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STATUS OF NEUROLOGICAL DISABILITY IN BALOCHISTAN – A CROSS-SECTIONAL OBSERVATIONAL STUDY AT BMC HOSPITAL QUETTA

Original Research

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ABSTRACT

Background: Neurological disorders are among the leading causes of long-term disability worldwide and impose a disproportionate burden on low- and middle-income regions. In Pakistan, particularly in Balochistan, limited epidemiological data and constrained health-system capacity hinder effective planning for prevention, rehabilitation, and long-term care. Understanding local patterns of neurological disability is essential to inform evidence-based health policies, optimize service delivery, and address unmet rehabilitation needs in underserved populations.

Objective: To evaluate the disability status, demographic trends, and distribution of neurological disabilities among patients presenting to a tertiary care hospital in Quetta, Balochistan, in order to inform healthcare planning and policy development.

Methods: A hospital-based cross-sectional study was conducted at Bolan Medical Complex Hospital, Quetta, from January 2024 to August 2025. A total of 238 residents of Quetta District with confirmed neurological disabilities were enrolled using purposive consecutive sampling. Diagnoses were established and verified by senior consultants using the International Classification of Diseases, Eleventh Revision (ICD-11), with functional assessment guided by the International Classification of Functioning, Disability and Health framework. Sociodemographic and clinical data were collected using a structured proforma. Statistical analysis was performed using SPSS, with descriptive statistics expressed as frequencies and percentages, and associations assessed using chi-square tests at a 95% confidence level.

Results: Of the 238 participants, 158 (66.4%) were male and 80 (33.6%) were female, while 217 (91.2%) were unmarried. The most represented age groups were 1–10 years (33.2%) and 11–20 years (25.2%). Cerebral palsy was the most frequent diagnosis (36.1%), followed by cognitive disabilities (23.1%) and stroke (20.2%). Stroke and autoimmune neurological conditions were relatively more common among adults aged 21–30 years. No statistically significant association was observed between diagnosis and gender ($p = 0.536$) or age group ($p = 0.345$).

Conclusion: Neurological disabilities represent a substantial and predominantly early-onset health burden in Quetta. The findings highlight critical gaps in preventive care, early diagnosis, and long-term rehabilitation services, underscoring the need for strengthened surveillance systems and integrated, community-oriented neurological care in Balochistan.

Keywords: Cerebral Palsy, Disability Evaluation, Nervous System Diseases, Neurological Rehabilitation, Prevalence, Stroke.

