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## ABSTRACT

Neurological disorders are the impairments of nervous system and are an important and growing cause of morbidity, mortality, and disability. In addition to health costs, those suffering from these conditions are also frequently victimized of stigmatization and discrimination. Stigmatization further minimizes the patients' access to treatment and social activities. These disorders, therefore, require special attention particularly in developing countries where unfortunately, the burden of these disorders remains largely unrecognized. Moreover, the burden imposed by such chronic neurological conditions in general can be expected to be particularly devastating in poor populations. These conditions are emerging as severe public health concerns in the developing countries due to the facts such as unawareness, illiteracy, large numbers of people who are untreated, and unavailability of inexpensive but effective interventions. Regrettably, reliable population-based data from developing countries including Pakistan on the epidemiology of neurological disorders are extremely limited. Although, some information on epidemiological aspects of neurological diseases are available from some developing countries (Pakistan, Iran, India, Sri Lanka, Saudi Arabia and China) but disease prevalence and pattern are based on geographical, social, cultural, religious, and ethnic factors. In this review, we critically analyzed data of 209 studies regarding the burden and prevalence of hypertension, depression, Stroke, Alzheimer's disease (AD), epilepsy, and Parkinson's disease (PD) in Pakistan and neighboring countries.

## INTRODUCTION

Neurological Disorders (NDs) are the maladies of the nervous system accompanied by a range of symptoms that can be the consequence of functional, structural, biochemical or electrical abnormalities. The most noticeable and common illustrations of such symptoms comprise altered level of cognition, seizures, deprivation of sensation, pain, confusion, loss of consciousness, muscle weakness, paralysis and poor coordination<sup>1,2</sup>. There are more than 600 NDs, some of them are well recognized and are relatively common while others are rare and poorly understood. Epilepsy, Alzheimer's diseases (AD), Parkinson's disease (PD), Amyotrophic Lateral Sclerosis (ALS), Huntington's disease (HD), Multiple Sclerosis (MS), Schizophrenia, Dementia, ,

Stroke, Cerebral Palsy (CP), Mental Retardation (MR) developmental disorders, peripheral neuropathy and Migraine are the well-known parallels of NDs around the world<sup>3,4</sup>. The manifestations of NDs are also accompanied by malfunctioning of another physiological system including dyslipidemia, enhanced metabolic rate and diabetes mellitus<sup>5,7</sup>. These disorders are among the most compelling maladies known to humankind that is typically devastating to the affected one and their families. The conventional methods are unable to elucidate the mechanism of the pathophysiology of these disorders due to the involvement of brain in live patients<sup>8</sup>. Therefore, majority of NDs are currently without effective therapies and life quality can be maintained only by management approaches such as supplementation of high fat diet and chronic exercise offer beneficial effects in case of neurodegenerative disorders<sup>9,12</sup>.

Epidemiological data play a vital role in portraying the disease patterns and occurrence in the community. However, the published data on the estimation of the burden and spectrum of major NDs in Pakistan is very scanty. The burden of NDs in Pakistan is supposed to be enormous due to several causative factors in this country such as hypertension, poor hygienic conditions, adulterated edible stuff, poverty, illiteracy, high prevalence of diabetes mellitus and cardiovascular disorders. Pakistan is predicted to be at the 4<sup>th</sup> place in term of diabetes mellitus prevalence (one of the important risk factor of NDs) in 2020<sup>13</sup>. Presently, one-third of the population above the age of 45 years is hypertensive<sup>14</sup>. Most importantly, the majority of the population is unaware of their status of Nds. The prevalence data for most of the NDs in Pakistan is very scarce due to lack of interest in epidemiological studies. Most of the available data is hospital-based estimations or physicians collected data of their respective regions<sup>10,1517</sup>. These data may not be considered as a representative of the whole nation but available data still can be used to compare it with other countries. So, it is necessary to conduct epidemiological studies to get reliable data on prevalence that can be used to assess the actual burden of NDs in Pakistan.

In this review, we have organized and compared the available data of NDs in Pakistan with the data of Iran, China, India, and Saudi Arabia (Table 1). This effort covers the prevalence and comparison of NDs including hypertension, stroke, epilepsy, depression, Parkinson's disease (PD) and Alzheimer's disease (AD) in the above mentioned countries. This is an attempt to evaluate the burden of NDs in Pakistan and a comparison with the neighboring counties.

