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# The association between disability and cognitive impairment in an elderly Tanzanian population

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**Abstract** Cognitive impairment is thought to be a major cause of disability worldwide, though data from sub-Saharan Africa (SSA) are sparse. This study aimed to investigate the association between cognitive impairment and disability in a cohort of community-dwelling older adults living in Tanzania. The study cohort of 296 people aged 70 years and over was recruited as part of a dementia prevalence study. Subjects were diagnosed as having dementia or mild cognitive impairment according to the DSM-IV criteria. Disability level was assessed according to the WHO Disability Assessment Schedule, version 2.0 (WHODAS). A higher WHODAS score indicates greater disability. The median WHODAS in the background population was 25.0; in those with dementia and in those with mild cognitive impairment, 72 of 78 (92.3%) and 41 of 46 (89.1%), respectively, had a WHODAS score above this level. The presence of dementia, mild cognitive impairment, hearing impairment, being unable to walk without an aid and not having attended school were independent predictors of having a WHODAS score above 25.0, though age and gender were not. In summary, cognitive impairment is a significant predictor of disability in elderly

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Tanzanians. Screening for early signs of cognitive decline would allow management strategies to be put in place that may reduce the associated disability burden.



## 1. Introduction

The number of people surviving into old age is increasing, with the biggest increase in the next 50 years predicted to be seen in low- and middle-income countries as they continue to undergo a demographic transition [1]. This is likely to be accompanied by an increase in the prevalence of age-related non-communicable diseases, such as dementia [2]. It is estimated that 58% of people with dementia live in low- and middle-income countries, and this figure is estimated to rise to 71% by 2050 [2].

Dementia is a major contributor to the overall worldwide disease burden in low- and middle-income countries [3—5]. However, data from sub-Saharan Africa (SSA) are sparse. The International Classification of Functioning, Disability and Health (ICF) was developed by the World Health Organization (WHO) with the aim of providing a quasi-objective framework within which subjective notions of disability and health could be more clearly defined [6]. Disability was defined as 'the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (personal and environmental factors)' [6]. The WHO Disability Assessment Schedule, version 2.0 (WHODAS) was developed to measure levels of disability, as defined by the ICF framework [7]. The WHODAS is a global measure of disability and aims to measure the types of functional limitations that may result from any health condition. It has been extensively validated in a number of world regions in people with a variety of health conditions [8—11].

The primary aim of this study is to investigate the level of disability, as defined by the WHODAS, experienced by a cohort of elderly people living in Tanzania.

## 2. Methods

Ethical approval for the study was granted locally by Tumaini University ethics committee and the Tanzanian National Institute of Medical Research. Data for this study were collected as part of a wider dementia prevalence study, details of which have already been published [12]. Brief details of the study methodology are given below.

### 2.1. Setting and study population

The rural Hai district is located in the north of Tanzania, on the southern side of Mount Kilimanjaro. Part of the district was established as a demographic surveillance site (DSS) in the early 1990s and, as such, there are regular population censuses of the area [13]. The most recent census was completed on the first of June 2009 and recorded the population as 161,119, of whom 8869 were 70 years and over. The DSS is broadly representative of the rural population of Tanzania. People live within large family units. The majority are subsistence farmers, and daily activities for older family members might consist of agricultural work, running the household and taking care of grandchildren. All data presented here were collected between 12 April and 30 September 2010 in the study villages. Participants were seen at a place of their convenience (village health centres or in their own home). Signed informed consent was obtained from each participant. For those who could not write, a thumbprint was obtained. If participants were unable to consent due to cognitive impairment, written assent was obtained from a close relative.

It was planned to see approximately one-eighth of the entire population aged 70 years and over in the DSS. Using a random number generator, six villages, with a census population of 1277 people aged 70 years and over, were selected to form the basis of the study cohort. Exclusions, refusals and additions have been described previously [12]. The final study population was 1198 people during phase one screening. Screening was conducted by trained census enumerators using the Community Screening Instrument for Dementia (CSI-D) [14].

During the second phase, a stratified sample of those screened ($n = 296$), with over-sampling for those with moderate or poor cognitive performance by CSI-D, was fully assessed by a doctor (A.L. or S.-M.P.). The second phase sample consisted of 168 people from 184 with 'poor performance', 56 people from 104 with 'moderate performance' and 72 people from 910 with good performance, according to the CSI-D. The 72 with good performance were randomly selected from the 910 people not thought to have dementia by

CSI-D screening and are likely to be representative of the cognitively normal background population of people aged 70 years and over. All 72 were seen by a doctor during phase II to confirm they were cognitively normal.

