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Rates of diagnosis and treatment of neurological disorders within a prevalent population of community-dwelling elderly people in sub-Saharan Africa

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Treatment; Diagnosis; Neurological disorders; Elderly; Africa

Abstract  Background: The prevalence of neurological disorders in those aged 70 years and over in the Hai district of Tanzania has been previously reported. The following research reports rates of patient’s treatment seeking, diagnosis and treatment within this prevalent population.

Methods: All people identified as having at least one neurological disorder in the prevalence study were questioned regarding whether they had sought treatment for their disorder, whether they had had a previous correct diagnosis and whether they were being currently treated.

Results: From a background population of 2232 people, 349 people had neurological disorders, of whom 225 (64.5%) had sought treatment for their symptoms. Of the 384 disorders identified in these 349 people, only 0.263% had been diagnosed and only...
9.9% were receiving appropriate treatment. Males were significantly more likely to have been diagnosed and were more likely to have been treated appropriately.

Conclusions: Levels of diagnosis and treatment were low, with some gender inequality. Reasons for this may include a lack of recognition of the condition within the local population and lack of access to appropriate services. In the absence of effective primary and secondary preventative measures, and effective treatment, the burden of neurological disorders is likely to increase with further demographic ageing.

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1. Introduction

1.1. Neurological disorders in high-income countries

The annual economic cost of neurological diseases in Europe in 2004 has been estimated at €139 billion (US$ 180 billion) [1]. This estimate did not include direct non-medical costs (e.g. community care and informal care) and indirect costs. The World Health Organization (WHO) has launched a programme to scale up the treatment of people with neurological disorders [2]. The WHO states that even in high-income countries substantial treatment gaps exist, with up to half the patients affected by these conditions left untreated, and most neurological problems are dealt with by general practitioners and hospital physicians, rather than by neurologists.

Neurological disorders account for 10–20% of acute hospital admissions. Around 10% of the adult population consult their general practitioner each year with neurological symptoms, but less than 10% of these people are referred to hospital clinics. Developments in the management of neurological disorders are therefore relevant to doctors without specialist neurological training [3].

In the past 10 years, new treatments have become available for neurological disorders previously considered untreatable (e.g. multiple sclerosis, Alzheimer's disease, motor neuron disease). However, the high cost of these treatments has sometimes led to issues with health budgeting [3].

1.2. Neurological disorders in low- and middle-income countries

Unfortunately, no equivalent estimates on the financial cost of neurological disorders are available for low-income countries [4]. Nevertheless, there can be little doubt that such disorders represent a significant burden at an individual and societal level [5,6]. Furthermore, access to effective treatment is often hampered by lack of knowledge of medical conditions and by beliefs that such conditions are caused by evil spirits or witchcraft [6–8].

1.3. Aims and objectives

The age-adjusted prevalence of people aged 70 years and over with neurological diagnoses in the rural Hai district of Tanzania was previously reported to be 154.1 per 1000 (95% CI: 139.2–169.1) [9]. The primary aim of this study is to identify the proportion of people seeking treatment, diagnosed and on appropriate treatment for these conditions.

2. Methods

Ethical approval for the study was obtained locally from Tumaini University ethics committee and nationally from the Tanzanian National Institute of Medical Research.

2.1. Design

The methods for the prevalence study have been reported previously [9]. The data presented here relate to rates of treatment seeking, diagnosis and treatment of all those people identified as having a neurological disorder in the prevalence study.

2.2. Setting and study population

The study setting has been described previously and is only described briefly here [10]. The Hai district of northern Tanzania is located around Mount Kilimanjaro and includes a demographic surveillance site (DSS) in which there are regular population censuses. The most recent census was completed on 1st June, 2009. It reported the population of the 52 villages in the district to be 161,119, of whom 8869 were aged 70 years and over. Most villages have a small health centre or a dispensary for basic treatment. There are three small hospitals in the district, and a tertiary hospital in the adjacent district, Kilimanjaro Christian Medical Centre.
The goal of this study was to screen one-quarter of the DSS population. Therefore, 12 villages were selected (using a random number generator, with stratification to allow a representative spread of upland and lowland villages), with a total census population of 2425. Exclusions, refusals and additions have been reported previously [9]. The final cohort of participants was 2232 people.

