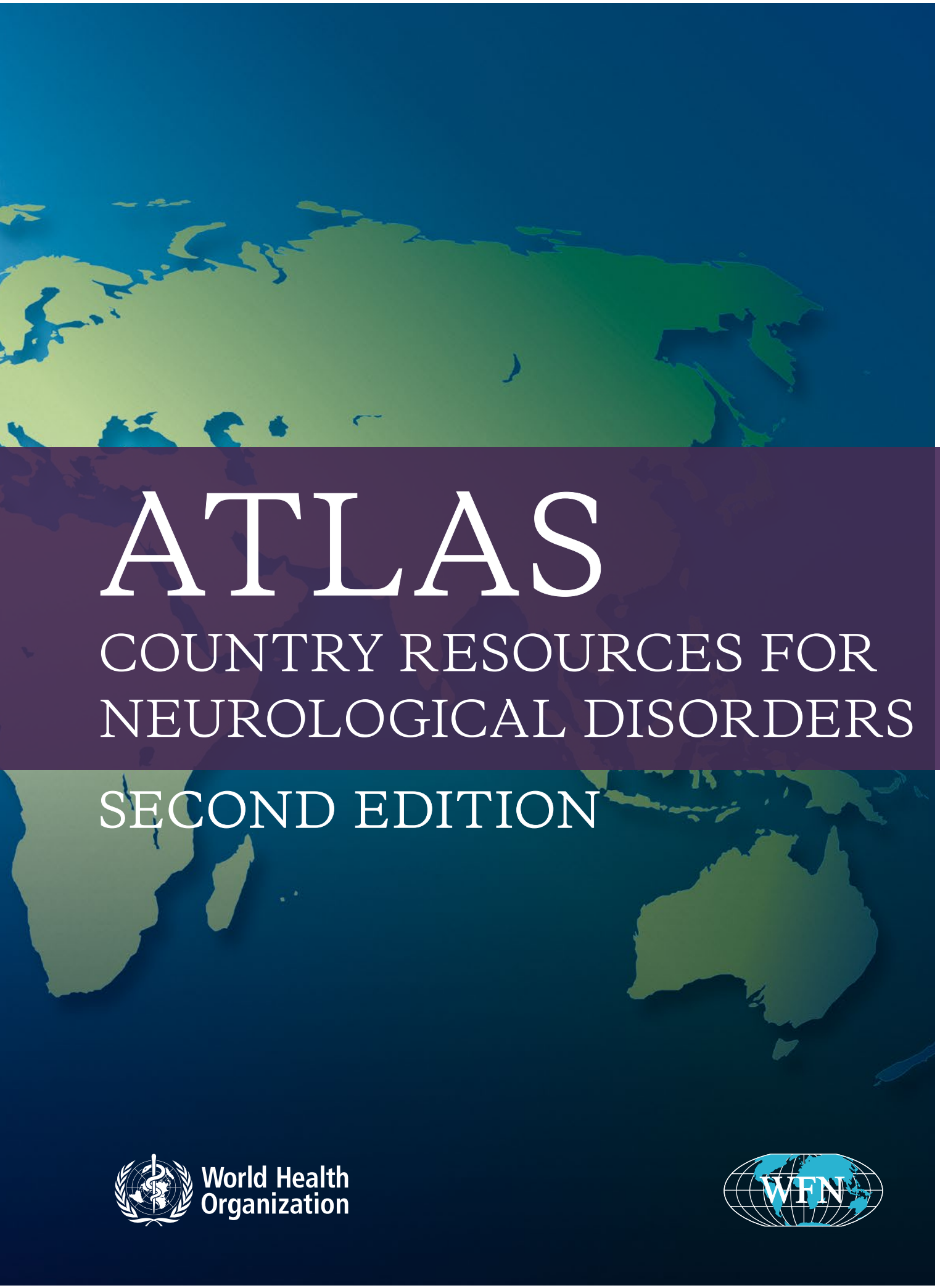

ATLAS

COUNTRY RESOURCES FOR NEUROLOGICAL DISORDERS

SECOND EDITION

World Health Organization

WFN

ATLAS

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FOREWORD

Global Burden of Disease data over the past 20 years show a large and growing burden of death and disability caused by neurological disorders. However, until recently, little was known about the resources available within countries to cope with this burden.

To fill this knowledge gap, WHO launched Project Atlas in 2000 with the objective of collecting, compiling and disseminating relevant information on health-care resources in countries. To assess country resources – and consequently country needs – WHO published the first edition of the Atlas of country resources for neurological disorders in 2004.

Prior to the Neurology Atlas, most information about resources for the care of people with neurological disorders was derived from few high-income countries, with little of it originating in the vast majority of lower-income countries. The Neurology Atlas was disseminated to ministries of health in all WHO Member States and to other stakeholders, and it has remained a valuable resource for health-care planners and others.

The second edition of the Neurology Atlas is intended to update the information provided in the first edition and show the extent to which such resources have grown, or otherwise, over the past 10 years. The information was collected from the answers to a questionnaire provided by 132 countries and two territories covering 94% of the world population. The World Federation of Neurology (WFN) collaborated closely in the collection and analysis of the data and the development of the second edition, with the active participation of leading neurology experts all over the world.

The second edition of the Neurology Atlas summarizes the current status of neurological services and provision of neurological care in various parts of the world. As with the results in 2004, the data demonstrate that the available resources for neurological disorders in most countries of the world are insufficient compared with the known significant burden associated with neurological disorders. In addition, there are large inequalities across regions globally, and among groups with different levels of income. Low-income countries have extremely scanty resources.

We believe that the information presented in this updated edition will prove useful to a large range of readers, including policy-makers, health planners and specialists at both international and national level. The survey results in the second edition of the Neurology Atlas clearly illustrate the need for substantial increases in neurology services and training, especially in low- and lower-middle-income countries, in order to provide adequate care and to decrease inequities. This will only be possible with significant increases in allocations of financial resources for these services. Some of the data also demonstrate the potential role of international collaboration and partnerships in a concerted effort to improve neurological care and to increase and strengthen appropriate training programmes.

At the country level, the data summarized in the Neurology Atlas should help to highlight needs and stimulate national programmes and the development of strategies to improve the diagnosis and management of neurological disorders.

The Neurology Atlas represents the best information we could procure through extensive professional and institutional networks and sources. We are cognizant of gaps in information and possible inaccuracies. We will continue our work in this area to provide more complete, accurate and comparable information in the coming years.

Shekhar Saxena

Director, Department of Mental Health and Substance Abuse, WHO

Raad Shakir

President, WFN

PROJECT TEAM AND PARTNERS

The Neurology Atlas (second edition) is a project of the Department of Mental Health and Substance Abuse, World Health Organization (WHO), Geneva, Switzerland. The Atlas project on neurological disorders is supervised and coordinated by Shekhar Saxena and Tarun Dua from the Department of Mental Health and Substance Abuse. The project was conducted in close collaboration with the World Federation of Neurology (WFN), coordinated by Raad Shakir and Donna Bergen. The second edition provides a comprehensive update of global neurological resources since the publication of the first edition in 2004.

In WHO Member States, key project collaborators were focal points from ministries of health and neurologists from national professional organizations. They provided information and responses to the Atlas survey questionnaire and responded to queries for clarification. Additional information from countries and territories was provided by key persons working in the field of neurology identified by WFN and WHO regional and country offices. A full list of collaborators is provided in Annex 1 of this report.

Key collaborators from the WHO regional offices who contributed to the planning and collation of data and liaised with focal points in Member States included: Sebastiana da Gama Nkomo (African Region), Devora Kestel (Region of the Americas), Nazneen Anwar (South-East Asia Region), Khalid Saeed (Eastern Mediterranean Region), Matthijs Muijen and Elena Shevkun (European Region) and Yutaro Setoya, Marie Villanueva and Xiangdong Wang (Western Pacific Region). We would like to specially thank WFN experts – Amadou Gallo Diop (Senegal) and Riadh Gouider (Tunisia), who supported data collection efforts.

At WHO Headquarters, a team comprising Elizabeth Centeno-Tablante, Melissa Harper Shehadeh and Kiran Thakur provided technical guidance and support for the project, including development of the questionnaire and an associated completion guide, management of the online data collection system, validation of information and responses, liaison with Member States including WHO regional and country offices and representatives from national neurology organizations, analysis of data and preparation of this report. We acknowledge the input and advice provided by Dan Chisholm, Neerja Chowdhary Michelle Funk, Fahmy Hanna, Antonio Lora, Vladimir Poznyak and Teisi Tamming for particular aspects of questionnaire development, data collection, processing, analysis or report finalization.

The graphic design of the Neurology Atlas publication was done by Erica Lefstad and editing by Teresa Lander.

The contribution of each of these team members and partners, which has been crucial to the success of this project, is very warmly acknowledged.

EXECUTIVE SUMMARY

It is now recognized that neurological disorders contribute significantly to global disability, often leading to serious physical, cognitive and psychosocial limitations. The Global Burden of Disease (GBD) study identifies mental, neurological and substance use disorders as a significant cause of the world's disease burden (1–3). The most recent estimates show that stroke is the second highest cause of morbidity and mortality worldwide (1). Dementia, meningitis and migraine rank in the top 30 factors in disability-adjusted life years, and epilepsy in the top 50, out of 315 diseases and injuries included (2, 3). There is a growing recognition that the burden of neurological disorders is disproportionately high in low- and middle-income countries, where health-care services and resources are often scarce. Importantly, the neurological burden of disease is expected to grow exponentially in the next decade, with highest burden in low- and middle-income countries. Innovative health-care management approaches are required in these countries because of the lack of specialist care. Though attitudes and knowledge of the burden of neurological disorders are starting to improve, increased financial investment and policy changes are ultimately required to improve neurological care globally.

The first edition of the Neurology Atlas dates back to 2004, when an initial assessment of available neurology resources in WHO Member States was carried out (4). Overall, results from 109 countries surveyed showed that global resources for neurological disorders are lacking, particularly in low- and middle-income countries. This current edition expands upon the topics addressed in the first edition, compiling data from 132 countries and two territories spanning all WHO regions and continents and representing 94% of the world population. Project Atlas is an assessment of the current infrastructure of health-care for people with mental, neurological and substance use disorders, and provides comprehensive information on the availability of services and resources across the world. The Neurology Atlas project spans several domains, including national health-care policies, financing of care for neurological disorders, access to essential neurological medicines and national guidelines on neurological disorders. The data are intended to serve as a resource for plans to improve the deficits in neurological care both at country level and globally. The burden of neurological disorders will continue to grow during the next decades, and plans need to be implemented to improve current health-care.

KEY FINDINGS

GLOBAL POLICIES ON NEUROLOGICAL DISORDERS

- A total of 24% of countries report stand-alone neurological health policies, although there is a major deficit in low- and middle-income countries.

LEGISLATION FOR NEUROLOGICAL DISORDERS

- A total of 41% of countries report the existence of legislation on epilepsy, and 30% report the existence of legislation relating to people with dementia; 29% of countries report legislation on “other” neurological disorders.

FINANCING FOR NEUROLOGICAL DISORDERS

- A total of 12% of countries surveyed report a separate budget line for neurological disorders. Similar findings were found in the Neurology Atlas 2004 project, where 10% of countries reported a separate budget line for neurological disorders.
- The number of countries with a separate budget line was low (less than 20%) across all income categories.
- A total of 58% of countries report the availability of financial support for people with neurological disorders; the figure for low- and middle-income countries is 24%.

NEUROLOGICAL WORKFORCE AND ALLIED HEALTH-CARE PROVIDERS

- The global median of the total neurological workforce (defined as the total number of neurologists, neurosurgeons and child neurologists) is 3.1 per 100 000 population.
- In the World Bank income group categories (5), low-income countries report a median of 0.1 per 100 000 population, compared with a median of 7.1 per 100 000 population in high-income countries.

NEUROLOGICAL TREATMENT ACCESSIBILITY THROUGH PRIMARY HEALTH CARE SERVICES

- Neurological care by primary health care providers is available in 91% of countries where no neurological expertise exists, although the level of expertise and training in neurological disorders is unknown.

ACCESS TO ESSENTIAL MEDICINES FOR NEUROLOGICAL DISORDERS

- Access to essential medications for neurological disorders is low in primary care settings across WHO regions, particularly in the African and South-East Asia regions.
- A total of 55% of countries report the availability of one or more anticonvulsants (carbamazepine, phenobarbital, phenytoin, or valproic acid) at all times in the primary care setting.
- A total of 92% of countries at the primary care level and 94% at the hospital level report the availability of at least one medication for headache disorders at all times.

NEUROLOGICAL SERVICES QUALITY

- A total of 55% of countries report having guidelines on neurological disorders, with the lowest number in the African Region (26%) and Eastern Mediterranean Region (47%).

NEUROLOGICAL INFORMATION-GATHERING SYSTEMS

- A total of 42% of countries report no neurological disorder data reporting in the last two years.

INTRODUCTION

Neurological disorders are an emerging challenge to health-care systems globally owing to the high burden of disease and lack of health-care infrastructure and resources, particularly in low- and middle-income countries. In the GBD study, mental, neurological and substance use disorders were identified as a significant cause of disability in the global population *(1-3)*. Between 1990 and 2010, absolute disability adjusted life-years due to these disorders rose by 41%, from 182 million to 258 million. The most recent estimates show that stroke is the second highest cause of morbidity and mortality worldwide *(1)*. Dementia, meningitis and migraine rank in the top 30 factors in disability-adjusted life years, and epilepsy in the top 50, out of 315 diseases and injuries studied *(2, 3)*. There is a growing recognition that the burden of neurological disorders is disproportionately high in low- and middle-income countries, where health-care services and resources are often scarce. The absolute burden of neurological disorders is six times higher in low- and middle-income countries compared with high-income countries, largely due to epilepsy (14-fold higher), cerebrovascular disease (eight-fold higher), and migraine (six-fold higher).

The neurological burden of disease is expected to grow exponentially in low- and middle-income countries in the next decade. Despite the significant impact of neurological disorders on patients and societies, knowledge of their burden remains limited. In addition to our limitations in epidemiological knowledge, there are major challenges in the assessment and management of people with neurological disorders. The first edition of the Neurology Atlas identified major deficits in availability of specialized neurological care, neurological beds, government financing and reporting/information systems for neurological conditions *(4)*. Additionally, in spite of major advances in therapy for neurological disorders over the last decade, medication availability remains limited in low- and middle-income countries. Indeed, the treatment gap for neurological conditions is substantial, driven by both patient and health-system factors, which are unlikely to improve without education of the public and health-care professionals, legislation and anti-stigma interventions. Fortunately, attitudes and knowledge about the burden of neurological disorders are starting to improve, and this progress may help to reduce the treatment gap and improve outcomes. In order to respond to the huge burden and challenge posed by neurological disorders, adequate resources must be made available and capacity strengthened within countries.

A vital component for planning and systems strengthening is reliable information about the availability of resources and infrastructure. Very little is known, however, especially in relation to low- and middle-income countries. To fill this knowledge gap, Project Atlas of the Department of Mental Health and Substance Abuse was designed to collect, compile and disseminate data on mental health, neurology and substance use resources throughout the world.

The Neurology Atlas has become an important tool for developing and planning services for people with neurological disorders. This second edition is the first reassessment of neurological resources globally since 2004, when the first edition of the Neurology Atlas was published, and provides comprehensive up-to-date information on national policies, financing for neurological disorders, services available, number and distribution of neurological health-care providers, access to essential neurological medicines and information-gathering systems for neurological disorders.

The second edition expands upon the topics addressed in the first Neurology Atlas, compiling data from 132 countries and two territories spanning all six WHO regions and representing 94% of the world population **(see Annex 1)**. It is intended to serve as a resource for plans to improve the deficits in neurological care both at country level and globally, and is expected to provide a powerful advocacy tool to promote the care of neurological disorders by governments, policy-makers, national and international organizations, health-care professionals and individuals with neurological disorders. Overall, the Neurology Atlas, second edition, emphasizes the need for significant improvements in resources for those with neurological disorders, particularly in low- and middle-income countries. It is hoped that it will provide the necessary impetus to improve the current state of neurological services at global as well as national level to improve care for those with neurological disorders.

METHODOLOGY

The Neurology Atlas project is an international study carried out between 2014 and 2015. Data from 132 countries, one Associate Member and one territory spanning all WHO regions and continents and representing 94% of the world population are included in this document. The methodological steps undertaken to develop the Neurology Atlas, second edition, are briefly outlined below.

STAGE 1. QUESTIONNAIRE DEVELOPMENT

The selection of topics and questions included in the questionnaire was based on the first edition of the Neurology Atlas questionnaire, consultations with WHO regional offices and international experts. A draft version of the questionnaire was piloted in selected countries and sent to international and regional experts for their feedback. Once consensus was reached on the survey components, the questionnaire was drafted in English and translated into three other official United Nations languages – French, Russian and Spanish. The final version sent to countries for completion can be found in English and other languages at the Neurology Atlas website (http://www.who.int/mental_health/neurology/atlas_second_edition/en). Alongside the questions, a completion guide and glossary of terms was developed to help standardize terms and to ensure that the terminology used in the questionnaire was understood by all respondents (see **Annex 2** for the glossary). Most of the questions broadly address resources and services. There were a few questions that addressed specific neurological disorders: dementia, epilepsy, headache disorders, infections of the nervous system, multiple sclerosis, neurodevelopmental disorders, Parkinson's disease, stroke and traumatic brain injury. These disorders were chosen because of their major contribution to morbidity and mortality worldwide.

STAGE 2. QUESTIONNAIRE DISSEMINATION

The ministry of health was requested to appoint a focal point to complete the Neurology Atlas questionnaire. The focal point was encouraged to contact other experts in the field to obtain relevant information in order to answer the survey questions. Close contact with the focal points was maintained during the course of their nomination and questionnaire submission. Staff members at WHO headquarters and regional offices were available to respond to enquiries and provide additional guidance and assistance for completion of the Neurology Atlas questionnaire. Additionally, official delegates from national neurology organizations were contacted to answer additional survey questions, complementing the information provided by the focal point through the ministry of health. All respondents were asked to follow the glossary definitions closely, in order to maintain uniformity and comparability of responses. The Neurology Atlas questionnaire was available online, and countries were strongly encouraged to use this medium for submission. However, an offline version of the questionnaire was available where preferred.

STAGE 3. DATA CLARIFICATION AND ANALYSIS

Questionnaires were screened for incomplete and inconsistent answers and, when necessary, respondents were contacted and asked to clarify their responses. Where appropriate, documents were requested to support completed questionnaires. Upon receipt of the final questionnaires, data were aggregated, analysed and reported both by WHO region and by World Bank income group (5). Countries were grouped into the six WHO regions (Africa, Americas, South-East Asia, Europe, Eastern Mediterranean and Western Pacific). World Bank income groups were defined according to 2014 standards. As of 1 July 2014, low-income economies are defined as those with a gross national income (GNI) per capita of US$ 1045 or less; middle-income economies are those with a GNI per capita of more than US$ 1045 but less than US$ 12 746; high-income economies are those with a GNI per capita of US$ 12 746 or more. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of US$ 4125.[1]

Completed data were entered into an electronic database system using suitable codes, and analysed using the software Stata version 13s. Values for continuous variables were grouped into categories based on distribution. Frequency distributions and measures of central tendency (mean, median and standard deviations) were calculated. Rates per 100 000 population were calculated for certain data points (e.g. workforce numbers), using official country data from the WHO Global Health Observatory, reported in 2015.[2]

[1] http://data.worldbank.org/news/2014-country-classifications, accessed 5 January 2017.