The population for the study described here are all those assessed during the second phase, 78 of whom had dementia, and 46 of whom had mild cognitive impairment (MCI).

## 2.2. Disability assessment

Disability can be measured in relation to a person's ability to perform activities of daily living (ADLs). Basic ADLs (feeding, dressing, personal hygiene, mobility, toileting) are those that are fundamental to staying alive. Instrumental ADLs are those ADLs that are required to allow a person to live independently within a community. Instrumental ADLs include shopping for food, dealing with money, transportation, use of technology, taking medication and cooking [15].

The 12-item WHODAS is designed as a global measure of disability and functioning. It measures ability to perform basic and instrumental ADLs as well as having questions directly related to mental and emotional health and cognition, such as ability to maintain friendships and participate in society [7]. Questions are divided into six domains: cognition (learning and concentrating), mobility (standing and walking), self-care (washing and dressing), getting along (personal relationships), life activities (work and domestic duties) and participation in society (emotions and social activities). The questions relate to a person's ability to perform tasks of daily living in the previous 30 days. Two questions are asked per domain and responses are scored on a five-point scale: 0 (none or no difficulty with the task), 1 (mild difficulty), 2 (moderate difficulty), 3 (severe difficulty) and 4 (extreme difficulty/cannot do). The short 12-item WHODAS has been shown to account for 81% of the variability in scores from the full 36-item WHODAS [7]. Although different scoring systems exist, the complex scoring system recommended by WHO was employed to allow for direct comparison with other studies [7]. The items are re-scored and weighted to give a global disability score, running from 0 to 36. This score is then re-scaled so that it runs from 0 to 100, with 100 representing the maximum level of disability.

The Barthel index is a measure of disability relating to a person's ability to perform basic ADLs. Although the ability to perform basic ADLs is likely to be associated with any cognitive, emotional or mental health problems, it is not a direct measure of such impairments. The Barthel index has ten questions and is scored from 0 (severe disability) to 20 (no disability). Self-reported information relating to mobility (independent, with a walking aid or not independently mobile), hearing and eyesight were also collected.

## 2.3. Cut-offs for disability

For illustration purposes, WHODAS data are presented in four categories depending on score, with 0—24 indicating minimum disability and 75—100 maximum disability. This categorization is consistent with that used by the WHO-SAGE INDEPTH study [16]. A cut-off for the presence of disability has not been established for the WHODAS in SSA. The 60th and 90th centile have both been used as a cut-off for disability in recent studies [3,17]. The WHO-SAGE INDEPTH studies from Tanzania, Kenya and Ghana used the median as a convenient cut-off to dichotomize their data [18—20]. However, since this study sample is not representative of the wider community of elderly people living in Hai, being biased towards people with dementia, the cut-off used was the median of those subjects selected randomly from the background population who had good cognitive performance by CSI-D ($n$ = 72). For the Barthel index, the cut-offs defined by Heslin et al. were used [21]. Severe disability was defined as a score of 0—14, moderate disability as a score of 15—18 and mild/no disability as a score of 19—20.

## 2.4. Statistical analysis

All data were non-normally distributed and are described in terms of median, interquartile range (IQR) and range as appropriate. Logistic regression models were used to identify univariate and multivariable predictors of a WHODAS score greater than the median. Demographic factors (age, sex and education) were included in the model as were variables measuring sensory impairment (hearing and eyesight), mobility impairment and cognitive impairment. Barthel index score was not included in the model, since it was felt to be measuring the same broad construct as the outcome variable and so its inclusion would not be informative. All predictor variables were categorized for the purposes of model building, with age split into five-year age bands. Multivariable models were constructed using backward elimination based on the Wald statistic. Robustness was checked by examination of deviance residuals, Cook's distances, loading of variables on individual eigenvalues and collinear-

ity diagnostic tests. Two-tailed tests and a significance level of 5% were used throughout.

### 2.5. Role of the funding source

This work was supported by a research fellowship from the Dunhill Foundation, an Academy of Medical Sciences (UK) clinical lecturer start-up Grant, a British Geriatric Society start-up Grant and the Royal College of Physicians, London. The sponsors of this study had no role in designing the study; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

## 3. Results

### 3.1. Demographic characteristics

Demographic and clinical characteristics of the cohort, split into quartiles based on WHODAS performance, are shown in Table 1. There is a clear trend towards higher prevalence of dementia and a less obvious trend towards less formal schooling and greater age in those with higher WHODAS scores. There was no obvious trend in gender distribution with WHODAS score.

