

## Current Status of Neurology and Neuroscience Research in Pakistan

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### Abstract:

**Background:** Neurology and neurosciences is most under-recognized field in most of the developing world. There is no statistical data available from Pakistan reporting the exact prevalence of neurological diseases. Most of the studies reported so far are either regional or hospital based.

**Objectives:** The aim of this review was to bring the current situation of neurology and neuroscience into the limelight and highlight the areas where Pakistan is lagging.

**Methodology:** PUBMED and Google scholar were explored for the period 2000-2017 to collect recent information regarding the current situation of neurology and neuroscience in Pakistan.

**Results:** It was observed that Neurology and neuroscience are not well recognized and well established fields in Pakistan, despite of the fact, that Pakistan carries a huge disease burden of neurological genetic disorders due to consanguineous marriages. Most of the medical and other Universities don't have separate departments to cater these areas, consequently, resulting in sufferings of patients and lack of required knowledge among students, researchers and practitioners.

**Conclusions:** There is a great need to do more research, improve diagnostic facilities, build neurology departments in medical universities and compulsory neurology education to all medical students. Research publications from Pakistan in area of neurology and neurosciences are very less compared to neighboring and developed countries. Health care and diagnostic facilities for neurological disorders are inadequate in Pakistan and there are very limited training facilities. Modifiable risk factors such as pollution, smoking, lack of healthcare facilities, low literacy rate, socioeconomic status, lack of awareness, hygiene issues, high ratio of cousin marriages and lack of genetic counseling facilities are contributing factors for neurological diseases in Pakistan. These issues should be properly addressed to prevent these diseases to some extent.

**Keywords:** *Neurology, neuroscience, neurodegenerative disorders, Pakistan, Neuroscientist, Consanguinity, Parkinson, Stroke, Alzheimer's*

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### Introduction

Neurology is a medical specialty, dealing with diagnosis and treatment of nervous system disorders,<sup>1</sup> while neuroscience is a broader term which involves cellular, molecular, developmental, structural, functional, evolutionary, computational and medical aspects of nervous system. The term neurobiology is a narrow term including only biology of nervous system<sup>2</sup>.

### Epidemiology of neurological disorders

The burden of neurological disease is high in developed countries (10-11%) compared to developing countries (4-5%) and overall burden of neurological diseases in the world is around 6.5%. Compared to many other diseases (ischemic heart diseases, tuberculosis) the death and disability due to neurological diseases is quite high and it is mainly due to stroke, dementias, migraine, epilepsy and tetanus<sup>3</sup>. As in developed countries, the burden of neurological diseases is on the increase in developing countries due to many factors including urbanization, increasing life expectancy, change in life-style, and better diagnostic facilities<sup>4</sup>.

According to Global Burden of Disease (GBD) study, the disability adjusted life year (DALY) in 1997, burden and prevalence of 107 disorders in different regions of the world was due to malnutrition, contaminated water, improper sanitation, poor hygiene, unprotected sex, smoking, alcohol consumption, hypertension, sedentary life style and environmental pollution. This analysis was based on estimates of mortality by cause, incidence, mean age of onset, duration and disability severity. Developed countries account for 11.6% of global burden of mortality and disability and 10.5% deaths were attributed to neuropsychiatric conditions worldwide. Among all the major causes of these mortalities, neuropsychiatric disorders were less recognized<sup>5</sup>, while in GBD study of 2012, it was recognized as a major cause of years lost because of disability (YLDs) among 10-24 year old people<sup>6</sup>. The burden of mental and substance use disorders increased by 37.6% between 1990 and 2010, which for most disorders was driven by population growth and aging<sup>6</sup>.