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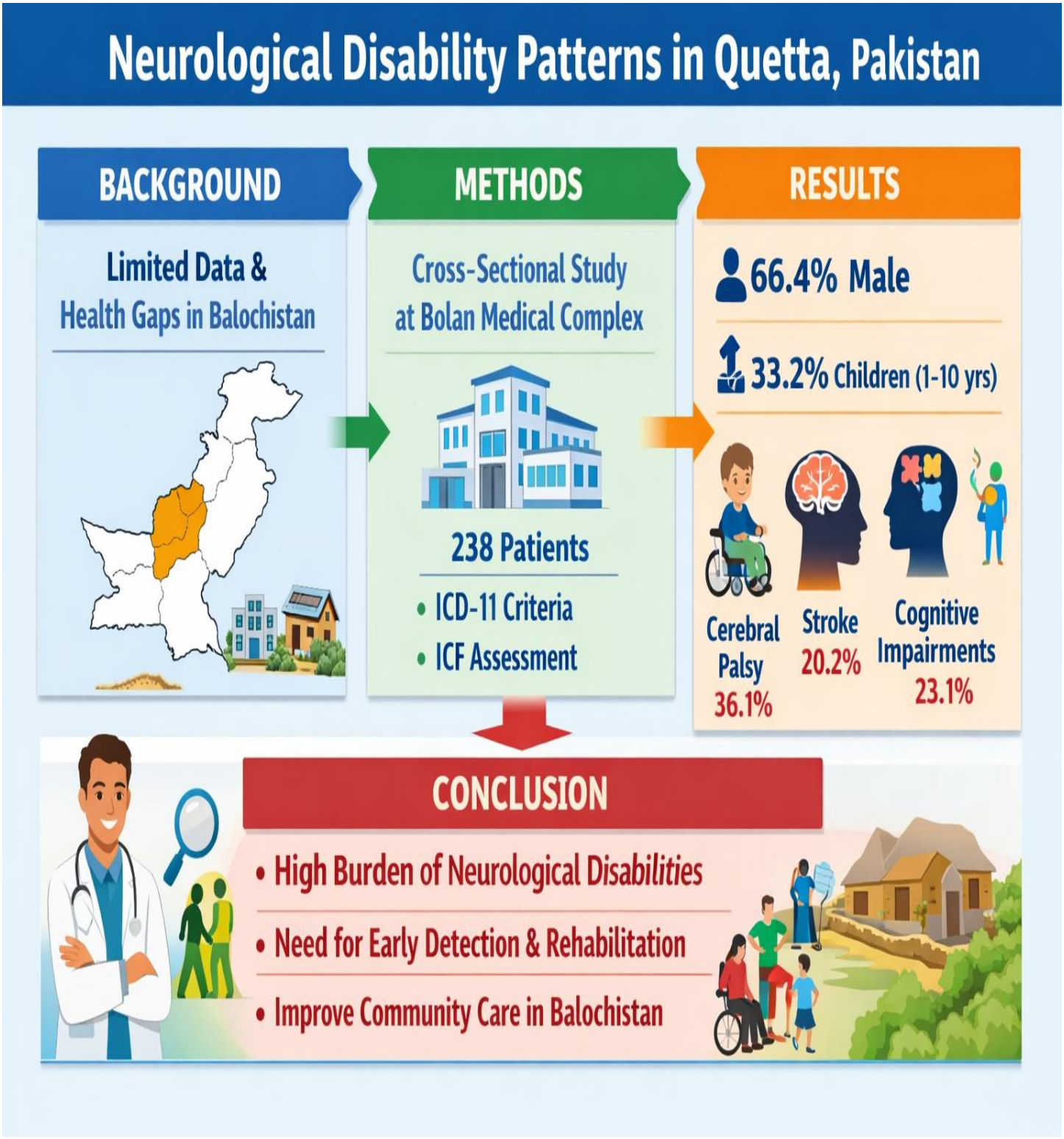

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INTRODUCTION

Neurological disorders have emerged as a leading cause of long-term disability worldwide and now rank as the second most common cause of death, reflecting their growing impact on individuals, families, and health systems (1). According to the Global Burden of Disease study, conditions such as headache syndromes, stroke, dementia, epilepsy, and cerebral palsy (CP) account for a substantial proportion of years lived with disability (YLDs) and disability-adjusted life years (DALYs), underscoring their pervasive and enduring consequences across the life course (2). Beyond mortality, these disorders often result in chronic functional limitations, dependence on long-term care, and social stigma, outcomes that are especially pronounced in low- and middle-income countries (LMICs), where access to timely diagnosis, treatment, and rehabilitation remains limited (3). Cerebral palsy, the most common motor disability of childhood, exemplifies the inequitable global distribution of neurological disability. While birth-prevalence estimates in high-income countries range from approximately 1.6 to 2.5 per 1,000 live births, markedly higher rates have been reported from LMICs (4). In South Asia, including Pakistan, population studies and regional estimates suggest a greater burden, with reports from Bangladesh and comparable LMIC settings documenting prevalence figures approaching 3.4 per 1,000 live births, largely driven by preventable perinatal complications and constrained access to quality neonatal care (5,6). These disparities highlight how health-system capacity and socioeconomic context shape neurological outcomes from early life. Other major neurological conditions further contribute to the cumulative burden. Epilepsy affects an estimated 50 million people globally, with the majority residing in LMICs, where treatment gaps remain wide despite evidence that up to 70% of affected individuals could achieve seizure control with timely and appropriate therapy (7,8). Stroke incidence and related disability continue to rise in these regions as populations age and exposure to vascular risk factors increases (6). Similarly, dementia represents a rapidly escalating public health challenge; in Pakistan alone, an estimated 150,000–200,000 people are currently living with dementia, placing growing strain on families and already stretched health systems (9). Collectively, these conditions impose substantial economic costs, long-term caregiving demands, and psychosocial consequences that extend beyond the individual patient (10).