### 2.3. Detection of neurological disorders and data collection

Data were collected between 1st November, 2009 and 31st July, 2010. The point prevalence date was the 1st January, 2010. Details of the screening instrument which we have developed and validated for neurological disorders in the elderly, was published in the Journal of Neurology. This instrument was used during the initial screening phase of the current study [10]. The sensitivity of the instrument was 87.8% and the specificity 94.9%. Participants were seen at a place of their convenience (village health centres or patients’ houses). Signed informed consent was obtained from each participant. A thumbprint was obtained for those who could not read and write and the purpose and implications of the study were verbally explained. In cases where patients were unable to consent, written assent was obtained from a close relative. The neurology screening questionnaire was performed by a trained non-medical investigator (NMI). Age, sex, tribe, and level of disability (Barthel index score [11]) were also recorded. Severe disability was defined as a Barthel index score of <15 and moderate disability as a Barthel index score of 15–18. All positive responders were seen by the research doctor (FD) who performed a full neurological history and examination to confirm or refute the presence of a neurological disorder. Diagnoses of positive responders were assigned using the World Health Organization’s (WHO) International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) [12]. Further specialist diagnoses were assigned as appropriate using internationally recognised standard diagnostic criteria. Details of all the diagnostic criteria used are given in the Appendix. Physiological tremor was not included. Headache had to be recurrent and affect the ability of the participant to perform their activities of daily living. All diagnoses were verified with a neurologist (WH) or a movement disorder expert (RW). Further details of the criteria used have been published previously [9].

All participants identified as having a neurological disorder were asked if they had sought treatment for their condition and whether they were currently being treated for it. Treatment seeking included visiting traditional healers and un-registered private pharmacies and dispensaries as well as more formal healthcare facilities. If patients responded that they were receiving treatment, the type and level of treatment was checked and recorded.

### 2.4. Statistical analysis

Confidence intervals (CIs) for prevalence and for odds ratios (OR) were calculated based on the assumptions of the binomial distribution. No attempt has been made to adjust our data for the effects of clustering of cases within villages.

### 3. Results

Of the study population of 2232 people, 1256 (56.3%) were female and 976 (43.7%) were male. There were 384 cases of neurological disorders amongst 349 people (35 people had two diagnoses). The age-adjusted prevalence of at least one neurological disorder was 154.1 per 1000 (95% CI: 139.2–169.1).

Of the 349 people with at least one neurological disorder, 64.5% had sought treatment for their symptoms. Of the 384 disorders, only 56 (14.6%) had been diagnosed correctly and only 38 (9.9%) had received appropriate treatment. A breakdown of these figures by sex is presented in Table 1 and by specific neurological disorders in Table 2. Males with a neurological condition were significantly more likely to be diagnosed than females (OR 2.05, 95% CI: 1.15–3.68). In cases where treatment was available in Tanzania, males were more likely to be treated, though the difference was not significant (OR 1.68, 95% CI: 0.85–3.32). The lack of significance in the latter result is likely to be due in part to the relatively small number of people being treated, representing a Type II error.

Overall, there was no significant difference in levels of disability between those who sought treatment and those who did not. Of 159 who did not seek treatment, 44 (27.7%) had moderate or severe disability, whilst of 225 who sought treatment, 67 (29.8%) had moderate or severe disability, OR 1.10 (95% CI: 0.71–1.74). Rates of treatment seeking and disability for selected neurological disorders are detailed in Table 3. For each specific disorder, the level of disability was not significantly associated with whether a person sought treatment or not. However, those disorders which were associated with the highest level of disability (epilepsy, stroke and Parkinson’s disease) also had the highest levels of treatment seeking.
4. Discussion

To the best of our knowledge, this is the first published study of rates of diagnosis and treatment for neurological disorders in SSA from within a prevalent population. They reveal that although almost two-thirds of people with neurological disorders had sought treatment for their condition, less than one-tenth were on appropriate treatment.