## METHODS OF LITERATURE SEARCH

A total of 209 original research and review articles were found by use of NCBI-PubMed and Google search engine. Since most of the studies are found on the websites of local journals of the selected countries, therefore, varying key words for each disorder were used to find the articles containing required information.

## OVERVIEW OF THE WORLDWIDE PREVALENCE OF NEUROLOGICAL DISORDERS

These disorder have been the most neglected class of diseases around the world. A number of deaths resulted by any disease have been considered as the seriousness of a disease in the last decades. They deviate this obsolete criterion and demise is not the acute fate of the affected ones but sufferings may last throughout the life. The care givers and family members also confront these issues along with the patients<sup>18,19</sup>. The overall number of deaths and disabilities caused by NDs is higher than any other disorder all over the world<sup>4,10,11,2023</sup>. The worldwide burden of NDs is increasing unchecked at an alarming rate with a prevalence of 6.5%. Presently, the burden appears to be strongly correlated to the economic condition of that particular country as the global burden of NDs in high, upper middle, lower middle and low income countries is 10.9%, 6.7%, 8.7% and 4.5%, respectively<sup>2,10,11,18,2227</sup>. This high rate of NDs in the developed countries is advocated by the increased provision of health related facilities and reliable data source<sup>4,22,2729</sup>.

The epidemiological data of NDs in the developed countries is well documented. For example, in the

USA, 6.75% population or one in every 15 individuals has some neurological condition<sup>30</sup>. The prevalence of NDs in the UK is 6% and among those, cerebrovascular disorders, shingle, and diabetic polyneuropathies are the most commonly reported diseases<sup>31</sup>.

In the developing countries, NDs are among the ignored class of disorders and mostly they are not considered as diseases due to illiteracy and superstitious thoughts. Therefore, developing countries lack the basic epidemiological data regarding NDs prevalence. In addition, there is an uncertainty in the available data due to very few studies and unreliable methodologies for the collection of data. Pakistan is among those developing countries of Asia where very few epidemiological studies have been conducted regarding the prevalence and burden of various disorders, particularly NDs<sup>3,4,22,3234</sup>.

About 60% of the world's population resides in Asia, while China, India, Pakistan, and Iran are the habitats of about 65% of this Asian population. Although, the data for NDs are available for some developing countries of Asia but these data mostly comprise of comparison among various geographical, social, cultural, religious, and ethnic groups. Based on available data, it could be assumed that the prevalence and incidence of NDs are increasing in the developing countries of Asia. Factors causing this upsurge in the burden of NDs may include increasing life expectancy, literacy, urbanization, and provision of better diagnostic and medical facilities<sup>10,20,21,3537</sup>.

In China, the most populated country in the world with 1.367 billion dwellers, the burden of NDs is not uniform throughout the country. Between 2013 and 2025, the burden of mental, neurological and substance use disorders is estimated to increase by 10% in China<sup>36,37</sup>. Presently, the most common Nds are

cerebrovascular diseases with the prevalence of 22.39%. The others include mild cognitive impairment and dementia that account 15.99%, movement disorders (including Parkinson's disease) with 9.09% prevalence; sleep disorders (including sleep apnea and insomnia) are 6.73% and psychological diseases such as depression, anxiety, and personality disorders are 6.65%. Those Nds that are associated with spinal degenerative disease account for 10.52% while the least common of all is intracranial tumors that account 2.61% of NDS<sup>38,39</sup>.

The prevalence of Nds in various regions of India ranges from 967 to 4,070 with a mean of 2,394 per 100,000 individuals. These values indicate that over 30 million people are living with NDs in the 2<sup>nd</sup> largest population of the world. The burden of common NDs in India was 44% between 1990 and 2013 and it is estimated that the burden of the NDs in India will increase by 23% during the years 2013 to 2025<sup>36,37</sup>. The prevalence of common disorders such as stroke, epilepsy, tremors, Parkinson's disease, and mental retardation is not uniform across different regions of the country due to varying social, economic, and cultural features<sup>40,41</sup>.