[2] http://www.who.int/gho/en, accessed 5 January 2017.

METHODOLOGY

REPRESENTATIVENESS OF THE DATA COLLECTED

Completed questionnaires were received from a wide range of WHO Member States, areas and territories: 132 Member States and two Associate Members or territories (Puerto Rico and Sint Maarten), which are henceforth referred to as countries collectively for convenience. The data were collected from 36 countries (77%) in the African Region, 25 (71%) in the Region of the Americas, 18 (86%) in the Eastern Mediterranean Region, 33 (62%) countries in the European Region, 10 (91%) countries in the South-East Asia Region and 12 (44%) in the Western Pacific Region. In terms of population, the data cover 94% of the world population.

LIMITATIONS

There are a number of methodological limitations which should be kept in mind when analysing and interpreting the results.

While best attempts have been made to obtain information from countries on all variables, some countries could not provide data for a number of questions. The most common reason for the missing data is that such data does not exist within the countries. Also, in some cases, it was difficult for countries to report the information in the manner specifically requested in the Neurology Atlas questionnaire. For example, some countries had difficulty providing information about the policy or budget for neurological disorders in the requested format, because neurological care in their country is integrated into the primary care system. The extent of missing data can be determined from the number of countries that have, or have not, been able to supply details. Each individual table or figure contains the number of countries able to respond to any item of the questionnaire.

A further limitation is that most of the information provided relates to the country as a whole, thereby overlooking potentially important variability within countries concerning, for example, the degree of availability of services in remote or rural areas versus urban areas. It was difficult to assess resources for particular populations within a country, such as children, adolescents or the elderly, and thus that information is not included in the Neurology Atlas.

Another important limitation is the self-reporting of data. In most cases, there was one focal person in each country who was the source of all information. Respondents were encouraged to obtain additional information from other experts and stakeholders. When responses warranted clarification, written requests from the WHO technical team included suggestions that respondents should contact individuals or groups within the given country. External validation was performed for questions in which there were formal reports, although such validation was limited because of the lack of national reporting systems on neurological disorders in many countries. In some instances, the data are best estimates by the respondents, as there was a limitation in official reporting systems for neurological disorders in some of the countries surveyed.

It is possible that definitions for various terms may vary from country to country. As a result, countries may have had difficulty in interpreting the definitions provided in the glossary. Also, while all possible care has been taken to compile, code and interpret the information given by countries using uniform definitions and criteria, it is possible that some errors may have occurred during data handling.

Project Atlas is an ongoing activity of the Department of Mental Health and Substance Abuse. As more accurate and comprehensive information covering all aspects of neurology resources becomes available and the concepts and definitions of resources become more refined, it is expected that the database will become better organized and more reliable. While it is clear that, in many cases, countries' information systems are weak, it is hoped that the Neurology Atlas may serve as a catalyst for further development by demonstrating the utility of such information for national planning, monitoring and evaluation.

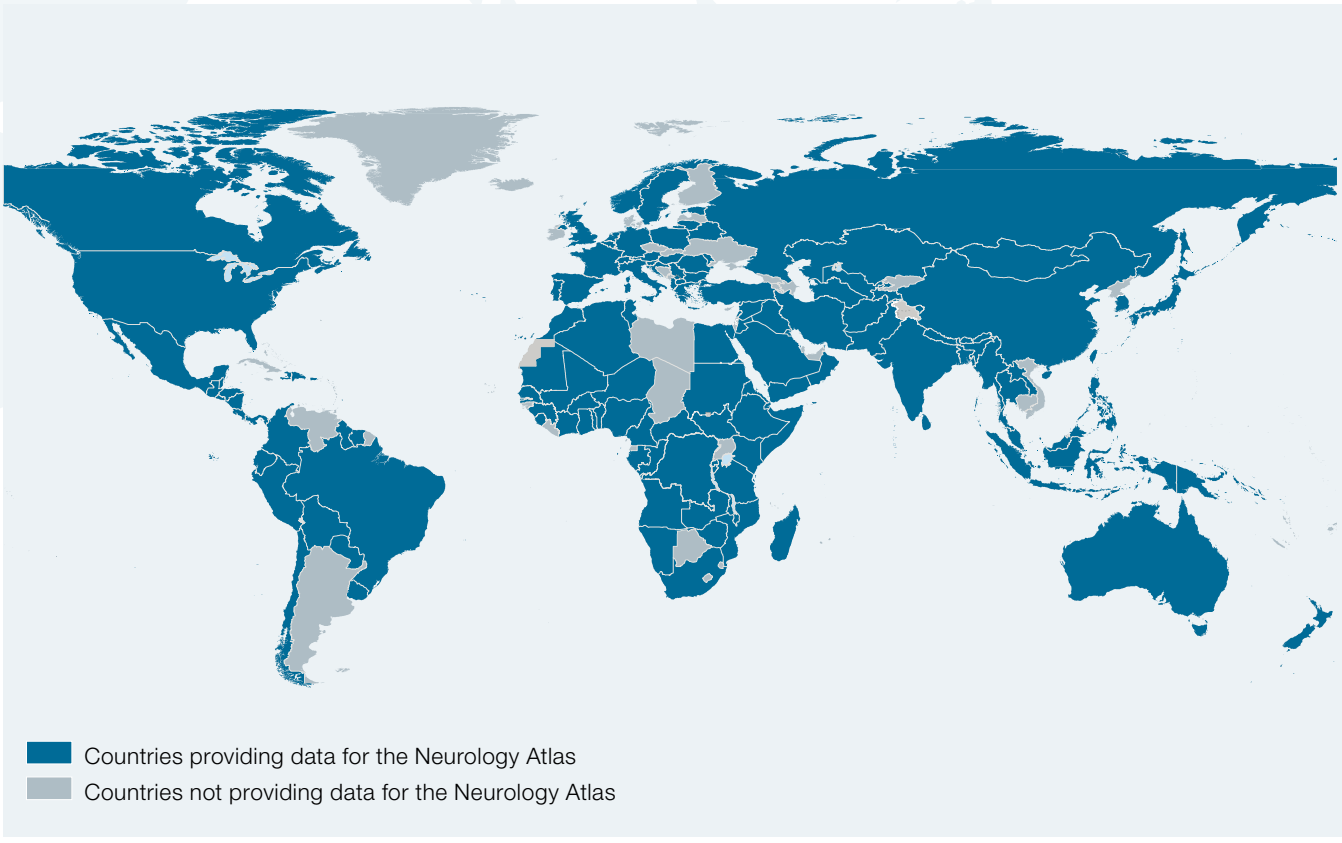
RESULTS

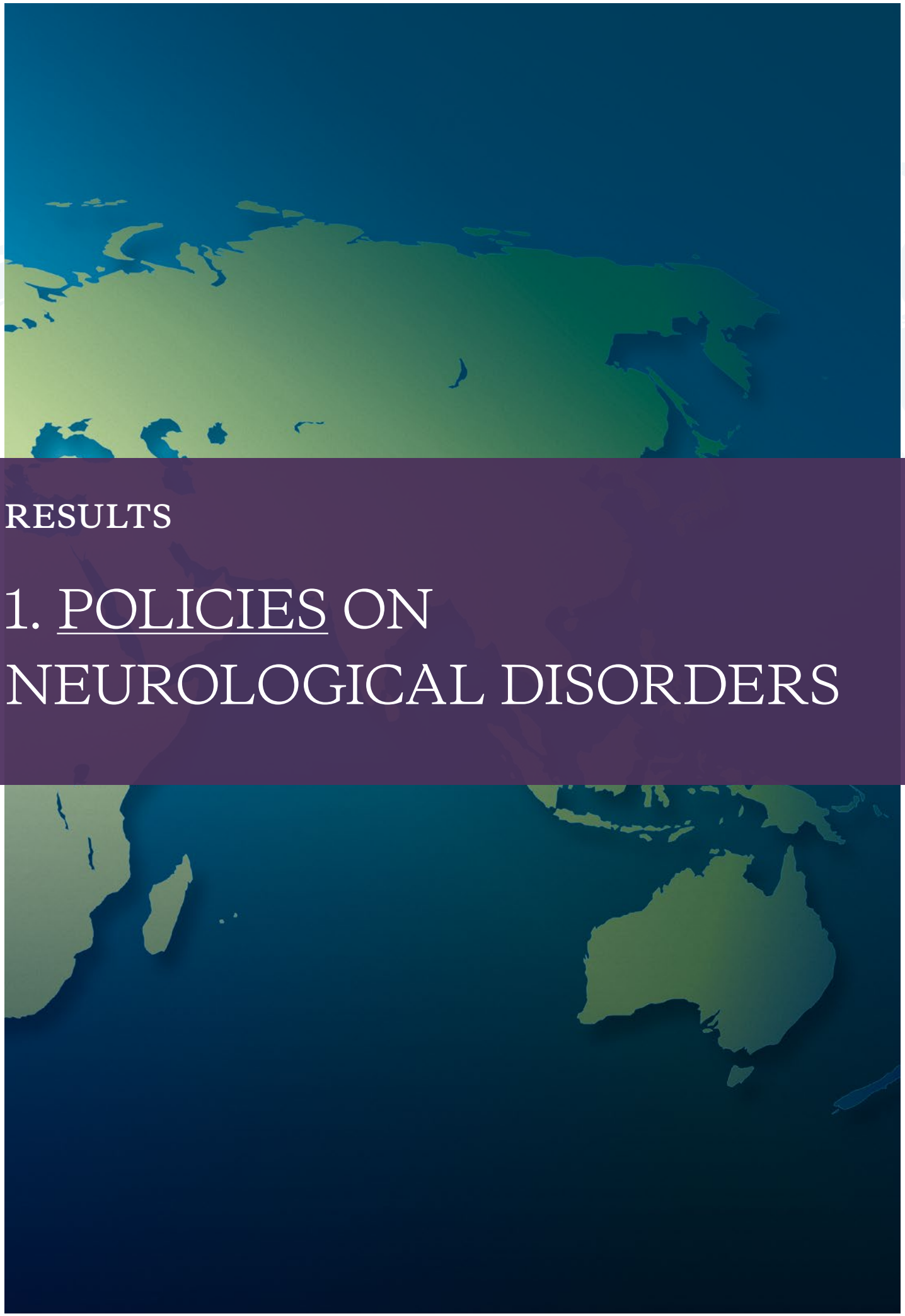
Data were received from 132 Member States and two Associate Members or territories (Puerto Rico and Sint Maarten), which are henceforth referred to as countries collectively for convenience **(see Fig. 1)**. The data is available from 36 countries in the African Region (77% of Member States), 25 countries in the Region of the Americas (71%), 18 countries in the Eastern Mediterranean Region (86%), 33 countries in the European Region (62%), 10 countries in the South-East Asia Region (91%) and 12 in the Western Pacific Region (44%).

Reporting of many core neurological care indicators was high including neurological policies and guidelines, legislation on neurological disorders, financing for neurological disorders, the number of adult neurological care providers, the availability of primary care providers for neurological care, and access to essential neurological medications. There was a considerably lower response rate for other indicators in particular items related to allied health-care providers, ancillary services, post-graduate training, neurological professional associations and the number of child neurologists and neurosurgeons. The lower response rate for these indicators reflects the difficulty of collecting or obtaining these data, with a lack of formal reporting on neurological care indicators in many countries.

The data is reported globally as well as by the WHO regions and World Bank income groups. The WHO regions are African Region (AFR), Region of the Americas (AMR), Eastern Mediterranean Region (EMR), European Region (EUR), South-East Asia Region (SEAR) and Western Pacific Region (WPR). The World Bank income groups are low-income, lower-middle-income, upper-middle-income and high-income.

FIG. 1. **Countries which provided data for the Neurology Atlas, second edition**





RESULTS

1. POLICIES ON NEUROLOGICAL DISORDERS

Health policies refer to plans and actions undertaken by governments to achieve specific health-care goals. An explicit health-care policy defines a vision for health-care targets. Countries use national health policies to strategize and plan for improvements in health-care. Neurological policies are defined as an organized set of values, principles and objectives for improving neurological health and reducing the burden of neurological disorders in a population. The existence of a policy on neurological disorders helps to improve the organization and quality of health-service delivery, accessibility and engagement of people with neurological disorders and their families.

The survey assessed whether countries have an approved neurological policy. Countries were asked whether neurological disorders were included in the general health or mental health policy, or whether a stand-alone or dedicated neurology policy exists, including policies for specific neurological disorders such as epilepsy and dementia.

Of the 122 responding countries, 79 countries (65%) report the inclusion of neurological disorders in the general health policy, equivalent to 36% of all WHO Member States **(see Table 1).** In 67 (57%) of 118 responding countries, neurological disorders are included within the national mental health policy. Only 46 countries (38%) report dedicated or specific policies on neurological disorders, with the lowest numbers in the WHO South-East Asia region (1 country (11%)) and African region (8 countries (24%)) **(Fig. 2).** By World Bank income group, seven (28%) of 25 low-income countries reported dedicated policies on neurological disorders, contrasting with 21 (64%) of the 33 responding countries in high-income regions **(Fig. 3).**

The overall deficit in dedicated or stand-alone neurological policies, especially in low- and middle-income countries, is particularly concerning, as this negatively impacts the organization and quality of neurological service delivery, accessibility and community care.

TABLE 1. **Country policies for neurological disorders**

WHO region	Included in general health policy		Included in mental health policy		Dedicated or specific policy for neurological disorders	
	Responding countries	N (%)	Responding countries	N (%)	Responding countries	N (%)
AFR	34	18 (53%)	33	21 (64%)	33	8 (24%)
AMR	24	13 (54%)	25	14 (56%)	25	7 (28%)
EMR	17	12 (71%)	16	11 (69%)	17	10 (59%)
EUR	27	22 (81%)	26	9 (35%)	28	14 (50%)
SEAR	10	8 (80%)	8	4 (50%)	9	1 (11%)
WPR	9	6 (67%)	10	8 (80%)	10	6 (60%)
Global	122	79 (65%)	118	67 (57%)	122	46 (38%)

RESULTS
POLICIES ON NEUROLOGICAL DISORDERS

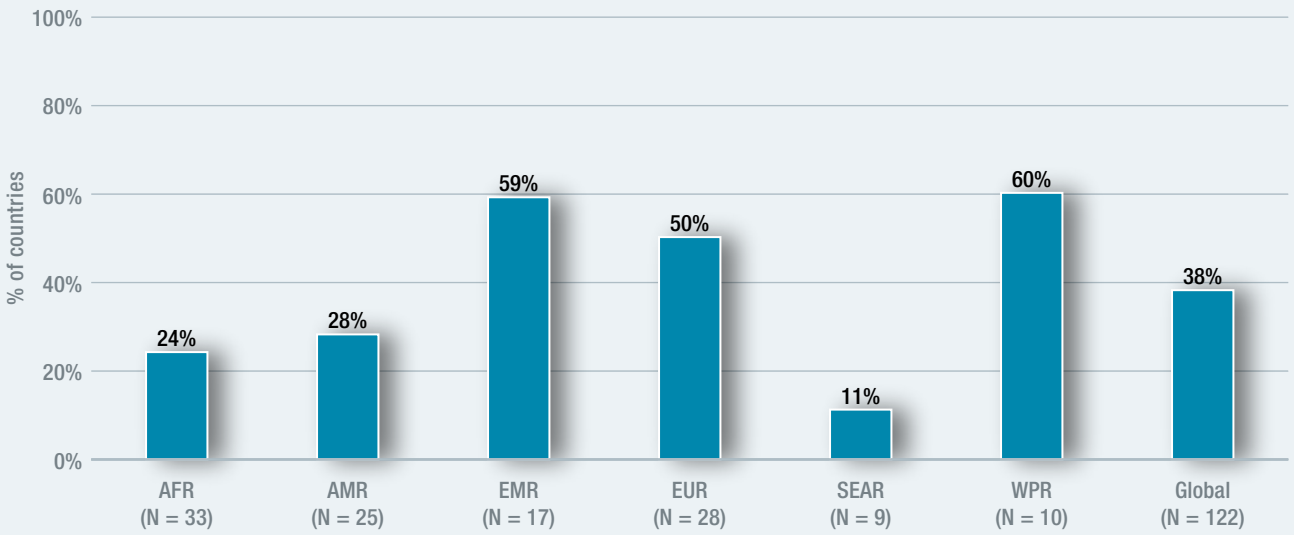


FIG. 2. Countries with a dedicated policy for neurological disorders, by WHO region

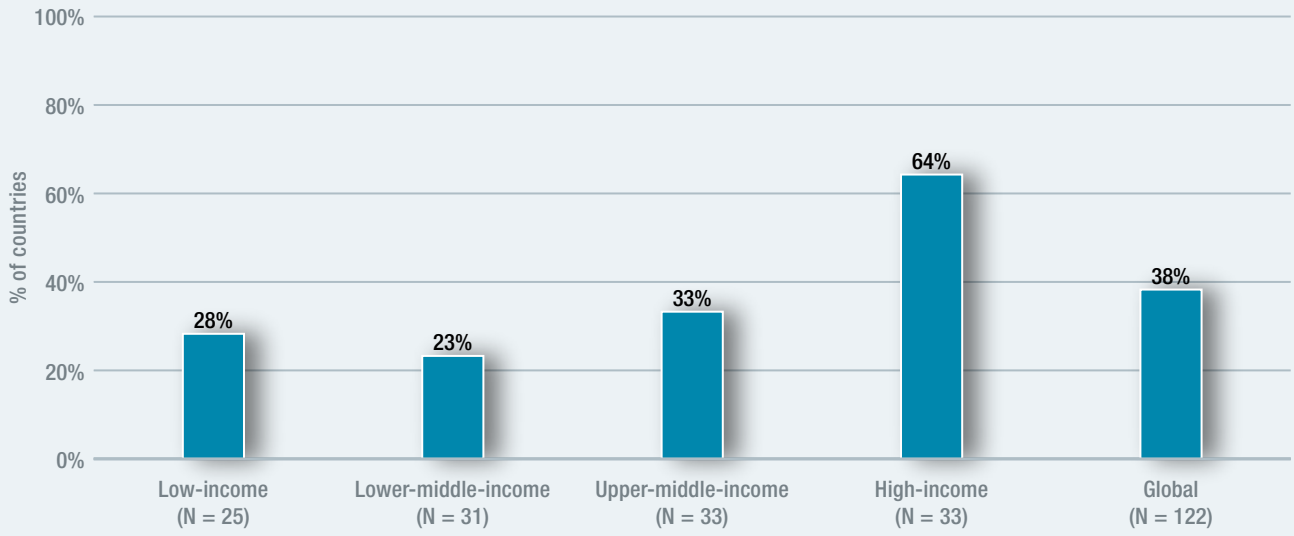


FIG. 3. Countries with a dedicated policy for neurological disorders, by World Bank income group

RESULTS

2. LEGISLATION FOR NEUROLOGICAL DISORDERS

Legislation for neurological disorders is a key component of good governance. It concerns the specific legal provisions that are related to neurological health. Health-care legislation typically focuses on issues including human rights protection for patients, such as employment restrictions and protections, guardianship, professional training and service structure. For example, legislation on neurological disorders may include medical fitness to drive in people with epilepsy or the capacity to act in people with dementia or other neurological disorders.