4.1. Treatment seeking behaviour

Of the more common disorders, rates of treatment seeking for stroke, epilepsy and Parkinson’s disease were high, whilst rates for tremor and headache were low. Although the reasons why treatment is sought for some conditions but not others are likely to be complex, the extent to which a condition is disabling appears not to be a significant factor. Previous researchers who have investigated treatment-seeking behavior in SSA have found that whether people seek medical treatment for their symptoms depends on a number of factors, such as access to services, financial issues, education level, social networks, intra-household power and health beliefs [5–8]. In the current study, rates of treatment seeking were similar for males and females. There is a growing need for effective interventions for many medical conditions in SSA. Further investigation of the factors which influence treatment seeking will help to inform strategies for the development of healthcare services in SSA.

4.2. Diagnosis and treatment

The majority of neurological disorders had not been diagnosed prior to the study. This was despite relatively high levels of treatment seeking. When patients sought treatment, it was often not in health centers and hospitals, but via un-registered private pharmacies and traditional healers. In these cases, an appropriate formal diagnosis was rarely made. Of the most prevalent disorders, stroke was the most likely to be diagnosed. Those who had been diagnosed were not necessarily treated, with just over two-thirds of those diagnosed receiving appropriate treatment. Those least likely to be receiving treatment when it was routinely available were patients with tremor disorders, and those most likely to be receiving treatment (secondary prevention) were those patients with a previous stroke. These generally low rates of diagnosis and treatment may partly reflect patterns of treatment-seeking behavior and health beliefs. However, in this resource-poor setting, it may also be due to a lack of access to formal healthcare.

The results of this study suggest some bias in rates of diagnosis and treatment for neurological disorders between men and women. There might be a number of reasons for this. First, in a society where healthcare is not free at the point of delivery, men are more likely to be the head of the household and have the final decision on financial matters [13,14]. When the male is the main provider of income, he must keep healthy and the health of a husband and the children is often prioritised over that of the mother. Women have different priorities in the home with the health of the husband and children coming above their own health [15]. Likewise, money for schooling and food for other family members often comes before the health of the mother [13]. Finally, women often hide symptoms if it reflects badly on their children or grandchildren and their suitability for marriage [16,17]. Such disparities are likely to be deep rooted in society and are present from early childhood in many cultures [18]. A study published in 2012 of 4822 people aged 18 years and over in Burkina Faso found a significantly higher prevalence of asthma, angina pectoris, back pain and joint disease in women compared to men [19].

People with neurological disorders in this population have been shown in this study to be significantly more likely to be disabled than people without neurological disorders [20]. Low diagnosis and treatment rates are likely to exacerbate the burden of non-communicable disease in SSA, a

| Cases | Number who previously sought treatment (%) | Number with previous diagnosis (%) | Number with previous appropriate treatment (%) | Number for whom treatment exists (%) | Number for whom treatment exists in Tanzania (%) |
|-------|--------------------------------------------|---------------------------------|---------------------------------------------|-------------------------------------|-----------------------------------------------|
| Males | 182 in 162 Males | 109 (59.9%) | 35 (19.2%) | 21 (11.5%) | 152 (83.5%) | 143 (78.6%) |
| Females | 202 in 187 Females | 116 (57.4%) | 21 (10.4%) | 17 (8.4%) | 188 (93.1%) | 183 (90.6%) |
| Total | 384 (in 349 Individuals) | 225 (58.6%) | 56 (14.6%) | 38 (9.9%) | 340 (88.5%) | 326 (84.9%) |
Table 2  Treatment seeking behaviour and rates of diagnosis and treatment of people with neurological disorders split into specific disorders.

