery	62%	63%
Medication	80%	84%

**Figure.1.5. Show the previous treatment in male and female.**

Interpretation:

The majority of patients had received pharmacological treatment, while very few reported surgical interventions. A notable portion of patients had received no medical treatment prior to diagnosis, reflecting limited awareness and healthcare access.

Family History of Alzheimer's Disease

A family history of Alzheimer's disease was found in a considerable number of patients, particularly among males.

Gender	Percentage with Family History (%)
Male	89%
Female	68%
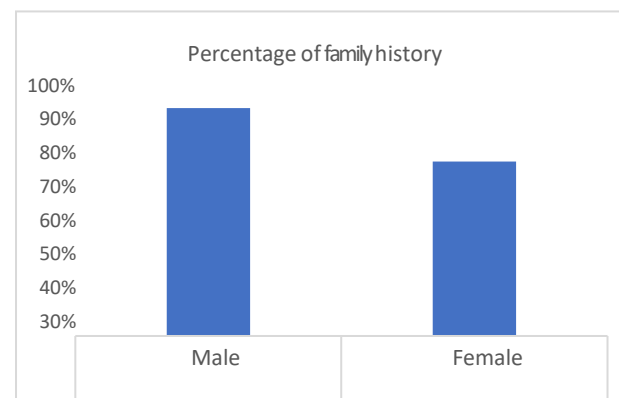
Interpretation:

A positive family history was more common in male patients, suggesting potential hereditary or genetic factors contributing to disease risk.

Summary of Key Findings

- Alzheimer's disease prevalence was higher in **females (76.25%)** than in males (23.75%).
- The majority of patients were aged **60–65 years**, indicating an increase in prevalence with advancing age.
- **Memory loss, confusion, and forgetfulness** were the most common symptoms.
- **Depression, diabetes, smoking, and low education** emerged as significant risk factors.
- **Family history** and **psychosocial stress** were strongly associated with disease occurrence.
- Despite the high burden, many patients remained **undiagnosed or untreated** prior to hospital consultation.

DISCUSSION

The present study aimed to evaluate the prevalence and gender-based risk factors of Alzheimer's disease among patients attending Qazi Hussain Ahmed Medical Complex, Nowshera. A total of 80 patients diagnosed with Alzheimer's disease were included in the study, of which 61 (76.25%) were females and 19 (23.75%) were males. The findings revealed a significantly higher prevalence of Alzheimer's disease among females compared to males, consistent with global epidemiological patterns (Barnes et al., 2011; Ertekin et al., 2015).

Gender and Age Distribution

The predominance of Alzheimer's disease among females in this study aligns with findings reported by Ertekin et al. (2015) in the Eastern region of Turkey, who observed that the disease was more frequent in women, particularly in the elderly age group. Biological factors such as hormonal changes after menopause, longer life expectancy, and increased susceptibility to metabolic and vascular risk factors may contribute to the higher female prevalence (Cipriani et al., 2011).

Furthermore, the age-wise analysis revealed that the frequency of Alzheimer's disease increased with advancing age, with the majority of patients falling within the 60–65 years category. This observation corroborates earlier findings by Hebert et al. (2013), who reported that the prevalence of Alzheimer's disease doubles every five years beyond the age of 65. The progressive nature of neurodegeneration and cumulative exposure to risk factors over time make aging the most significant determinant of disease occurrence.

Symptom Profile

In the present study, common symptoms such as memory loss, confusion, difficulty in performing daily tasks, and forgetfulness were prominent in both genders but more intense among female patients. This finding is in agreement with James and Mack (1994), who emphasized that cognitive and behavioral symptoms such as irritability, sleep disturbances, and language impairment are characteristic features of Alzheimer's disease. Neuroimaging studies have demonstrated that these

clinical symptoms correlate with hippocampal and cortical atrophy, which are hallmark structural changes in Alzheimer's pathology (Faturrahman et al., 2017).

Risk Factors

The study identified several modifiable risk factors including depression, diabetes, smoking, low education, and psychosocial stress. Depression was highly prevalent among female patients, in line with the findings of Usman et al. (2010), who reported that depression and lack of social support are significant contributors to Alzheimer's disease progression in Pakistani patients. Similarly, Barnes et al. (2011) highlighted that modifiable lifestyle factors such as obesity, smoking, and low educational attainment could account for up to one-quarter of Alzheimer's disease cases worldwide.

Smoking, though absent in female patients in this study, was a major risk factor among males (84%), consistent with Luchsinger and Mayeux (2004), who observed that smoking exacerbates cerebrovascular damage, thereby accelerating cognitive decline. The strong association between diabetes and Alzheimer's disease also mirrors findings by Kivipelto et al. (2001), who linked insulin resistance and hyperglycemia with neurodegenerative processes.

The influence of education level was also notable; participants with low educational attainment exhibited higher rates of Alzheimer's disease. This supports the concept of "cognitive reserve," where higher education enhances neuronal resilience against age-related degeneration (Stern et al., 1994). Psychosocial stress and social isolation, observed in both genders, further contributed to disease risk, reflecting broader public health challenges in resource-limited communities.

Treatment and Family History

The majority of patients reported pharmacological treatment with cholinesterase inhibitors and memantine, while few had received surgical or specialized interventions. A substantial portion of patients had never received formal treatment before hospital admission, indicating a lack of awareness and delayed healthcare-seeking behavior.

Family history of Alzheimer's disease was observed in 68% of females and 89% of males, suggesting a possible genetic predisposition. Previous studies have shown that familial clustering of Alzheimer's disease may be linked to genetic variants in the *APOE* gene and other loci associated with amyloid and tau pathology (Borenstein et al., 2006). Overall, the findings from this study are consistent with global and regional trends, underscoring that Alzheimer's disease in Pakistan is influenced by a combination of age, gender, genetics, lifestyle, and psychosocial factors.

CONCLUSION

The current study highlights that Alzheimer's disease is a growing neurodegenerative condition in District Nowshera, with a clear predominance among females and elderly individuals. The results demonstrate that **76.25%** of the Alzheimer's patients were female, emphasizing gender-related biological and social determinants of health. The key risk factors identified in this study included depression, low educational attainment, diabetes, smoking, psychosocial stress, and family history of Alzheimer's disease. Among these, depression and social stress were more frequent in females; while smoking and familial predisposition were more common in males. The disease was also found to increase with advancing age, particularly beyond 60 years.

From these findings, it can be concluded that:

1. Alzheimer's disease prevalence is notably higher in elderly females in District Nowshera.
2. Modifiable lifestyle factors such as smoking, poor glycemic control, and lack of physical activity play a substantial role in disease progression.
3. Psychological and social stressors significantly contribute to disease onset, especially among low-income and less-educated populations.
4. Early diagnosis, community-based awareness, and preventive strategies focusing on lifestyle modification and mental health are essential to mitigate the rising burden of Alzheimer's disease in Pakistan.

Future studies with larger sample sizes and inclusion of biochemical and neuroimaging markers are recommended to explore genetic susceptibility and environmental influences in greater depth. Strengthening healthcare awareness programs, particularly among women and the elderly, can play a vital role in early detection and improved disease management.

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