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Neurological disorder burden in Faisalabad, Punjab-Pakistan: Data from the major tertiary care centers of the city

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Neurological disorders (NDs) cause functional, structural, biochemical or electrical abnormalities in the nervous system and may result in cognitive impairment, mood alteration, muscle weakness, paralysis, poor coordination, seizures, and pain. The burden of NDs in developing countries is 4-5%, compared to 10-11% documented in developed countries. However, the burden of NDs is rising in developing countries due to factors such as prolonged life expectancy, improved health facilities, easy access to diagnostic facilities, and a trend in urbanization. There is inadequate data about the epidemiology of major NDs in Pakistan and most available information are hospital-based estimations or physicians' collected data, mostly in Karachi. Data concerning other areas of Pakistan is limited. In the present study, we focused on Faisalabad, Pakistan's third largest city. Data from more than 3,000 patients were collected between March 2015 and May 2015 from the neurology and psychiatry departments of Allied, DHQ, Aziz Fatima Trust, Faisal, and Al-Noor hospitals. Our data indicated that 19.6% (n=602) of the study population has depression, 16.6% (n=508) epilepsy, and 15.2% (n=466) migraines. The distribution of NDs varied between the 8 towns, ranging from 1.9% in Tandliyanwala town to 30.7% in Layalpur town. Of all ND cases, 27% (n=382) demonstrated an inherited pattern of transmission. The male group accounted for a smaller percentage of NDs (41.5%, n=1300) than the female group (58.5%, n=1829). Age groups I (10-30 years) and II (31-50 years) had a similar distribution of NDs (37.8%, n=1073; 37.5%, n=1065), respectively, while the distribution was significantly lower in age groups III (51-70 years) and IV (70-90 years), with rates of 20.7% (n=587) and 4% (n=115), respectively. This descriptive study reports the epidemiology of NDs in this region and establishes a foundation of data to address the existing gap in literature on NDs in this region.

Keywords: Neurological disorders, disease burden, Faisalabad, Punjab, Pakistan.

INTRODUCTION

A major contributor to mortality and morbidity all over the world, and particularly in developing countries,

are neurological disorders (NDs) that affect the nervous system. The most prominent symptoms of NDs include mood alteration, impaired cognitive ability, muscle weakness, paralysis, poor coordination, seizures, deprivation of sensation, pain, confusion, and altered levels of consciousness. There are more than 600 NDs; while some

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are well recognized and relatively common, others are rare or poorly understood. NDs are among the most compelling medical conditions afflicting individuals because they are often devastating to those affected as well as their families. In addition to the morbidity and mortality burden attributable to these conditions, there is currently no effective therapy to treat or cure the majority of NDs (G. Hussain et al., 2013a, 2013b; La Spada and Ranum, 2010; Wasay and Ali, 2010; WHO, 2006a).

The mortality rate and burden of disability caused by NDs is higher than any other major disease worldwide (Chin and Vora, 2014; Cottler et al., 2017; Mathers et al., 2009; Murray et al., 2012; Vijayalakshmi et al., 2015; Wasay and Ali, 2010; WHO, 2006a, 2006b). The overall prevalence of NDs is 6.5% and incidence trends have shown an alarming rate of increase over time (WHO, 2006a). Demographic, geographic, and socioeconomic conditions are major factors that affect the epidemiology of NDs. Previous research has shown that prevalence and incidence of NDs is positively correlated with the economic condition of a given country. The burden of NDs increases as a country expands economically (Whiteford et al., 2013; WHO, 2006a). In lower-income countries, the reported prevalence of NDs ranges from 4% to 5%, while prevalence in countries with higher GDP is 10-11% (Awan et al., 2015; Cottler et al., 2017; Lopez and Mathers, 2006; Mathers et al., 2009; Soboka et al., 2017; Vos et al., 2015; Wasay and Ali, 2010; Whiteford et al., 2015, 2013, WHO, 2006b, 2006a). The higher rate of NDs in developed countries may be due to their more robust system of public health services and health-related facilities that screen and provide health services for the average patient. It has been documented that 6.75% of the American population (Borlongan et al., 2013) and 6% of the British population (MacDonald et al., 2000) have been diagnosed with NDs. In recent years, the burden of NDs in developing countries has continued to increase; this growth is correlated with increasing epidemiological data, prolonged life expectancy, improved health facilities, facilitated access to healthcare centers, provision of advanced diagnostic technology, and a trend in urbanization among the population. Although there are data regarding the incidence and prevalence of NDs in developing countries of Asia, such as China, India, and Sri Lanka, these data may not be generalizable to Pakistan, due to differing social, geographical, religious, cultural, and ethnic aspects unique to those countries. Therefore, it is necessary to conduct epidemiological studies in Pakistan to collect and analyze reliable data for this region of the world (Baxter et al., 2016; Charlson et al., 2016; Murray et al., 2012; Vijayalakshmi et al., 2015; Wasay and Ali, 2010; "WHO," 2006c). The prevalence of NDs in India ranges from 967–4,070/100,000 with a mean of 2,394/100,000 population. Such prevalence indicates that over 30 million people are living with NDs in