| Cases | Number who previously sought treatment (%) | Number with previous diagnosis (%) | Number with previous appropriate treatment (%) | Number for whom treatment exists (%) | Number for whom treatment exists in Tanzania (%) |
|-------|-------------------------------------------|----------------------------------|-----------------------------------------------|-------------------------------------|-----------------------------------------------|
| **Central nervous system disorders** | | | | | |
| **Movement disorders** | | | | | |
| Tremor – all causes including cerebellar disease and Parkinsonism | 110$^*$ | 36 (32.7%) | 6 (5.5%) | 4 (3.6%) | 103 (93.6%) | 96 (87.3%) |
| Parkinsonism | 14 | 10 (71.4%) | 4 (28.6%) | 3 (21.4%) | 14 (100%) | 14 (100%) |
| Cerebellar disorders | 11$^†$ | 5 (45.5%) | 2 (18.2%) | 1 (9.1%) | 4 (36.4%) | 4 (36.4%) |
| Other dyskinesias | 5 | 0 | 0 | 0 | 5 (100%) | 2 (20%) |
| **Episodic and paroxysmal disorders** | | | | | |
| Headache disorders | 92 | 62 (67.4%) | 4 (4.3%) | 12 (13.0%) | 92 (100%) | 92 (100%) |
| Stroke | 54 | 44 (81.5%) | 36 (68.7%) | 16 (29.6%) | 54 (100%) | 54 (100%) |
| Epilepsy | 10 | 9 (90.0%) | 2 (20.0%) | 2 (20.0%) | 10 (100%) | 10 (100%) |
| Systemic atrophies/degenerative diseases affecting the central nervous system | | | | | |
| Motor neuron disease | 2 | 2 (100%) | 0 | 0 | 2 (100%) | 0 |
| **Injury resulting in CNS dysfunction** | | | | | |
| Spinal cord injury | 5 | 4 (80.0%) | 0 | 0 | 5 (100%) | 0 |
| Spinal cord dysfunction – other | 0 | – | – | – | – | – |
| **Infection resulting in CNS dysfunction** | 0 | – | – | – | – | – |
| **Peripheral nervous system disorders** | | | | | |
| Polyneuropathies | 42 | 21 (50.0%) | 3 (7.1%) | 4 (9.5%) | 42 (100%) | 42 (100%) |
| Nerve, nerve root and plexus disorders | | | | | |
| Cranial nerves | 14 | 14 (100%) | 1 (7.1%) | 0 | 4 (28.6%) | 3 (21.4%) |
| Upper limb | 15 | 6 (40.0%) | 2 (13.3%) | 0 | 8 (53.3%) | 8 (53.3%) |
| mononeuropathies | | | | | |
| Lower limb | 5 | 4 (80.0%) | 0 | 0 | 0 | 0 |
| mononeuropathies | | | | | |
| Plexus pathology | 4 | 4 (100%) | 1 (25.0%) | 0 | 0 | 0 |
| Root pathology | 4 | 3 (75.0%) | 0 | 0 | 3 (75.0%) | 0 |
| **Inflammatory/infectious diseases of the peripheral nervous system** | | | | | |
| Polio | 5 | 5 (100%) | 2 (40.0%) | 0 | 0 | 0 |
| Leprosy | 1 | 1 (100%) | 1 (100%) | 0 | 1 (100%) | 1 (100%) |
| Diseases of the myoneural junction and muscle | | | | | |
| Myasthenia gravis | 1 | 0 | 0 | 0 | 1 (100%) | 0 |
| Muscle wasting and atrophy | 17 | 11 (64.7%) | 0 | 0 | 15 (88.2%) | 13 (76.5%) |

$^*$ Including cases of tremor due to parkinsonism/Parkinson disease ($n = 12$) and tremor due to cerebellar disorders ($n = 11$) but not tremor due to stroke affecting the cerebellum ($n = 4$).

$^†$ Including cases of cerebellar disorders secondary to stroke ($n = 4$).
burden which is predicted to increase substantially as the population ages and the infection rates for communicable diseases, such as HIV/AIDS, tuberculosis and malaria, decline [21–23].

4.3. Limitations

The limitations of the initial neurological disorders prevalence study have been acknowledged [9]. The main additional limitation that relates to the current study is that a number of previous epidemiological studies have been carried out in the Hai district by this team of researchers over the last 10 years [6,24,25]. Consequently, rates of diagnosis and treatment may be higher than would be found otherwise. Specifically, those who had had a stroke were most likely to be receiving treatment to prevent recurrence. This may be partly a reflection of the educational work done by the Tanzanian Stroke Incidence Project, which ran from 2003 to 2006 [24]. Rates of secondary preventative treatment for stroke in other areas of SSA have been reported to be substantially lower [26].