Within Pakistan, available evidence points to a considerable burden of neurological disorders, although data remain fragmented. Community-based research from District Swabi in Khyber Pakhtunkhwa reported a CP prevalence of 1.22 per 1,000 live births, while hospital-based and outpatient series consistently identify CP, stroke, and epilepsy among the most frequent diagnoses encountered in tertiary neurology clinics (11,12). In Balochistan, population-level estimates are particularly scarce; however, recent multicentre data indicate that congenital and hereditary anomalies account for a large proportion of clinical presentations, with neurological disorders comprising approximately 27% of cases, reflecting a high caseload of CP, stroke, epilepsy, and peripheral neuropathies at tertiary care level (13). Compounding this burden, malnutrition and feeding difficulties are common among children with CP in LMICs, emphasizing the need for integrated nutritional, medical, and rehabilitation services (14). Balochistan, Pakistan's largest province by geographic area, faces pronounced health-system challenges, including limited infrastructure, workforce shortages, difficult terrain, and widespread poverty, all of which contribute to underdiagnosis, underreporting, and inadequate service provision for neurological disability (15). The absence of comprehensive, province-wide epidemiological data from Quetta and the wider region represents a critical knowledge gap, hindering rational health-service planning and resource allocation. In this context, the present study was undertaken to systematically determine the prevalence and patterns of neurological disability in Quetta, Balochistan, with the objective of generating locally relevant evidence to inform targeted prevention strategies, strengthen clinical and rehabilitation services, and support policy-level planning for neurological care in this underserved population.

METHODS

A hospital-based cross-sectional study was conducted at Bolan Medical College (BMC) Teaching Hospital, Quetta, from January 2024 to August 2025 to assess the prevalence and distribution of neurological disabilities among residents of Quetta District. The study setting was intentionally selected because BMC Teaching Hospital is the largest tertiary care referral center in the province, serving both urban and rural populations, thereby allowing access to a broad spectrum of neurological cases presenting from across the district. The study population included individuals of all ages and both genders who were permanent residents of Quetta District and had a confirmed diagnosis of neurological disability. Diagnoses were established and verified by senior consultant neurologists using standardized criteria based on the International Classification of Diseases, 11th Revision (ICD-11), alongside functional assessment guided by the International Classification of Functioning, Disability and Health (ICF) framework. Patients were excluded if their disabilities were attributable to non-neurological causes, such as primary musculoskeletal or orthopedic conditions, or if they were residents of districts

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other than Quetta. A purposive, consecutive sampling approach was employed, whereby all eligible patients presenting during the study period through outpatient clinics, inpatient admissions, or formal referrals within BMC Hospital were invited to participate. After providing a detailed explanation of the study objectives and procedures, written informed consent was obtained from adult participants, while assent and guardian consent were secured for minors or individuals unable to provide consent independently. Data were collected using a structured, predesigned proforma that captured sociodemographic variables including age, gender, marital status, educational level, and occupation, as well as clinical characteristics such as primary neurological diagnosis, duration of illness, associated comorbidities, and patterns of functional limitation across relevant ICF domains. To ensure diagnostic consistency and data reliability, each recorded diagnosis and functional classification was reconfirmed by a senior consultant neurologist before inclusion in the final dataset. Data entry and statistical analysis were carried out using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were generated by calculating frequencies and percentages for categorical variables. Associations between categorical variables were explored using chi-square tests, with statistical significance defined as a p-value of less than 0.05 at a 95% confidence interval for all inferential analyses. Ethical approval for the study was obtained from the Postgraduate Medical Institute (PGMI), Civil Hospital Quetta, prior to commencement, and all study procedures were conducted in accordance with established ethical principles for research involving human participants.