The survey assessed whether countries have legislation affecting people with dementia, epilepsy and other neurological disorders, as defined by the categories in the Neurology Atlas. Of the 110 countries which responded regarding legislation on epilepsy 41% reported the existence of legislation. The lowest numbers were in the African Region (13%) and the South-East Asia Region (0%) **(Fig. 4)**. By World Bank income category, high-income countries most often have legislation on epilepsy (78%) with a significantly lower number in low-income (17%) and lower middle-income countries (17%) **(Fig. 5)**.

A total of 104 countries responded regarding legislation addressing dementia. Globally, 31 countries (30%) report the existence of dementia legislation, with the lowest number in the African (7%) and South-East Asia regions (14%) **(Fig. 4)**. With regards to World Bank income categories, the largest number of countries with legislation on dementia was in high-income countries (60%) contrasting with low-income (13%) and lower-middle-income countries (7%) **(Fig. 5)**.

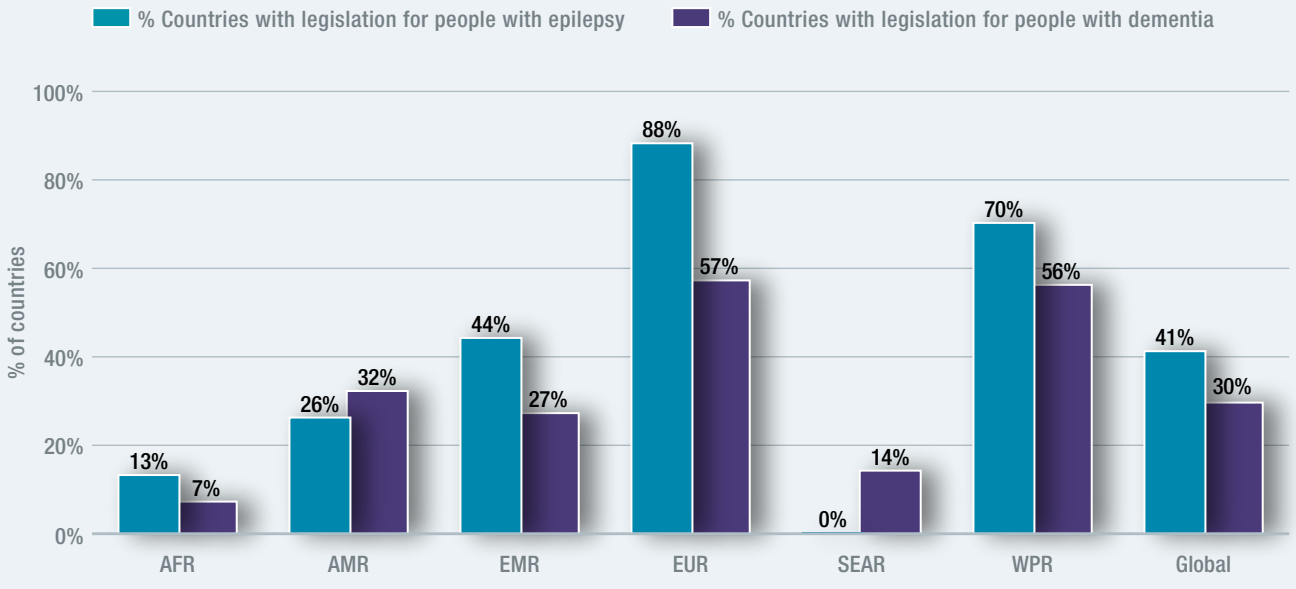


FIG. 4. **Countries with legislation for people with neurological disorders, by WHO region**

RESULTS
LEGISLATION FOR NEUROLOGICAL DISORDERS

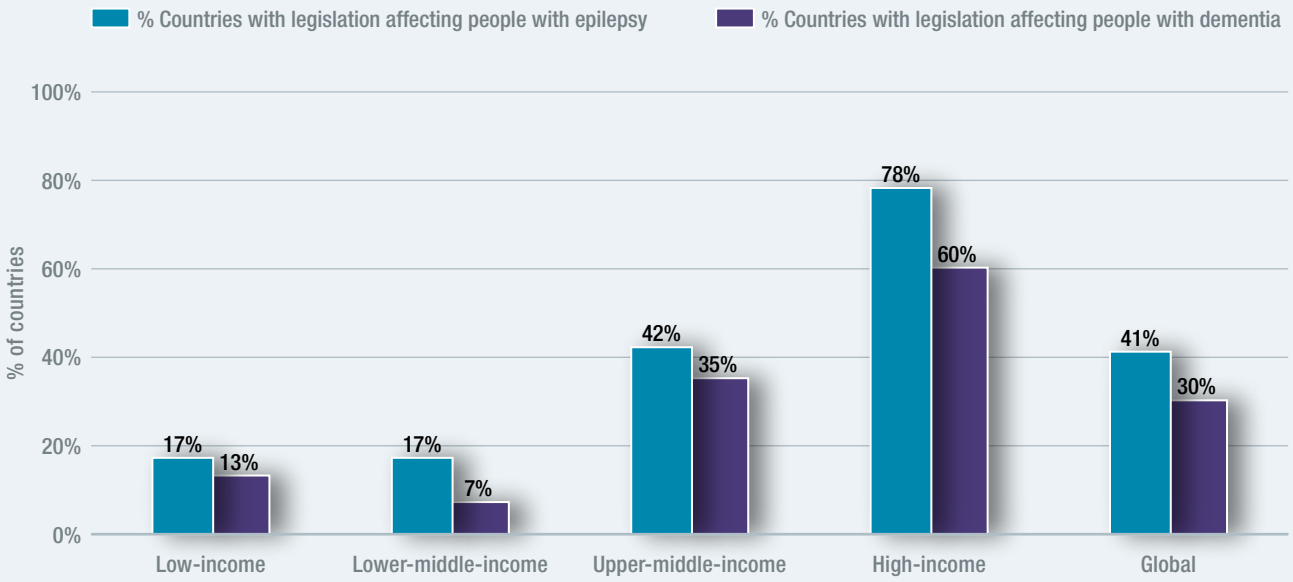


FIG. 5. Countries with legislation for people with neurological disorders, by World Bank income group

Overall, the results show that there is a deficit in legislation on epilepsy and dementia, particularly in low- and lower-middle-income countries. Without legislation, people with epilepsy and dementia are at increasing risk of further stigmatization and loss of socioeconomic rights. Importantly, though, response rates to the survey question on dementia and epilepsy legislation were significantly lower in low-income compared with high-income countries, which may affect data results.

Regarding legislation for neurological disorders other than epilepsy and dementia, 96 countries responded, with 28 countries (29%) reporting that legislation existed. The most common disorders addressed by legislation were cerebrovascular disease, head injury, multiple sclerosis, neuromuscular disorders, Parkinson's disease and vestibular disorders, though data are not available on the details of legislation for these disorders.

RESULTS

3. FINANCING FOR NEUROLOGICAL SERVICES

Financial resources are required for developing, improving and maintaining health-care services for neurological disorders, including reducing the treatment gap and improving service coverage.

In the survey, countries were asked whether a separate budget line for neurological disorders was included in the Ministry of Health's annual budget. A budget line for neurological disorders is defined as a source of money available and allocated for action directed towards the treatment and care of neurological disorders. Of the 125 countries which responded, 12% overall report a separate budget line, with none reported in the African Region followed by 4% in the American Region **(Fig. 6 and Fig. 7)** contrasting with 30% of countries reporting from the South-East Asian Region. The number of countries with a separate budget line was low (less than 20%) across all World Bank income categories **(Fig. 8)**. Similar findings were found in the Neurology Atlas 2004 project, where 10% of countries reported a separate budget line for neurological disorders. The low number of countries with a separate budget line across all WHO regions and income categories, with little change since 2004, suggests that there is an ongoing lack of prioritization, earmarking and planning of financial resources for the care of people with neurological disorders globally.

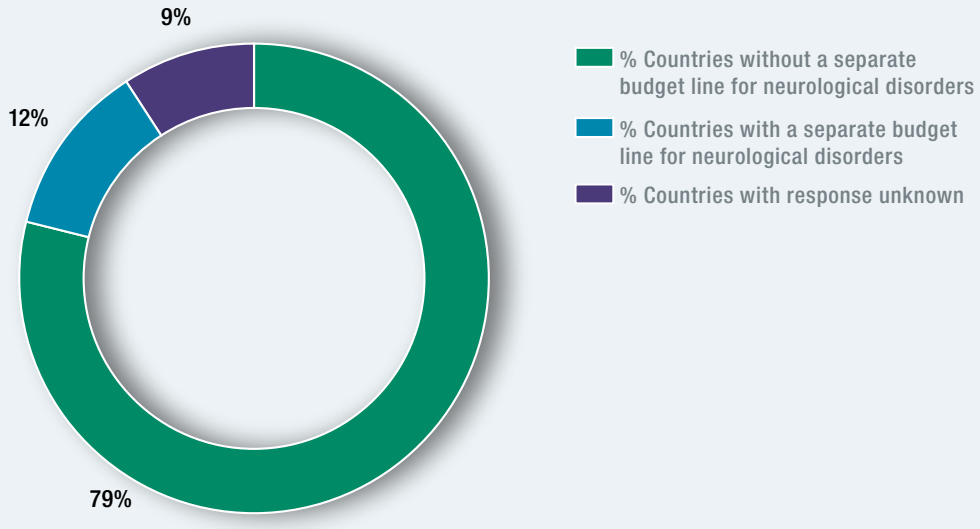


FIG. 6. **Countries with a separate budget line for neurological disorders: global perspective (N=125)**

FINANCING FOR NEUROLOGICAL DISORDERS

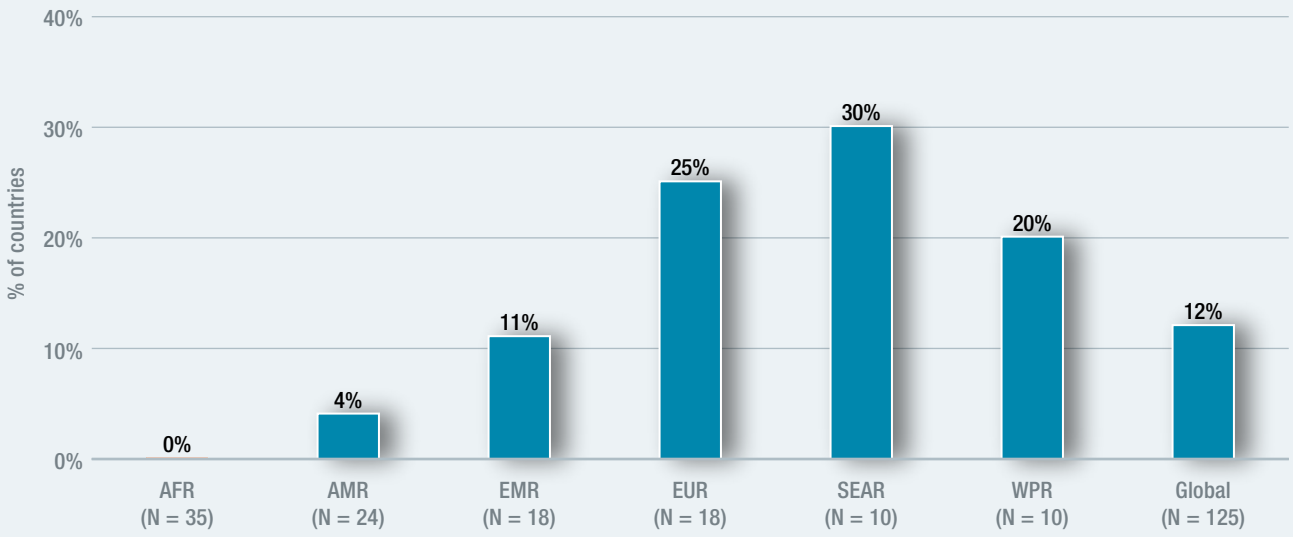


FIG. 7. Countries with a separate budget line for neurological disorders, by WHO region

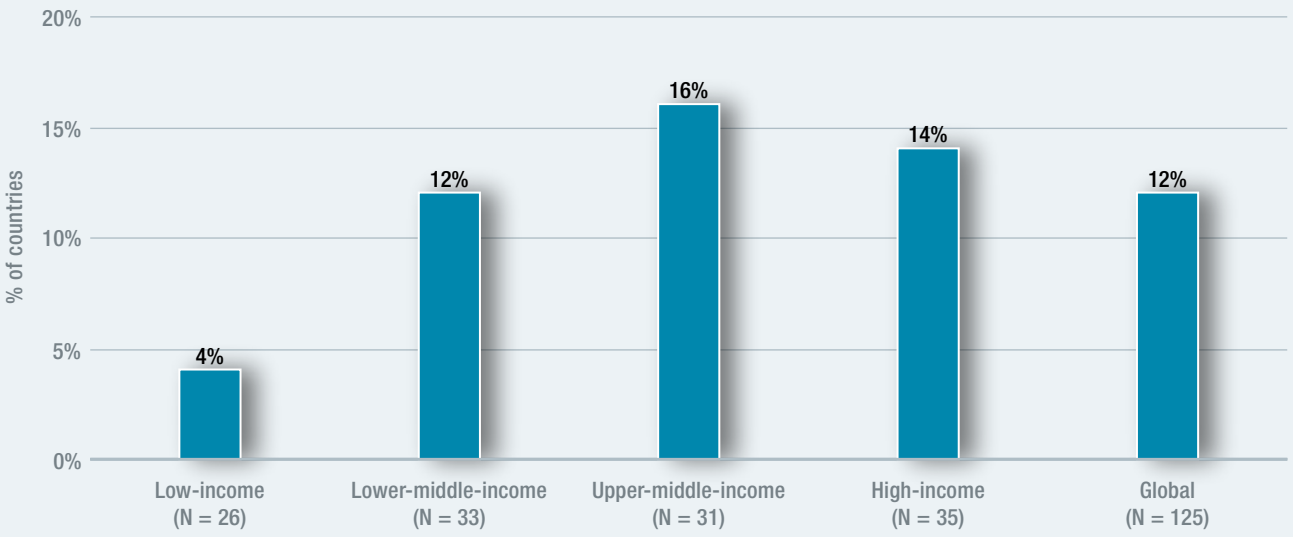


FIG. 8. Countries with a separate budget line for neurological disorders, by World Bank income group

RESULTS

4. SOCIAL WELFARE SUPPORT FOR NEUROLOGICAL DISORDERS

Social welfare support provides a minimal level of well-being for all citizens. It is sometimes referred to as public aid. Countries were asked about the types of social welfare support available for people with neurological disorders and their carers, including: monetary support (e.g. disability benefit payments or income support); non-monetary support (e.g. housing support, access to employment, educational assistance); and residential care provision (e.g. provision of care in institutions, such as nursing homes or group homes). Seventy-two (58%) of the 124 countries which responded reported that monetary support is available for people with neurological disorders **(Fig. 9)**. Among high-income countries, 86% offer monetary support, while in low-income countries only 24% provide monetary support **(Fig. 10)**. 45% of countries overall report that they provide non-monetary support, 86% of the high-income countries and 12% of the low-income countries. Residential care provision was reported by 38% of countries overall, with 8% of the low-income countries versus 83% of the high-income countries. The European Region had the highest percentage of social support services across all categories, while the African Region had the lowest. In general, lower-income countries report a lower level of social welfare support services, which adversely affects access to treatment and care.

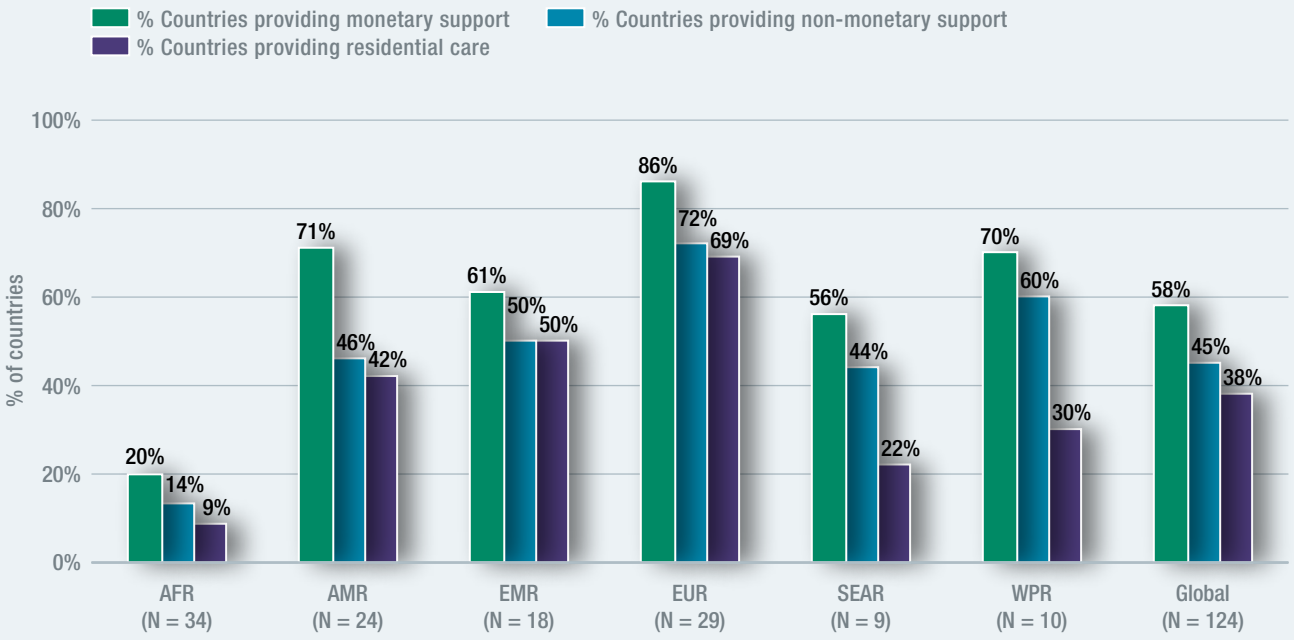


FIG. 9. **Countries providing social support for people with neurological disorders, by WHO region**