this country with the second largest population in the world. It is estimated that the burden of the NDs in India will increase by 23% during the years 2013 to 2025 (Baxter et al., 2016; Charlson et al., 2016). The prevalence of common disorders, such as stroke, epilepsy, tremors, Parkinson's disease (PD), and mental retardation, is not uniform across the different regions of the country (Gourie-Devi, 2014; Gourie-Devi et al., 2004).

The overall crude prevalence of NDs in Saudi Arabia was reported to be 131/1,000 population (Al Rajeh et al., 1993). Recent reports indicate about 68.5/10,000 prevalence of NDs in the pediatric population of Saudi Arabia (Al Salloum et al., 2011). Epilepsy and seizure disorders were the most noted diseases at the tertiary care centers (Khamis, 2016).

Published data regarding the epidemiology of major NDs in Pakistan is limited, and most available information are hospital-based estimations or physician-collected data, limited to a few cities. These data are likely not nationally representative (Mehndiratta et al., 2014; Wasay, 2003; Wasay and Ali, 2010). In comparison to neighboring countries, it may be possible to determine the prevalence of NDs in Pakistan based on aggregation of the existing, disparate data sources. The existing information concerning the prevalence of NDs in selected cities of Pakistan indicate that the burden of NDs is a serious concern.

Epidemiological data concerning selected NDs are available, but this information is limited to particular locations and, therefore, cannot be generalized to determine the overall burden of NDs in Pakistan nationally. Most available data are from the city of Karachi, while prevalence and incidence in the other mega-cities of Pakistan have yet to be investigated. In the present study, we focused our evaluation of NDs in Faisalabad, the third largest city of Pakistan. To our knowledge, this is the first study concerning the prevalence and burden of NDs at the leading tertiary care centers of this mega-city.

MATERIALS AND METHODS

In the present study, study subjects were recruited from the patient population at the outpatient neurology and psychiatry departments of Allied Hospital, DHQ Hospital, Aziz Fatima Trust Hospital, Faisal Hospital, and Al-Noor Hospital in Faisalabad, Punjab-Pakistan. The inclusion criteria for selecting the hospitals were that the facility was well-equipped, possessed functional basic and advanced facilities for diagnosis of complicated NDs, and had a sufficient patient population for recruitment at the outpatient facility. The selected tertiary care centers are the highest-volume centers in Faisalabad district. The

health care centers were selected from 4 different corners of the city in order to acquire representative data from each region of the district. Furthermore, a mix of government and private-sector hospitals were selected to ensure the inclusion of an economically diverse cohort that would be more representative of the population in general. A printed questionnaire was used to gather basic data about the patients receiving care in the selected hospital departments.

The data were collected from March 2015 to May 2015, at the outpatient facility of the neurology and psychiatry departments of the selected hospitals. Prior authorization was sought from the hospital administration for collection of data. Neurophysicians and neuropsychiatrists of the participating departments were contacted for their permission and cooperation regarding data collection of their patients. The physicians and psychiatrists of participating patients were requested to make a detailed diagnosis based on the maximum number of medical tests for the possible ND. Patients were interviewed and data were recorded on printed questionnaires. A patient population of more than 3,000 from the selected hospitals was identified for possible participation in the study. Patients undergoing their first clinical visit were excluded, as their clinical diagnosis may not have been fully determined. Patients with confirmed diagnoses were included in the study, and data were collected from the subjects after obtaining consent of either the patient or his/her caregiver. The available record of medications and treatment was also collected for further verification as needed. Information about gender, age, marital status, type of disorder, familial history for the disorders of interest, and consanguineous marriage were collected for further analysis of related risk factors.