RESULTS

A total of 238 participants with confirmed neurological disabilities were included in the analysis. Males constituted the majority of the study population (n = 158, 66.4%), while females accounted for 80 cases (33.6%). The age distribution demonstrated a predominance of younger individuals, with the highest proportion observed in the 1–10-year age group (n = 79, 33.2%), followed by those aged 11–20 years (n = 60, 25.2%) and 21–30 years (n = 50, 20.0%). Participants older than 40 years collectively represented ≤5% of the sample. With respect to marital status, most participants were unmarried (n = 217, 91.2%), whereas 21 individuals (8.8%) were married. Across the entire cohort, cerebral palsy emerged as the most frequent neurological disability (n = 86, 36.1%), followed by cognitive disabilities (n = 55, 23.1%) and stroke (n = 48, 20.2%). Less frequent diagnoses included autoimmune disabilities (n = 18, 7.6%), infectious neurological injuries (n = 16, 6.7%), and neuropathies (n = 15, 6.3%). When stratified by gender, cerebral palsy remained the leading diagnosis among both males (n = 56, 35.4%) and females (n = 30, 37.5%). Among male participants, stroke (n = 33, 20.9%) and cognitive disabilities (n = 33, 20.9%) were equally prevalent, whereas among females, cognitive or mental disabilities were the second most common diagnosis (n = 22, 27.5%), followed by stroke (n = 15, 18.8%). Other neurological conditions were comparatively infrequent in both genders. Statistical testing revealed no significant association between gender and diagnostic category, as demonstrated by Pearson's chi-square test ($\chi^2 = 4.09$, df = 5, p = 0.536), supported by the likelihood ratio ($\chi^2 = 4.30$, df = 5, p = 0.507) and the linear-by-linear association (p = 0.979). The minimum expected cell frequency was 5.04, indicating acceptable adherence to test assumptions.

Age-wise distribution showed distinct patterns of neurological disability. In children aged 1–10 years, cerebral palsy was the predominant diagnosis (n = 38, 48.1%), followed by cognitive disabilities (n = 15, 19.0%) and stroke (n = 12, 15.2%). A similar pattern was observed in the 11–20-year group, where cerebral palsy (n = 25, 41.7%) and cognitive disabilities (n = 14, 23.3%) were most common. In contrast, among young adults aged 21–30 years, stroke accounted for a relatively higher proportion of cases (n = 12, 24.0%), with autoimmune neurological disabilities also showing notable representation (n = 7, 14.0%). In older age groups, the absolute number of cases declined markedly; however, stroke, cognitive disabilities, and autoimmune conditions continued to appear sporadically across ages above 40 years. Statistical analysis did not demonstrate a significant association between age group and diagnostic category. Pearson's chi-square test yielded $\chi^2 = 42.98$ with 40 degrees of freedom (p = 0.345), and the likelihood ratio test showed similar findings ($\chi^2 = 42.50$, df = 40, p = 0.364). Although the linear-by-linear association approached significance (p = 0.109), it did not meet the predefined threshold of statistical significance. It is noteworthy that a large proportion of cells (75.9%) had expected counts below five, indicating partial violation of chi-square assumptions and suggesting that these age-diagnosis associations should be interpreted with caution.

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Table 1: Sociodemographic Characteristics of Participants with Neurological Disabilities (N = 238)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	158	66.4
	Female	80	33.6
Age Group (years)	1–10	79	33.2
	11–20	60	25.2
	21–30	50	20.0
	31–40	22	9.2
	>40	27	11.3
Marital Status	Unmarried	217	91.2
	Married	21	8.8

Table 2: Distribution of Neurological Disabilities According to ICD-11 Categories (N = 238)

ICD-11 Diagnostic Category	Frequency (n)	Percentage (%)
Cerebral Palsy	86	36.1
Cognitive Disabilities	55	23.1
Stroke	48	20.2
Autoimmune Neurological Disabilities	18	7.6
Infectious Neurological Injuries	16	6.7
Neuropathy	15	6.3

Table 3: Gender-wise Distribution of Major Neurological Disabilities (N = 238)

Diagnosis	Male n (%)	Female n (%)	Total n (%)
Cerebral Palsy	56 (35.4)	30 (37.5)	86 (36.1)
Cognitive Disabilities	33 (20.9)	22 (27.5)	55 (23.1)
Stroke	33 (20.9)	15 (18.8)	48 (20.2)
Other Neurological Conditions*	36 (22.8)	13 (16.2)	49 (20.6)
Total	158 (100)	80 (100)	238 (100)

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Table 4: Distribution of ICD-11 Diagnoses by Age Group

