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PREVALENCE OF EXECUTIVE DYSFUNCTION IN OLDER ADULTS WITH NEUROLOGICAL DISORDERS IN PAKISTAN: A PRISMA-COMPLIANT SYSTEMATIC REVIEW

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Abstract

Background: *Executive dysfunction, characterized by impairments in working memory, attentional shifting, inhibitory control, and task planning, significantly affects the daily functioning of older adults. Neurological diseases, including Parkinson's disease, stroke, and epilepsy, contribute to executive dysfunction; however, prevalence patterns among older adults in Pakistan remain unclear.*

Aims: *The current systematic review aimed at quantifying the prevalence of executive dysfunction in Pakistani adults aged 60 years and above with the diagnosis of neurological disorders, to identify demographic and clinical features, and identify critical gaps in the existing literature.*

Methods: *A systematic search was implemented in the PubMed, Scopus, Web of Science, PsycINFO, PakMediNet, and Google Scholar according to the PRISMA guidelines. Studies reporting executive-function outcomes in older adults diagnosed with Parkinson's disease, stroke, dementia, epilepsy, multiple sclerosis, or traumatic brain injury were included. Data were extracted in the following categories; disorder type, sample characteristics, regional distribution, assessment tools and prevalence estimates of executive dysfunction.*

Results: *The inclusion criteria were met in eight studies, which included about 29,700 participants. Executive dysfunction prevalence was 22-38% with the highest prevalence in Parkinson's disease (30-38%), then post stroke cognitive impairment (22.4%), and epilepsy (28-35%). The most commonly affected domains were the working memory, attentional shifting and the inhibitory control. The urban centers (Karachi, Lahore, and Rawalpindi) were found to be the main source of providing the evidence base, whereas rural populations were underrepresented.*

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Conclusion: *Executive dysfunction is a common but under-recognized outcome of neurological diseases among older adults in Pakistan. The current results demonstrate the dire necessity of culturally validated, standardized executive-function tests, population-based and longitudinal studies. It is recommended that cognitive screening should be introduced into regular clinical practice to inform early intervention measures, cognitive rehabilitation programs and the public health policy initiatives in improving the functional outcomes and quality of life of older adults in Pakistan.*

1. INTRODUCTION

Executive dysfunction refers to impairments of the higher-order cognitive functions that support planning, organization, initiation, monitoring and control of goal-oriented behavior. All of these processes are known as executive functions and they involve working memory, inhibitory control, cognitive flexibility (including attentional shifting), and emotional regulation (Diamond, 2013; Miyake & Friedman, 2012). Executive dysfunction is closely linked to functional decline, reduced autonomy, increased caregiver burden, lower treatment adherence, and poorer quality of life in older adults (Diamond, 2013; Lezak et al., 2012). Neurological diseases are one of the leading and fast-growing sources of morbidity in the ageing populations of the world, often with cognitive deficit, especially in the executive functional domains. Stroke, dementia, Parkinson's disease, and epilepsy, among others, are conditions that have a disproportionate effect on executive functioning by damaging both frontal-subcortical and vascular neural networks. In low- and middle-income countries (LMICs), there is an additional effect that the executive dysfunction has due to the limited access to early diagnosis, rehabilitation, and standardized cognitive assessment (Siddique et al., 2024; Wasay et al., 2023).

Neurological disorders represent a large percentage of adult morbidity in Pakistan (Wasay et al., 2023). According to investigations conducted at hospitals, about 20% of adult cases of neurology include vascular neurology conditions, that is epilepsy (12.5%), dementia (8%) and movement disorders (Parkinson's disease, 7.9%). There is emerging evidence to show that executive dysfunction is prevalent in these disorders. As an example, research on Parkinson's disease shows that over one in every three elderly patients have cognitive impairment where the executive domains are mostly impaired specifically in working memory, inhibitory control and cognitive flexibility. Similarly, a significant percentage of the elderly stroke survivors have post-stroke cognitive impairment and dementia, and an important characteristic of vascular cognitive impairment refers to executive dysfunction. It has also been reported in epileptics of adult age and this indicates that executive impairment is a transdiagnostic outcome of disabilities of the nervous system. Along with this growing literature, the prevalence and distribution of executive dysfunction among older adults with neurological conditions in Pakistan at the population level are yet to be outlined. The current literature is mostly institutional and usually focuses on global cognitive impairment or dementia and heavily dependent on screening tools with low sensitivity to the executive domains. In addition, variation in the method of assessment, and irregularity of reported age-specific data also make the meaningful synthesis of prevalence estimates difficult. As a result, the real burden and epidemiology of the executive dysfunction among older Pakistani adults with neurological conditions are insufficiently known.