### Prevalence of neurological diseases in Pakistan

There are very few population based studies in Pakistan related to neurological diseases and mainly studies are hospital based. As hospital based studies are not true representation of prevalence of neurological diseases in Pakistan so the exact data is not available<sup>7,8,9,10</sup>. According to a survey based study,

there is 33% prevalence of hypertension in the age group of 45 or older<sup>4</sup>. Diabetes is one of the major reasons of many neurological problems in Pakistan and there is diabetes prevalence of 10.8% in urban population, while 6.5% in rural<sup>11</sup>. The users of paan (betel leaf filled with areca nut and sometimes tobacco) or tobacco in Pakistan are around 20% adult man and women<sup>4</sup>. The exact data on prevalence of stroke in Pakistan is not known but according to a few hospital based studies, the prevalence is as high as any western countries<sup>12</sup>. According to estimates there are 250 stroke cases per 100,000 population in Pakistan and this will increase to 350,000 new cases every year<sup>13</sup>. In addition, stroke is relatively common at young age in South Asian countries. There is still epidemic of tetanus, rabies and polio in Pakistan, although effective vaccines of these diseases are available. Due to certain myths (vaccine cause sterility, bad for health) and misleading information, some people are against the use of polio vaccine. The government is involving all the stake holders to reduce mistrust and to increase vaccine coverage area. The prevalence of epilepsy is quite high in Pakistan and it is more prevalent in younger adults below the age of 30. According to estimates, there are around 10 cases of epilepsy in Pakistan in the population of 1000 and there is global prevalence of around 5-10 cases per 1000 population. According to statistics, epilepsy is one of very common and serious neurological problems in Pakistan<sup>14,15</sup>.

Low education, sedentary life style, obesity, smoking, hypertension and environmental pollution are established environmental factors that are associated with neurological disorders<sup>16</sup>. In another study, more depressive disorders were observed among people of over 40 years, females, married, with medium or low educational level, dysfunctional family environment, victims of family violence and who were the middle siblings<sup>17</sup>. Malnutrition is another risk factor of developing neurological disorders among children, which compromise physical and intellectual growth. Pakistan is ranked second for having 1.4 million

children suffering from severe acute malnutrition (SAM) among a total of 12 million in Asia<sup>18</sup>. Breast-feeding should be promoted in the region and standard healthcare facilities should be provided to whole population<sup>19</sup>. In a study conducted in Iran, male children, less socioeconomic background, lower maternal education, poor water supply and children of urban areas were found more stunted<sup>20</sup>.

Another major problem in developing countries like Pakistan is lack of health care facilities to people with low socioeconomic status. Mother and neonatal health is not given priority, this result in pregnancy complications along with congenital anomalies and pre-term birth leading to neurological disorders<sup>18,21</sup>. Apart from high maternal age, low maternal education, less awareness and high cesarean section deliveries are responsible for adverse neonatal outcome in the region<sup>22,23</sup>.

### **Social problems in Pakistan**

As illiteracy rate is high in Pakistan, so people from rural areas are not aware of psychiatric and neurological disorders. In most of the cases, they believe on superstitions, supernatural powers and go to quacks instead of consulting a doctor. This is also a major reason that we do not have any confirmed and correct statistical data regarding the magnitude of neurological problems in Pakistan. Socially, it is not considered good if a person has some kind of psychiatric or neurological disorder, so people try to hide it and never consult doctors. In this way, people never consult doctors or visit doctors at last stage of disease, when it is almost impossible to treat the patient.

### **Genetic predisposition in Pakistan**

Rate of consanguineous marriages is high in Pakistan as compared to rest of the world. For this reason, Pakistani population has more genetic predisposition for genetically inherited disorders but unfortunately focused research on mutation screening is not carried out in Pakistan<sup>24</sup>. This is leading to increase rate of neurologic problems in the country, which can be prevented by screening

and genetic counseling.

### **Neurology and Neuroscience in Pakistan**

Although neurology is one of the most important fields of education and research but it is not very much appreciated in Pakistan and so far, it is under-recognized. The field of neurology started in Pakistan back in 1960s with the establishment of 3 neurology departments in two major cities of Pakistan. Although, there is a long history of neurology in Pakistan but still it is not very progressive<sup>25,15</sup>. According to Pakistan Medical and Dental Council (PMDC), it is not compulsory to have a neurology department in medical colleges for undergraduate studies. Up-till now, there are only 15 medical colleges in Pakistan that have a separate neurology department among 72 medical colleges. Most of the students who are graduating from these medical colleges do not study neurology as a separate subject but study it as part of different other courses (anatomy, physiology)<sup>26</sup>.