Institutional Review Board Approval

The Institutional Review Board (IRB) of Government College University, Faisalabad-Pakistan carefully reviewed and granted approval for this study.

RESULTS

The overall burden of NDs in Faisalabad District was assessed in the 3,068 study participants. The rate of each ND reported in this population was as follows: depression 19.6% (n = 602), epilepsy 16.6% (n = 508), migraine 15.2% (n = 466), disc prolapse 8.8% (n = 269), paralysis 8.5% (n = 262), trauma 5.3% (n = 163), brain hemorrhage 5% (n = 153), PD 3% (n = 92), schizophrenia 2.7% (n = 83), congenital anomaly 2.2% (n = 68), tumor 1.6% (n = 50), dementia 1.7% (n = 52), mania 0.8% (n = 25), acute psychological disorder 1.4% (n = 43), disruptive behavior disorder 0.6% (n = 19), bipolar affective disorder 0.7% (n = 22), and miscellaneous 6.2% (n = 191) (Figure 1).

Faisalabad District is divided into 8 different towns named "Layalpur town", "Jinnah town", "Iqbal town", "Madinatown", "Chak Jhumra town", "Jaranwala town", "Samundri town" and "Tandliyanwala town". The rate of NDs among the population varied by the towns of Faisalabad, with rates as follows, Layalpur town 30.7% (n = 863), Jinnah town 15.0% (n = 421), Iqbal town 19.3% (n = 542), Madina town 17.7% (n = 498), Chak Jhumra town 2.2% (n = 63), Jaranwala Town 8.6% (n = 243), Samundri town 4.5% (n = 126), and Tandliyanwala town 1.9% (n = 54) (Figure 2).

There were 382 patients (27%) for which a family history of mental illness was noted. The percentage of patients with positive family history by disease category was 80% (n = 4) PD, 23.5% (n = 4) schizophrenia, 76.9% (n = 10) disc prolapse, 11.5% (n = 15) depression, 30.8% (n = 37) epilepsy, and 33% (n = 33) migraine (Figure 3).

NDs were more prevalent in the female group as compared to the male group in Faisalabad. Among the study population, 41.5% (n = 1300) were male gender and 58.5% (n = 1829) were female gender. Depression, migraines, disc prolapse, brain hemorrhage, PD, dementia, mania, and other mental illnesses were more common in the female group (67.1%, n = 444; 75.4%, n = 352; 61.7%, n = 262; 52.3%, n = 80; 63.0%, n = 58; 51.9%, n = 27; 60.0%, n = 15; 56.0%, n = 154, respectively) than in the male group (32.9%, n = 218; 24.6%, n = 115; 38.3%, n = 103; 47.7%, n = 73; 37.0%, n = 34; 41.8%, n = 25; 40.0%, n = 10; 44.0%, n = 121, respectively). Epilepsy, paralysis, and trauma were more common in the male group (53.0%, n = 269; 53.4%, n = 140; 55.8%, n = 91) than in the female group (47.5%, n = 239; 46.6%, n = 122; 44.2%, n = 72). The burden of schizophrenia, congenital anomaly, tumor, and dementia was approximately equivalent between the female group (50.6%, n = 42; 48.5%, n = 33; 50.0%, n = 25; 51.9%, n = 27, respectively) and the male group (49.4%, n = 41; 51.5%, n = 35; 50.0%, n = 25; 48.1%, n = 25, respectively) (Figure 4).