RESULTS
SOCIAL WELFARE SUPPORT FOR NEUROLOGICAL DISORDERS

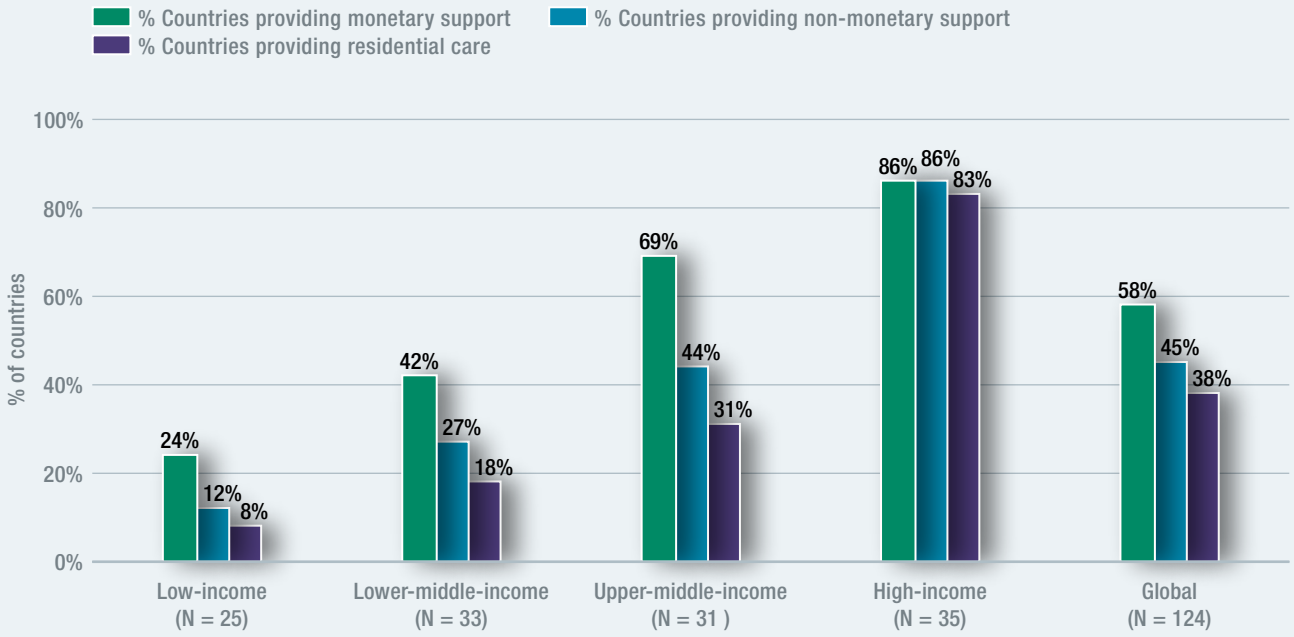
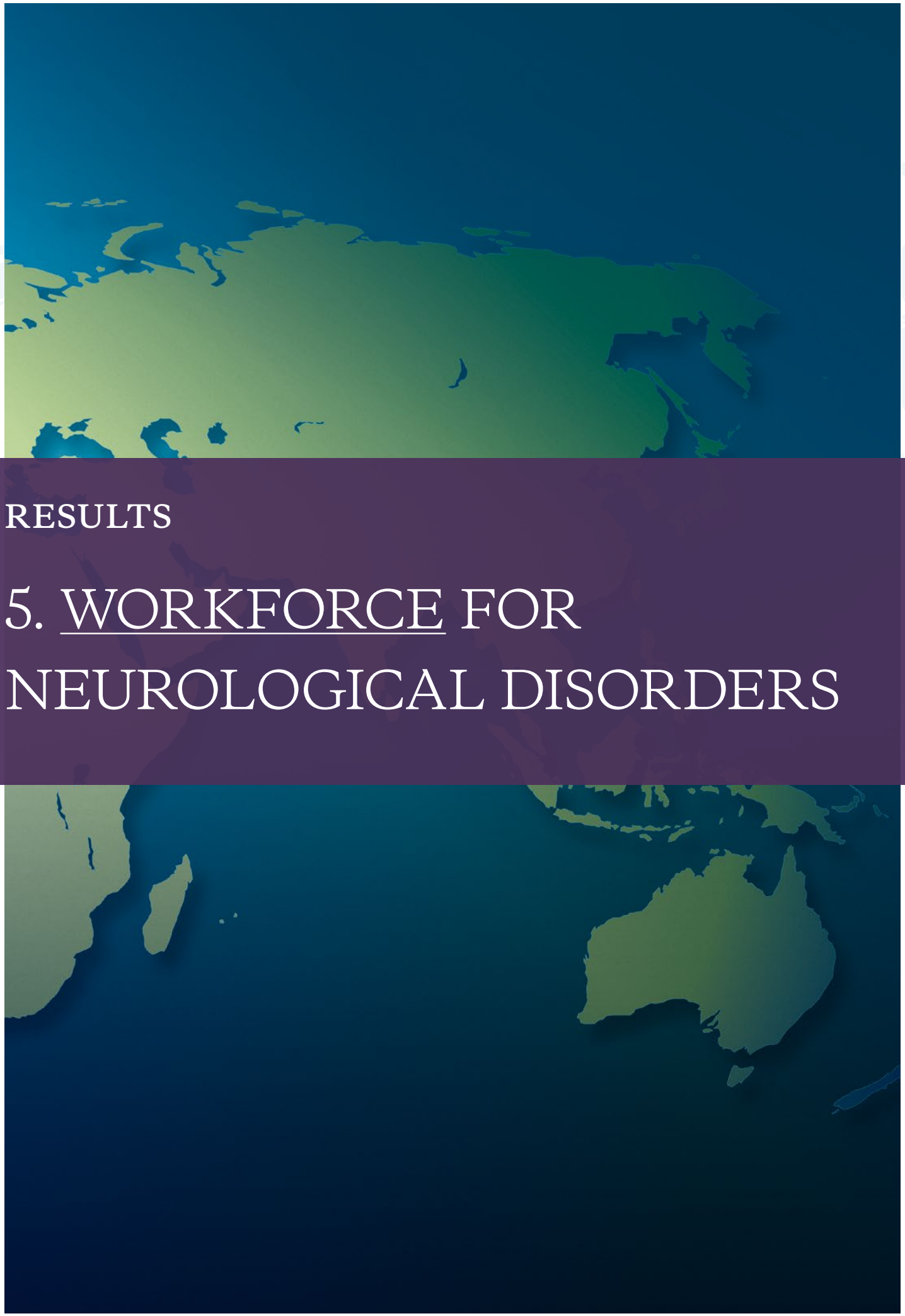


FIG. 10. Countries providing social support for people with neurological disorders, by World Bank income group



RESULTS

5. WORKFORCE FOR NEUROLOGICAL DISORDERS

NEUROLOGICAL CARE PROVIDERS

A dedicated neurological workforce is needed to care for and manage the growing number of individuals with acute and chronic neurological disorders worldwide. Countries were asked to provide estimates of the total number of specialists (adult neurologists, child neurologists and neurosurgeons) and their geographical locations (capital city, other urban areas, rural regions).

Among the 114 responding countries, the global median of the total neurological workforce (defined as the total number of adult neurologists, neurosurgeons and child neurologists), is 3.1 per 100 000 population. There are disparities among the WHO regions, with the European Region reporting the largest number, with a median of 9 per 100 000 population and the Western Pacific Region a median of 3.7, while the African Region and South-East Asia Region report a median of 0.1 and 0.3, respectively **(Fig. 11)**. These values may be influenced by the variability in response rate across WHO regions, with the Eastern Mediterranean Region, South-East Asia Region and Western Pacific Region having lower response rates. The largest differences are seen between the World Bank income groups, with low-income countries reporting a median of 0.1 per 100 000 population, compared with a median of 7.1 per 100 000 population in high-income countries **(Fig. 12)**.

In respect of specific types of specialists, the global median of adult neurologists is 0.43 per 100 000 population, based on data collected from 114 responding countries **(Table 2, Fig. 13)**. The number of adult neurologists is lowest in the African Region, with a median of 0.04 per 100 000 population, and the South-East Asia Region, with a median of 0.1 per 100 000 population **(Table 2)**. There is a particular deficiency of adult neurologists in low-income (median of 0.03 per 100 000 population) and lower-middle-income countries (median of 0.13 per 100 000 population), which contrasts with the number of neurologists in upper-middle-income (median of 1.09 per 100 000 population) and high-income countries (median of 4.75 per 100 000 population) **(Table 3, Fig. 14)**.

The same trend was seen amongst neurosurgeons (median of 0.02 per 100 000 population in low-income countries and 1.24 per 100 000 population in high-income countries) and child neurologists (0.002 per 100 000 population in low-income countries compared with 0.39 per 100 000 population in high-income countries) **(Table 3)**. The lowest number of neurosurgeons (0.026 per 100 000 population) and child neurologists (0.003 per 100 000 population) was seen in the African Region **(Table 2)**. There were particularly low response rates in the Western Pacific Region relating to the total number of adult and child neurologists and neurosurgeons. Overall, the results show that there is a particular deficit of adult and child neurologists and neurosurgeons, especially in the African Region and South-East Asia Region, as well as in low-income and lower-middle-income countries more generally. The strikingly low number of paediatric neurologists across all income categories and WHO regions is of particular concern.

WORKFORCE FOR NEUROLOGICAL DISORDERS

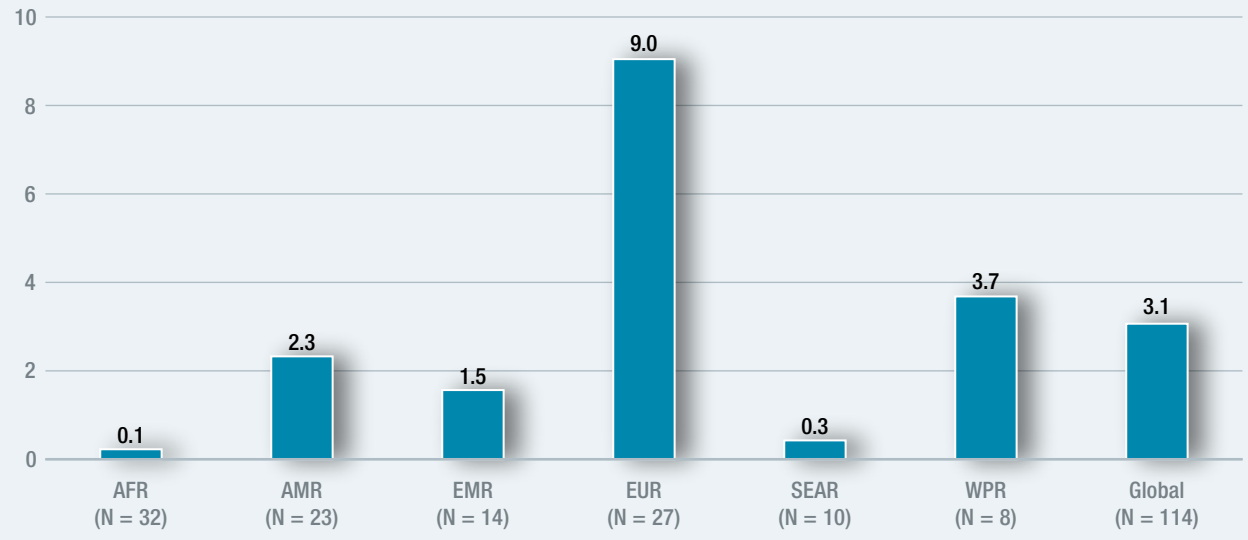


FIG. 11. Median neurological workforce per 100 000 population, by WHO region

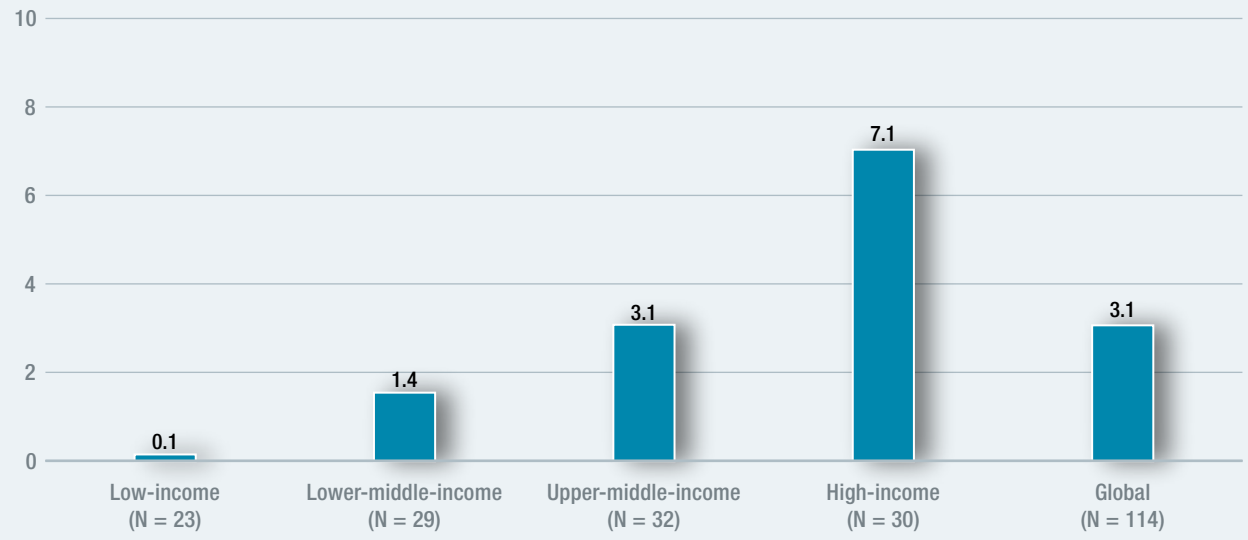


FIG. 12. Median neurological workforce per 100 000 population, by World Bank income group

TABLE 2. Median number of neurological workforce per 100 000 population by WHO region

WHO region	Adult neurologists		Neurosurgeons		Child neurologists	
	Number of responding countries	Median	Number of responding countries	Median	Number of responding countries	Median
AFR	33	**0.043**	32	**0.026**	29	**0.003**
AMR	23	**0.7**	21	**0.6**	20	**0.1**
EUR	27	**6.6**	24	**1.5**	20	**0.8**
EMR	14	**0.8**	13	**0.5**	13	**0.06**
SEAR	9	**0.1**	10	**0.07**	6	**0.02**
WPR	8	**1.2**	8	**0.6**	5	**0.06**
Global	114	**0.43**	108	**0.34**	93	**0.05**

TABLE 3. Median number of neurological workforce per 100 000 population by World Bank income group

World Bank income group	Adult neurologists		Neurosurgeons		Child neurologists	
	Number of responding countries	Median	Number of responding countries	Median	Number of responding countries	Median
Low-income	23	**0.03**	23	**0.02**	18	**0.002**
Lower-middle-income	29	**0.13**	28	**0.11**	27	**0.02**
Upper-middle-income	32	**1.09**	28	**0.6**	25	**0.1**
High-income	30	**4.75**	29	**1.24**	23	**0.39**
Global	114	**0.43**	108	**0.34**	93	**0.05**

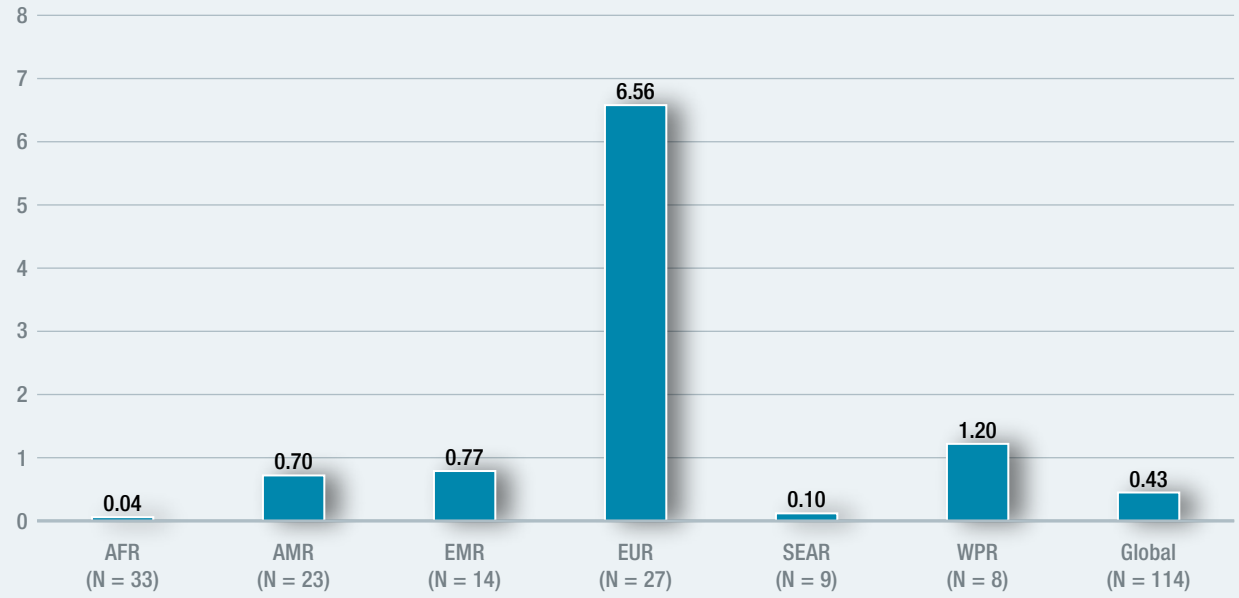


FIG. 13. Median number of adult neurologists per 100 000 population in the responding countries, by WHO region

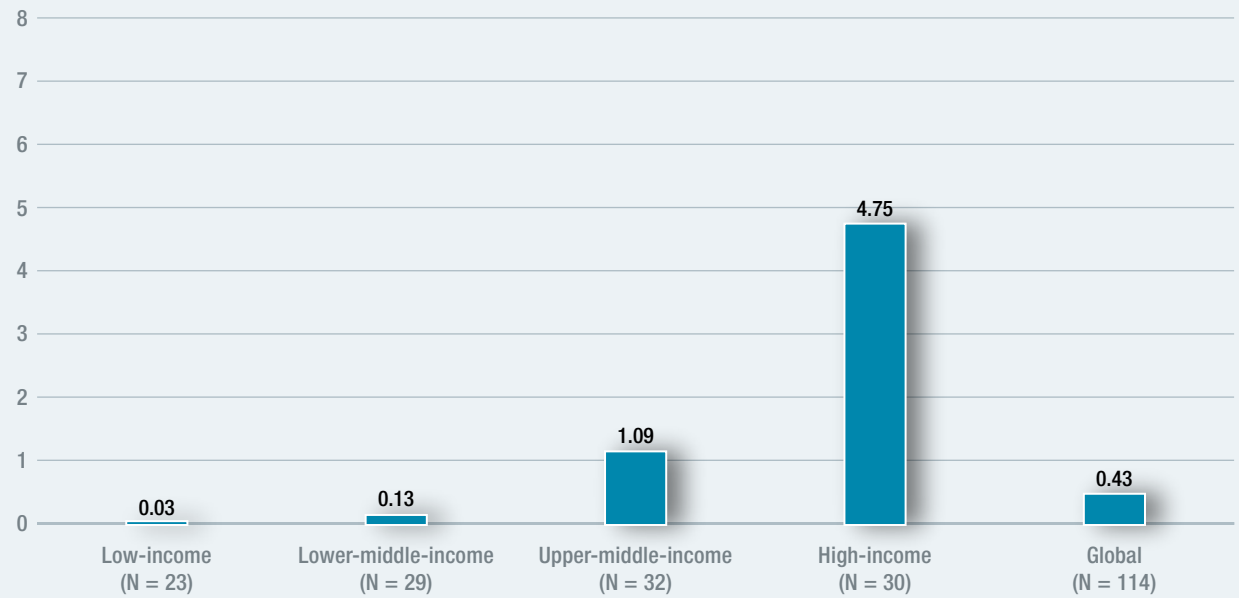


FIG. 14. Median number of adult neurologists per 100 000 population in the responding countries, by World Bank income group

Countries were also asked to identify the principal locations of neurologists (capital city, other urban areas, or rural regions). Of the 114 countries that responded, the majority (97%) report that neurologists practice in the capital city, with significantly fewer neurologists in rural regions (23%) **(Fig. 15)**. Viewing by World Bank income category, no low-income countries report neurologists practising in rural areas, compared with 45% in high-income countries **(Fig. 16)**.