According to current scenario there are 15 programs accredited by the College of Physicians and Surgeons of Pakistan. These programs are running in 7 major cities of Pakistan for post graduate training in neurology. These programs are both in public and private hospitals so there are a lot of variations in these programs; including number and level of experts for training, number of patients, infrastructure and level of exposure to patients. There is also great difference in sub-specialties of neurology as some sub-specialties are greatly focused in Pakistan including headache and stroke but other have least focus like cognitive impairment. The neurologists also have a complain that there are not enough neurology jobs in Pakistan and mostly they leave the country and practice in other countries resulting in substantial brain drain<sup>26</sup>. There are very less epidemiological studies from Pakistan and mainly work was done in area of epilepsy, so national level prevalence data of other neurological diseases is unknown.

### **The Pakistan Society of Neurology**

The Pakistan society of neurology (PSN) was

established to provide a platform to neurologists of the country. The aim of society is to improve the neurological services in Pakistan and also to promote academic and research activities. The society has a mission of fostering the best standards and neurological practices, to develop collaboration at both national and international level, promote education and research. In addition, society also provides advocacy services to patients suffering from different neurological disorders at national level. PSN is now more than 2 decades old and in 2014, 21st annual meeting of PSN was organized in Karachi. Many societies of different sub-specialties of neurology namely; stroke, headache and epilepsy were established under the umbrella of PSN. Furthermore, in order to promote research culture in Pakistan, PSN also started its official journal entitled “Pakistan Journal of Neurological Sciences” ([www.pakjns.com](http://www.pakjns.com)) and mostly neurological studies from Pakistan were published in this journal. The journal is recognized by PMDC. The society also celebrates different national and international days (World Brain Day) and arranges different events for awareness purpose.