The study subjects were divided into 4 age groups, group I (10-30 years), group II (31-50 years), group III (51-70 years), and group IV (70-90 years), in order to capture the prevalence of NDs at early or late age onset. Groups I and II, covering the age ranges of 10-50 years, manifested a similar rate of ND burden (37.8% and 37.5%, n = 1073 and n = 1065, respectively). The burden was remarkably lower in age groups III and IV (20.7%, n = 587 and 4%, n = 115, respectively). Similarly, depression was noted in group I 35.6% (n = 209), group II 45.7% (n = 268), group III 16% (n = 94), and group IV 2.7% (n = 16); epilepsy in group I 71.6% (n = 302), group II 21.3% (n = 90), group III 5.7% (n = 24), and group IV 1.4% (n = 6); migraine in group I 39.7% (n = 182), group II 45.1% (n = 207), group III 13.7% (n = 63), and group IV 1.5% (n = 7); disc prolapse in group I 22.7% (n = 59),

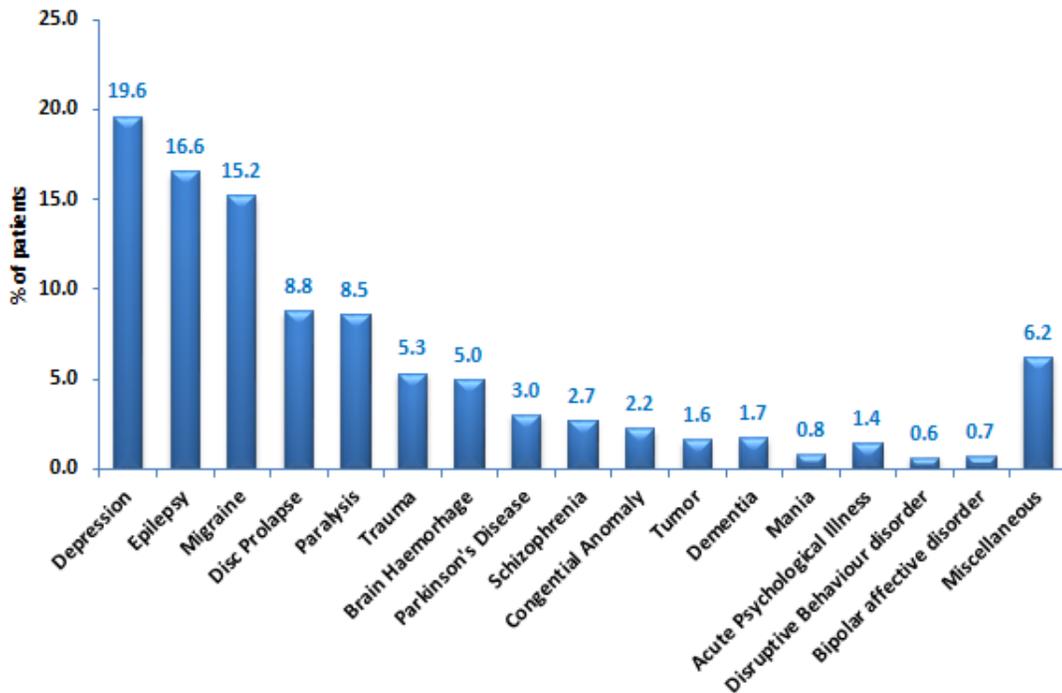


Figure 1. Proportion of Patients by Disease Type in Faisalabad (N = 3068).

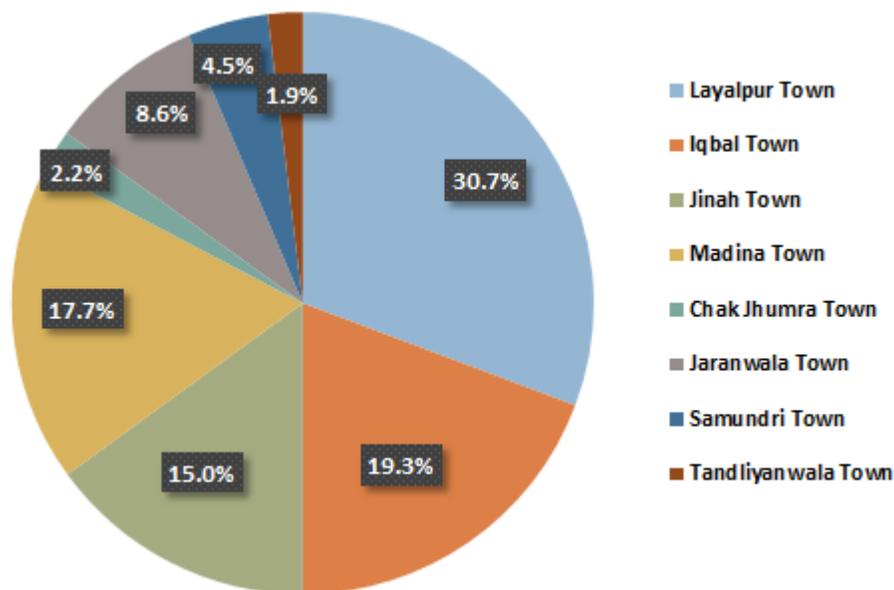


Figure 2. Distribution of NDs by Town (N = 2810).