The overall shortage of a neurology workforce causes significant strain on care for the vulnerable population of patients with neurological conditions, which is especially felt in rural areas in low-and lower-middle income countries. A specialist neurology workforce is not only essential for comprehensive neurological care but is also important for the provision of training, support and supervision for nurses, other paramedical staff and primary health care providers providing ancillary care.

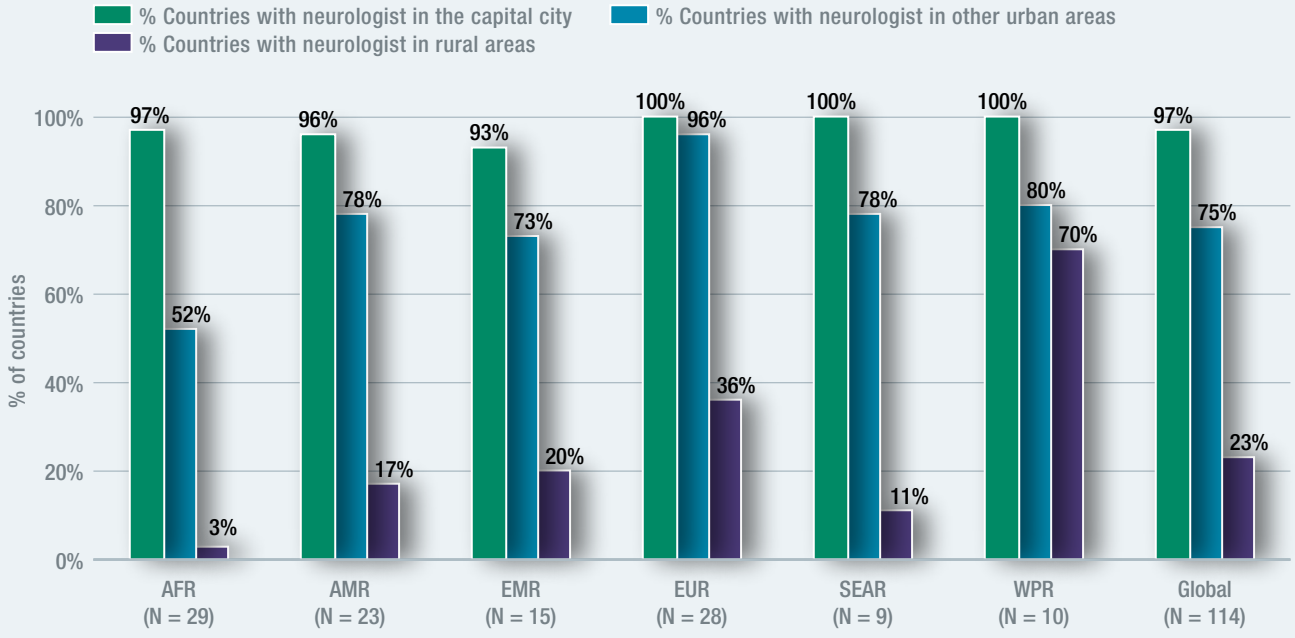


FIG. 15. **Countries with neurologists in urban and rural areas, by WHO region**

WORKFORCE FOR NEUROLOGICAL DISORDERS

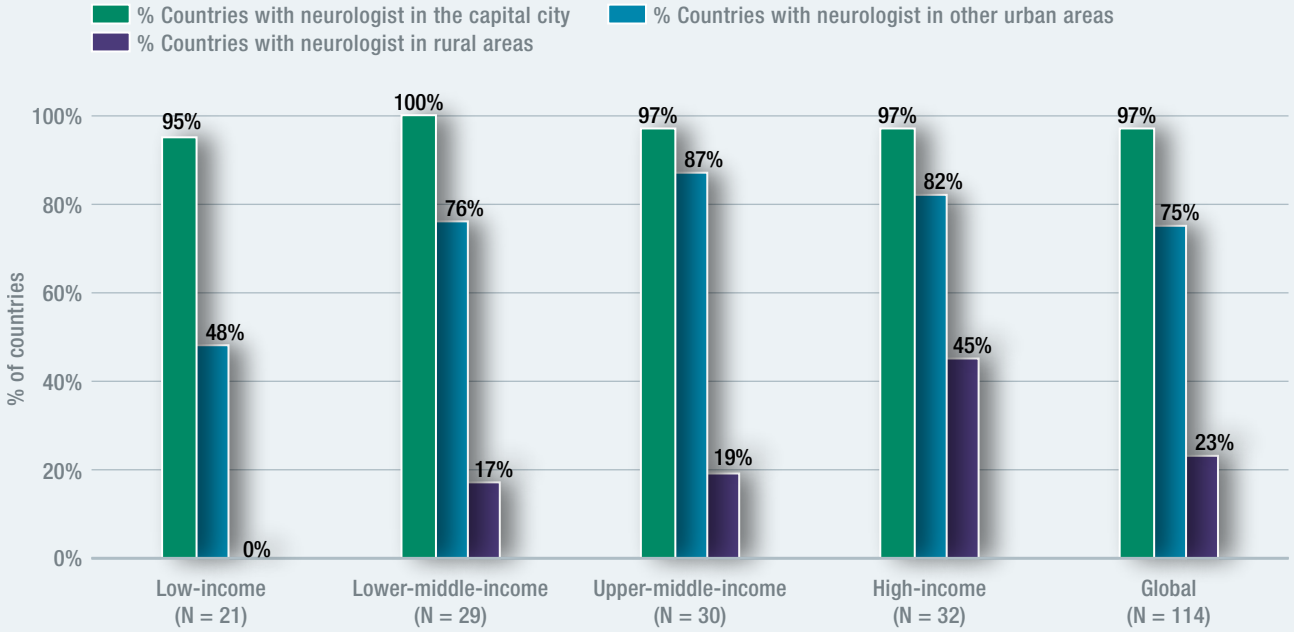


FIG. 16. Countries with neurologists in urban and rural areas, by World Bank income group

POSTGRADUATE NEUROLOGICAL TRAINING

Countries were asked whether postgraduate training is available in general neurology and neurosurgery. Of the 55 countries that responded, 48 (87%) report that postgraduate training is available in general neurology. Forty-six countries (92%) of the 50 countries which responded report postgraduate training programmes in neurosurgery. These data are difficult to interpret, given the overall low response rate to this survey question.

ALLIED HEALTH-CARE PROVIDERS

Countries were also asked whether allied health-care providers are involved in neurological care in their country, including psychologists, neuroradiologists, electroencephalography (EEG) technicians, physical therapists, occupational therapists and speech therapists. Of the 56 countries that responded, 44 (79%) report that psychologists provide neurological care in the public sector. In 83% of countries, it was reported that neuroradiologists were available. EEG technicians were reported in 45 countries (81%). Physical therapists provide services for persons with neurological disorders in the public sector in 88% of countries, occupational therapists in 67% and speech therapists in 74%. These data are difficult to interpret, given the overall low response rate to this question.

RESULTS

6. SERVICES FOR NEUROLOGICAL DISORDERS

Countries were asked about the availability of specialized neurological services including specialist neurology and neurosurgery facilities, stroke units, epilepsy surgery units, neurorehabilitation services and general rehabilitation services offering neurological rehabilitation. Of the 105 countries which responded to this question, 20% report that there are specialist neurology/neurosurgery facilities, 18% report stroke units, 16% report epilepsy surgery units, 16% report specialized neurorehabilitation services and 17% report general rehabilitation units offering neurological rehabilitation **(Fig. 17)**.

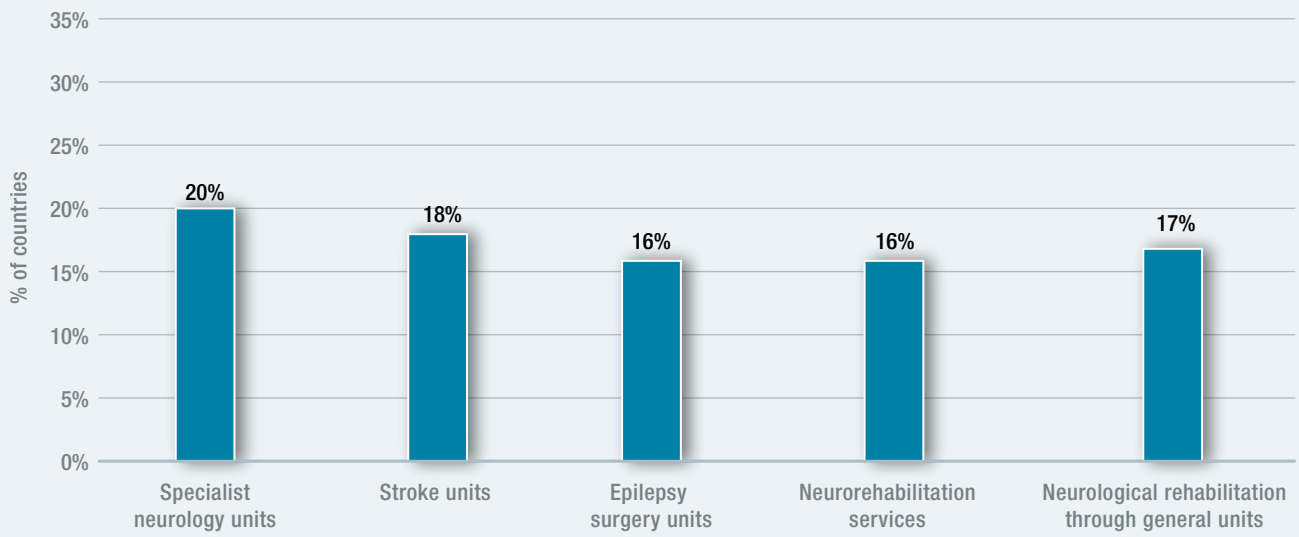


FIG. 17. **Countries with specialized neurological services: global perspective (N=105)**

RESULTS
SERVICES FOR NEUROLOGICAL DISORDERS

NEUROLOGICAL TREATMENT ACCESSIBILITY THROUGH PRIMARY HEALTH CARE SERVICES

It is of critical importance that primary health care providers are able to recognize and treat persons with neurological disorders, especially given the evidence of a lack of neurological expertise in many regions of the world. Countries were asked to report whether primary health care providers (primary health care physicians, paramedical practitioners, primary health care nurses) provide care for people with neurological disorders where no specialist neurologists or neurosurgeons exist.

Of the 106 responding countries, 96 (91%) report that primary health care physicians may be consulted for neurological care in areas where no specialists work, though their level of expertise and training is unknown **(Fig. 18, Fig. 19)**. Of the 56 countries that responded regarding paramedical practitioners, 39 (74%) report that paramedical practitioners care for people with neurological disorders. Of the 65 countries that responded regarding primary care nurses, 56 (86%) report that primary health care nurses provide care for people with neurological disorders.

ACCESS TO ESSENTIAL MEDICINES FOR NEUROLOGICAL DISORDERS

The medicines included in national essential medicines lists are those that satisfy the priority health-care needs of the population. They are selected with due regard to public health relevance, efficacy, safety and comparative cost-effectiveness. Essential medicines are intended to be available within the context of functioning health systems at all times, in adequate amounts, in the appropriate dosage forms, with assured quality and at a price the individual and the community can afford. Lists of essential medicines also guide the procurement and supply in the public sector. The inclusion of medicines to treat or prevent neurological disorders in national essential medicine lists is therefore of critical importance.

Countries were asked whether specific medicines for neurological disorders are available at the primary care and hospital levels. Categories of medicines included anticonvulsant medicines, medicines for headache, levodopa/carbidopa for Parkinson's disease, medicines for primary and secondary prevention of cerebrovascular disease and mannitol for the treatment of elevated intracranial pressure.

Of the 123 responding countries, 68 (55%) report the availability of one or more anticonvulsants (carbamazepine, phenobarbital, phenytoin, or valproic acid) at all times in the primary care setting **(Fig. 20)**. Less than or equal to 50% of countries in the African Region, South-East Asia Region and Western Pacific Region report the availability of at least one anticonvulsant medicine in the primary care setting. There was a trend in the availability of at least one anticonvulsant at all times by World Bank income category, ranging from 42% in low-income countries to 79% in high-income countries **(Fig. 21)**. Of the 132 reporting countries at the hospital level, 65 (70%) countries report at least one anticonvulsant always available **(Fig. 20, Fig. 21)**.

Countries were asked about the availability of at least one medicine (acetylsalicylic acid, ibuprofen, paracetamol, or propranolol) which may be used for the treatment of headache disorders at both the primary and hospital levels **(Fig. 22, Fig. 23)**. Of the 117 reporting countries, 108 (92%) of countries at the primary care and 110 (94%) at the hospital level report the availability of at least one medicine at all times.

With regards to levodopa/carbidopa for Parkinson's disease, only 37 (34%) of 110 countries report availability at all times at the primary care level, including only 3% in the African Region and none in the South-East Asia Region **(Fig. 24)**. No low-income countries report availability at the primary care level **(Fig. 25)**. In contrast, 77% of high-income countries report that levodopa/carbidopa is always available at primary care level. Countries also reported on the availability of biperiden, for the treatment of Parkinson's disease, with 21% reporting that biperiden is routinely available at the primary care level.

One hundred and twelve countries provided information on the availability of the anticoagulant warfarin at the primary care level. In all WHO regions, warfarin was more widely available at hospital level where 69 (61%) of the 114 reporting countries report that the medicine is available at all times, while 36 (32%) countries report availability at the primary care level **(Fig. 26)**. The difference in the availability of warfarin is significant across World Bank income categories, with only one low-income country having the medicine available, compared with 73% of high-income countries **(Fig. 27)**.

Regarding treatment for elevated intracranial pressure, 80 (70%) of 114 countries report mannitol being always available at a hospital level **(Fig. 28, Fig. 29).** The availability of mannitol in hospital settings was lowest in the African Region, with 15 (45%) of 33 countries reporting availability at all times.

Despite the strong and growing knowledge base for the importance of delivery of neurological services, including essential neurological medicines, the “treatment gap” remains quite large. One important reason for this is poor access to medicines for neurological disorders. It is thus important that governments prioritize improving access to neurological medicines.

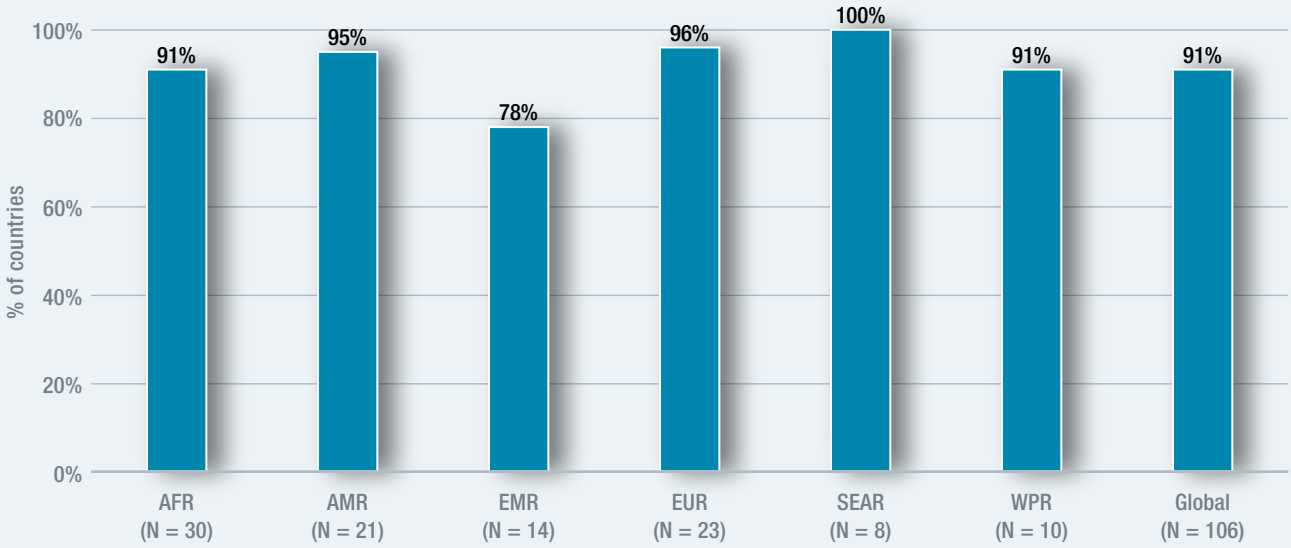


FIG. 18. Countries with primary health care physicians offering neurological care, by WHO region

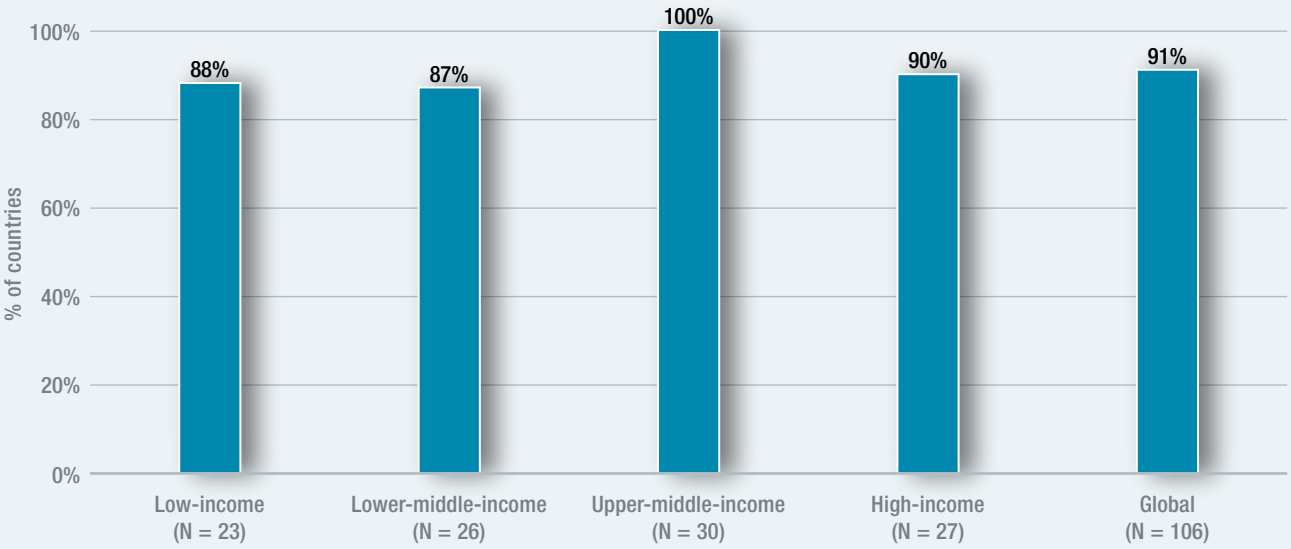


FIG. 19. Countries with primary health care physicians offering neurological care, by World Bank income group