It is thus justified that a systematic synthesis of the evidence available be conducted in order to bring together the existing evidence, outline prevalence patterns disorder-specific, and outline gaps in measurement and reporting that are of critical concern. The scale and scope of the executive

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dysfunction is the key information that can be used to inform clinical assessment practice, to guide cognitive rehabilitation and to form evidence-based health policy in regard to the ageing population of Pakistan.

2. Literature Review

This part will summarize the available empirical data on the topic of executive dysfunction among the Pakistani elderly who are affected by neurological conditions. The review evaluates the characteristics of the study, pattern of disorder-specific prevalence, geographic skew, demographic correlates, and the modalities of assessment, research gaps that are salient.

2.1 Study Characteristics

Most studies on executive dysfunction in Pakistan are hospital based and conducted in tertiary care centers located in large urban areas. The sample sizes are highly heterogeneous, including small and disorganized cohorts (50-124 individuals) and large and multicenter surveys with over 28,000 neurological patients (Wasay et al., 2023). Majority of the studies are cross sectional in design due to the logistical and resource pressures inherent to low- and middle-income economies. The participants are mostly older adults (ages of 55-90 years) with the median age of the participants falling within the sixth and seventh decades. Despite being balanced, the proportion of males is disproportionate in the research that incorporated studies on Parkinson's disease and the post-stroke demographics (Taimur et al., 2019; Khan et al., 2025). Executive dysfunction is often not explicitly operationalized, many studies also exhibit global cognitive impairment, but in an unspecified manner, which generates methodological heterogeneity.

2.2 Prevalence of Executive Dysfunction

There is a range of studies that have reported prevalence of executive dysfunction among older adults with neurological disorders in Pakistan with varying degrees of appreciation. The cognitive impairment of a patient with a severe executive deficit is seen in about one-third of patients with Parkinson's disease (Taimur et al., 2019). The incidence of post stroke dementia has been recorded to be 22.4% in geriatric stroke survivors, with executive dysfunction becoming a key element of vascular cognitive impairment (Khan et al., 2025). Epileptic patients exhibit executive deficits in around 28-35% compared to age controls (Jaffri et al., 2022). These figures are disorder-specific estimates based on clinical samples, as opposed to population-based prevalence; there are limitations to their comparability because of design and performance differences.

2.3 Disorder-Specific Evidence

Stroke: Among elderly stroke survivors, there is often poststroke cognitive impairment that involves problems with executive functions, in particular, working memory, cognitive flexibility, and planning. These deficits coincide with the damage to frontal-subcortical and vascular networks and have a significant negative impact on functional autonomy (Khan et al., 2025).

Dementia: The prevalence of cognitive impairment in older adults in Pakistan has been reported to range between 20-28% among Pakistani adults, with executive dysfunction usually associated with memory and attention deficits (Siddiqi et al., 2024). However, the majority of studies are based on generic cognitive screening instruments, and hence they do not allow a close evaluation of executive functions.

Parkinson's Disease: The PD is the most widely studied neurological disorder as compared to executive dysfunction in Pakistan. Cognitive impairment is mentioned in 36.3% of patients, with the executive functions of inhibitory control, working memory, and cognitive flexibility are unevenly impacted (Taimur et al., 2019). Specific executive tests have affirmed severe impairment as

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compared to healthy controls (Gul & Youseaf, 2021).

Epilepsy: Epileptic older adults display quantifiable executive impairments, especially in attention and working memory, and the prevalence rates of epilepsy range between 28-35% (Jaffri et al., 2022). The impairments can be controlled by the seizure features, duration of the disease, and antiepileptic drugs, but these factors are not consistently reported.