Age Group (years)	Stroke	Cerebral Palsy	Neuropathy	Infectious Injuries	Cognitive Disabilities	Autoimmune Disabilities	Total
1–10	12	38	6	4	15	4	79
11–20	12	25	3	3	14	3	60
21–30	12	14	1	4	12	7	50
31–40	7	3	2	2	7	1	22
41–50	1	4	2	0	3	2	12
51–60	3	1	0	1	2	1	8
61–70	0	0	0	1	1	0	2
71–80	1	0	1	1	1	0	4
81–90	0	1	0	0	0	0	1
Total (N=238)	48	86	15	16	55	18	238

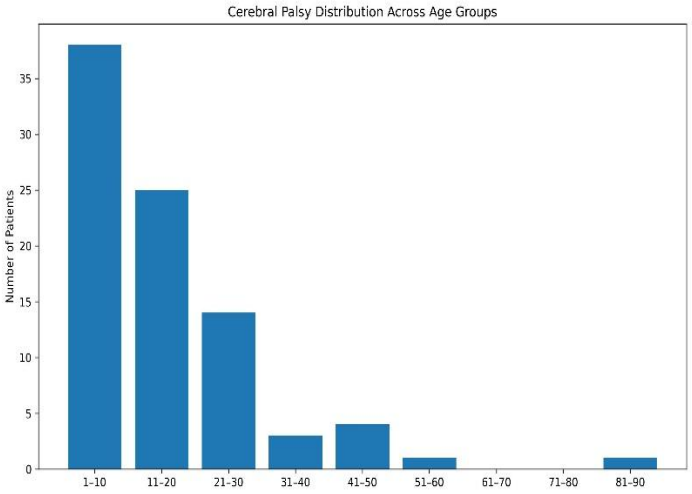

Figure 2 Cerebral Palsy Distribution Across Age Groups

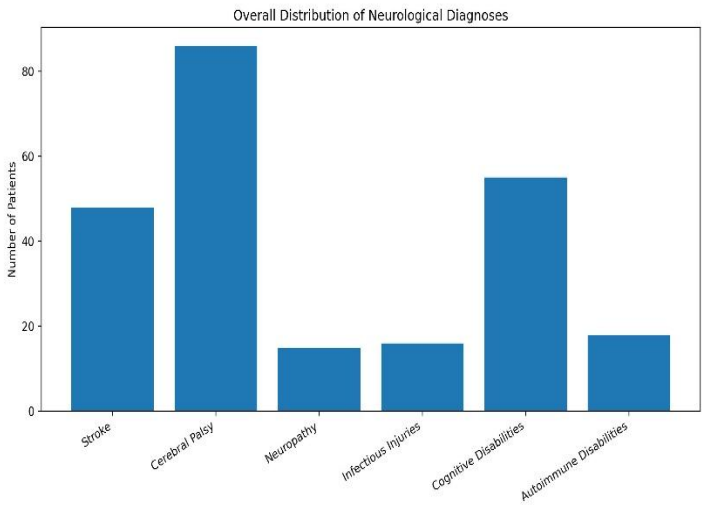

Figure 2 Overall Distribution of Neurological Diagnoses

DISCUSSION

The present study offered a contemporary overview of the epidemiology of neurological disabilities in Quetta District, Balochistan, and highlighted important demographic and diagnostic patterns within a resource-constrained setting. The predominance of male participants was consistent with regional South Asian literature, where differential health-seeking behavior, gender roles, and sociocultural constraints often result in greater health-service utilization by men, while women face barriers related to mobility, decision-making autonomy, and access to specialized care (12). This imbalance likely reflected not only disease occurrence but also structural inequities in access to tertiary healthcare, an issue repeatedly documented in similar LMIC contexts. A striking finding was the concentration of neurological disabilities among children, adolescents, and young adults, underscoring the disproportionate burden of early-onset neurological conditions in the region. Cerebral palsy, cognitive disabilities, and stroke together accounted for more than three-quarters