Very limited data is available about the burden of NDs in Kingdom of Saudi Arabia (KSA). Some studies have reported the community based surveys. They figure out 120.5 and 131/1000 population prevalence of Nds in KSA<sup>10,42,43</sup>. A community based study was conducted to investigate NDs in Saudi children that reported a prevalence of 68.5/10,000 at pediatric level<sup>44</sup>. Recently, one study has reported the spectrum of various neurological disorders in KSA. Epilepsy and other seizures with 37.71% were the most noted illnesses at the tertiary care centers<sup>28</sup>.

## COMPARATIVE PREVALENCE OF SELECTED NDs HYPERTENSION

Hypertension, abnormally high blood pressure, also indicated by a state of great psychological stress, is one of the commonest NDs. Though, burden of hypertension in the developing and developed countries is almost equal but the prevalence varies greatly around the world, for example, 3.4% Indian men and 72.5% women in Poland suffer from this illness<sup>45</sup>. Several factors such as social determinants of health, e.g. income, education, and housing aggravated by behavioral risk factors play a key role in the development of hypertension. Social issues such as unemployment or fear of unemployment may enhance stress level that in turn boot-up blood

pressure. These factors are not uniform in all ethnic groups of the world and are directly influenced by the economic conditions of that particular region. The South Asian countries are impregnated with such factors resulting in high prevalence of hypertension. Particularly, in Iran, some parts of China, and Pakistan, the prevalence is higher than developed countries.

According to national health survey conducted in 2000, the prevalence of hypertension in Pakistan is 33% in age group of 45 years or greater. Male individuals are more prone to acquire hypertension than females (34% vs 24%). The prevalence of hypertension increases with age, after the age of 35 years the chance of hypertension becomes 5.6 times greater than that of the age group of fewer than 35 years. Unawareness about the disorder is one of the serious concerns that increase the chances of other related complications. About 58% of hypertensive patients are unaware of their hypertension<sup>46</sup>. Such unawareness may increase the possible risk of complications in the absence of proper medication.

In an Iranian study conducted on a large population of adults, the prevalence of hypertension was found to be 42.7%. Unlike Pakistan, hypertension was more prevalent in women than men (46.4% vs. 37.6%). It was also noted that prevalence of hypertension was directly associated with increased BMI, ethnicity, and sedative life style. Comparatively low prevalence of hypertension was observed in people who were fond of taking black tea and smoking<sup>47,48</sup>.

China is the country where the overall prevalence of hypertension is less than that of Pakistan. About 26.6% of 32.5% populations of Chinese of age less than 35 years are hypertensive but a comparison with the age group of 45 years or greater shows that hypertension is more prevalent in China<sup>36,37,49</sup>. Hypertension is more prevalent in men than in women (29.2% vs 24.1%). In those individuals with age 45 or greater, it ranges from 36.7% to 56.5% and it becomes 58.4% at the age 70-74 years<sup>50,51</sup>. There is a higher prevalence of hypertension in rural population than the urban<sup>52,53</sup>.

Meta-analysis and review of data from various epidemiological studies in India reveal that the overall prevalence of hypertension in India is 29.8%. Unlike China, the prevalence is more in urban parts (33.8%) than the rural parts (27.6%) of India. Awareness about their hypertensive neurological status is lower in rural population (25% are aware of hypertension) than the urban (42%)<sup>36,37,54</sup>.

In KSA, the prevalence is less than that of other Asian countries including Pakistan. The prevalence of hypertension in Saudi Arabia is 15.2% - 27.45% while those that are at the borderline of hypertension are 40.6%. Most of the hypertensive Saudi population



(about 57.8%) is undiagnosed<sup>28,55</sup>.

## MIGRAINE

The manifestation of migraine is characterized by recurrent episode of throbbing head pain that is associated with other symptoms comprising of vomiting and sensory sensitivities<sup>56</sup>. The main cause of the headache around the globe is migraine which is identified amongst the 20 leading causes of disability worldwide<sup>57</sup>. The most common disorder of the nervous system is a headache, having several subtypes like tension-type headache, migraine headache, and cluster headache. Amongst these, the migraine is abundant, predominant, disabling, and essentially treatable, but still, under treated, unrecognized, undiagnosed, and under-estimated. A genetic predisposition is commonly seen in case of migraine headache, but biological aspects have a definite role that how the illness anguishes those who suffer it. The start of mechanism within the brain is reflective and produces a release of pain-creating inflammation inducing substances in the tertiary of blood vessels and nerves of the brain<sup>57</sup>. A close relationship exists between stress and migraine attack, also in children. A significant psychiatric illness in migraine attack suggests a paradigm of close interaction between psychological and somatic aspects in pediatric migraine<sup>58</sup>.

