Dementia prevalence and risk factors: data from rural Tanzania

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Abstract

Objectives: The burden of dementia is increasing in sub-Saharan Africa (SSA), but there are limited epidemiological data on dementia in SSA. This study investigated the prevalence and associations of dementia in older adults (<60 years) attending the outpatient department of Mount Meru Hospital in Tanzania.

Methods: This one phase cross-sectional study screened a sample using the IDEA cognitive screening tool. Those that screened as having possible and probable dementia were further assessed, and diagnosis of dementia was made according to the diagnostic and statistical manual of mental disorders 4 (DSM-IV). Demographic and risk factor data were collected.

Results: Within those screened, 57/1141 (5.0%) (95% confidence interval (CI): 3.7-6.3) had dementia. Female sex (odds ratio (OR)=2.778, 95%CI:1.074-7.189), having never attended school (OR=6.088, 95%CI:1.360-27.256), alcohol consumption (units/week) (OR=1.080, 95%CI:1.016-1.149), uncorrected visual impairment (OR=4.260, 95%CI:1.623-11.180), body mass index <18.5kg/m^2 (OR=6.588, 95%CI:2.089-20.775) and stroke (OR=15.790, 95%CI:3.48-74.475) were found to be significantly, independently associated with dementia.

Conclusions: The prevalence of dementia in this population is similar to a recent community-based rate in Tanzania and lower than a hospital-based rate in Senegal. This is the first time the association between visual impairment and dementia has been reported in SSA. Other associations are in keeping with previous literature.

Key words: prevalence, risk factors, Tanzania, sub-Saharan Africa

Introduction

There are currently an estimated 55 million people living with dementia worldwide. This number is expected to increase to 139 million by 2050, of whom 71% will be from low- and middle-income countries (LMIC) [1,2]. Current literature from LMIC suggests that prevalence rates and risk factor profiles may differ from those in high-income countries (HIC) [3-15]. However there are limited data from sub-Saharan Africa (SSA), especially East Africa.

There have been four estimates of dementia prevalence in East Africa, three of which are from Tanzania. In 2013 a cross-sectional community-based study was conducted in the Hai District in Tanzania of 1198 people over 70 years old, reporting age adjusted prevalence of 6.4% (95% CI 4.9 to 7.9) using The Diagnostic and Statistical Manual of Mental Disorders 4 (DSM-IV) criteria [12] and 21.6% (95% CI 17.5 to 25.7) using 10/66 Dementia Research Group criteria [7]. In 2021 the same authors estimated prevalence to be 4.6% (95% CI 2.9-6.4) using The Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-V) criteria [16]. One further estimate was reported by Mubangizi et al. [10] in 2020 who found prevalence of probable dementia to be 20% in rural Uganda when using the Community Screening Interview for Dementia (CSI-D).

[Insert Table 1 here]

Performance on screening tools developed for use in HIC such as the Mini Mental State Examination is significantly affected in individuals with a low level of education or literacy. Furthermore, screening tools should be linguistically and culturally appropriate [17]. In SSA there is a significant shortage of specialist clinicians such as neurologists, geriatricians and psychiatrists [18]. Additionally, illiteracy is prevalent in older adults in LMIC, especially those living in rural areas [19]. This led to the development of the Identification of Dementia in Elderly Africans (IDEA) cognitive screen, a screening tool which was specifically designed to be used in low literacy settings by non-specialist healthcare workers to overcome these barriers to assessment. The IDEA screening tool has been validated for use in hospital inpatient, outpatient and community settings in Tanzania [19-21]. It contains six sections from existing cognitive assessments used in developing countries and assesses multiple areas of cognition affected in dementia including long- and short-term memory, language fluency and comprehension, abstract thinking, orientation and praxis [20].

Clinical diagnosis using The Diagnostic and Statistical Manual of Mental Disorders 4 (DSM-IV) criteria is considered the 'gold standard' for diagnosing dementia. However, as it requires functional impairment to be present for diagnosis, it may underestimate prevalence in SSA where functional impairment may be obscured. Multigenerational households are common and younger generations care for their older relatives [12]. More recently The Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-V) criteria recategorised dementia as a 'major neurocognitive disorder' a category which also includes earlier states of cognitive decline [22].