Other Neurological Conditions: The executive dysfunction of older adults with traumatic brain injury and multiple sclerosis has little evidence base in Pakistan. Although these groups make significant contributions to neurological disability, executive outcomes in these groups remain mostly uncharted (Wasay et al., 2023).

2.4 Geographic Distribution

The current evidence is highly located in urban centers like Karachi, Lahore and Rawalpindi which reflects a tertiary distribution of the neurological services. Nationwide studies provide more extensive epidemiological, but often lack specific cognitive or executive-domain results. This means that generalizability is limited since rural and underserved populations are underrepresented.

2.5 Assessment Tools

The most frequently used instrument of cognitive screening is the Mini-Mental State Examination (MMSE) which gives a limited sensitivity to executive malfunction. Executive-specific tests like the Executive Interview (EXIT-25) and Trail Making Test Part B are also used rather rarely and mostly in Parkinson's disease groups (Gul and Yousaf, 2021; Taimur et al., 2019). A lack of standardized executive-function assessment also is a major factor in the reported heterogeneity.

2.6 Research Gaps

The literature indicates that executive dysfunction is common but inadequately characterized among older adults with neurological disorders in Pakistan. Major gaps include reliance on hospital-based samples, inconsistent operationalization of executive dysfunction, limited use of executive-specific instruments, and insufficient representation of rural populations. These limitations highlight the need for standardized, culturally validated executive-function assessments and population-based studies to better estimate prevalence and inform clinical practice and policy.

3. Methods

To ensure methodological transparency and reproducibility, this systematic review was done in the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

3.1 Eligibility Criteria

Selection of studies was done according to pre-set inclusion and exclusion criteria, organized around population, condition, outcomes and study design.

Inclusion Criteria

The studies included in the study must have:

1. Aged individuals of 60 years and above living in Pakistan;
2. Diagnosed with a neurological condition, such as but not restricted to stroke, Parkinson's disease, dementia, epilepsy, traumatic brain injury, or multiple sclerosis;
3. Impaired executive functioning evaluated directly or reported cognitive impairment with discernible domains of executive functioning (e.g., working memory, inhibitory control, cognitive flexibility or planning);
4. Quantitative study designs were used, such as cross-sectional studies, cohort studies, or case-control studies;
5. Had at least 10 subjects in the sample; and
6. Published in peer-reviewed English journals.

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Exclusion Criteria

Studies were excluded if they:

- Were reviews, editorials, commentaries, letters, abstracts of conferences, or case reports;
- Failed to report original data on cognitive or executive functioning;
- Did not have clear diagnostic criteria of neurological disorders;
- Targeting the non-Pakistani communities; or
- Oddball samples with no reported data of older adults or too little age-specific data.

3.2 Search Strategy

To find out the relevant studies, a thorough and methodical literature search was performed to find the studies that were published until December 2025. The following electronic databases were used: PubMed, Scopus, Web of science, PsycINFO, PakMediNet, and Google scholar (first 200 results). The controlled vocabulary and free-text search terms were generated based on the terms related to executive dysfunction (e.g., executive dysfunction, executive function, working memory, inhibitory control, cognitive flexibility, attention shifting), neurological disorders (e.g., stroke, dementia, Parkinson's disease, epilepsy, multiple sclerosis, traumatic brain injury), ageing (e.g., older adults, elderly, aged), and a geographic location (Pakistan). Appropriate Boolean operators were used such as AND, OR and truncation. The search strategies in each database were also modified to be the most sensitive. Besides this, reference lists of included articles were screened manually to come up with any supplementary relevant study.

3.3 Study Selection

The retrieved records were all imported into a reference managing software and the duplicates were then deleted. Two reviewers screened titles and abstracts to determine possible eligibility. Articles with full-text were then retrieved and considered according to the inclusion criteria. Any differences in opinions between reviewers at any point of the screening process were solved by discussion. Third reviewer, in case no agreement was made possible. A PRISMA flow diagram was used to record the process of the study selection.

3.4 Data Extraction

Two reviewers extracted the data using a standardized data extraction form.