The median WHODAS score for subjects who were selected from the background population with good cognitive performance by CSI-D ($n = 72$) was 25.0 (IQR 9.0—41.7). The mean WHODAS score for this group was 28.0. Of the 72 subjects, 14 (19.4%) scored zero, indicating no disability. People with dementia had a median WHODAS score of 72.2 (IQR 47.2—84.0) and people with MCI had a median score of 54.2 (IQR 38.9—70.8).

Two-hundred and eighteen subjects (73.6%) had a score above the median of the background population. This included 72 of 78 people (92.3%) with dementia, 41 of 46 people (89.1%) with MCI and 105 of 172 (61.0%) with no cognitive impairment. The relatively high rate of disability in those with no cognitive impairment is likely to be partly due to the fact that many people who did not have cognitive impairment scored poorly on the CSI-D (and so were included in phase two assessment) due to other health problems, such as depression or sensory impairment. By logistic regression, the presence of MCI, dementia, no formal education, hearing problems, and being unable to walk without any aids were significant independent predictors of having a WHODAS score above the median (Table 2).

**Table 1** Relationship of WHODAS scores to clinical and demographic characteristics.

| | WHODAS score 0—24 (lowest level of disability) | WHODAS score 25—49 | WHODAS score 50—74 | WHODAS score 75—100 (highest level of disability) | Significance |
|---|---|---|---|---|---|
| Number | 70 | 84 | 72 | 70 | |
| Dementia present ($n = 78$) | 5 (7.1%) | 15 (17.9%) | 20 (27.8%) | 38 (54.3%) | $\chi^2$ (3) = 44.652, $p < 0.001$ |
| Mild cognitive impairment present ($n = 46$) | 4 (5.7%) | 16 (19.0%) | 15 (20.8%) | 11 (15.7%) | $\chi^2$ (3) = 7.475, $p = 0.058$ |
| Number of Females ($n = 202$) | 41 (58.6%) | 59 (70.2%) | 53 (73.6%) | 49 (70.0%) | $\chi^2$ (3) = 4.233, $p = 0.237$ |
| Median age in years (IQR) | 76.0 (72.0—80.3) | 78.0 (73.3—87.0) | 82.0 (77.3—89.0) | 81.5 (74.8—92.3) | Spearman's $r = 0.278$, $p < 0.001$ |
| No formal education ($n = 167$ from 283) | 27 (38.6%) | 46/76 (60.5%), 8 missing values | 45/69 (65.2%), 3 missing values | 49/68 (72.1%), 2 missing values | $\chi^2$ (3) = 18.047, $p < 0.001$ |
| Moderate or severe disability in basic ADLs ($n = 89$) | 7 (10.0%) | 12 (14.3%) | 22 (30.6%) | 48 (68.6%) | $\chi^2$ (3) = 72.719, $p < 0.001$ |
| Self-reported hearing problem which interferes with life activities | 10 (14.3%) | 16 | 21 | 28 | $\chi^2$ (3) = 15.282, $p = 0.002$ |
| Self-reported eyesight problem which interferes with life activities | 34 | 47 | 43 | 44 | $\chi^2$ (3) = 4.339, $p = 0.227$ |
| Unable to walk without the use of an aid | 2 (2.9%) | 3 (3.6%) | 9 (12.5%) | 30 (42.9%) | $\chi^2$ (3) = 60.101, $p < 0.001$ |