5. Conclusions

This study has demonstrated low levels of diagnosis and treatment of neurological disorders in the community. Many neurological disorders can be treated readily and inexpensively. However, the reasons for these low rates are likely to be multifactorial and relate not only to availability and affordability in the broadest sense, but also to accessibility and cultural acceptability [8]. Identification and diagnosis of those with neurological disorders is clearly an important component in reducing the morbidity burden in SSA. It has recently been reported that African nations have very limited numbers of neurologists and geriatricians, with some countries having none [27,28]. As this situation is unlikely to change in the immediate future, other strategies to manage this burden should be sought. Since diagnosis must precede treatment, screening for neurological disorders by NMI is an important first step to improving treatment rates. Programs to raise awareness of medical conditions at a community level should be considered. In addition, the training of primary caregivers in the use of non-pharmacological interventions to manage such conditions should be considered. In the absence of initiatives to improve rates of diagnosis and treatment, neurological morbidity will continue to make a substantial, and increasing, contribution to the non-communicable disease epidemic in SSA [19].

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Contributions

Design/conception — Richard Walker, Felicity Dewhurst. Literature search — Richard Walker, Felicity Dewhurst. Data collection — Felicity Dewhurst, Matthew Dewhurst, Golda Orega. Data analysis — William K. Gray, Felicity Dewhurst. Interpretation of results — Richard Walker, William Howlett, Paul Chaote, William K. Gray, Felicity Dewhurst. Writing of paper and review — Richard Walker, William K. Gray, Felicity Dewhurst, William Howlett, Paul Chaote, Golda Orega.

Table 3  Treatment seeking behaviour and level of disability for selected neurological disorders.

| Disorder                    | Total number who sought treatment | Number with moderate or severe disability (Barthel index <15) | Odds ratio (95% CI) |
|-----------------------------|----------------------------------|-------------------------------------------------------------|---------------------|
|                             | Treatment sought                  | No treatment sought                                        |                     |
| Epilepsy (n = 10)           | 9 (90.0%)                         | 8 (88.9%)                                                  | 0.52 (0.01–20.19)   |
| Stroke (n = 54)             | 44 (81.5%)                        | 28 (63.6%)                                                 | 1.17 (0.29–4.76)    |
| Parkinson’s disease (n = 14)| 10 (71.4%)                        | 6 (60.0%)                                                  | 0.50 (0.04–6.68)    |
| Muscle wasting and atrophy (n = 17) | 11 (64.7%)      | 7 (63.6%)                                                 | 0.95 (0.20–4.64)    |
| Headache (n = 62)           | 32 (51.6%)                        | 5 (15.6%)                                                  | 0.21 (0.06–0.68)    |
| Peripheral polyneuropathy (n = 42) | 21 (50.0%)      | 3 (14.3%)                                                 | 0.53 (0.11–2.59)    |
| Tremor (n = 110)            | 36 (32.7%)                        | 12 (33.3%)                                                 | 1.97 (0.80–4.81)    |
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Appendix A

Criteria. used for the diagnosis of specific neurological conditions

- Essential tremor — Movement Disorder Society (MDS) [1], National Institutes of Health (NIH) [2], Tremor Research Investigation Group (TRIG) [3,4].
- Other tremors — Movement Disorder Society (MDS) [1].
- Parkinson’s disease — UK PDS Brain Bank Criteria/Modified Hoehn and Yahr [5,6].
- Vascular Parkinsonism — Winikates criteria [7].
- Progressive supranuclear palsy — National Institute of Neurological Disorders and the Society for Progressive Supranuclear Palsy (NINDS–SPSP) [8].
- Stroke — The Oxford Community Stroke Project Classification (OCSPP/ Bamford Classification [9].
- Tardive dyskinesias — American Psychiatric Association Task Force [10].
- Headaches — International Headache Society (IHS) [11–16].
- Epilepsy — International League Against Epilepsy (ILAE) [17,18].
- Motor Neuron Disease — National Institute of Neurological Disorders and Stroke (NINDS) [19].
- Spinal injury — American Spinal Injury Association (ASIA) [20,21].
- Myasthenia gravis — Myasthenia Gravis Foundation of America (MGFA) [22].