Information extracted included:

- Characteristics of study (author, year of publication, study design, city, or region);
- Participant (sample size, mean age or age range, gender distribution);
- Neurological disorder type;
- Tools of executive functioning and cognitive evaluation used (e.g., MMSE, EXIT -25, Trail Making Test Part B, neuropsychological batteries);
- Relevant prevalence or frequency of executive dysfunction or executive-domain impairment; and
- Available information on pertinent comorbidities (e.g., high blood pressure, diabetes, depression).

Any differences in the extracted data were solved by having the reviewers discuss it and cross-cheque with the initial articles.

3.5 Quality Assessment

The quality of methodological value of the included studies was determined with the help of Joanna Briggs Institute (JBI) Critical Appraisal Checklists suitable to the design of the study. It evaluated the sampling techniques, validity of measurements, clarity of results and the statistical analyses that were used. Two reviewers independently carried out quality assessment and disagreements were overcome through consensus. Findings were interpreted based on quality ratings which were not employed as exclusion criteria.

3.6 Data Synthesis and Analysis

There was no meta-analysis given the high degree of heterogeneity in the study samples, conditions of the nervous system, executive functions definition, and measures. Rather, narrative synthesis approach was followed.

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Synthesis and organization of findings were done based on:

- Neurological disorder type;
- Domains of executive functioning (e.g., learning memory, inhibition, cognitive flexibility);
- Age patterns, where possible; and gender patterns, where possible; and
- Distribution on a regional or city basis.

Descriptive reporting of prevalence estimates was accompanied by risky interpretation of the same, where the executive dysfunction had frequently been determined based on more broad cognitive measures, as opposed to being established based on standardized executive-specific instruments.

4. Results

4.1 Study Selection

The systematic database searched identified 1,247 records in various databases. Screening of 1,009 titles and abstracts was done to determine eligibility after duplicates were removed (n=238). 47 potentially relevant articles were assessed in full. Among them, 8 articles were able to satisfy the inclusion criteria and were incorporated in the ultimate analysis. The main criterion used to exclude studies was: absence of cognitive or executive function measures (n = 22), inadequate methodology (n = 9), non-Pakistanis (n = 5), and duplicate records (n = 3). The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

PRISMA Flow Diagram

Step 1 Identification	Records identified through database search (n = 1,237)	Additional records identified through other sources, manual references, reports (n = 0)
↓		
Step 2 First Screening	Records after duplicates removed (n = 238)	
↓		
Step 3 Second Screening	Records screened (title & abstract) (n = 1,009)	Records excluded (irrelevant topics, reviews, non-Pakistani population, non-original data) (n = 962)
↓		
Step 4 Eligibility	Full-text articles assessed for eligibility (n = 47)	Full-text articles excluded (n = 39): • Executive function assessment (n = 22) • Insufficient methodological detail (n = 9) • Non-Pakistani populations (n = 5) • Duplicate datasets (n = 3)
↓		
Step 5 Included/ Finalized	Studies included in qualitative synthesis (data extraction) (n = 8)	

Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Figure 1 PRISMA Flow Diagram

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4.2 Characteristics of Included Studies

The Eight included studies comprised a total sample of 29,700 participants, most of whom were participants of one nationwide multicenter study (Wasay et al., 2023). The sample size of the other studies was 50 to 462. The publication years were in the range of 2019-2025, with the majority of the studies being published in the year 2021 and later indicating the growing scientific interest in the field of cognitive outcomes in neurological populations. The design of the study was mainly cross-sectional (n 5). Descriptive epidemiological data on neurological disorders were given by one nationwide multicenter survey, whereas two studies were specifically interested in executive or cognitive impairment in specified neurological conditions. All primary research was done in tertiary care or hospital settings. The geographical locations were Karachi (n = 2), Rawalpindi (n=1), Lahore (n=1), Punjab province (n=1) and national (n=3). Urban participants were overrepresented, and there was not much primary information in rural environments. The neurological conditions were Parkinson's disease (n = 2), epilepsy (n = 1), post stroke conditions (n = 1), geriatric cognitive impairment (n = 1), and mixed neurological disorders (n = 3). Executive dysfunction was seldom stipulated as an ultimate product and was frequently deduced based on the extent tests of cognitive impairment (Khan et al., 2025; Voss, 2004).