**Table 2** Odds associated with having a WHODAS score above the median of the background population.

| | Univariate odds ratio | Multivariable odds ratio |
|---|---|---|
| *Cognitive function* | | |
| Normal | 1 | 1 |
| Mild cognitive impairment | 5.23 (95% CI 1.97—13.91, $p = 0.001$) | 5.31 (95% CI 1.91—14.76, $p = 0.001$) |
| Dementia | 7.66 (95% CI 3.18—18.60, $p < 0.001$) | 5.93 (95% CI 2.35—14.98, $p < 0.001$) |
| *Education* | | |
| Some formal education | 1 | 1 |
| No formal education | 2.88 (95% CI 1.68—4.94, $p < 0.001$) | 3.30 (95% CI 1.81—6.01, $p < 0.001$) |
| *Age band (years)* | | |
| 70—74 | 1 | — |
| 75—79 | 1.30 (95% CI 0.65—2.58, $p = 0.455$) | — |
| 80—84 | 2.31 (95% CI 1.04—5.16, $p = 0.041$) | — |
| 85 and over | 3.43 (95% CI 1.69—6.97, $p = 0.001$) | — |
| *Gender* | | |
| Male | 1 | — |
| Female | 1.75 (95% CI 1.02—3.00, $p = 0.042$) | — |
| *Self-reported hearing problem which interferes with life activities* | | |
| No | 1 | 1 |
| Yes | 2.63 (95% CI 1.30—5.31, $p = 0.007$) | 2.22 (95% CI 1.03—4.79, $p = 0.042$) |
| *Self-reported eyesight problem which interferes with life activities* | | |
| No | 1 | — |
| Yes | 1.55 (95% CI 0.92—2.63, $p = 0.102$) | — |
| *Unable to walk without the use of an aid* | | |
| No | 1 | 1 |
| Yes | 9.07 (95% CI 2.14—38.42, $p = 0.003$) | 7.38 (95% CI 1.64—33.15, $p = 0.009$) |

**Table 3** Point biserial correlation of WHODAS domain scores with moderate or severe disability in basic ADLs and dementia.

| Domain | Correlation with presence of dementia | Correlation with presence of moderate or severe impairment in basic ADLs |
|---|---|---|
| Cognition | $r = 0.382$, $p < 0.001$ | $r = 0.379$, $p < 0.001$ |
| Mobility | $r = 0.250$, $p = 0.001$ | $r = 0.343$, $p = 0.001$ |
| Self-care | $r = 0.446$, $p < 0.001$ | $r = 0.654$, $p < 0.001$ |
| Getting along | $r = 0.291$, $p < 0.001$ | $r = 0.371$, $p < 0.001$ |
| Life activities | $r = 0.353$, $p < 0.001$ | $r = 0.462$, $p < 0.001$ |
| Participation | $r = 0.261$, $p < 0.001$ | $r = 0.328$, $p < 0.001$ |
| Overall scale | $r = 0.397$, $p < 0.001$ | $r = 0.505$, $p < 0.001$ |

There was a strong correlation between the Barthel index score and the WHODAS score ($r = 0.533$, $p < 0.001$). The odds of someone with moderate or severe functional impairment in basic ADLs having a WHODAS score above the median were 6.12 (95% CI 2.68—13.93). The correlations of each of the six domains for the WHODAS with the presence of dementia and the presence of moderate or severe disability in basic ADLs are presented in Table 3. The presence of dementia was associated with higher WHODAS scores across all domains, though it was highest for self-care, cognition and life activities.

Barthel index score was also associated with the presence of dementia, with the odds of someone with moderate or severe disability by Barthel index score having dementia being 4.24 (95% CI 2.45—7.36).

## 4. Discussion

The influence of cognitive impairment on disability levels within a group of elderly, community dwelling people from Tanzania has been investigated in this study. WHODAS scores in people without dementia or MCI from the background population were similar to those of people aged 70 years and over in the Ifakara region of Tanzania (mean = 27.6) and lower than those reported from rural northern Ghana (mean 39.3) for this age group [18,20]. Comparison between studies is hampered by demographic, cultural and lifestyle factors and different methodologies used. It was recognized that the exclusion of people with MCI and dementia from this background population is likely to have reduced the median WHODAS score for this group, and this may help to explain the higher scores seen in other cohorts.

Interestingly, in this cohort, although age and gender were significant univariate predictors of a disability score greater than the median, they were not significant independent predictors, though education level was. It is not clear why this should be, although previous studies have noted education to be a useful marker for socio-economic status in this population [13]. The 10/66 Dementia Research Group has suggested dementia to be a major cause of disability worldwide [3]. Although some chronic conditions, such as stroke, may be more disabling at a personal level, the higher prevalence of dementia means that, at a population level, the attributable burden may be greater. This study reveals a strong association between impaired cognitive function and disability, even after adjusting for the effects of the more obvious disabilities of hearing problems, eyesight problems and being unable to walk without an aid. Dementia was significantly associated with higher scores in all WHODAS domains. It has previously been suggested that many people in low- and middle-income countries do not recognize the symptoms of dementia as a problem in their older relatives, attributing any changes to the normal process of ageing [22—23]. Although this may be the case, the symptoms of dementia and MCI appear to lead to greater levels of disability.