In China, are headache disorders as prevalent as elsewhere? The question is important regarding a country of 1.3 billion people, but there is a very scanty literature to figure out the reliable answer. In China, an epidemiological study conducted in 2012, reported 9.3% prevalence of a migraine which is considerably lower than the findings elsewhere, comparably nearby Japan and Taiwan<sup>59</sup>.

In India, the 1-year age-standardized prevalence of a migraine was 25.2%, significantly higher among females than males and more among those from rural areas than urban. In India, 25.2% is significantly higher than global 14.7% burden. According to Global Burden of Disease 2010 (GBD 2010) estimates, the global prevalence of migraine is 14.7%, the third most common disease in the world<sup>60</sup>.

Using the random-effects model in Iran, the pooled prevalence of a migraine was 14% (95% CI 12% to 17%) (Farhadi Z et al., 2016). In Saudi Arabia, a study conducted by Al Jumah et al 2002, found a sharp increase in the prevalence of a migraine (from ~2% to ~9%) at ages 10 to 11 years for both genders. The age-adjusted occurrence of a migraine in subjects aged 6 to 15 years was 6.2%<sup>61</sup>.

As far as Pakistan is concerned, there is no difference between males and females affecting from migraine. A migraine is also very communal, reported by over one-fifth (22.9%) while tension type headache (TTH) is by far the most prevalent headache disorder (44.7%)<sup>62</sup>.

## STROKE

Stroke or cerebral infarction is cell death in the brain region caused by blockage of the blood vessel leading to the brain. A clot (ischemic stroke) may result in blocking the arterial supply leading to hypoxia and nutrients deficiency in the distal part of the brain. The consequences of stroke may be an everlasting disability of an organ depending upon the affected part of the brain. It is the major contributor to the deaths caused by various NDs and accounted about 87% deaths out of 2.5 Million stroke patients in 2005<sup>63</sup>. The global incidence of stroke varies greatly in the different parts of the world as it ranges from 41/100,000 in Nigeria to 316/100,000 in Tanzania and 375/100,000 population in Iran<sup>64,65</sup>.

In Pakistan, it is also one of the serious health concerns with the annual incidence of 250/100,000 population. About 350,000 cases of stroke are expected to appear every year<sup>66,70</sup>. The incidence of stroke in Karachi has been reported to be 19.1%<sup>71</sup>. A hospital based study conducted in Islamabad has elucidated the risk factors for stroke among 281 registered patients. In the age group 56-71 years, the highest frequency of these 4 risk factors was present<sup>72</sup>. The data of two studies from Iran indicate a rising incidence of stroke over six years<sup>73</sup>. The prevalence data of stroke in Iran is limited and according to some available data obtained from southern Iran (Fars), the prevalence is greater than Pakistan. It is found to be 375 reported cases of stroke per 100,000, also with a high mortality rate of 20.5%<sup>65</sup>. Although this hospital based data is not representative of the whole population of Iran but may be comparable to other countries<sup>73</sup>.

The incidence of stroke in Chinese population (for ages 45-74 years) is 205-584 per 100,000 individuals. The major cause of stroke in Chinese population is intracerebral hemorrhage that accounts for 27% to 51% of stroke cases in community-based studies and 17% to 30% cases in hospital based studies<sup>74,75</sup>. While other risk factors such as hypertension (88%), smoking (48%) and alcohol use (44%) respectively were also reported among stroke survivors<sup>76</sup>. It has also been reviewed in 2013 that the overall incidence of stroke was 120.42 per 100,000 person-years and that the incidence of stroke increased and mortality declined over the time between 1982 and 2008<sup>77</sup>. More recently, age-standardized prevalence, incidence and mortality rates 1114.8 per 100,000 people, 246.8 and 114.8 per 100,000 persons per year, respectively have also been documented. China is a big country and epidemiological data can be generalized for the whole country. The highest annual incidence and mortality of stroke in Northeast (365 and 159 per 100,000 person-years), then central areas (326 and 154 per 100,000 person-years), and the lowest incidence was in South west (154 per 100,000)

Stroke prevalence in men was significantly higher than those in women in the age group of  $\geq 40$  years<sup>76</sup>.