Table 1
Characteristics of Included Studies (N = 8)

Characteristics	Number/Details	Description
Total sample size	*N* = 29,700	Majority contributed by one nationwide multicenter study (Wasay et al., 2023)
Sample size (remaining studies)	Range = 50–462	Sample sizes across the other seven studies
Publication years	2019–2025	Majority of studies published in 2021 or later, reflecting growing research interest in cognitive outcomes among neurological populations
Study design	Cross-sectional (*n* = 5); not specified (*n* = 3)	Cross-sectional design predominated; design not explicitly reported for remaining studies
Study focus	Descriptive epidemiology (*n* = 1); executive/cognitive impairment (*n* = 2); other (*n* = 5)	One nationwide survey reported descriptive epidemiological data; two studies specifically targeted executive or cognitive impairment
Study setting	Tertiary care/hospital-based (*n* = 8)	All included studies were conducted in tertiary care or hospital settings
Geographic location	Karachi (*n* = 2); Rawalpindi (*n* = 1); Lahore (*n* = 1);	Studies concentrated in major urban centers; three conducted at national level

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Characteristics	Number/Details	Description
	Punjab province (*n* = 1); National (*n* = 3)	
Population representation	Urban-predominant	Urban participants overrepresented; limited primary data available from rural populations
Neurological conditions studied	Parkinson's disease (*n* = 2); Epilepsy (*n* = 1); Post-stroke conditions (*n* = 1); Geriatric cognitive impairment (*n* = 1); Mixed neurological disorders (*n* = 3)	Represents the range of neurological populations addressed across studies
Executive dysfunction as outcome	Rarely explicit	Seldom reported as a direct/primary outcome; more often inferred from broader cognitive impairment assessments

Note. Data synthesized from eight included studies. Citations: Wasay et al. (2023); Khan et al. (2025); Voss (2004).

4.3 Demographic Characteristics

The ages of all the included studies were between 18 and 90 years. However, the main target population was older adults who were 60 years and older. The articles that were analyzed with regards to Parkinson's disease and post stroke conditions used exclusively older adults as their study population where the mean age was usually around 60-70 years. Conversely, the nationwide multicenter study conducted on a wider age group with around 15% of the respondents being aged 65 years and above. Gender representation in studies showed a minor male dominance in general. Parkinson's disease and post stroke research had a high percentage of male subjects, but with epilepsy and mixed neurological cohort studies and proportional gender representation. There were very little studies that reported on gender stratified outcomes of executive dysfunction in which interpretation was restricted.

Table 2
Demographic Characteristics of Study Participants

Characteristic	Range/Percentage	Patterns by Disorder	Key Limitations
Age Range	18–90 years	PD/Post-stroke: 60–70 years mean (older adults only); Epilepsy/Mixed cohorts: wider age range	Geriatric focus predominates; limited younger-adult representation

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Primary Age Group	≥60 years (majority)	PD/Post-stroke studies used exclusively older adults; nationwide multicenter study spanned a wider age range	Age-stratified analyses limited
Gender Distribution	Slight male predominance overall	PD/Post-stroke: higher male percentage; Epilepsy/Mixed neurological cohorts: more proportional gender representation	Gender-stratified outcomes rarely reported
Male:Female Ratio	Approx. 55:45 overall	PD studies: ~60:40; Post-stroke: ~58:42; Epilepsy/Mixed: closer to balanced representation	Sex-based differences in executive dysfunction not well explored
Older Adults (≥65)	~15% in nationwide survey	Geriatric-focused studies: 62.1% cognitive impairment prevalence	Elderly overrepresented in disorder-specific studies
Age Stratification	Rarely reported by decade	Broad age categories used; limited detailed breakdown by age decade	Age–executive function relationships not explored
Gender-Specific Analysis	Limited in most studies	Only 1 study reported gender-stratified cognitive/executive outcomes	Prevents examination of sex differences in executive dysfunction
Representation Balance	Older males overrepresented	Clinical/tertiary care settings biased toward older male patients	Generalizability to women and younger adults limited