group II 46.9% (n = 122), group III 27.3% (n = 71), and group IV 3.1% (n = 8); paralysis in group I 11.3% (n = 29), group II 34.8% (n = 89), group III 40.2% (n = 103), and group IV 13.7% (n = 35); trauma in group I 40.6% (n

= 63), group II 33.5% (n = 52), group III 22.6% (n = 35), and group IV 3.2% (n = 5); brain hemorrhage in group I 6.0% (n = 9), group II 30.0% (n = 45), group III 52.0% (n = 78), and group IV 12.0% (n = 18); PD in group I 21.1%

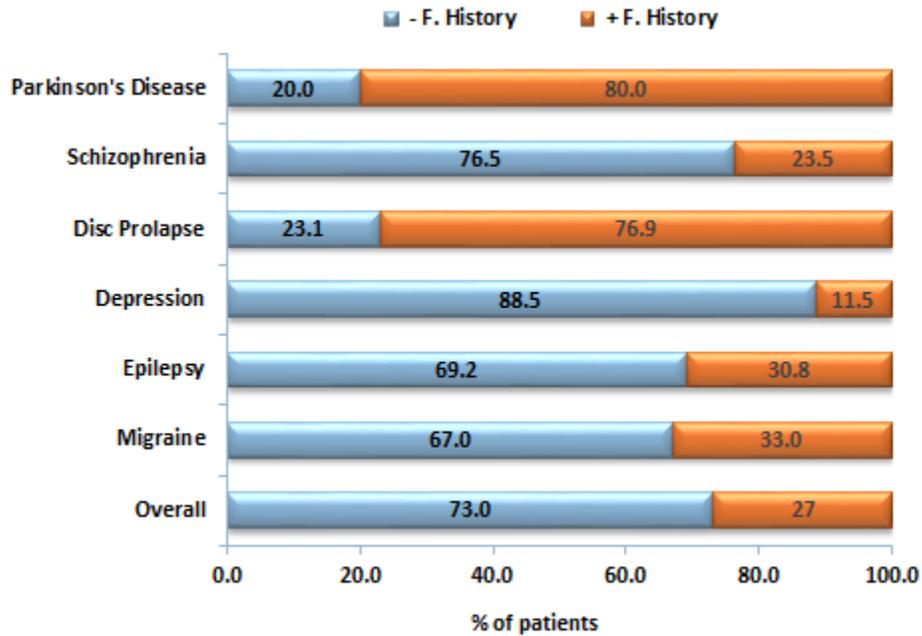


Figure 3. Percentage of Patients with Positive Family History of ND (N = 382).