References

[1] Andlin-Sobocki P, Jonsson B, Wittchen HU, Olesen J. Cost of disorders of the brain in Europe. Eur J Neurol 2005;12(Suppl. 1):1–27.
[2] Zarocostas J. WHO launches programme to extend treatment of mental and neurological disorders. BMJ 2008;337:a2090.
[3] Larner AJ, Farmer SF. Recent Advances: Neurology. BMJ 1999;319:362–6.
[4] World Health Organization. Neurological disorders: public health challenges. Geneva, Switzerland: World Health Organization; 2006.
[5] Mshana G, Dotchin CL, Walker RW. ‘We call it the shaking illness’: perceptions and experiences of Parkinson’s disease in rural northern Tanzania. BMC Public Health 2011;11:219.
[6] Mushi D, Hunter E, Mtuya C, Mshana G, Aris E, Walker R. Social-cultural aspects of epilepsy in Kilimanjaro region, Tanzania: knowledge and experience among patients and carers. Epilepsy Behav 2011;20:338–43.
[7] Mshana G, Hampshire K, Panter-Brick C, Walker R. Urban—rural contrasts in explanatory models and treatment-seeking behaviours for stroke in Tanzania. J Biosoc Sci 2008;40:35–52.
[8] Muela SH, Mushi AK, Ribera JM. The paradox of the cost and affordability of traditional and government health services in Tanzania. Health Policy Plan 2000;15:296–302.
[9] Dewhurst F, Dewhurst MJ, Gray WK, Aris E, Orega G, Howlett W, et al. The prevalence of neurological disorders in older people in Tanzania. Acta Neurol Scand in press.
[10] Dewhurst F, Dewhurst MJ, Orega G, Gray WK, Howlett W, Warren N, et al. Neurological disorder screening in the elderly in low-income countries. J Neurol 2012 Apr 12 (published online) DOI: 10.1007/s00415-012-6482-x.
[11] Mahoney FI, Barthel D. Functional evaluation: the Barthel index. Maryland State Medical Journal 1965;14:56–61.
[12] World Health Organization. International statistical classification of disease and related problems (tenth edition). Geneva, Switzerland: World Health Organization; 1993.
[13] Vlassoff C. Gender inequalities in health in the third world: uncharted ground. Soc Sci Med 1994;39:1249–59.
[14] Djanuaga DN, Gilbert C. Women’s access to health care in developing countries. Soc Sci Med 1992;35:613–7.
[15] Vlassoff C, Garcia Moreno C. Placing gender at the centre of health programming: challenges and limitations. Soc Sci Med 2002;54:1713–23.
[16] Bates LM, Hankivsky O, Springer KW. Gender and health inequities: a comment on the Final Report of the WHO Commission on the Social Determinants of Health. Soc Sci Med 2009;69:1002–4.
[17] Sen G, Ostlin P. Gender inequality in health: why it exists and how we can change it. Glob Public Health 2008;3(Suppl. 1):1–12.
[18] United Nations Children’s Fund. Boys and girls in the life cycle: sex-disaggregated data on a selection of well-being indicators, from early childhood to young adulthood. New York: United Nations Children’s Fund; 2011.
[19] Miszkurka M, Haddad S, Langlois EV, Freeman EE, Kounada S, Lunzunegui MV. Heavy burden of non-communicable diseases at early age and gender disparities in an adult population of Burkina Faso: World Health Survey. BMC Public Health 2012;12:24.
[20] Dewhurst F, Dewhurst MJ, Gray WK, Orega G, Howlett W, Chaote P, et al. The prevalence of disability in older people in Hai, Tanzania. Age Ageing 2012;41:517–23.
[21] Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. Lancet Neurol 2009;8:588–95.
[22] Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. Lancet 2007;370:1929–38.
[23] Mayosi BM, Fisher AJ, Laloo UG, Sitas F, Tollman SM, Bradshaw D. The burden of non-communicable diseases in South Africa. Lancet 2009;374:934–47.
[24] Walker R, Whiting D, Unwin N, Mugusi F, Swai M, Aris E, et al. Stroke incidence in rural and urban Tanzania: a prospective, community-based study. Lancet Neurol 2010;9:786–92.
[25] Dotchin C, Musya O, Kissima J, Masawe J, Mhina A, Moshy A, et al. The prevalence of Parkinson’s disease in rural Tanzania. Mov Disord 2008;23:1567–672.
[26] Thorogood M, Connor MD, Lewando-Hundt G, Tollman S, Ngoma B. Secondary prevention of stroke — results from the Southern Africa Stroke Prevention Initiative (SASPI) study. Bull World Health Organ 2004;82:503–8.
[27] Bower JH, Zenebe G. Neuroligic services in the nations of Africa. Neurology 2005;64:412–5.
Appendix references