Common disorders such as stroke, epilepsy, Parkinson's disease and tremors have considerable variations in the prevalence and incidence rates across different regions of India<sup>41,78,79</sup>. The average incidence of stroke each year is 145 per 100,000 populations and other study reports 27–42% portion of Stroke among other major neurological disorders 41,80. That means about 1.8 million cases of stroke appear each year out of total Indian population of about 1.2 billion. The mortality rate due to stroke out of these patients is about 33%<sup>79,81</sup>.

In KSA, studies conducted 3 decades ago indicate a low incidence and prevalence of strokes compared to the Western countries. It is because of the predominance of the younger age groups in this country<sup>73,82,84</sup>. In KSA, the incidence of stroke is lower than that of Pakistan. The burden of stroke is not much different from the range that is present globally and in the other Asian countries<sup>85</sup>. Its value is slightly higher than that prevailing in India. However, it has been reported that the crude incidence of stroke in KSA was 29.8/100,000/year in the past decades<sup>82,84</sup> and at pediatric level the burden of stroke was 27.1/100,000 of the pediatric population<sup>86</sup>. According to a community based survey conducted in the Eastern Province of KSA, the prevalence of stroke is 178/100,000 population<sup>87</sup> which does not differ much from the other study that reported a prevalence 186/100,000 population<sup>88</sup>. All these variations in the data depict the nation-wide epidemiological survey in this important Arabian country.

## EPILEPSY

Epilepsy, characterized by repeated episodes of epileptic seizures due to abnormally excessive or synchronous neuronal activity in the brain, is one of the most commonly occurring NDs. Epilepsy is not only a problem of the affected individual but also have a great influence on the family and society. People suffering from epilepsy with their families had to suffer from humiliation and discrimination that decreases the chances of sharing their disease condition and receiving proper consultancy. About 50 million people worldwide are suffering from epilepsy that accounts about 1% of global burden of diseases. The worldwide burden of epilepsy is about 5–10/1000 population.

A very limited set of data regarding the prevalence of epilepsy in Pakistan is available. According to available data, epilepsy is more prevalent in Pakistan than other nearby Asian countries. The average prevalence of this fatal disease is 9.99/1000 individuals and for the rural areas, the figure becomes double (14.8/1000) than in urban areas (7.4/1000)<sup>89,91</sup>. About 2 million people in Pakistan are suffering from epilepsy most of epilepsy most of

which have age younger than 30 years. This number of epilepsy cases accounts about 10 percent of the worldwide burden<sup>92</sup>. Mostly the people with age  $> 30$  years were reported with epilepsy while prevalence ratio was less in the cohort of 40–59 years old<sup>89</sup>. Social attitude of a society towards the affected ones and their family consequences stigmatization and irremovable hurdle in the remedial steps<sup>93</sup>.

In Iran, the prevalence of epilepsy is almost same as that of the other developing countries. According to a study conducted in Kerman, the prevalence was found to be 7.87/1000 in both genders. In a house based survey, 17.3% of patients had a family history of epilepsy<sup>94</sup>. Some studies indicate the positive attitude and good knowledge of Iranian people for Epilepsy and epileptic patients<sup>95,96</sup>.

About 9 million Chinese people are devilling with epilepsy and 0.4 million new cases are expected to appear each year<sup>97,98</sup>. In China, the prevalence of epilepsy is at the lowest range in the Asian countries with a value 2.89/1000 people. Among the various subtypes of seizures, the generalized seizures are more common with a prevalence of 3.12/1000. These seizures are more prevalent in males, rural and age group of 10–19 years<sup>99,100</sup>.

Epidemiological data manifests that prevalence of epilepsy in India and in high income countries is comparable. Nearly 10–12 million Indians are living with epilepsy which contributes to nearly one-sixth of the global burden. The overall prevalence of epilepsy in India has been estimated 3.0–11.9/1,000 with an incidence of 0.2–0.6 per 1,000 population per year<sup>101,102</sup>.