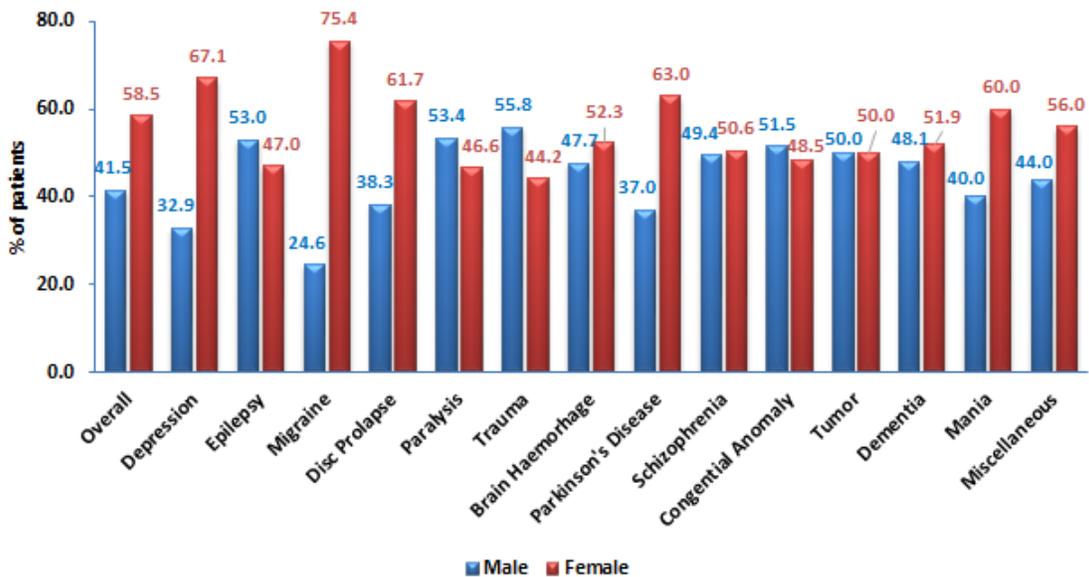


Figure 4. Distribution of NDs by Gender (N = 3129).

(n = 19), group II 38.9% (n = 35), group III 31.1% (n = 28), and group IV 8.9% (n = 8); schizophrenia in group I 60.2% (n = 50), group II 33.7% (n = 28), group III 4.8% (n

= 4), and group IV 1.2% (n = 1); tumor in group I 42.1% (n = 16), group II 31.6% (n = 12), group III 26.3% (n = 10), and group IV 0.0% (n = 00); dementia in group I

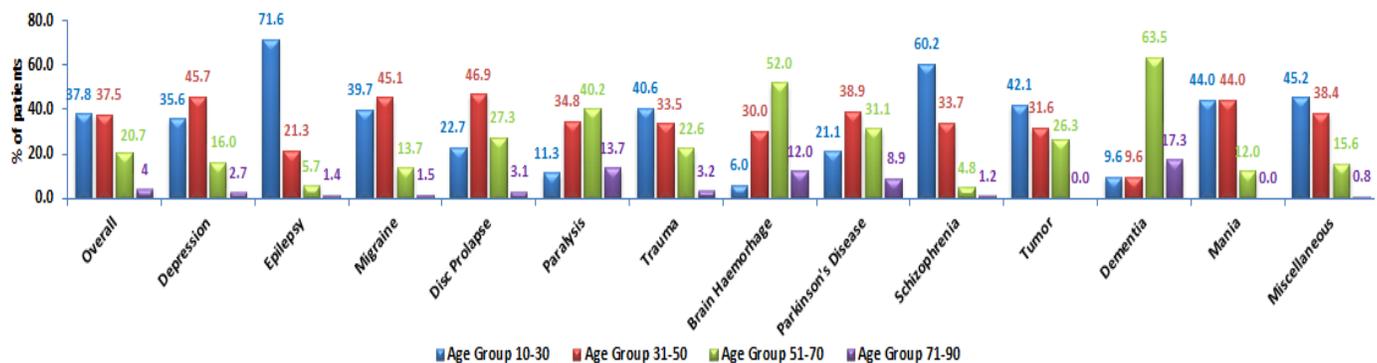


Figure 5. Distribution of NDs by Age Group (N = 2840).

9.6% (n = 5), group II 9.6% (n = 5), group III 63.5% (n = 33), and group IV 17.3% (n = 9); mania in group I 44.0% (n = 11), group II 44.0% (n = 11), group III 12.0% (n = 3), and group IV 0.0% (n = 00); miscellaneous in group I 45.2% (n = 119), group II 38.4% (n = 101), group III 15.6% (n = 41), and group IV 0.8% (n = 2) (Figure 5).

DISCUSSION

In developing countries, prevalence and incidence of NDs are underestimated, and treatment and provision of care is often limited due to lack of data and awareness about the burden and impact. In the case of most NDs, such as meningitis, encephalitis, and cerebral malaria, the onset of the condition is acute in nature and frequently lethal in a short course of time. Mortality due to many of these NDs could be prevented by early diagnosis and providing effective treatment. Other NDs are chronic in nature, for example epilepsy, and, in addition to the morbidity experienced by the patient, this illness carries a socioeconomic burden and stigmatization is commonly observed in many cases, which also affects the broader family. Timely and accurate diagnosis of such cases may facilitate provision of effective treatment and help prevent the chronicity and post-disease effects on patients and their families (Winkler et al., 2009).