The strong association between dementia and disability may be unsurprising, given that functional impairment is required in order for a diagnosis of dementia to be made. However, the extent of functional impairment required to diagnose dementia may mean that performance of basic ADLs is unaffected. Thus, the levels of disability reported here greatly exceed those required to diagnose dementia, in most cases. Moreover, it is notable that the association between MCI and disability was also strong.

Fewer cases of MCI than dementia were identified in this cohort. A study of cognitive impairment in people aged 65 years and over in Nigeria identified more cases of MCI than dementia [24]. Although the reasons for this are not clear, this older age structure together with genetic and lifestyle factors and the high prevalence of vascular risk factors (e.g., hypertension and stroke) in this East African population are likely to be important [25—26].

Dementia cannot be cured and management strategies usually focus on patient and caregiver education, reducing the associated disability burden and improving quality of life [27]. Nevertheless, if people with MCI, at risk of developing dementia, can be identified in the community at an early stage, it may be possible to reduce the burden of disability using management strategies appropriate to this setting [28]. Given the relatively high prevalence of dementia, compared with other chronic non-communicable diseases, the societal and economic impacts of such interventions are likely to be substantial.

The main limitation of this study is that this population was a stratified sample of people aged 70 years and over living in the study villages. People with dementia and MCI were over-sampled relative to the background population, where the prevalence of dementia is 6.4% [12]. Nevertheless, the data analysis techniques used are robust to these population characteristics, and no inferences have been drawn regarding the population as a whole. This study focuses on the role of cognitive impairment in disability. It is recognized that other mental and physical health disorders, such as depression, are likely to contribute to the burden of disability; however, no specific conclusions on the role of these potentially confounding variables have been drawn. The interplay between disability and depression in Nigeria has been described by Gureje et al. [29]. However, the effects of sensory impairments and mobility as confounding variables were allowed for, and these data are felt to be robust.

In summary, dementia and MCI are significant predictors of disability in elderly people living in Tanzania. Screening for early signs of cognitive decline would allow management strategies to be put in place that may reduce the disability burden of people with MCI and dementia. However, such strategies must be community-based, affordable, sustainable and culturally acceptable if they are to have the desired impact. In SSA, a resource-poor

setting, the successful implementation of such interventions will require an integrated, multi-disciplinary approach.

## Conflicts of interest

There are no conflicts of interest.

## Contributions

Design/conception — Richard Walker, Catherine Dotchin. Literature search — Richard Walker, Catherine Dotchin, Stella-Maria Paddick, William K. Gray. Data collection — Aloyce Kisoli, Golda Orega, Anna Longdon, Stella-Maria Paddick, Felicity Dewhurst, Matthew Dewhurst. Data analysis — William K. Gray. Interpretation of results — Richard Walker, William K. Gray, Catherine Dotchin, Stella-Maria Paddick. Writing of paper and review — Richard Walker, William K. Gray, Catherine Dotchin, Stella-Maria Paddick, Felicity Dewhurst, Golda Orega, Aloyce Kisoli, Paul Chaote, Anna Longdon, Matthew Dewhurst.