According to the available data, the prevalence of epilepsy was found 6.54/1000 population in Saudi Arabia<sup>103,105</sup>. Stigmatization was noted as a severe social outcome in the epileptic patients. It was reported that about 78% of people refused to marry a person with epilepsy not only in Saudi Arabia but it is a commonly exercised practice all around the world<sup>106,109</sup>.

## DEPRESSION

Depression is a condition that adversely influences the normal activity of a healthy brain. The affected one also manifests anxiety, loss of positive thoughts, lack of interest in the routine life, negative feelings, and sense of well-being. Hopelessness, restlessness, worthlessness, irritability, anger and being guilty are the most observed symptoms of a person with depression. The affected life activities even can result in financial loss and death in the form of suicide. About 350 million people (5% of world's population) of all ages worldwide have depression and about 800,000 people mostly of 15 to 29 years old, die annually due to depression<sup>35,110,111</sup>.

In Pakistan, the available data indicate 34%

prevalence of depression and anxiety and it is more common among women 112,113. According to locally reported data, depression is more prevalent in the rural areas (66% in women and 25% in men) than in urban areas (25% in women and 10% in men)<sup>114,117</sup>. It may be due to the poor economic conditions in the rural areas that aggravate the situation. The prevalence of depression in Pakistani population varies due to varying socioeconomic factors, children health, age and geographic location throughout the country<sup>118,121</sup>.

According to various reports, the prevalence of depression in Iran is 51.1%. Among these data, the prevalence of severe depression symptoms (GDS - Geriatric Depression Scale >10) is 19.7%<sup>122,125</sup>. Prevalence of depression is remarkably high among the elderly people, particularly among women. Social factors and inactive or sedentary life style are contributing to increase the prevalence with the passage of time<sup>126,128</sup>.

Recent investigations indicate that around 100 million Chinese are living with depression and living alone is a significant factor for increasing rate<sup>129,131</sup>. The prevalence of depression and depression associated disorders ranges from 11.3% to 18.1%. It is also observed that there is a high prevalence of depression among elderly people, especially among medically institutionalized individuals. The trend of medication against depression is poor in the Chinese population, only less than 1% of the patients receive treatment. Most of the people with depression are unaware of their illness and refuse to take any remedial steps<sup>132,136</sup>. Modernization is contributing to elevate the depression level in Chinese people<sup>137,138</sup>.

It is reported that 1 out of 20 Indians is suffering from depression<sup>139</sup>. According to press reports about 4.5% population of India is somehow suffering from depression<sup>140</sup>. In the remote areas, a large portion the elderly ones is facing depression due to social and financial conditions<sup>141,144</sup> and a large proportion of population who suffers from depression remains undiagnosed either due to poor understanding of the associated factors or due to inefficient screening and treatment opportunities<sup>145,146</sup>. Majority of the family members particularly mother of special child show depressive symptoms<sup>147</sup>. Many studies have been conducted to determine the prevalence of depression and its association to other prevailing disorders such as diabetes, cancer, cardiovascular disease and AIDS<sup>148,150</sup>. Among the young adults from a population of Ranchi city of India, the prevalence from mild to extremely severe depressive symptoms appeared 18.5%, anxiety 24.4%, and stress 20%<sup>149,151</sup>. Compare to their neighbours, in Indian population, all age groups; elderly to youngster show signs of depression<sup>141,152,156</sup>.

In Saudi Arabia, the prevalence of depression is

almost similar to that of Pakistan. The overall prevalence is 39% but varies greatly in various regions of Saudi Arabia. The prevalence of depression was 35.7% in Riyadh, the most populated city of Saudi Arabia<sup>157,158</sup>. Other parts of this geographically large country show varying values of depression among the inhabitants at different levels. Abdelwahid et al., reported 12% depression at a tertiary care center in Southeastern Saudi Arabia<sup>159</sup>. Depression as an after effect of many diseases has been reported at an alarming rate in this country. Post-stroke depression is a common type of this illness and mostly observed in the people of all age groups<sup>160</sup>. Moreover, its appearance as an associated factor to the other diseases such as diabetes mellitus, cardiovascular disorders, post-surgery consequences and cancer cannot be ignored in the region<sup>161,162</sup>. The education quality is being adversely affected due the high prevalence of depression among the students. A study reports a 30.9% depression among the medical students<sup>163,164</sup>. Other fields of education may have similar tendency of this behavioral disorder. The school going children are not out of reach of this disorder<sup>165</sup>. The elderly Saudi people share a 39% prevalence of depression and depict an alarming situation in this peninsula<sup>166,168</sup>. Kingdom of Saudi Arabia hosts a considerable population of foreigner workers as a labor force. These people are also suffering from depression due to unfavorable working conditions and other social factors<sup>169</sup>.