The aims of this study were (1) to estimate the prevalence of dementia in adults aged 60 years and older attending the medical outpatient department (OPD) of Mount Meru Hospital (MMH) northern Tanzania, East Africa, using the IDEA cognitive screening tool and DSM-IV criteria, and (2) to assess risk factors for dementia in this population.

Methods

Ethics

Signed informed consent was obtained from each participant. For those who could not write, a thumb print was obtained. If a participant was unable to give valid consent, written assent was obtained from a family member. The purpose of the study was explained verbally. All information was provided in Swahili.

Study Design and Population

This one phase cross-sectional study was conducted at MMH OPD in Arusha in Northern Tanzania. MMH is the main hospital for Arusha and surrounding regions. It has 240 inpatient beds and provides care for around 500 outpatients per day. A fee is usually charged to attend a clinic, but, as a government hospital, free care is provided to those who cannot afford it [23].

All patients who attend MMH OPD must sign in at the reception desk. Convenience sampling was used to identify adults aged 60 years and over from this register and invite them to be part of the study. Unwell patients were not approached at the discretion of the research team. Prior to the beginning of data collection, the research team were trained in the use of the IDEA cognitive screening tool and dementia diagnosis using DSM-IV criteria.

Assessment

Data collection occurred in one phase between 22nd October 2018 and 1st March 2019. All participants were screened for dementia using the IDEA cognitive screening tool (available in supplemental material), which is scored out of 15. A score of 0-7 indicated poor performance and

the individual was screened as having 'probable dementia'. A score of 8-9 indicated intermediate performance and the individual was screened as having 'possible dementia'. A score of 10-15 indicated good performance and the individual was screened as having 'dementia unlikely' [19]. All participants who screened as having 'probable' or 'possible dementia' were invited for a consultation with a doctor trained in dementia diagnosis. Patients who screened as 'dementia unlikely' were not assessed by a clinician due to resource constraints.

Demographic variables assessed included age, gender, education, literacy and marital status. Age was self-reported. When age was not known, a method of estimate based upon remembering important life events, which is validated for use in SSA, was used [24]. Education was categorised by the highest level of schooling achieved. Literacy was determined by those who could read and write and was specifically asked separately to acknowledge some participants might have been taught at home. Marital status was self-reported.

Lifestyle variables recorded were smoking, alcohol consumption and body mass index (BMI). Participants were asked to confirm their smoking status and how many years they had smoked. An individual was considered to drink alcohol if they consumed it at least once per week. Quantity of alcohol consumed was measured by number of bottles of beer consumed per week. A 500ml bottle was assumed to contain 1.7 units of alcohol [25]. BMI was calculated from height and weight measurements recorded during the physical assessment.

Participants who reported a previous positive HIV test, diagnosis of diabetes mellitus or hypertension were considered to have the comorbidity. Additionally, all participants attending the outpatient department were reviewed by General Physicians. They diagnosed current or previous

stroke using the WHO definition, with onward referral to physiotherapy as necessary. History from both patients and their families were taken into account as well as results of investigations, such as CT head scans, where available. Blood pressure was measured during the assessment. Three measurements were taken 10 minutes apart using a Nutec BP09 electronic blood pressure machine. An average of the last two measurements was calculated. Hypertension was defined as diastolic blood pressure ≥90mm/Hg in any age group and/or systolic blood pressure (SBP) ≥140mm/Hg in individuals under 80 years old or a SBP ≥150mm/Hg in individuals 80 years or older [26]. All participants had their hearing assessed by the otorhinolaryngology department at MMH to identify cases of hearing impairment. Any participants who reported having, or were observed to have, problems with their vision were assessed by the ophthalmology department at MMH to identify causes of visual impairment.

Dementia diagnosis

Clinical diagnosis was determined by one of the study doctors in accordance with DSM-IV criteria using all information available. DSM-IV rather than DSM-V criteria were used as they recognise dementia specifically rather than under the umbrella term of 'neurocognitive disorders'. Furthermore at the time of data collection DSM-IV criteria were widely used allowing comparison with other studies [22]. The assessing doctor was blinded to the cognitive screening score.