### **Pakistani neurologist at international forums**

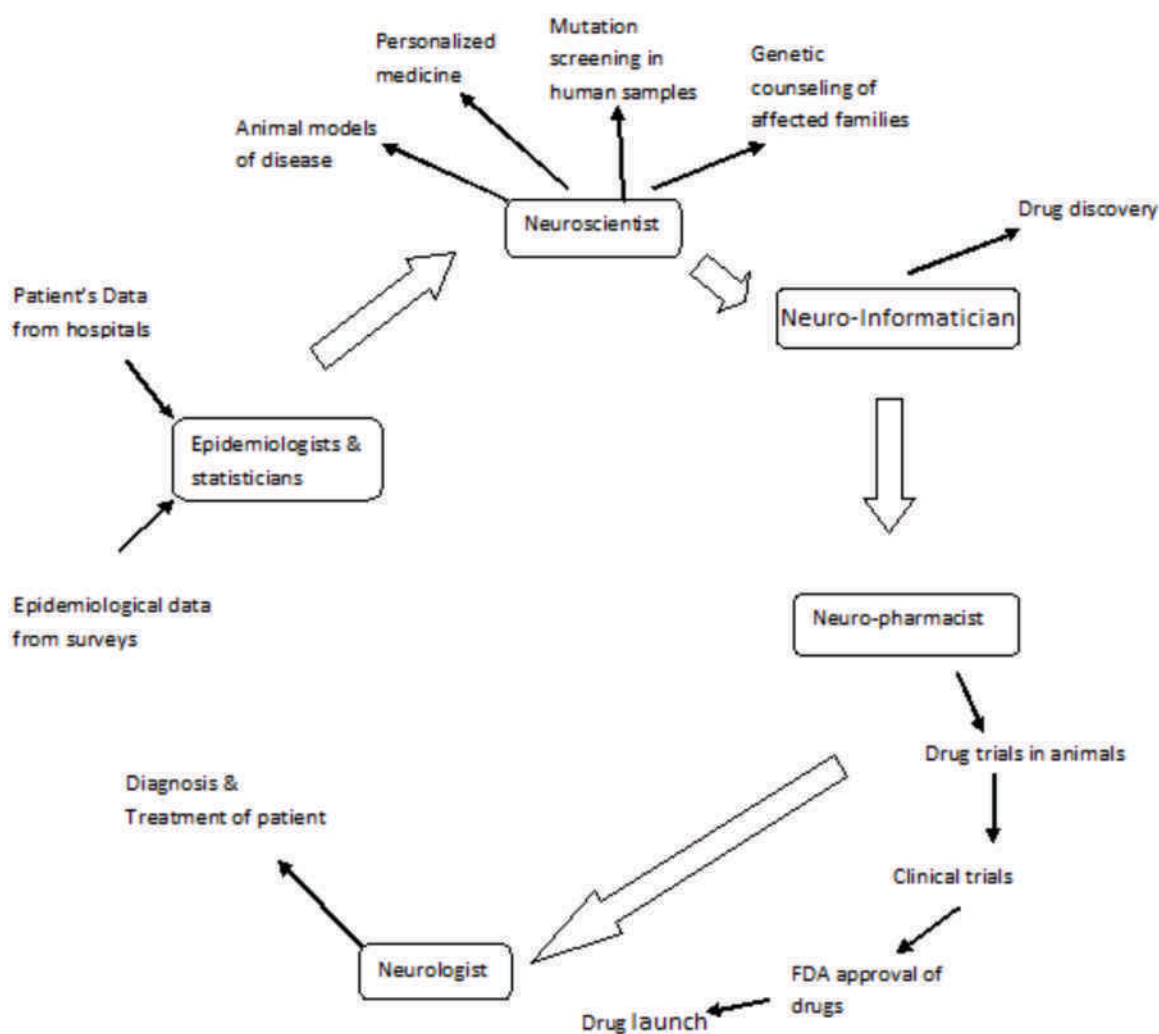
The neurologists from Pakistan are part of different neurological forums/organizations at international level, which is greatly helping to develop collaborations and exchange of knowledge and expertise. Presently the neurologists are part of different platforms, especially; World Federation of Neurology, the Asian Oceanic Organization of Neurology, World Stroke Organization and the American Academy of Neurology<sup>27</sup>.

### **Present status of neurologist and neuroscientists in Pakistan**

There is a growing interest to get training in area of neurology and very good numbers of graduates are registering themselves for post graduate training. Presently, there are 16 centers in Pakistan for neurology training and the number will

be increased to over 30 in next 5 years. It is expected that there will be more than 500 trained neurologists in Pakistan by the year 2017. In addition, the Aga Khan University has received funding from NIH to train neurologists in area of stroke and recently National Academy of Young Scientists (NAYS), Pakistan ([www.nays.com.pk](http://www.nays.com.pk)) in collaboration with Society for Treatment and Study of Pain (STSP) also arranged 6 knowledge transfer workshops for general practitioners on chronic pain management, in different cities of Punjab. Many other sub-specialties of neurology are also arranging different workshops and training courses in different hospitals and medical colleges of Pakistan. Presently, the research is mainly focused in area of stroke, epilepsy and CNS infections, which is mostly done at hospital level. If we talk about the diagnostic facilities for neurological disorders, they are not sufficient; for example, for 6 million population of Lahore, there are just 10 Magnetic Resonance Imaging (MRI) machines (4 in government and 6 in private sector) and only 20 CT scanners. There is also need to expand research to society at large so population based data could be obtained. Moreover, there is need to focus on other sub-specialties of neurosciences (cognitive, developmental, cellular and molecular).

As there is very little understanding of the neurological diseases and effective treatment strategies are not developed so far, the role of neurologists is limited to diagnosis and exclusion of disease<sup>28</sup>. For this reason, there is need to explore the mechanism of these disorders by doing more research and clinical investigations. This is prerequisite to treat and manage neurological patients in a better way. More emphasis should be given on team and collaborative work, rather than independent (Fig.1). Neurologists and neuroscientists should work side by side along with other health care professionals to cope with the monster of neurological disorders in the country.