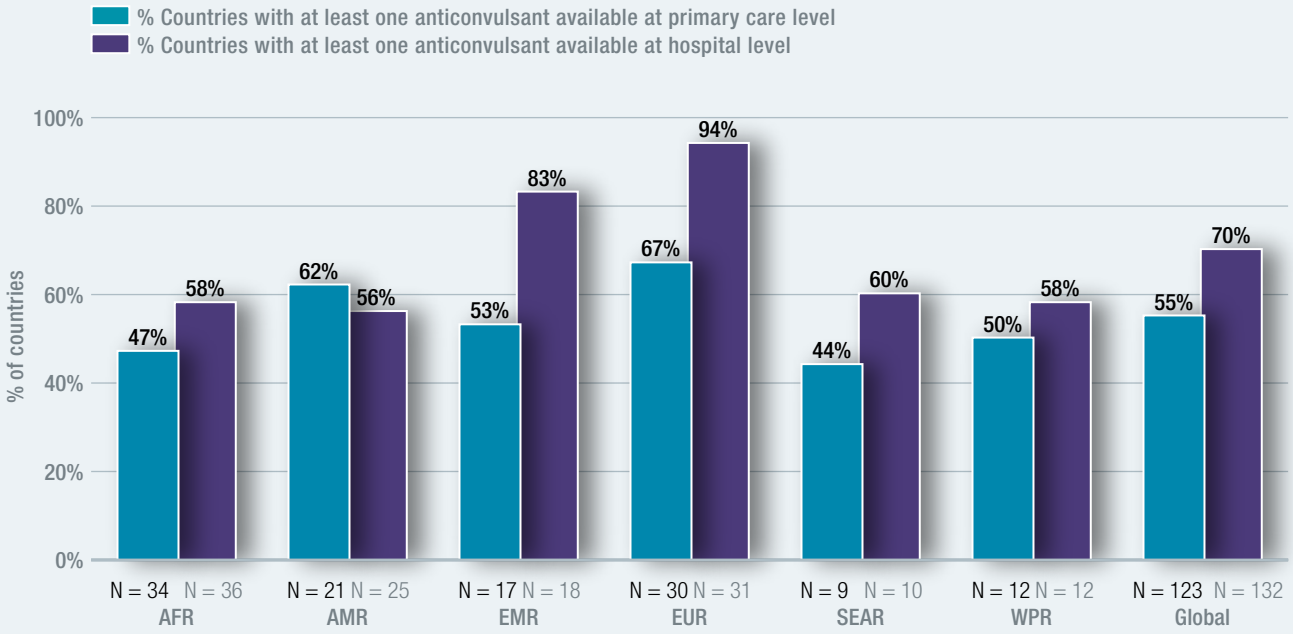


FIG. 20. Countries with at least one anticonvulsant (carbamazepine, phenobarbital, phenytoin, valproic acid) always available at primary care and hospital level, by WHO region

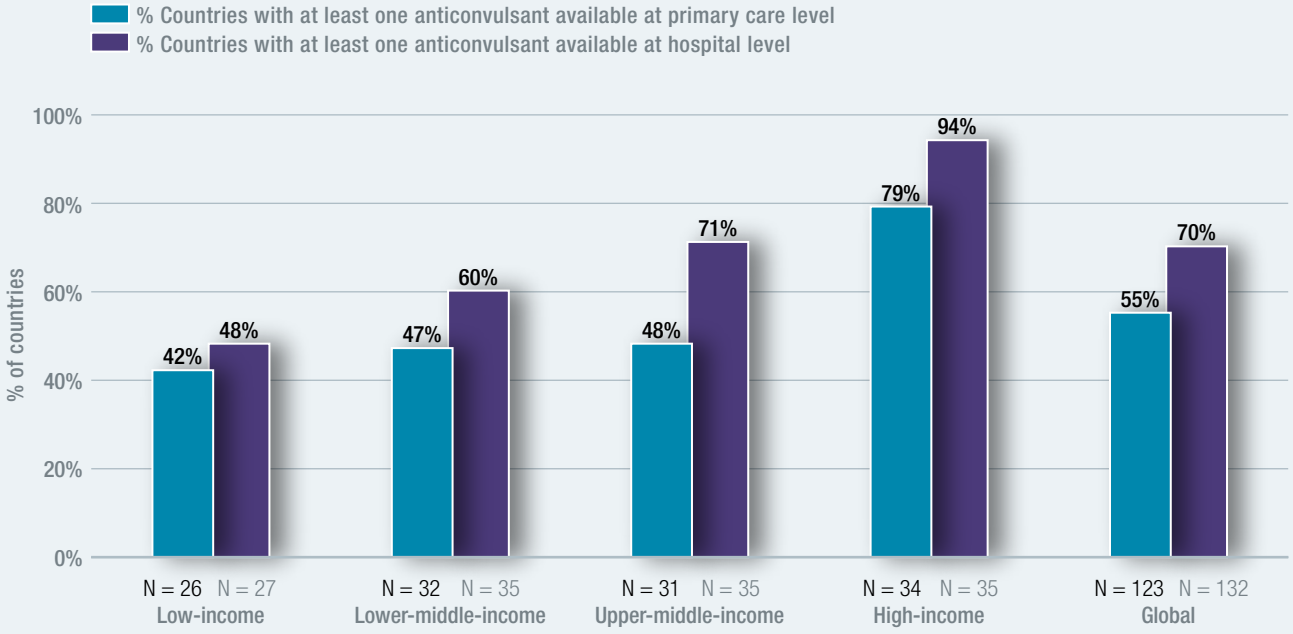


FIG. 21. Countries with at least one anticonvulsant (carbamazepine, phenobarbital, phenytoin, valproic acid) always available at primary care and hospital level, by World Bank income group

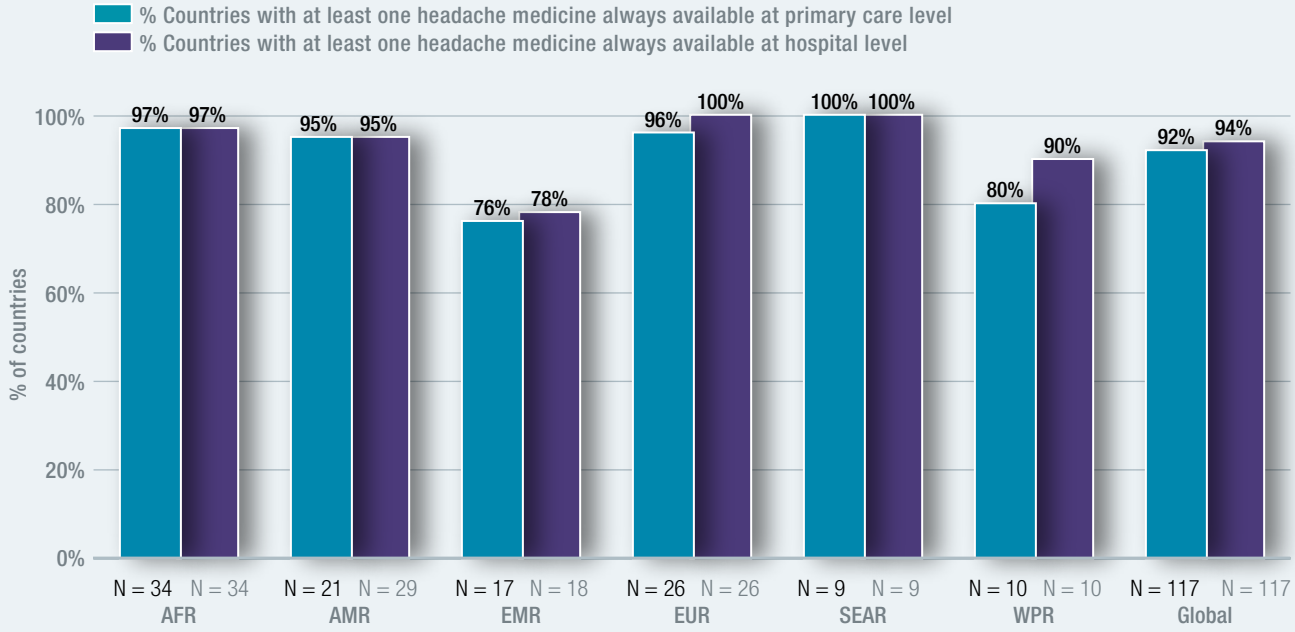


FIG. 22. Countries with at least one medicine for headache disorders (acetylsalicylic acid, ibuprofen, paracetamol, propanolol) always available at primary care and hospital level, by WHO region

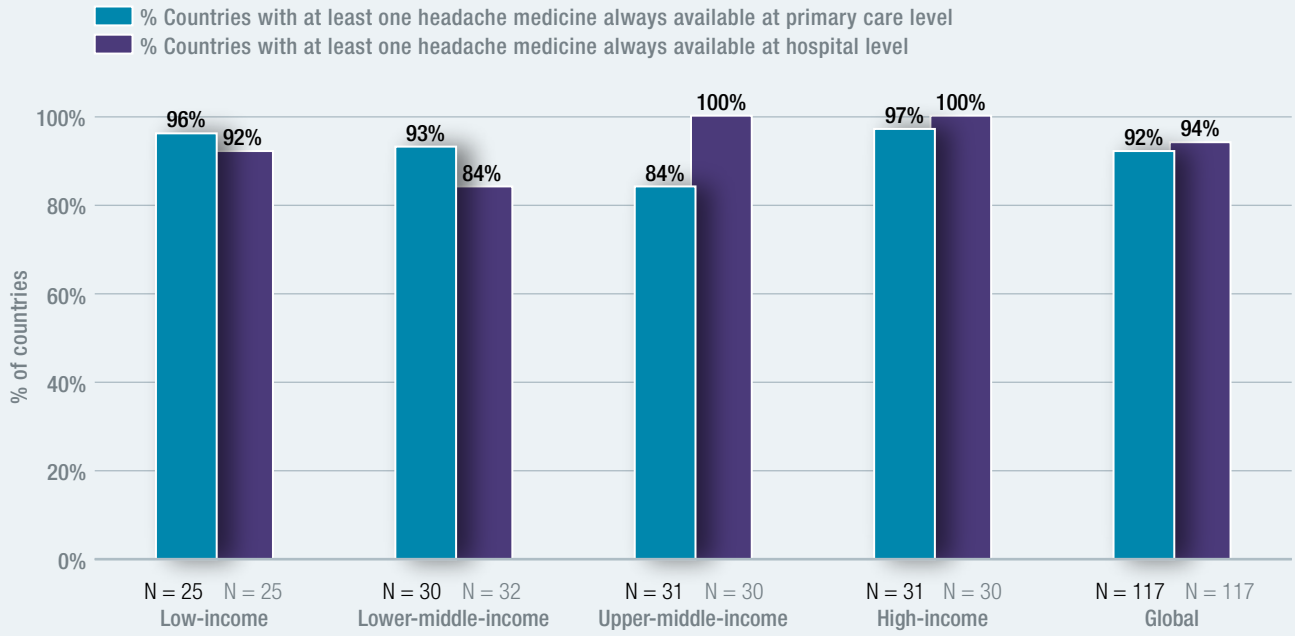


FIG. 23. Countries with at least one medicine for headache disorders (acetylsalicylic acid, ibuprofen, paracetamol, propanolol) always available at primary care and hospital level, by World Bank income group

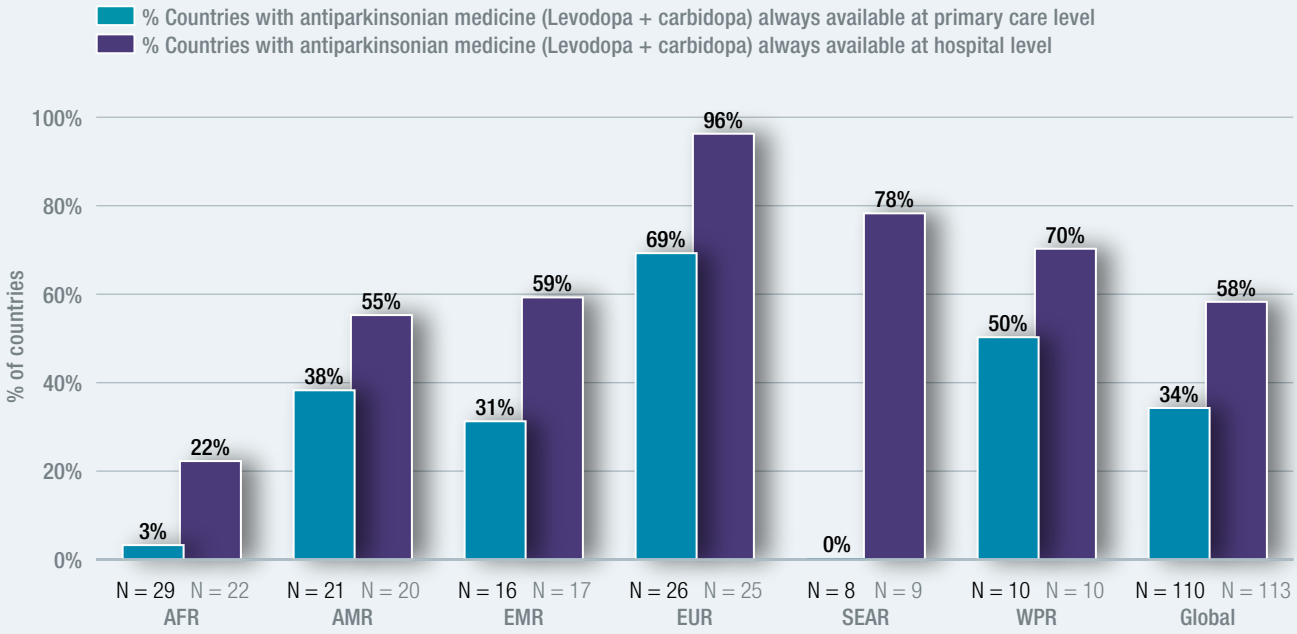


FIG. 24. Countries with antiparkinsonian medicine (levodopa + carbidopa) always available at primary care and hospital level, by WHO region

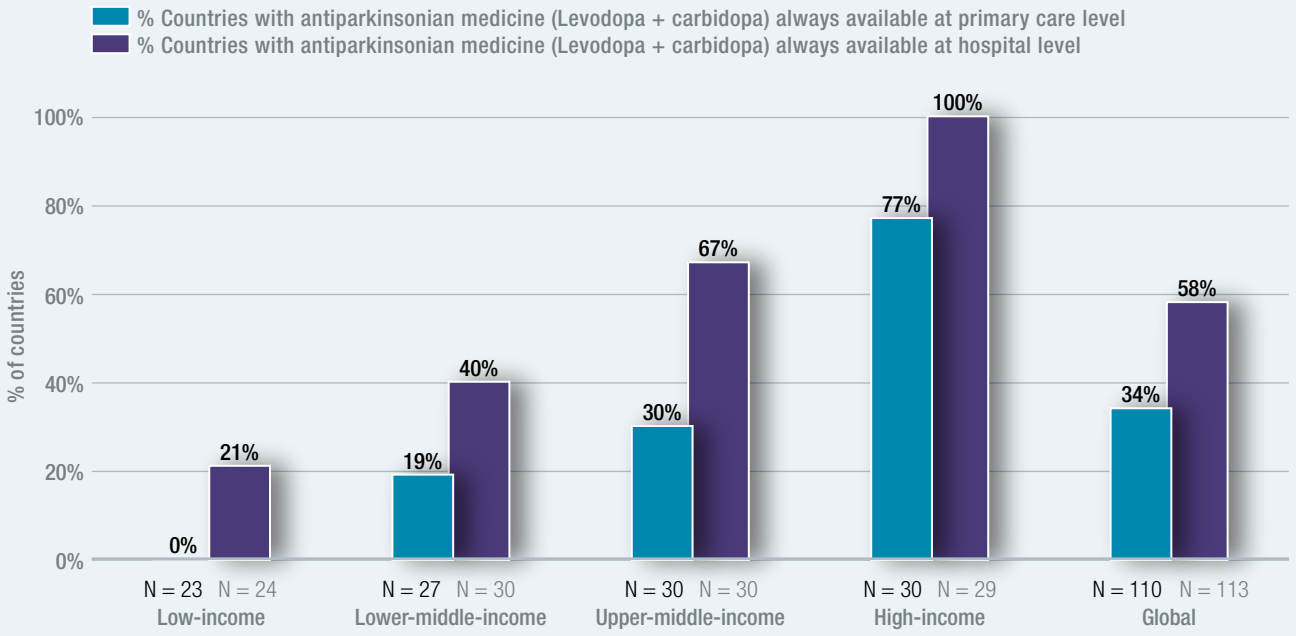


FIG. 25. Countries with antiparkinsonian medicine (levodopa + carbidopa) always available at primary care and hospital level, by World Bank income group

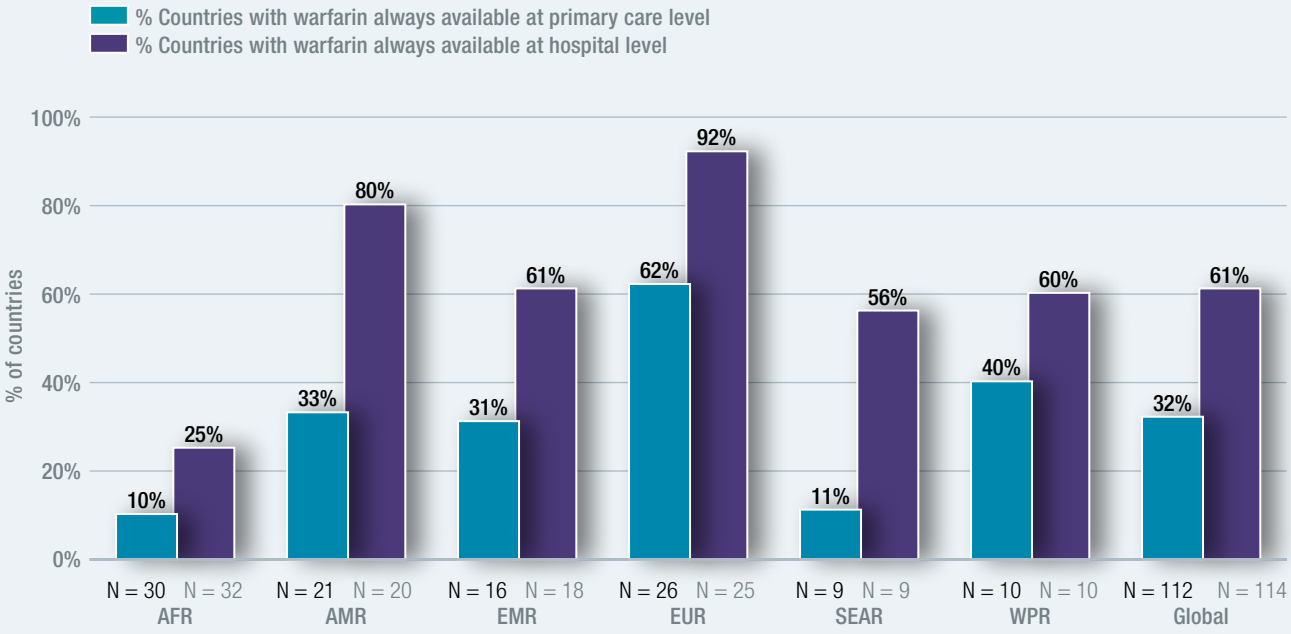


FIG. 26. Countries with warfarin always available at primary care and hospital level, by WHO region