Analysis

Statistical analysis was conducted using IBM SPSS statistics version 26. Binominal 95% confidence intervals were calculated for prevalence based on the assumptions of binomial distribution. Positive predictive value was calculated for the IDEA cognitive screen.

The normally distributed continuous variable BMI was analysed using an unpaired two-sided t test. Levene's test was insignificant and so equal variance was assumed. Age was grouped into five categories and treated as a categorical variable for the purpose of analysis. A Mann-Whitney U test was performed for non-normally distributed continuous variables including smoking duration and quantity of alcohol consumption. Mean and standard deviation were calculated for continuous variables. Pearson's Chi-Squared test was run on categorical variables including the remaining variables investigated, clinic attended and to assess the representativeness of the cohort. Two tailed tests with the significance level set at 5% were used throughout analyses. Binary logistic regression was performed on variables that produced a bivariate p value of ≤0.05 using the backward Wald function where dementia diagnosis was the dependent variable.

Results

Over the 90 day research period 17,472 adults aged 60 years and over attended MMH OPD. From these a psychologist invited individuals for screening. Omissions and refusals are outlined in figure 1. There was a significant difference between age of the cohort and the age of the 17,472 adults aged 60 years and over MMH OPD during the research period, with the cohort being younger (χ^2= 803.294 p=1.48). Demographic data on those excluded due to illness was not recorded.

[insert figure 1]

The demographic characteristics and risk factors of the cohort are outlined in table 2. The largest proportion of participants were aged 60-64 years (31.1%), female (52.4%) and married (95.7%). Only 2.1% of the cohort had never attended school and 98.4% were literate. There was no statistically significant difference between the number of men and women who had never attended school or were illiterate.

Hearing impairment was found in 23 individuals (2.0%) none of whom wore hearing aids. Uncorrected visual impairment was found in 214 participants (18.8%), of whom 42 wore glasses which did not adequately correct their vision. Two members of the cohort wore hearing aids and 34 wore glasses which adequately corrected their hearing or vision respectively and so were not recorded as having visual or hearing impairment.

The clinics participants attended at the OPD are as follows; 366 attended the diabetes mellitus clinic (32.3%), 476 the hypertension clinic (41.7%), 49 the HIV clinic (4.3%) and 250 attended other clinics (21.9%). Other clinics included general medicine, oncology, cardiology, communicable disease, ears nose and throat, gastrointestinal, respiratory and urology clinics.

Prevalence

We found the prevalence of DSM-IV dementia in this cohort attending MMH OPD to be 5.0% (95% CI 3.7-6.3). Prevalence of dementia was greatly increased in the 75-79 years (13.3%), and the 80 years and over age groups (15.1%) compared to the 70-74 years (2.9%), 65-69 years (3.3%) and 60-64 years (0.2%) age groups. Prevalence of dementia was higher in women (6.7%) compared to men (3.1%). High rates of dementia were seen in those who had never attended school (37.5%) and who were illiterate (33.4%). However, only a small number of people (23) who had never attended school were included in the study so this result may be due to a type 2 statistical error. High rates of dementia were seen in those with previous stroke (20.0%) and uncorrected hearing impairment (17.4%). Again, only a small number of people from these groups were included in the study (23 and 40 respectively) so these results may be due to a type 2 statistical error.

[Insert Table 2 here]

Associations

Univariate and multivariate logistic regression models were constructed to investigate whether the variables age, gender, education, literacy, marital status, smoking status or duration, alcohol consumption, BMI, presence of hypertension, diabetes mellitus, HIV, previous stroke or uncorrected visual or hearing impairment were significant predictors of dementia. The results of univariate analysis are displayed in table 2. Multivariate analysis only found associations between dementia and female gender, education, uncorrected visual impairment, BMI, quantity of alcohol consumption and previous stroke. The results of multivariate analysis are displayed in table 3.