**Figure 1:** Schematic representation of interactive team work of different healthcare professionals to combat neurological disorders

### Recommendations

There are some suggestions to improve the field of neurology and neurosciences in Pakistan both in academic and research.

1. There should be mandatory neurology education in medical colleges.
2. There should be neurology faculty in all the medical colleges and also positions for neurologists in district hospitals.
3. The collaboration should be promoted in basic and applied neurosciences research in Pakistan
4. There should be more funding for neurosciences research in Pakistan as USA and European countries are focusing on this important area of research by US brain initiative and EU's Human Brain Project.
5. A center of excellence should be established in area of neurosciences, which will promote basic and applied neuroscience research in

Pakistan and will also develop linkages with other institutes related to the field to promote research and clinical translation.

6. Neuroscientists and neurologists should work as a team to combat the dilemma of neurological disorders.
7. A research center should be dedicated in each medical university/hospital for basic and applied research in neuroscience by providing well equipped research labs, animal house facility and proper storage facility for samples.
8. More research should be done towards personalized medicine because South Asian population has different genetic makeup from other populations and we must know the kind of mutations that exist in our population and produce personalized medicine or medicine that is suitable for our population.
9. New genetic and molecular biomarkers should be developed for the diagnosis of neurological diseases in population.
10. There should be more research in new therapeutic strategies for neurological disorders in this region.
11. Diagnostic facilities such as MRI and CT scanners for neurological disorders should be upgraded in all medical hospitals.
12. In collaboration with engineering and information technology experts, there should be work on brain computer interface to produce bionic limbs and other similar technologies. As there are thousands of victims of terrorisms and other incidents in Pakistan so it could be great help for them. In addition, it will greatly popularize the area of neurosciences in Pakistan, not only in common public but also among the scientist.
13. Government should give better incentives to neuroscientists so Pakistan could stop the brain drain process. In addition, some expatriate neuroscientist should be called in Pakistan to bring more knowledge and expertise.
14. Funding should be allocated to conduct national level survey on brain diseases, as no data is available on number of brain disorders in Pakistan so far, this will give true picture of prevalence of different neurological disorders and then these diseases can be better managed by planning. In addition, it will increase the research output of Pakistan.
15. There is need of more linkages with institutes in developed countries to get more recent knowledge and expertise to better cure and treat mental diseases in Pakistan.
16. More learning and training opportunities for young neurologists so they could better understand and apply their field.
17. Simple and easy to understand literature should be produced by PSN to educate researchers of other science disciplines and also common public of Pakistan.
18. Healthy activates (walk, exercise, balanced diet) for the management of hypertension should be promoted in common public and in school and colleges. In addition print and electronic media should be involved and there should be more programs on brain health.
19. In addition to medical professional, general awareness should be created in common people through print and electronic media and in school children. People should be taught that psychiatric and neurological disorders exist and no one should feel ashamed to consult doctor for this purpose.
20. Genetic testing of all the susceptible couples should be done and genetic counseling should be provided to them for future pregnancy in order to prevent any genetics based neurological anomaly.
21. Government should take proper steps to improve maternal and child healthcare facilities and take serious action on un-necessary caesarian section deliveries by hospitals.
22. Strategies to cope with malnutrition should be developed to reduce the very early symptoms of neurological disorders and also to reduce the

burden of neurological illness in Pakistan.

## Conclusion

This review provides a brief overview of current scenario of neurology and neuroscience in Pakistan. Based on the recommendations, health policies should be devised to cope with neurological disorders in the country. The fields can be flourished by promoting research, collaborations and translation of basic research in clinical settings. Now, there is need to not only understand the challenges but also make effective strategies to develop infrastructure and manpower to reduce neurologic illness and effectively treat them. This can be done by mutual efforts of government, non-government organizations, private sector and other stake holders. This review article not only present the picture of Pakistan but also situation, risk factors and loops in health policy systems in most of the under developing and developing countries of the world.

## Competing interests

Authors declare no competing interests. No financial assistance was provided for this study.

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