In developing countries, such as Pakistan, diagnosis of complex NDs is challenging due to lack of infrastructure and expertise, which creates a hurdle in determining and providing proper treatment. These countries have insufficient basic facilities and lack the necessary medications in part due to lack of data regarding the prevalence of NDs. Policy makers do not include management against NDs or provide resources for their treatment in their health policy framework and strategies, as it is assumed that there is a low prevalence of NDs due to limited epidemiological data. In the present study,

that is the first epidemiological study of NDs conducted in Faisalabad, the third largest city of Pakistan, we assessed the burden of NDs at the major tertiary care centers of the city. Our study subjects included patients with a diagnosis of ND, confirmed by neurophysicians and psychiatrists to avoid any ambiguity about the presence and burden of the diagnosed disorder. We relied on the printed questionnaires recommended by practitioners to gather patient-reported data assessing aspects of the NDs and related risk factors. A set of data collected over 2 months provides valuable information about this class of diseases in this territory.

Depression accounted for a substantial portion (19.6%) of the NDs among the study subjects, 11.5% of which were in youth with at least 1 parent who also had depression. This value was close to the global burden (20%), and local burden of depression in Karachi (20-23%) (Bhamani et al., 2013; Ganatra et al., 2008; Taqui et al., 2007). The higher proportion of depression among the female group (67.1%), as compared to the male group (32.9%), was in accordance with previous studies by various authors (Mumford et al., 2000, 1997). The heritability and burden of ND among the younger generation (10-30 years of age) is reported here for the first time in Pakistan, and highlights an issue of pressing concern. The substantial proportion of NDs among younger generations in Faisalabad suggests that national rates of NDs may be higher than previously assumed and affect more of the population, posing a serious health burden.

Epilepsy appeared to be the second most common ND, accounting for 16.6% of cases. One third of cases were found to have a positive family history, and slightly more of the male group (53%) than female group (47%) experienced epilepsy. There was also a higher proportion among patients in the age range of 10-30 years, which is in accordance with previously reported data (Aziz et al., 1997; Khatri et al., 2003). We also found that of the 15.2% of subjects with a diagnosis of migraine, one third

had a positive family history, and the female group (75.4%) accounted for a larger proportion of cases compared to the male group (24.6%). The age groups 10-30 and 30-50 years of age experienced the highest proportion of cases. Our results regarding headache and migraine are not in accordance with other studies conducted elsewhere in Pakistan (Herekar et al., 2013; Kafeel and Rukh, 2014; Khan et al., 2012; Murtaza et al., 2009; Zahid et al., 2014). This contradiction of ND burden observed in our results is possibly due to demographic factors, parameters, and the methodology used in those studies. Although specific aspects of our findings differ from previous studies, the trend of NDs in gender and age groups of patients appear similar to data reported previously.

The number of patients with PD in Asian countries is expected to reach 6.17 million in a few decades (Tan, 2013). The presence and increasing burden of PD in some cities of Pakistan has also been documented (Adnan et al., 2012; Asumal et al., 2006; T. Hussain et al., 2013; Rahman et al., 2012; Wasay and Ali, 2010; Yakunin et al., 2012), but the nationwide data on prevalence of PD is limited. In the present study, our finding that 3% of the study population has a diagnosis of PD has not been validated in the literature and is higher than the worldwide prevalence of PD of about 1% (Ahmed et al., 2014). A majority of cases in this study was found to demonstrate an inherited pattern of transmission, and the female group experienced a higher proportion of NDs (63%) than the male group (37%). Of concern, the age group 31-50 years were noted to account for a high proportion of cases (38.9%) as compared to other age groups, although NDs are generally a late onset disorder (Ahmed et al., 2014).