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## References

[1] United Nations Department of Economic and Social Affairs; Population Division. World population prospects: the 2008 revision. New York: United Nations; 2009.
[2] Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. The global prevalence of dementia: a systematic review and metaanalysis. Alzheimers Dement 2013;9, 63—75 e2.
[3] Sousa RM, Ferri CP, Acosta D, Albanese E, Guerra M, Huang Y, et al. Contribution of chronic diseases to disability in elderly people in countries with low and middle incomes: a 10/66 Dementia Research Group population-based survey. Lancet 2009;374:1821—30.
[4] Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990—2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380:2163—96.
[5] Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990—2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012;380:2197—223.
[6] World Health Organization. International Classification of Functioning, Disability and Health (ICF). Geneva: World Health Organization; 2001.
[7] Ustun TB, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, Epping-Jordan J, et al. Developing the World Health Organization Disability Assessment Schedule 2.0. Bull World Health Organ 2010;88:815—23.
[8] Schlote A, Richter M, Wunderlich MT, Poppendick U, Moller C, Schwelm K, et al. WHODAS II with people after stroke and their relatives. Disabil Rehabil 2009;31:855—64.
[9] Garin O, Ayuso-Mateos JL, Almansa J, Nieto M, Chatterji S, Vilagut G, et al. Validation of the ''World Health Organization Disability Assessment Schedule, WHODAS-2'' in patients with chronic diseases. Health Qual Life Outcomes 2010;8:51.
[10] Sousa RM, Dewey ME, Acosta D, Jotheeswaran AT, Castro-Costa E, Ferri CP, et al. Measuring disability across cultures—the psychometric properties of the WHODAS II in older people from seven low- and middle-income countries. The 10/66 Dementia Research Group population-based survey. Int J Methods Psychiatr Res 2010;19:1—17.
[11] Kutlay S, Kucukdeveci AA, Elhan AH, Oztuna D, Koc N, Tennant A. Validation of the World Health Organization disability assessment schedule II (WHODAS-II) in patients with osteoarthritis. Rheumatol Int 2011;31:339—46.
[12] Longdon AR, Paddick SM, Kisoli A, Dotchin C, Gray WK, Dewhurst F, et al. The prevalence of dementia in rural Tanzania: a cross-sectional community-based study. Int J Geriatr Psychiatry 2013;28:728—37.
[13] Adult Morbidity and Mortality Project (AMMP). Policy implications of adult morbidity and mortality; final report. Dar-es-Salaam: Tanzanian Ministry of Health; 2004.
[14] Hall KS, Hendrie HC, Brittain HM, Norton JA, Rodgers DD, Prince CS, et al. The development of a dementia screening interview in 2 distinct languages. Int J Methods Psychiatr Res 1993;3:1—28.
[15] Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist 1969;9:179—86.
[16] He W, Muenchrath MN, Kowal P. Shades of gray: a cross-country study of health and well-being of the older populations in SAGE countries, 2007—2010. Washington, DC, USA: U.S. Government Printing Office; 2012.
[17] Xavier Gomez-Olive F, Thorogood M, Clark BD, Kahn K, Tollman SM. Assessing health and well-being among older people in rural South Africa. Glob Health Action 2010;3.
[18] Mwanyangala MA, Mayombana C, Urassa H, Charles J, Mahutanga C, Abdullah S, et al. Health status and quality of life among older adults in rural Tanzania. Glob Health Action 2010;3.
[19] Kyobutungi C, Egondi T, Ezeh A. The health and well-being of older people in Nairobi's slums. Glob Health Action 2010;3.
[20] Debpuur C, Welaga P, Wak G, Hodgson A. Self-reported health and functional limitations among older people in the Kassena-Nankana district, Ghana. Glob Health Action 2010;3.
[21] Heslin JM, Soveri PJ, Winoy JB, Lyons RA, Buttanshaw AC, Kovacic L, et al. Health status and service utilisation of older people in different European countries. Scand J Prim Health Care 2001;19:218—22.
[22] Mushi D, Rongai A, Paddick SM, Dotchin C, Mtuya C, Walker R. Social representation and practices related to dementia in Hai district of Tanzania. BMC Public Health 2014;14:260.
[23] Shaji KS, Arun Kishore NR, Lal KP, Prince M. Revealing a hidden problem. An evaluation of a community dementia case-finding program from the Indian 10/66 dementia research network. Int J Geriatr Psychiatry 2002;17:222—5.
[24] Baiyewu O, Unverzagt FW, Ogunniyi A, Hall KS, Gureje O, Gao S, et al. Cognitive impairment in community-dwelling

older Nigerians: clinical correlates and stability of diagnosis. Eur J Neurol 2002;9:573—80.
[25] Dewhurst MJ, Dewhurst F, Gray WK, Chaote P, Orega GP, Walker RW. The high prevalence of hypertension in rural-dwelling Tanzanian older adults and the disparity between detection, treatment and control: a rule of sixths? J Hum Hypertens 2013;27:374—80.
[26] 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.
[27] Woods B, Aguirre E, Spector AE, Orrell M. Cognitive stimulation to improve cognitive functioning in people with dementia. Cochrane Database Syst Rev 2012;2:CD005562.
[28] Prince M, Bryce R, Ferri CP. World alzheimer report 2011: the benefits of early diagnosis and intervention. London, UK: Alzheimer Disease International; 2011.
[29] Gureje O, Ogunniyi A, Kola L, Afolabi E. Functional disability in elderly Nigerians: results from the Ibadan study of aging. J Am Geriatr Soc 2006;54:1784—9.