[1] Deuschl G, Bain P, Brin M. Consensus statement of the Movement Disorder Society on Tremor. Ad Hoc Scientific Committee. Mov Disord 1998;13(Suppl. 3):2–23.
[2] Chouinard S, Louis ED, Fahn S. Agreement among movement disorder specialists on the clinical diagnosis of essential tremor. Mov Disord 1997;12:973–6.
[3] Findley LJ, Koller WC. Handbook of tremor disorders. New York: Marcel Dekker Inc.; 1995.
[4] Louis ED, Ford B, Lee H, Andrews H, Cameron G. Diagnostic criteria for essential tremor: a population perspective. Arch Neurol 1998;55:823–8.
[5] National Institute for Health and Clinical Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. London; 2006. Available from: www.nice.org.uk/CG035.
[6] Hughes AJ, Daniel SE, Kilford L, Lees AJ. Accuracy of clinical diagnosis of idiopathic Parkinson’s disease – a clinicopathological study of 100 cases. J Neurol Neurosurg Psychiatry 1992;55:181–4.
[7] Winikates J, Jankovic J. Clinical correlates of vascular Parkinsonism. Arch Neurol 1999;56:98–102.
[8] Litvan I, Agid Y, Calne D, Campbell G, Dubois B, Duvoisin RC, et al. Clinical research criteria for the diagnosis of progressive supranuclear palsy (Steele–Richardson–Olszewski syndrome): report of the NINDS–SPSP international workshop. Neurology 1996;47:1–9.
[9] Bamford J, Sandercock P, Dennis M, Burn J, Warlow C. Classification and natural history of clinically identifiable subtypes of cerebral infarction. Lancet 1991;337:1521–6.
[10] Tardive dyskinesia: summary of a Task Force Report of the American Psychiatric Association. By the task force on late neurological effects of antipsychotic drugs. Am J Psychiatry 1980;137:1163–72.
[11] International Headache Society. International classification of headache disorders. 2nd ed. 2003. Available from: www.ihs-classification.org.
[12] Manzoni GC, Torelli P. International Headache Society classification: new proposals about chronic headache. Neurol Sci 2003;24(Suppl. 2):S56–9.
[13] Manzoni GC, Granella F, Sandrini G, Cavallini A, Zanferrari C, Nappi G. Classification of chronic daily headache by International Headache Society criteria: limits and new proposals. Cephalalgia 1995;15:37–43.
[14] Olesen J, Lipton RB. Migraine classification and diagnosis. International Headache Society criteria. Neurology 1994;44(6 Suppl. 4):S56–510.
[15] Classification of headache: methods and empirical data. Satellite meeting of the VI International Headache Society Congress. Washington, DC, 29 June 1992. Proceedings. Cephalalgia 1993;13(Suppl. 12):1–96.
[16] Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. Headache Classification Committee of the International Headache Society. Cephalalgia 1988;8(Suppl. 7):1–96.
[17] Proposal for revised clinical and electroencephalographic classification of epileptic seizures. From the Commission on Classification and Terminology of the International League against Epilepsy. Epilepsia 1981;22:489–501.
[18] Guidelines for epidemiologic studies on epilepsy. Commission on Epidemiology and Prognosis, International League against Epilepsy. Epilepsia 1993;34:592–6.
[19] National Institute of Neurological Disorders and Stroke. Guidelines on the diagnosis of motor neuron disease. 2011.
[20] American Spinal Injury Association. International Standards for Neurological Classifications of Spinal Cord Injury. revised ed. Chicago: American Spinal Injury Association; 2000.
[21] Ditunno Jr JF, Young W, Donovan WH, Creasey G. The international standards booklet for neurological and functional classification of spinal cord injury. American Spinal Injury Association. Paraplegia 1994;32:70–80.
[22] Jaretzki 3rd A, Barohn RJ, Ernstoff RM, Kaminski HJ, Keesey JC, Penn AS, et al. Myasthenia gravis: recommendations for clinical research standards. Task Force of the Medical Scientific Advisory Board of the Myasthenia Gravis Foundation of America. Neurology 2000;55:16–23.