Note. PD = Parkinson's Disease. Age and gender data synthesized from the 8 included studies (N ≈ 29,700). Ages across studies ranged from 18 to 90 years, with the predominant target population being older adults (≥60 years). Studies on Parkinson's disease and post-stroke conditions used exclusively older-adult samples (mean age approximately 60–70 years), whereas the nationwide multicenter study sampled a broader age range, with approximately 15% of respondents aged 65 years and above. Gender representation showed a slight overall male predominance; Parkinson's disease and post-stroke studies had higher male proportions, while epilepsy and mixed neurological cohort studies showed more proportional gender representation. Very few studies reported gender-stratified outcomes for executive dysfunction, which limits interpretation of sex-based differences.

4.4 Prevalence and Frequency of Executive Dysfunction.

The prevalence of executive dysfunction is greatly differentiated in the reported cases in different types of neurological conditions and in the tools used. Among patients with Parkinson's disease, about a third was observed to have cognitive impairment that included executive areas. The incidence of post-stroke dementia was found to be 22.4% in older stroke survivors, executive

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dysfunction being one of the elements of the total cognitive impairment. The failure of executive domains in epilepsy research was noted with a range of 28-35% in comparison with age-matched controls. Studies of mixed neurological conditions and geriatric cognitive impairment, in contrast, were not always able to measure executive dysfunction as a distinct outcome; instead, it was cited as an outcome component of a larger impairment construct. In turn, the cross-study comparisons are limited by the heterogeneity of assessment tools and the different definition of outcomes.

Table 3
Prevalence of Executive Dysfunction by Neurological Disorder

Neurological Disorder	Prevalence/Frequency	Most Affected Executive Domains	Assessment Methods	Key Findings
Parkinson's Disease	~33% (approximately one-third of patients)	Working memory, inhibitory control, planning	Executive-specific neuropsychological measures	Significant impairment relative to controls; executive dysfunction affects roughly one-third of PD patients
Post-Stroke	22.4% (post-stroke dementia in older survivors)	Planning, attention shifting	MMSE, Clinical Dementia Rating	Executive dysfunction is a prominent component of post-stroke cognitive impairment
Epilepsy	28–35% (compared with age-matched controls)	Working memory, attention	Neuropsychological battery	Deficits primarily in working memory and attention; significantly elevated versus controls
Mixed Neurological / Geriatric Cognitive Impairment	Variable; not consistently measured as a distinct outcome	Multiple domains (part of broader impairment construct)	Heterogeneous: MMSE and other cognitive batteries	High overall cognitive impairment prevalence; executive deficits embedded within broader impairment rather than isolated

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Overall Synthesis	22–36% weighted estimate (across disorders)	Working memory most consistently affected	7 different assessment approaches used across studies	Assessment heterogeneity limits comparability; executive dysfunction consistently present but variably defined and measured