[Insert Table 3 here]

Discussion

Prevalence

This is the first dementia prevalence study conducted in an East African outpatient population. We found the prevalence of dementia to be 5.0% (95% CI 3.7-6.3). Differences in setting and methodology makes direct comparison with other SSA studies challenging (table 1). Community-based studies may report higher rates than hospital-based studies as they include individuals who live rurally or with very severe disease who may not be able to travel to hospital. Our rate is lower than the 2013 estimate of Longdon et al. [12] (6.4%), however slightly higher than the 2021 estimate of Yoseph et al.[16] (4.6%) who conducted community-based studies in the Hai District in Tanzania, using DSM-IV and DSM-V criteria respectively (figure 2). It was also lower than the rate (8.1%) from a study conducted in a specialist elderly primary care facility in Senegal in West Africa which is the only other published prevalence study conducted in a medical centre in SSA. A comparable one phase methodology, diagnostic criteria and specifically developed and validated screening tool (Aging in Senegal) were used [4]. However, due to the setting the age structure of their patient population was older than ours, which may explain the higher rate.

[insert figure 2]

Associations

Female gender, having never attended school, uncorrected visual impairment, quantity of alcohol consumption, BMI <18.5kg/m^2 and previous stroke were found to be independently associated with dementia. We found prevalence of dementia was higher in women (6.4%) than men (3.1%), a finding in line with literature from Nigeria [9,13,27] and HIC [28]. As dementia is associated with older age and women tend to live longer than men, one would expect dementia prevalence to be higher in women. Furthermore, in SSA women tend to be less well educated than men which impacts on cognitive reserve [29]. In multivariate analysis female sex was independently associated with dementia even when controlling for age and education level. The reason for this is unclear, however studies in HIC suggest it may be linked to low oestrogen levels following the menopause [30].

Cognitive reserve describes how some individuals can withstand a much greater disease burden without displaying clinical evidence of dementia [17]. Educational attainment and literacy can be used as proxy measures for cognitive reserve and are thought to increase it through neuroplasticity [22]. Rates of dementia were very high in those who had never attended school (37.5%) and were illiterate (27.8%), however, on multivariate analysis only having never attended school was found to be independently associated with dementia. Our findings are consistent with those of a Ugandan study which reported having never attended school to be associated with dementia when controlling for age and gender, and in part with a Tanzanian study which reported both illiteracy and having never attended school to be independently associated with dementia [10,17]. Education (2.1% never attended school) and literacy levels (1.6% were illiterate) of our cohort were high compared to those of a 2014 study conducted in the Hai district, Tanzania, (49% and 52% respectively)[17,29]. The reason for this is not clear although is possibly a result of our study being set in an OPD rather than the community.

In multivariate analysis quantity of alcohol consumed was independently associated with dementia, with each unit increase in average consumption of alcohol per week conveying a 1.08 times increased risk of dementia. The negative effects of excessive alcohol consumption on memory have been well documented in HIC and once before in SSA in Nigeria, where those who drank excessive alcohol were twice as likely to develop dementia [13]. Excessive alcohol intake promotes amyloid-beta induced neuronal death which in turn increases the risk of dementia [31].

Having had a previous stroke was found to convey a nearly 16 times increased risk of dementia. However, the 95% confidence intervals for the odds ratio were very wide (3.348-74.475) due to the small number of individuals with previous stroke and dementia included in our study. This association has been well documented in HIC, especially in relation to vascular dementia, and our results are consistent with two studies from Nigeria, which found previous stroke to be a risk factor for dementia when adjusting for age, gender and education [32,33].

A greater proportion of those with dementia had uncorrected visual impairment (42%) than those without dementia (17%). Uncorrected visual impairment was found to be independently associated with a four times increased risk of dementia. This is the first time visual impairment has been formally tested for alongside cognition in SSA [34]. One symptom of Alzheimer's dementia is impaired vision resulting from loss of retinol ganglion cells [35]. Additionally, there is evidence that visual changes may occur prior to cognitive deterioration meaning visual impairment could be used as a predictor for dementia [36]. It may exacerbate symptoms such as confusion, disorientation and social isolation by limiting the individual's ability to identify visual clues such as facial expression or landmarks [37]. Visual impairment also affects cognitive assessment and may make it more difficult to utilize standardized tests. Within the IDEA screen there is an option to use pencils for the

construction test, rather than matchsticks, for those who have visual impairment therefore minimising the impact of visual impairment on screening in this study.