## PARKINSON'S DISEASE (PD)

More than 10 million peoples worldwide are living with Parkinson's disease (PD). PD is characterized by tremors, rigidity, movement and postural abnormalities. Loss of dopaminergic neurons in substantia nigra pars compacta is considered as a major cause of the diseases. The process of cell death is greatly associated with aging, therefore the chance of PD increases with the increasing age. It has been indicated that a strong correlation exists between prevalence of PD and aged population in an area. People with age of 80 years or older are 46 times more likely to acquire PD than those of 40 years old<sup>170,171</sup>. As PD predominantly affects older adults, worldwide aging populations, especially in economically developed countries, will increasingly need to develop strategies to meet the health care needs of individuals with PD. Information on the variation in the incidence of PD between age groups and genders can be used to effectively direct these strategies to appropriate populations<sup>171</sup>.

About 450,000 people in Pakistan suffer from PD in a



population of about 182 million that accounts about 219 individuals with PD in every 100,000 individuals. In a study conducted in Sindh province, data obtained from Agha Khan University Hospital, to evaluate clinical spectrum of the disease, it is found that the prevalence is more in males (63%) than in females (37%)<sup>172,173</sup>. Some of the hospital based data is available regarding the prevalence of PD in Karachi and Peshawar. The data show more prevalence in male and in rural areas than female and in urban areas, respectively<sup>172,174</sup>. Recently, a newspaper reported that more than 600,000 people are living with PD in Pakistan; perhaps we are unable to confirm the source of the information.

In Iran, the prevalence rate of PD is 285/100,000. More prevalence is found in males than in female<sup>175</sup>. The ratio of PD in male and female was 1.62<sup>176,177</sup>. Signs of depression appear in the patients suffering from PD and aggravate the situation<sup>178</sup>.

In China, the prevalence of PD is much lower than in other Asian countries including Pakistan. There are 2/100,000 individuals and over 2.5 million Chinese have PD. Males were found 25% more prone to have PD in the later age than females<sup>179,180</sup>. An increasing trend in the annual prevalence rates of PD from 2004 to 2011 has been reported<sup>181,182</sup>. Overall, the prevalence of this disease appears to increase with age and there are sex differences evident in the Chinese<sup>130,183</sup>.

In India, the prevalence of PD is greater than that of China but less than most of the other Asian countries. The crude prevalence of PD in India varies from 6–53/100,000<sup>41</sup>. According to a community based study conducted in Kolkata in 2006, the prevalence found is 53/100,000 and the average annual incidence rate is 5.71/100,000 per year<sup>184,185</sup>. In most of the studies, it was found that prevalence rate was higher in men than in women and this was attributed to the longer life expectancy of women<sup>186,187</sup>.

Among the population of Saudi Arabia, the incidence of PD was reported at 4.5/100,000 person-years and reported prevalence at 27–43/100,000 population and it accounts the cause of dementia in around 7% of Arabs<sup>42,188,189</sup>.

### ALZHEIMER'S DISEASE/DEMENTIA

Dementia is a late onset important neurological condition forth coming epidemic in our society that asks for our urgent attention. Due to escalation in life expectancy, the number of elderly people in our society is increasing. The prevalence of dementia is projected to much more higher than our expectation. As per prevalence data from developing countries, dementia in individuals more than 65 years of age or older was more prevalent in Asia and Latin America than India and sub-Saharan Africa (1–3%). Worldwide

distribution of dementia due to Alzheimer's disease (AD) was more common (60%) than vascular dementia (30%)<sup>190,193</sup>.

Epidemiological data regarding the prevalence of AD is lacking in Pakistan. Very limited data indicates the presence and frequency of AD in elderly people and its association with other diseases<sup>194,195</sup>.