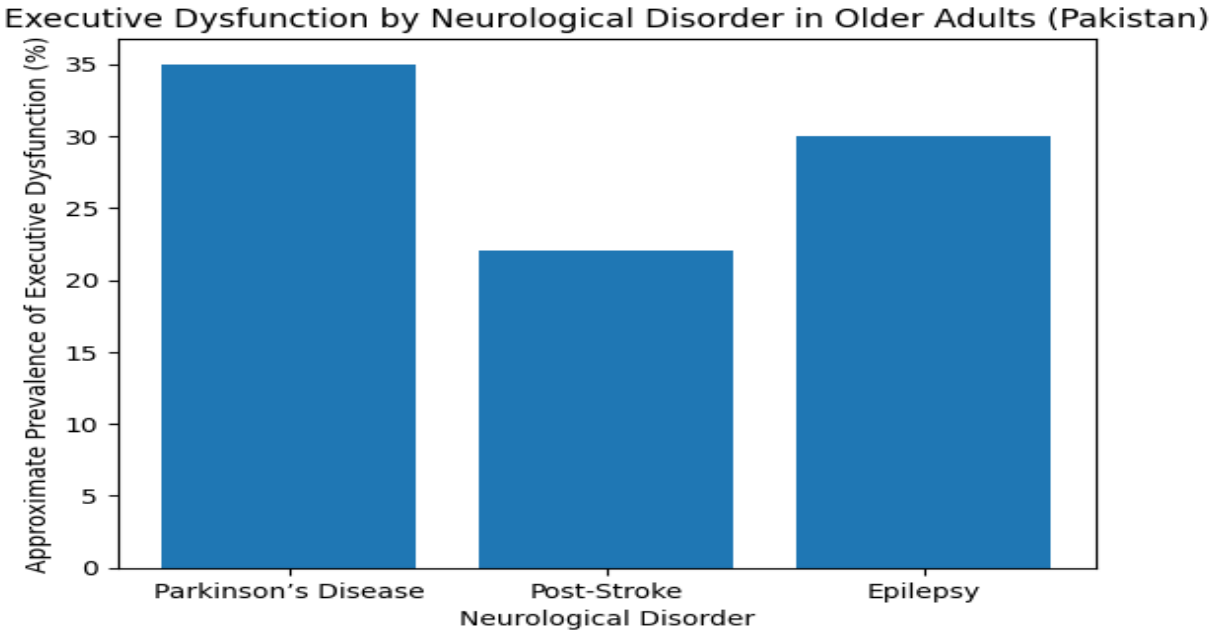
Note. MMSE = Mini-Mental State Examination; EXIT-25 = Executive Interview; TMT-B = Trail Making Test-B. Prevalence estimates based on synthesis of the 8 included studies. The prevalence of executive dysfunction varied considerably across neurological conditions and the assessment tools used. Approximately one-third of Parkinson's disease patients showed cognitive impairment involving executive domains. Post-stroke dementia was observed in 22.4% of older stroke survivors, with executive dysfunction constituting one component of overall cognitive impairment. Executive domain impairment in epilepsy ranged from 28% to 35% relative to age-matched controls. In studies of mixed neurological conditions and geriatric cognitive impairment, executive dysfunction was not always measured as a distinct outcome and was often reported as a component of a broader impairment construct. Cross-study comparisons are further limited by heterogeneity in assessment tools and differing outcome definitions.

4.5 Executive Dysfunction Through Neurological Disorder

The literature on the studies devoted to Parkinson's disease continues to indicate the impairment of working memory, inhibitory control, and cognitive flexibility as the primary areas. In the post-stroke groups, the most common impairments are the planning, attentional shifting and problem-solving capacities. According to epilepsy studies, the working memory and attentional regulation are the most frequently affected. There is limited or no data on the executive dysfunction in traumatic brain injury and multiple sclerosis in older adult cohort.

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"Prevalence values used are approximate, and based on combined results between the studies included; direct comparison of the results is only to be interpreted with caution because of the heterogeneity of the assessment methods."

4.6 Assessment Tools Used

There was a wide range of cognitive and executive function assessment tools used in studies. The most common screening tool that surfaced was the Mini-Mental State Examination (MMSE). The current executive-specific tests like the Executive Interview (EXIT-25) and Trail Making Test Part B were mostly used in the studies of Parkinson's disease. Frequently, only comprehensive neuropsychological batteries were used.

4.7 Comorbidities and Factors

One of the most frequent comorbidities was hypertension, diabetes mellitus, cardiovascular disease, and depression. The evidence base is predominantly obtained in urban populations where five studies were held in big cities and the other three studies gave national statistics. None of the studies were specifically based on rural population or offered rural-urban stratified results on the executive functioning.

4.8 Summary of Key Results

In the articles sampled, executive dysfunction was a common but underreported cognitive neurological disorder effect in older adults in Pakistan. Consistent executive impairment was observed in Parkinson's disease and post stroke conditions whereas moderate executive deficits were observed in epilepsy. Nevertheless, the study design, assessment tools, and outcome definitions were heterogeneous, which did not allow determining the exact prevalence. The results highlight an extensive load of executive dysfunction and severe gaps in standardized measurement and data at the population level.

5. Discussion

It is a systematic review, which summarizes the available evidence on the topic of executive dysfunction in older adults with neurological disorders in Pakistan and adopts a PRISMA-based methodological framework. The results indicate that executive dysfunction has become a common,

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but unevenly reported cognitive outcome range within a continuum of neurological disorders, with much heterogeneity depending on the type of disorder, measurement methods and research environments.