Schizophrenia affects about 1% of the population and is among the top 25 leading causes of disability worldwide. Its prevalence varies by region and ethnic group (Chong et al., 2016; Millier et al., 2014). Our study has found that 2.7% of the study population has been diagnosed with schizophrenia, out of which almost 25% have a positive family history. These results cannot be compared with other studies, due to unavailability of existing epidemiological data regarding schizophrenia in Pakistan. Regarding schizophrenia, the burden did not vary significantly by gender and most patients belonged to the 10-30-year age group. The substantial burden of this psychological disorder affecting youth highlights the morbidity experienced in this age group, as well as the expected life-long, future morbidity. Previous studies have reported that birth order, gender differences and age of onset influence diagnosis and disease trajectory for schizophrenia in Pakistan population (Ansari et al., 2010; Bender, 2001; Naqvi et al., 2010; Stompe et al., 1999).

About 2% of cases were found to be congenital anomalies, and distribution was similar between males

and females. Due to varying results from different regions of Pakistan, the present results are in accordance with some studies, 2.9% reported by Khan et al., 2015 (Khan et al., 2015), and contradictory to other results, for example Hussain et al., 2014 (Hussain et al., 2014), who reported that about 7% of neonates had congenital anomalies. In UK, researchers have noted that babies born to mothers of Pakistani origin are more prone to be affected with congenital anomalies as compared to babies of mothers from other regions (Sheridan et al., 2013). Various factors such as malnutrition, consanguineous marriages, illiteracy, and unavailability of adequate health care facilities in Pakistan may explain the higher rate of NDs (Hussain et al., 2014; Jabeen and Malik, 2014; Khan et al., 2015; Raza M.Z., Sheikh A., Ahmed S.S., Ali S. et al., 2012; Sheridan et al., 2013).

Dementia has increased and is approaching epidemic levels in Pakistan, and requires timely, focused resources. Prevalence of dementia is projected to be much higher in the future (Ahmad et al., 2013; Anonymous, 2015; Kalaria et al., 2008; Khatri and Wasay, 2013). Dementia accounted for 1.7% of the NDs among study subjects, similar to previous findings of a 1.9% prevalence of dementia in South Asia (Ahmad et al., 2013). The available prevalence data about dementia is limited and prior studies report 8% and 7% of elderly people are suffering from dementia. These findings are controversial because the studies used unreliable methodology and sources (Ahmad et al., 2013; Anonymous, 2015; Kalaria et al., 2008; Khatri and Wasay, 2013; Wasay and Ali, 2010).

Although other disorders, such as disc prolapse (8.8%), paralysis (8.5%), trauma (5.3%), brain hemorrhage (5%), mania (0.8%), tumor (1.6%), acute psychological illness (1.4%), disruptive behavior disorder (0.6%), bipolar affective disorder (0.7%) and other miscellaneous minor diseases (6.2%) account for more than one quarter of the NDs among the study population, other studies with which to compare the finding at a national level are unavailable.

The presence of major neurological, psychological, and neurodegenerative disorders in Pakistan, the sixth largest population in the world, should not be assumed to be absent nor speculated upon, due to the lack of epidemiological data. Due to an improved health infrastructure and facilitated access to health facilities, life expectancy in Pakistan is increasing, which leads to an increasing population vulnerable to late onset neurodegenerative disorders such as Alzheimer's disease (AD), Huntington's disease (HD), Amyotrophic Lateral Sclerosis (ALS), and PD. These diseases may be prevalent in elderly people of Pakistan, but available data do not exist to describe the epidemiology and describe the population burden. Although the presence of multiple sclerosis (MS) and PD, in Karachi and Peshawar, has

been documented at the hospital level (Hoori et al., 2008; Rahman et al., 2012).

The present study lays a foundation of data regarding ND burden in this region to build a bank of data and address the gap in existing information about this neglected area of disease epidemiology. Thus far, NDs have not attracted the attention of researchers and higher authorities in Pakistan to facilitate future planning of resource allocation and treatment for these diseases. In the health policy framework of Pakistan, there is little focus on management and treatment of NDs due to lack of data regarding the epidemiology of NDs. There is an urgent need for a data bank about the health issues prevailing in Pakistan to inform health policy planning and objectives. It is recommended for future studies to conduct a detailed assessment of the incidence and prevalence of NDs nationally in Pakistan. The findings of such studies will pave the way for health policies and funding allocation for research, eradication, and improved treatment of NDs in Pakistan.

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