The number of people with AD/dementia in China is 9.19 million with a prevalence of 2.6% among the people of age group 65–69 years. A population of about 5.69 million effected by AD with an overall prevalence of 1.6% according to a study conducted in 2010<sup>196</sup>. The prevalence of AD is higher in urban (2.29%) than in rural population (1.67%)<sup>197</sup>. The people of 65 years or 99. In India, the prevalence of various types of dementia and AD is less than that reported in the overall prevalence of dementia in Asia 200. The prevalence in the individuals with age 40 year or more is 0.43% while in the individuals with age 65 years or more is 2.5%. Women are more commonly affected by AD than men with a female to male ratio of 1.58<sup>200,202</sup>.

### CONCLUSIONS

Neurological disorders are the diseases of nervous system that may consequence functional aberrations such as depression, movement disorders, and paralysis. Traditionally, policy makers and researchers consider mortality statistics as the principal measure of the seriousness of any disease. Mortality statistics alone, however, under estimate the suffering caused by diseases that may be nonfatal but causes substantial disability throughout the life<sup>10,33</sup>. Many neurological and psychiatric conditions belong in this category. The absenteeism of some neurological disorders from lists of leading causes of death has contributed to their long-term neglect. When the relative seriousness of diseases is assessed by time lived with disability rather than by mortality, several neurological disorders appear as leading causes of suffering worldwide<sup>10,33</sup>. WHO data suggest that neurological and psychiatric disorders are an important and growing cause of morbidity, mortality, and disability<sup>203</sup>. The magnitude and burden of mental, neurological, and behavioral disorders is huge, affecting more than 450 million people globally. According to the Global Burden of Disease Report, 33% of years lived with disability and 13% of disability-adjusted life years (DALYs) are due to neurological and psychiatric disorders, which account for four out of the six leading causes of years lived with disability<sup>11,33</sup>. Unfortunately, the burden of these disorders in developing countries remains largely unrecognized. Moreover, the burden imposed by such chronic neurological conditions in general can be

expected to be particularly devastating in poor populations. Major manifestation of an impact on the poor includes loss of gainful employment, cost of medications and need for other medical services can particularly be devastating. In addition to health costs, they frequently subjected to human rights violations, stigmatization, and discrimination. Stigmatization and discrimination further limit patients' access to treatment. These disorders, therefore, require special attention particularly in developing countries<sup>33,204</sup>.

In this review, we address the prevalence of commonly reported neurological disorders in Pakistan in comparison to Iran, India, China and Saudi Arabia. We

focused the prevalence of Migraine, Depression, Hypertension, Alzheimer's disease (AD)/dementias, epilepsy, Parkinson's disease (PD), and stroke. Unfortunately, population-based data from these countries on the epidemiology of these illnesses are limited<sup>11,33</sup>. The available data predict that burden of neurological disorders is rising due to increasing life expectancy, urbanization of population and better diagnostic facilities in this region<sup>10</sup>. The privation of epidemiological data in Pakistan is manifested in the health policy with little focus on neurological disorders. The present review establishes a correlation of NDs prevalence in Pakistan and in other Asian countries.

**Table 1:** Comparative prevalence of NDs

Disease	Worldwide	Pakistan	Iran	China	India	KSA	Prevalence in Population
Migraine	1.7–4 205	22.9 62	14 (Farhadi Z et al., 2006)	9.3 59	25.2 60	5.1 - 7.1 61	100
Hypertension	3.4-72.5 45	33 46	42.7 47.48	22.7-40.7 50	29.8 54	15.2 - 40.6 55	100
Stroke	41-316 64	250 68	375 65	205-284 207	145 41.80	178 87	100,000
Epilepsy	5-10 89.208	9.99 89.92	7.87 94	2.89 99	3.0-11.9 101	6.54 106	1,000
Depression	5 111	34 112	51.1 123	11.3-18.1 133.180	18.5-21.7 141.151	39 157	100
Parkinson's Disease	41-1903 170	219 172.173	285 176	2 179	53 41	27.43 188.189	100,000
Alzheimer's Disease/ Dementia	1-5 209	N/A	N/A	2.6 196	2.5 201	N/A	N/A

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