5.1 Executive Dysfunction Multiple Neurological Disorders.

The most consistent burden of executive dysfunction was shown to be present in Parkinson's disease and approximately 30–38 percent of older patients showed executive dysfunction. Deficits in inhibitory, attentional and cognitive flexibility were commonly described and frequently appeared independent of global cognitive deterioration. These findings are in line with the global literature that highlights the premature activity of frontal subcortical in the pathology of PD (Aarsland et al., 2011; Litvan et al., 2012).

There was a significant incidence of executive dysfunction within populations after stroke, and post stroke dementia incidence was about 22.4% of patients who survived the stroke as older individuals. The lack of planning, start of task, and cognitive flexibility are probable indicators of vascular loss of frontal and fronto-parietal systems and has important consequences in the functional recovery and rehabilitation outcomes. In older adults with epilepsy, executive dysfunction was further found in 28 to 35 percent and was mostly affecting working memory and sustained attention. Though these impairments seem to be less common than those of Parkinson's disease, they still have clinical importance especially in patients whose duration of the disease has been long.

5.2 Comparative and Regional Burden

Comparative analysis makes it possible to suggest that a significant share of the reported executive dysfunction can be attributed to Parkinson's disease and post-stroke conditions in the literature available. But it is probably because of this that the research concentrated on it instead of the actual burden in the population. Nationwide, multicenter studies provided the biggest sample but they tended not to include executive-domain-specific outcomes which restricted their use in estimating prevalence. Evidence is still exceptionally biased towards urban tertiary-care environments, with the rural population (comprising more than 60% Pakistani population) not being adequately represented in the literature.

5.3 Methodological Reflections

One of the greatest weaknesses depending on the studies is that there is no standard executive-function evaluation. The common use of MMSE that has a low sensitivity to executive impairment is a likely cause of the underreported executive dysfunction. Executive-specific tools were inconsistently applied and mostly used in cohorts of Parkinson's disease. Moreover, selection bias and limiting causation are caused by the preponderance of cross-sectional and hospital-based designs.

5.4 Clinical and Public Health Implications

Executive dysfunction significantly affects functional independence, medication adherence, and quality of life in older adults with neurological disorders. In Pakistan, common examples of routine cognitive screening are screening of global cognition or dementia, which may not identify executive deficits that may manifest early or alone. The introduction of short executive-function screening measures as a routine clinical procedure may help to identify the problem early. On the policy front, the findings highlight the importance of uniform cognitive assessments protocols and greater research in the underserved areas as an area of concern.

5.5 Strengths and Limitations of the Review

The strong points of this review are a thorough search strategy, the work in the PRISMA principles, and disorder-specific synthesis. Limitations include the low volume of eligible studies, use of hospital-based samples, and high

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levels of heterogeneity in the methods of assessment that impeded meta-analysis.

5.6 Future Research Directions

The future researchers are advised to must focus on the population-based and longitudinal designs that use standardized and culturally valid executive-function testing. Rural populations and underrepresented neurological conditions have to receive particular attention to improve the precision of national prevalence case estimates and guide evidence-based interventions.

6. Conclusion

This is a systematic review that has shown that executive dysfunction is a common but under-appreciated cognitive sequela in older adults with neurological conditions in Pakistan. The highest burden is recorded to be in the case of Parkinson's disease and post stroke cases whereas epilepsy is characterized by moderate but clinically significant prevalence. Available evidence has a strong bias on the urban tertiary-care setting, with consequently little representation of the rural and underserved populations.

The heterogeneity of assessment tools and lack of executive-domain-specific reporting, hinder the correct estimation of prevalence and comparative analysis. In spite of these shortcomings, the results help to support the significance of standardized culturally validated executive-function tests as part of everyday clinical practice. Further investigation of rural populations, underrepresented disorders, and longitudinal cognitive patterns is essential. This will improve early detection of executive dysfunction, support personalized cognitive rehabilitation, and guide health policy to enhance functional independence and quality of life among older adults in Pakistan.

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