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of all diagnoses, identifying them as the dominant contributors to neurological disability in Quetta. The high frequency of cerebral palsy among younger age groups aligned with international and regional evidence indicating higher prevalence in LMICs, where preventable perinatal factors such as birth asphyxia, prematurity, neonatal infections, and limited access to advanced neonatal intensive care continue to play a major role (13,14). These findings reinforced the concept that neurological disability in childhood in such settings is closely linked to maternal health, quality of obstetric care, and early-life health system performance. In contrast, stroke was relatively more frequent among young and middle-aged adults, particularly those aged 21–30 years, a pattern increasingly reported from South Asia. Previous studies from comparable settings have attributed this shift toward earlier stroke onset to the rising prevalence of poorly controlled hypertension, diabetes mellitus, tobacco use, and sedentary lifestyles, often compounded by delayed diagnosis and limited preventive services (15,16). This early manifestation of cerebrovascular disease reflected an ongoing epidemiological transition in Balochistan, where communicable and non-communicable neurological conditions coexist and place competing demands on an already overstretched health system. Although statistical testing did not demonstrate significant associations between age or gender and diagnostic categories, the observed distribution patterns still provided meaningful epidemiological insights relevant for service planning and priority setting.

The implications of these findings were substantial for health policy and clinical practice. The predominance of cerebral palsy and cognitive disabilities among children highlighted an urgent need to strengthen maternal, perinatal, and neonatal care, with emphasis on timely antenatal monitoring, skilled birth attendance, neonatal screening, and early referral to rehabilitation services (17). Similarly, the burden of stroke among younger adults emphasized the importance of early cardiovascular risk assessment, community-level screening, and culturally appropriate prevention strategies targeting modifiable risk factors (18,19). The overall diagnostic profile pointed toward the necessity of integrated neurorehabilitation services capable of addressing both congenital and acquired neurological conditions across the life span. In geographically vast and underserved regions such as Balochistan, the expansion of cost-effective approaches, including community-based rehabilitation and telerehabilitation models, appeared particularly relevant to bridge urban–rural disparities in access to care (20,21). Several strengths of the study warranted consideration. The use of standardized diagnostic and functional classification systems, namely ICD-11 and the ICF framework, enhanced diagnostic consistency and allowed for a structured characterization of neurological disability that is comparable with international data. Additionally, the inclusion of participants across a wide age range provided a life-course perspective on neurological disability patterns within the district. Nonetheless, important limitations were also evident. The hospital-based design inherently limited generalizability, as individuals who did not seek tertiary care or who lacked access to referral pathways were unlikely to be captured, potentially underestimating the true community burden (22). Furthermore, small expected cell counts in several subgroup analyses reduced the robustness of chi-square testing, constraining the strength of statistical inference for age- and gender-specific associations. Despite these limitations, the study contributed valuable baseline data for a region where epidemiological information on neurological disability has been scarce. The findings supported the need for future community-based prevalence studies to obtain more representative estimates and to capture hidden disability within the population. Establishing population-based registries for conditions such as cerebral palsy, stroke, and epilepsy in Balochistan would further strengthen surveillance, guide resource allocation, and facilitate long-term planning. Additional research exploring socioeconomic, cultural, and health-system determinants of delayed presentation and poor access to care would deepen understanding of observed patterns, while intervention-focused studies could evaluate the feasibility and cost-effectiveness of community and technology-assisted rehabilitation models. Collectively, such efforts would provide actionable evidence to inform policies aimed at reducing the growing burden of neurological disability in underserved regions.

CONCLUSION

This study demonstrated a substantial burden of neurological disabilities in Quetta, with childhood-onset conditions and acquired disorders together shaping a complex and persistent public health challenge. The predominance of conditions such as cerebral palsy, stroke, and cognitive impairments highlighted the need for a coordinated response that spans early identification, sustained rehabilitation, and long-term supportive care. Although clear demographic associations were not observed, the overall pattern aligned with broader global evidence showing neurological disorders as major contributors to disability. By systematically documenting the spectrum of neurological disability in an underserved setting, the study fulfilled its objective of addressing a critical evidence gap and provided a foundation for informed policy development, service planning, and equitable resource allocation. Strengthening community-based surveillance, expanding integrated rehabilitation and nutritional support, and improving access to care across geographic and socioeconomic divides are essential steps toward reducing disability and improving quality of life in Balochistan.

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AUTHOR CONTRIBUTIONS

Author	Contribution
Noorahmed Khosa*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Abdul Aleem	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sadia Khan Nasar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Nazia Razzaq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mir Abdul Qadir	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Syed Muhammad Essa	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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