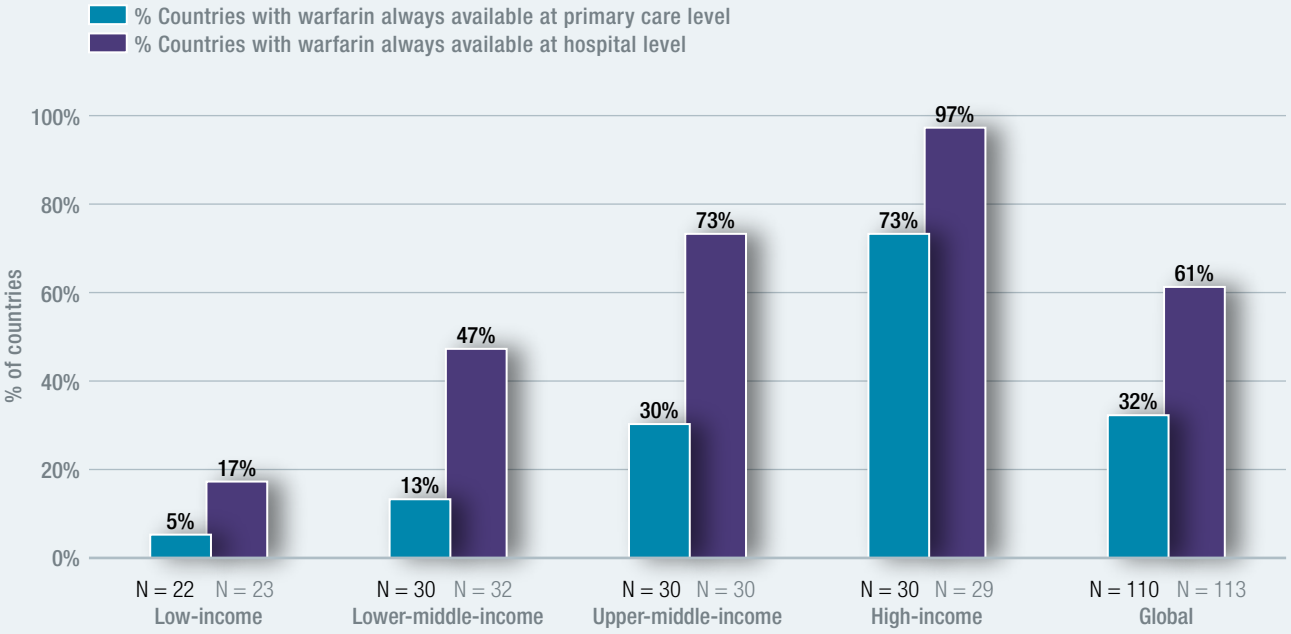


FIG. 27. Countries with warfarin always available at primary care and hospital level, by World Bank income group

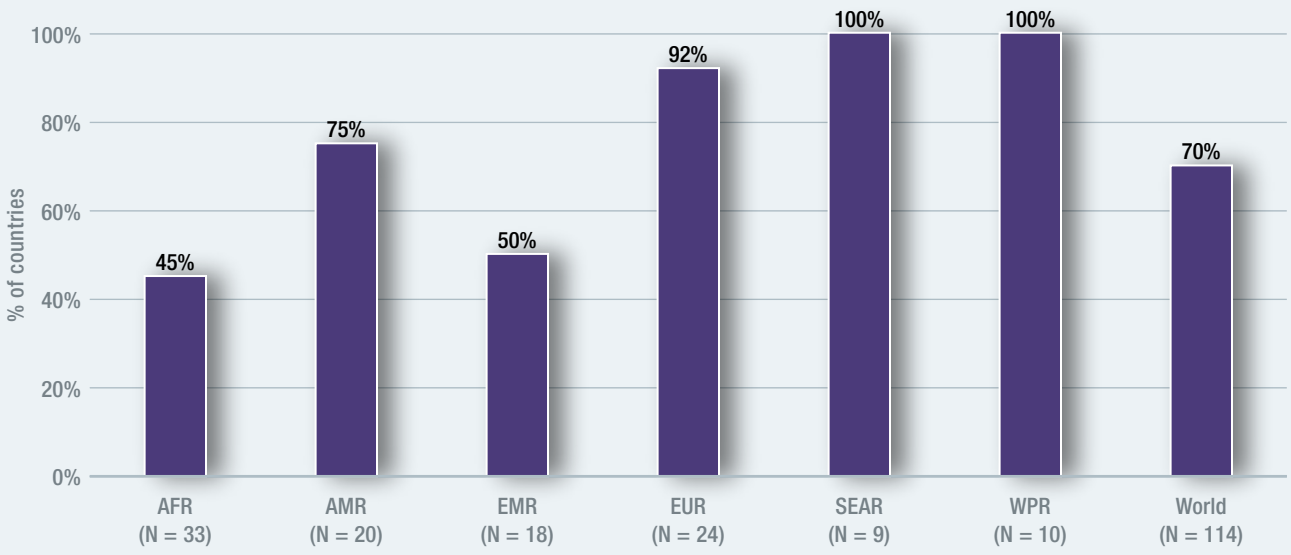


FIG. 28. Countries with mannitol always available at the hospital level, by WHO region

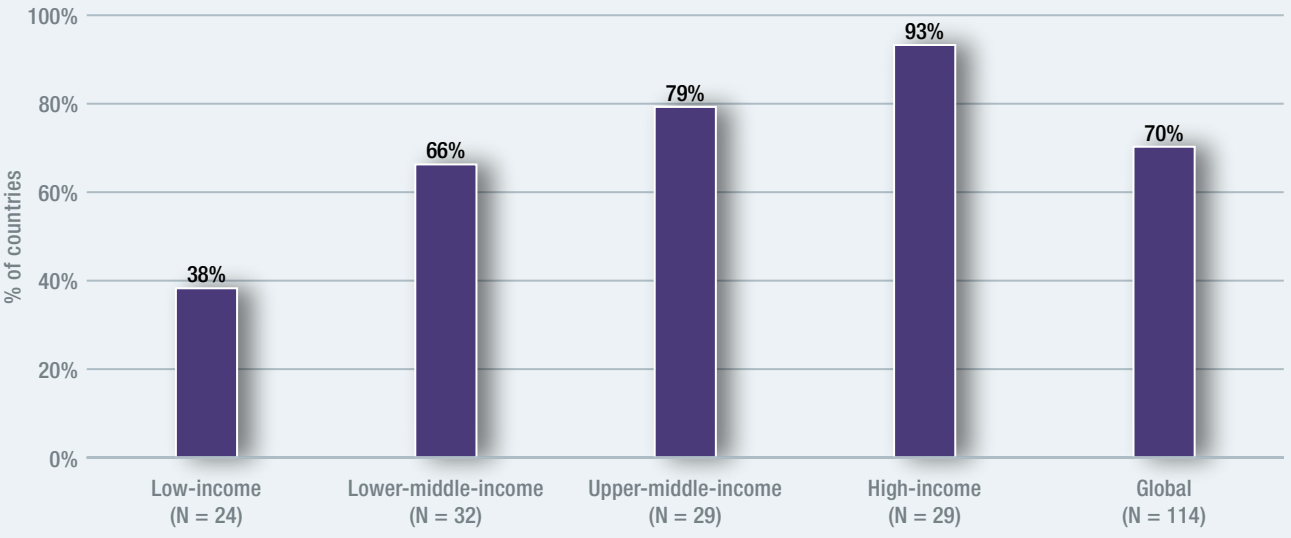


FIG. 29. Countries with mannitol always available at the hospital level, by World Bank income group

NEUROLOGICAL SERVICE QUALITY

National guidelines help to develop quality standards and performance metrics for those providing and commissioning health and social care services. For the purposes of the questionnaire, guidelines for neurological disorders are defined as a systematically developed statement or recommendations designed to assist practitioners and patients in making decisions about appropriate health-care for neurological disorders. Guidelines developed for neurological disorders help to provide evidence-based information for practitioners.

Countries were asked whether guidelines exist on the care of neurological disorders in their country. Of the responding 125 countries, 55% (N=69) countries report guidelines on neurological disorders, with the lowest number in the African Region (26%) and Eastern Mediterranean Region (47%) **(Fig. 30)**. The European Region reports the largest number of countries with neurological guidelines (89%). Seventy-nine per cent of high-income countries report the existence of neurology guidelines, compared with 23% of low-income countries **(Fig. 31)**. Epilepsy was the most common neurological disorder included in national guidelines.

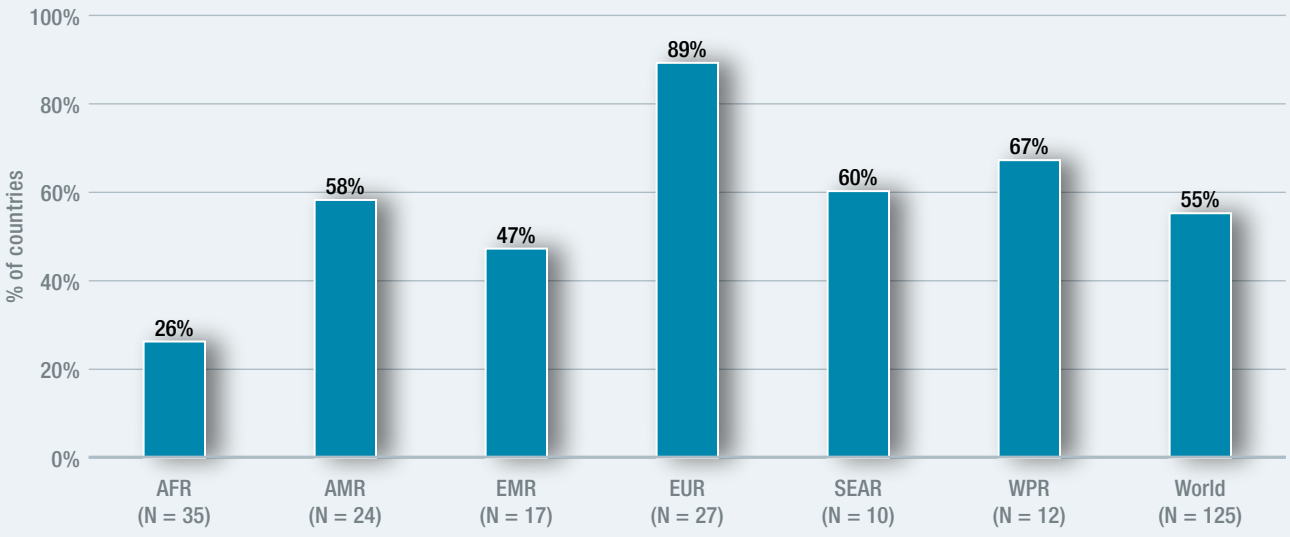


FIG. 30. **Countries with guidelines for the care of neurological disorders, by WHO region**

RESULTS
SERVICES FOR NEUROLOGICAL DISORDERS

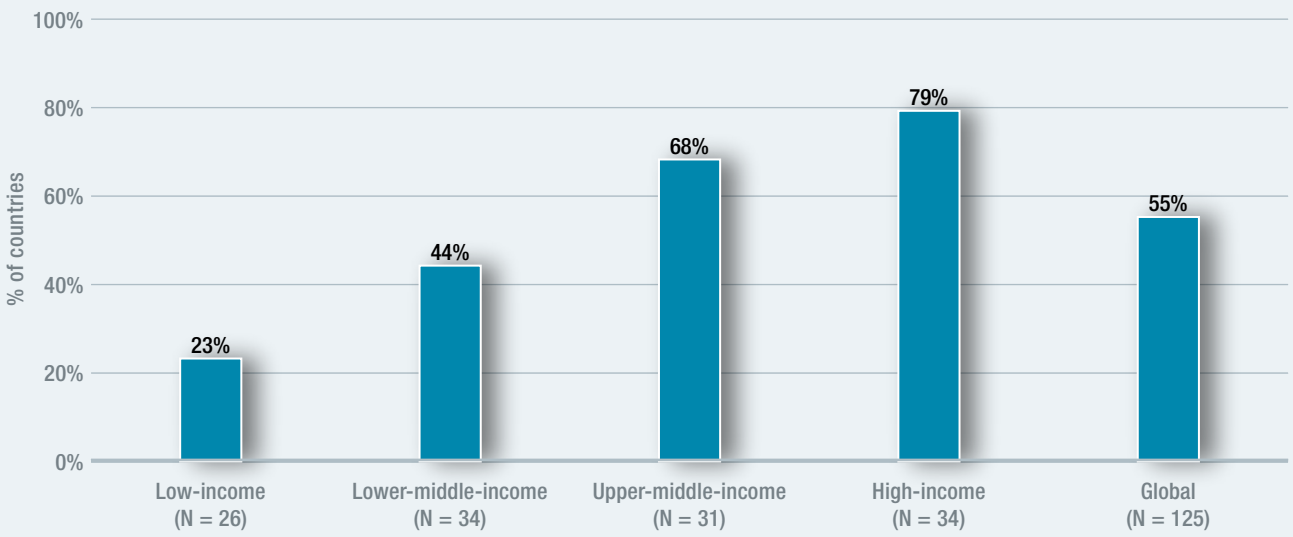


FIG. 31. Countries with guidelines for the care of neurological disorders, by World Bank income group

RESULTS

7. INFORMATION-GATHERING SYSTEMS FOR NEUROLOGICAL DISORDERS

Data reporting systems help to monitor trends in disease burden, identify high-priority health-care issues and develop plans for improvements in health services. A national annual reporting system refers to the preparation of yearly reports covering all health service functions, including the use of allocated funds. Countries were asked about the existence of a national annual reporting system for neurological disorders in the last two years. Of the 110 countries that responded, 46 (42%) countries overall report no neurological disorder data reporting in the last two years, with a particular lack of data reporting systems in the African Region (60%) and the Eastern Mediterranean Region (73%) **(Table 4)**. Lack of data reporting system for neurological disorders was also true for low- and lower-middle-income countries **(Table 5)**. Countries were asked regarding specific neurological disorders included in the national annual reporting system. Of the 108 countries which responded, epilepsy (49%), stroke (46%), infections of the nervous system (35%) and traumatic brain injury (35%) were included in the national annual reporting system more frequently than other neurological disorders **(Table 6, Table 7).** Data-gathering information systems were particularly lacking in headache (23%), Parkinson's disease (25%), dementia (27%), neurodevelopmental disorders (27%), multiple sclerosis (27%) and infections of the nervous system (35%). Countries were also surveyed on service utilization data for neurological disorders, which refers to an organized information-gathering system for service activity data. It usually incorporates incidence and prevalence of diseases, admission and discharge rates, number of outpatient contacts and similar data. Only epilepsy (56%), traumatic brain injury (50%), and stroke (55%), were reported in more than 50% of cases in the 97 countries reporting on service utilization data **(Table 8, Table 9)**. The low rate of disease-specific reporting on dementia, neurodevelopmental disorders, headache, Parkinson's disease and infections of the nervous system is particularly concerning, as these diseases are increasingly prevalent globally.

TABLE 4. **Status of neurological disorder data reporting in the last two years, by WHO region**

Responding countries	AFR N=30	AMR N=20	EMR N=15	EUR N=26	SEAR N=8	WPR N=11	Global N=110
No neurological disorder data have been compiled in a report for policy, planning or management purposes in the last two years	18 (60%)	6 (30%)	11 (73%)	6 (23%)	3 (38%)	2 (18%)	46 (42%)
Neurological disorder data (in either the public or the private system or both) have been compiled for general health statistics in the last two years, but not in a specific report	9 (30%)	12 (60%)	2 (13%)	15 (58%)	3 (58%)	6 (55%)	47 (43%)
A specific report focusing on neurological care activities, in the public sector only, has been published by the health department or any other responsible government unit in the last two years	1 (3%)	1 (5%)	2 (13%)	3 (12%)	2 (25%)	1 (9%)	10 (9%)
A specific report focusing on neurological care activities in both public and private sector has been published by the health department or any other responsible government unit in the last two years	2 (7%)	1 (5%)	0 (0%)	2 (8%)	0 (0%)	2 (18%)	7 (6%)

TABLE 5. Status of neurological disorder data reporting in the last two years, by World Bank income group

Responding countries	Low-income N=24	Lower-middle-income N=27	Upper-middle-income N=29	High-income N=30	Global N=110
No neurological disorder data have been compiled in a report for policy, planning or management purposes in the last two years	14 (58%)	16 (59%)	11 (38%)	5 (17%)	46 (42%)
Neurological disorder data (in either the public or the private system or both) have been compiled for general health statistics in the last two years, but not in a specific report	6 (25%)	9 (33%)	14 (48%)	18 (60%)	47 (43%)
A specific report focusing on neurological care activities, in the public sector only, has been published by the health department or any other responsible government unit in the last two years	2 (8%)	2 (7%)	2 (7%)	4 (13%)	10 (9%)
A specific report focusing on neurological care activities in both public and private sector has been published by the health department or any other responsible government unit in the last two years	2 (8%)	0 (0%)	2 (7%)	3 (10%)	7 (6%)

TABLE 6. Neurological disorders included in the national annual reporting system, by WHO region

Neurological disorder	AFR N=29	AMR N=19	EMR N=17	EUR N=24	SEAR N=9	WPR N=10	Global N=108
Dementia	4 (14%)	10 (53%)	2 (12%)	7 (29%)	1 (11%)	5 (50%)	29 (27%)
Epilepsy	15 (52%)	10 (53%)	7 (41%)	11 (46%)	3 (33%)	7 (70%)	53 (49%)
Headache	8 (28%)	6 (32%)	1 (6%)	6 (25%)	0 (0%)	4 (40%)	25 (23%)
Infections of the nervous systems	11 (38%)	6 (32%)	3 (18%)	10 (42%)	1 (11%)	7 (70%)	38 (35%)
Multiple sclerosis	3 (10%)	7 (37%)	4 (24%)	11 (46%)	0 (0%)	4 (40%)	29 (27%)
Neurodevelopmental disorders	5 (17%)	8 (42%)	3 (18%)	9 (38%)	1 (11%)	3 (30%)	29 (27%)
Parkinson's disease	4 (14%)	9 (47%)	2 (12%)	8 (33%)	0 (0%)	4 (40%)	27 (25%)
Stroke	13 (45%)	8 (42%)	6 (35%)	14 (58%)	1 (11%)	8 (80%)	50 (46%)
Traumatic brain injury	10 (34%)	7 (37%)	4 (24%)	10 (42%)	0 (0%)	7 (70%)	38 (35%)