The prevalence of dementia in those with low BMI (<18.5kg/m^2) was very high (28.6%) and low BMI was found to be independently associated with dementia. This is in keeping with findings from Nigeria and the Central African Republic [9,11]. Reduced BMI is likely the result of, rather than a cause, of dementia and has been shown to occur with incident dementia [38].

Increasing age was not found to be independently associated with dementia; this was an unusual finding and differed from results of other SSA studies [3,7-10,12-14,17,39,40]. It is possible that the oldest individuals with the most severe disease were unable to make the journey to the OPD and so will be underrepresented in our cohort. Our cohort includes substantially more individuals aged 60-64-years (n=355) and 65-69-years (n=303) than 70-79-years (n=120) and ≥80-years (n=159). However, SSA studies (3 from Nigeria, 1 from Benin) which reported this association and displayed age data in a way which allowed comparison, included a larger proportion of those age 75 years and over [3,8,14,40].

Limitations

The hospital setting means our prevalence estimate is likely an underestimation of population prevalence. Those with severe disease, reduced mobility, a lack of access to transport and poorer individuals may not be able to attend the hospital and therefore would not have been included in our study. Additionally, stigma towards the condition and the symptoms of dementia being viewed as a natural part of aging may prevent individuals with the disease from seeking medical attention.

Due to the use of convenience sampling the acquired sample may not be as representative of those attending the clinic than it might have been if a more systematic method of sampling had been used. The main difference noted was the younger age of the study sample compared to the cohort. This perhaps suggests an increased motivation to participate in research among this group. No record of demographic information, or reason for exclusion, was made of those who were excluded resulting in a possible selection bias.

As no individuals who screened as 'dementia unlikely' were assessed the prevalence rate should be regarded as a minimum estimate in this population. However, as the sensitivity of the IDEA screen has previously been reported to be 84.6% when a cut off of ≤8 was used in Tanzanian outpatients (our study used a cut off of ≤9) we suspect not assessing those with 'dementia unlikely' will have resulted in very few missed cases [19]. Whilst the assessing doctor was blinded to the screening score, as no negative screens were assessed they would have known the participant would have either had poor or moderate performance, resulting in a potential observer bias. Diagnosis of dementia was made by relatively junior doctors, however both doctors had received training on dementia diagnosis.

We assessed alcohol consumption in terms of bottles of beer consumed per week assuming each 500ml bottle to contain 1.7 units of alcohol, to make the measure more objective [25]. In Tanzania a wide range of different alcohol with varying concentrations are available; these will have been inaccurately recorded using this method. Furthermore, the retrospective nature of this question means the data are subject to recall and reporting bias. Participants may not accurately remember, or purposefully underreport, their alcohol consumption to avoid associated stigma.

Implications for future research and practice

Prevalence and risk factor data from this study will contribute to the growing research base for dementia in East Africa and provide baseline figures for future hospital based studies in this area. Identification of modifiable risk factors for dementia including visual impairment and quantity of alcohol consumption may be areas for preventative intervention.

Conclusions

This is the first hospital based dementia prevalence and risk factor study to be conducted in an East African population. The prevalence of dementia in this cohort was similar to the most recent community-based DSM-IV estimate from Tanzania and lower than the estimate from a primary elderly care facility in Senegal. This is the first time the association between visual impairment and dementia has been demonstrated in SSA and the first time visual impairment has been formally assessed alongside cognition in SSA. Visual impairment is likely an important symptom, predictor and exacerbator of dementia. Assessment and prescription of glasses may reduce confusion, disorientation and social isolation in this group. Other associations of dementia identified, including having never attended school, previous stroke, BMI <18.5kg/m^2 and alcohol consumption, have previously been demonstrated in SSA populations. Modifiable risk factors including alcohol consumption may be amenable to public health and patient education schemes.

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Figure Legends

Figure 1. A flow diagram demonstrating recruitment into the study and participant numbers

Figure 2. Prevalence rates of dementia in SSA in the last 15 years using DSM-IV diagnostic criteria