TABLE 7. Neurological disorders included in the national annual reporting system, by World Bank income group

Neurological disorder	Low-income N=23	Lower-middle-income N=29	Upper-middle-income N=25	High-income N=31	Global N=108
Dementia	4 (17%)	8 (28%)	5 (20%)	12 (39%)	29 (27%)
Epilepsy	15 (65%)	16 (55%)	8 (32%)	14 (45%)	53 (49%)
Headache	6 (26%)	7 (24%)	5 (20%)	7 (23%)	25 (23%)
Infections of the nervous systems	10 (43%)	9 (31%)	7 (28%)	12 (39%)	38 (35%)
Multiple sclerosis	3 (13%)	6 (21%)	5 (20%)	15 (48%)	29 (27%)
Neurodevelopmental disorders	6 (26%)	5 (17%)	6 (24%)	12 (39%)	29 (27%)
Parkinson's disease	4 (17%)	7 (24%)	4 (16%)	12 (39%)	27 (25%)
Stroke	13 (57%)	12 (41%)	7 (28%)	18 (58%)	50 (46%)
Traumatic brain injury	9 (39%)	9 (31%)	8 (32%)	12 (39%)	38 (35%)

NEUROLOGICAL INFORMATION-GATHERING SYSTEMS

TABLE 8. Neurological disorders included in service utilization data, by WHO region

	AFR N=26		AMR N=19		EMR N=13		EUR N=21		SEAR N=8		WPR N=9		Global N=97	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dementia	10	38%	10	53%	2	14%	10	48%	3	38%	5	56%	40	41%
Epilepsy	15	58%	11	58%	7	50%	13	62%	3	38%	5	56%	54	56%
Headache	12	46%	8	42%	2	14%	10	48%	2	25%	4	44%	38	39%
Infections of the nervous systems	14	54%	8	42%	4	29%	12	57%	2	25%	6	67%	46	47%
Multiple sclerosis	8	31%	9	47%	5	36%	15	71%	1	13%	4	44%	42	43%
Neurodevelopmental disorders	11	42%	8	42%	2	14%	11	52%	0	0%	3	33%	35	36%
Parkinson's disease	10	38%	9	47%	2	14%	12	57%	1	13%	5	56%	39	40%
Stroke	15	58%	10	53%	3	21%	16	76%	2	25%	7	78%	53	55%
Traumatic brain injury	14	54%	10	53%	3	23%	13	62%	2	25%	6	67%	48	50%

TABLE 9. Neurological disorders included in service utilization data, by World Bank income group

	Low-income N=21		Lower-middle-income N=26		Upper-middle-income N=23		High-income N=27		Global N=97	
	N	%	N	%	N	%	N	%	N	%
Dementia	8	38%	11	42%	7	30%	14	52%	40	41%
Epilepsy	13	62%	16	62%	9	39%	16	52%	54	56%
Headache	9	43%	11	42%	5	22%	13	48%	38	39%
Infections of the nervous systems	11	52%	13	50%	7	30%	15	56%	46	47%
Multiple sclerosis	6	29%	9	35%	7	30%	20	74%	42	43%
Neurodevelopmental disorders	7	33%	9	35%	6	26%	13	48%	35	36%
Parkinson's disease	7	33%	10	38%	6	26%	16	59%	39	40%
Stroke	13	62%	13	50%	8	35%	19	70%	53	55%
Traumatic brain injury	12	57%	12	46%	9	39%	15	56%	48	49%

RESULTS

8. NEUROLOGICAL PROFESSIONAL ASSOCIATIONS AND NONGOVERNMENTAL ORGANIZATIONS

The presence of professional associations highlights the commitment and organization of health-care professionals to improve the status of care for neurological disorders at a national level. Countries were asked whether a professional organization exists for neurology, neurosurgery and neurological subspecialties, and the specific activities of the associations. Of the 55 countries that responded, 87% report a professional organization in neurology, 84% report a professional organization in neurosurgery and 66% have professional organizations for neurological subspecialties. The most common activities of the professional organizations are organizing professional meetings, conferences and continuing medical education activities.

Additionally, countries were asked whether there are any service user or support groups for people with neurological disorders and their families. Of the 50 countries which responded, 43 (86%) report service user or support groups for people with neurological disorders and their families. The most common neurological disorders addressed by support groups are multiple sclerosis, Parkinson's disease and dementia.

Countries were also asked whether there are any nongovernmental organizations which provide neurological or neurosurgical services or engage in activities related to neurological disorders. Of the 50 countries which responded, 46% report that nongovernmental organizations undertake activities on awareness, promotion, treatment and rehabilitation for people with neurological disorders including epilepsy, multiple sclerosis, dementia, Parkinson's disease and stroke.

Overall, the scope for interpretation of the results relating to neurological professional associations, support groups and nongovernmental organizations is limited, as less than 50% of countries surveyed responded to this section of the survey.

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ANNEX 1

PARTICIPATING COUNTRIES AND CONTRIBUTORS

WHO Member State / territory	WHO region	World Bank income group	Contributor to Neurology Atlas second edition
Afghanistan	Eastern Mediterranean Region	Low-income	Musa Zia
Albania	European Region	Upper-middle income	Jera Kruja
Algeria	African Region	Upper-middle income	Chakali Mohamed
Angola	African Region	Upper-middle income	Miguel Santana, Bettencourt Mateus
Australia	Western Pacific Region	High-income	Mandy Jones
Austria	European Region	High-income	Magdalena Arrouas, Wolfgang Grisold, Regina Katzenschlager
Bahrain	Eastern Mediterranean Region	High-income	Isa Abdulla AlSharoqi
Bangladesh	South-East Asia Region	Lower-middle income	Quazi Deen Mohammad
Barbados	Region of the Americas	High-income	Heather Payne-Drakes
Belarus	European Region	Upper-middle income	GD Sitnik
Belgium	European Region	High-income	Gerits
Belize	Region of the Americas	Upper-middle income	Eleanor Bennett
Benin	African Region	Low-income	Dismand Stephan Houinato
Bhutan	South-East Asia Region	Lower-middle income	Tandin Dorji, Tandin Chogyel
Bolivia (Plurinational State of)	Region of the Americas	Lower-middle income	Juan Carlos Duran Quiroz
Brazil	Region of the Americas	Upper-middle income	Celeste de Souza Rodrigues
Bulgaria	European Region	Upper-middle income	Ivan Milanov
Burkina Faso	African Region	Low-income	Isaie Medah
Burundi	African Region	Low-income	Miburo Joselyne
Cameroon	African Region	Lower-middle income	Alfred K Njamnshi
Canada	Region of the Americas	High-income	Eric Arnold
Central African Republic	African Region	Low-income	Mbelesso Pascal
Chile	Region of the Americas	High-income	Alfredo Pemjeam, Carlos Acevedo
China	Western Pacific Region	Upper-middle income	Ning Ma
Colombia	Region of the Americas	Upper-middle income	Nubia Esperanza Bautista
Congo	African Region	Lower-middle income	Bandzouzi Ndamba
Costa Rica	Region of the Americas	Upper-middle income	Allan Rimola Rivas
Côte d'Ivoire	African Region	Lower-middle income	Delafosse Roger Charles Joseph
Croatia	European Region	High-income	Ivo Lušić
Democratic Republic of the Congo	African Region	Low-income	Ildéphonse Muteba Mushidi
Djibouti	Eastern Mediterranean Region	Lower-middle income	Idd Wais Ibrahim
Dominican Republic	Region of the Americas	Upper-middle income	Jose Mieses Michel
Ecuador	Region of the Americas	Upper-middle income	Rocio Santibanez
Egypt	Eastern Mediterranean Region	Lower-middle income	Mohamed S. El-Tamawy
El Salvador	Region of the Americas	Lower-middle income	Susana Lissette Peña Martinez, Mauricio Ramirez Zamora
Eritrea	African Region	Low-income	Ghedewon Yirgaw
Estonia	European Region	High-income	Inna Vabamäe
Ethiopia	African Region	Low-income	Hermon Amare
France	European Region	High-income	Didier Leyz
Gabon	African Region	Upper-middle income	Frédéric Mbungu Mabiala
Gambia	African Region	Low-income	John Nute Jabang
Germany	European Region	High-income	Thomas Stracke

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Ghana	African Region	Lower-middle income	Albert Akpalu
Greece	European Region	High-income	Ioannis Evdokimidis
Guatemala	Region of the Americas	Lower-middle income	Jorge Pinot
Guinea	African Region	Low-income	Cisse Fode Abass
Guyana	Region of the Americas	Lower-middle income	Bhiro Persaud Harry
Haiti	Region of the Americas	Low-income	Fabiola Dalvius
Honduras	Region of the Americas	Lower-middle income	Marco T Medina
Hungary	European Region	High-income	László Vécsei
India	South-East Asia Region	Lower-middle income	Kameshwar Prasad
Indonesia	South-East Asia Region	Lower-middle income	Priska Apsari Primastuti
Iran (Islamic Republic of)	Eastern Mediterranean Region	Upper-middle income	Ahmad Hajebi
Iraq	Eastern Mediterranean Region	Upper-middle income	Sarmad Abdul Rassol Mohammed
Italy	European Region	High-income	Antonio Federico
Japan	Western Pacific Region	High-income	Takashi Suzuki
Jordan	Eastern Mediterranean Region	Upper-middle income	Basher al Qasser
Kazakhstan	European Region	Upper-middle income	Gulnaz Kaishibayeva
Kenya	African Region	Lower-middle income	Pauline Samia
Kuwait	Eastern Mediterranean Region	High-income	Jasem Yousef Al-Hashel
Lao People's Democratic Republic	Western Pacific Region	Lower-middle income	Ketmanee Phetsiriseng
Lebanon	Eastern Mediterranean Region	Upper-middle income	Wissam Kheir
Lithuania	European Region	High-income	Valmantas Budrys
Madagascar	African Region	Low-income	Raharinivo
Malawi	African Region	Low-income	Kiran Thakur
Malaysia	Western Pacific Region	Upper-middle income	Hanip Rafia
Maldives	South-East Asia Region	Upper-middle income	Shanooha Mansoor
Mali	African Region	Low-income	Maiga Youssoufa
Mauritania	African Region	Lower-middle income	Diagana Mouhamadou
Mexico	Region of the Americas	Upper-middle income	Lilia Núñez Orozco
Monaco	European Region	High-income	Dominique de Furst
Mongolia	Western Pacific Region	Upper-middle income	Avirmed Tovuudorj
Morocco	Eastern Mediterranean Region	Lower-middle income	Rachidi Soumaya
Mozambique	African Region	Low-income	Paula Andrassone
Myanmar	South-East Asia Region	Lower-middle income	Win Min Thit
Namibia	African Region	Upper-middle income	Lawrence Tucker
Nepal	South-East Asia Region	Low-income	Dinesh Biram Shah
Netherlands	European Region	High-income	Caroline Morton
New Zealand	Western Pacific Region	High-income	Jane Chambers
Nicaragua	Region of the Americas	Lower-middle income	Walter Díaz Neira
Niger	African Region	Low-income	Yamien Ibrahim
Nigeria	African Region	Lower-middle income	Olubunmi Akindele Ogunrin
Norway	European Region	High-income	Espen Dietrichs
Oman	Eastern Mediterranean Region	High-income	Jaber K. Al-Khabouri
Pakistan	Eastern Mediterranean Region	Lower-middle income	Mohammad Wasay
Panama	Region of the Americas	Upper-middle income	Ricardo Goti

WHO Member State / territory	WHO region	World Bank income group	Contributor to Neurology Atlas second edition
Papua New Guinea	Western Pacific Region	Lower-middle income	Umadevi Ambihaipahar
Paraguay	Region of the Americas	Upper-middle income	Carolina Velázquez Oviedo, Martha Sady Galeano
Peru	Region of the Americas	Upper-middle income	Yuri Licinio Cutipé Cárdenas
Philippines	Western Pacific Region	Lower-middle income	–
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Portugal	European Region	High-income	Ricardo Rego
Puerto Rico	Region of the Americas	High-income	Briseida E. Feliciano
Republic of Korea	Western Pacific Region	High-income	Joung-Ho Rha
Republic of Moldova	European Region	Lower-middle income	Vitalie Lisnic
Romania	European Region	Upper-middle income	Ovidiu Bajenaru
Russian Federation	European Region	High-income	Alla Guekht
Rwanda	African Region	Low-income	Sebera Fidèle
Sint Maarten	Region of the Americas	High-income	Sharmilla Muller
Sao Tome and Principe	African Region	Lower-middle income	Yoinelma Marques Daio
Saudi Arabia	Eastern Mediterranean Region	High-income	Saeed Bohlega
Senegal	African Region	Lower-middle income	Mansour Ndiaye
Serbia	European Region	Upper-middle income	Vladimir Kostic
Seychelles	African Region	High-income	Gina Michel
Sierra Leone	African Region	Low-income	Durodami Radcliffe Lisk
Singapore	Western Pacific Region	High-income	Ong Lay Tin
Slovenia	European Region	High-income	David B.Vodušek
Solomon Islands	Western Pacific Region	Lower-middle income	Stephen Araitewa
Somalia	Eastern Mediterranean Region	Low-income	Zeynab Ahmed Noor
South Africa	African Region	Upper-middle income	Jo Wilmshurst
South Sudan	African Region	Low	Mohamedi Boy Sebit
Spain	European Region	High-income	Jose Rodríguez Escobar
Sri Lanka	South-East Asia Region	Lower-middle income	Sudath Gunasekera
Sudan	Eastern Mediterranean Region	Lower-middle income	Zeinat Sanhori
Suriname	Region of the Americas	Upper-middle income	Maltie Mohan-Algoe
Sweden	European Region	High-income	Tina Isaksson
Switzerland	European Region	High-income	Pierre Burkhard
Syrian Arab Republic	Eastern Mediterranean Region	Lower-middle income	Ramadan Mahfouri
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Timor-Leste	South-East Asia Region	Lower-middle income	Anabela Clemetina da Costa Guterres
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Uruguay	Region of the Americas	High-income	Laura Fojgiel
Uzbekistan	European Region	Lower-middle income	Bakhtiar Gafurovic Gafurov
Yemen	Eastern Mediterranean Region	Lower-middle income	Mohammed Abdulhabeb Al Khulaidi
Zambia	African Region	Lower-middle income	Omar Siddiqi
Zimbabwe	African Region	Low-income	Dorcas Shirley Sithole

ANNEX 2

GLOSSARY FOR THE COUNTRY RESOURCES FOR NEUROLOGICAL DISORDERS

Term	Definition
Budget line for neurological disorders	Source of money available and allocated for actions directed towards the treatment and care of neurological disorders.
Child neurologist	A medical doctor with successfully completed subspecialist training in child neurology in a recognized teaching institution.
Employer financing sources	Social health insurance schemes in which workers and employers are obliged to contribute to health insurance funds.
Epilepsy surgery unit	A medical facility which is dedicated to treating seizure disorders which do not respond to medication by performing brain surgery.
General health policy	An organized set of values, principles and objectives defining a vision for future action in general health.
General rehabilitation units	General rehabilitation facilities are those that are found in general health services e.g. hospitals, which rehabilitate patients after medical illness/injury to help them achieve their optimum level of functioning.
Government financing sources	National, regional/subnational or local government financing from any form of tax-based funding, or national health insurance scheme.
Guidelines on the care of neurological disorders	A systematically developed statement or recommendations designed to assist practitioners and patients in making decisions about appropriate health-care for neurological disorders.
Household financing sources	Direct out-of-pocket payment or private insurance payment.
Inpatient neurological services	Inpatient services that provide care for people with neurological disorders whose condition requires admission to hospital. This includes specialist neurology hospitals or neurology beds in a general hospital or community facility.
Legislation affecting people with neurological disorders	Legal provisions related to neurological disorders: for example, medical fitness to drive in people with epilepsy, a capacity act for people with dementia or other neurological disorders.
Medicines for neurological disorders	Medications that are used to treat or alleviate the symptoms related to neurological disorders.
Mental health policy	An organized set of values, principles and objectives for improving mental health and reducing the burden of mental disorders in a population. It defines a vision for future action.
National annual health reporting system	The annual health reporting system refers to the preparation of yearly reports covering all health service functions, including the use of allocated funds.
National essential medicines list	The core national essential medicines list presents a list of minimum medicine needs for a basic health-care system, listing the most efficacious, safe and cost-effective medicines for priority conditions.
Neurological diagnostic services	Investigations or procedures which provide information for the diagnosis of neurological disorders and help physicians confirm or rule out the presence of a neurological disorder or other medical condition.
Neurological disorders	Neurological disorders are diseases of the central and peripheral nervous system. For the purposes of this questionnaire, we included the following neurological disorders: dementia, epilepsy, headache disorders, infections of the nervous system, multiple sclerosis, neurodevelopmental disorders, Parkinson's disease, stroke and traumatic brain injury.
Neurological health policy	An organized set of values, principles and objectives for improving neurological health and reducing the burden of neurological disorders in a population. It defines a vision for future action.
Neurologist	A medical doctor who has successfully completed postgraduate training in neurology in a recognized teaching institution.
Neurology nurse	A registered nurse who has graduated from a recognized nursing school and successfully completed required additional training in neurological nursing.
Neurorehabilitation services	Services dedicated to helping people regain skills or abilities lost due to a neurological disorder or injury.
Neurosurgeon	A medical doctor who has successfully completed postgraduate training in neurosurgery in a recognized teaching institution.

ANNEX 2
GLOSSARY FOR THE COUNTRY RESOURCES FOR NEUROLOGICAL DISORDERS

Term	Definition
Nongovernmental organization sources	Financing through funds provided by voluntary organizations, charitable groups, service-user groups, advocacy groups, professional associations or international organizations.
Nurse prescribers	Nurse prescribers are nurses who have undergone professional development training, which enables them to prescribe particular medicines normally restricted to being prescribed by physicians only.
Other primary health care providers	Primary care service providers who are not physicians, paramedical professionals or nurses. This may include psychiatric technicians or assistants or psychiatric nurses.
Outpatient neurological services	Outpatient services that provide care for people with neurological disorders who receive treatment on an ambulatory basis at a hospital or clinic.
Paramedical practitioners	Paramedical practitioners, including clinical officers and physician assistants, provide diagnostic, curative and preventive medical services more limited in scope and complexity than those carried out by medical doctors. They work autonomously or with limited supervision by medical doctors, and perform clinical, therapeutic and surgical procedures for preventing and treating disease, injuries and other physical or mental impairments common to specific communities.
Policy for any specific neurological disorder	An organized set of values, principles and objectives for improving neurological health and reducing the burden among people with a particular neurological disorder, such as a national dementia policy. It defines a vision for future action.

The Atlas project on neurological disorders aims at collecting, compiling and disseminating information on global health-care resources available to cope with the growing burden of neurological disorders. This second edition of the Neurology Atlas represents updated information on the status of neurological services and provision of neurological care from 132 countries and two Associate Members/ territories covering 94% of the world population. The data demonstrates that the available resources for neurological disorders within most countries remain insufficient. In addition, there are large inequalities across regions and different income levels with extremely scanty resources in low-income countries. The results in the second edition of the Neurology Atlas illustrate the need for substantial increase in neurology services and training, especially in low-and lower-middle-income countries.

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