*Minireview Article*

# The burden of cognitive impairment in Nigeria: perspectives and research prospects

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**ABSTRACT**

Cognitive impairment represents deficits in memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgement. It is seen in Alzheimer's dementia, vascular dementia, diabetes mellitus, stroke, and many other conditions. Cognitive impairment and dementia constitute a huge burden worldwide, with the majority of individuals coming from low- and middle-income countries including Nigeria. This paper reviews the existing studies regarding the prevalence and burden of these conditions in Nigeria, highlighting the dearth of comprehensive nation-wide studies that addresses the situation. The study also brings perspectives on research ideas and way forward towards improving access to healthcare services for people living with cognitive impairment and dementia.

## BACKGROUND

Research into cognitive impairment and dementia is not receiving the desired attention in Nigeria. Despite the huge global and local burden of cognitive impairment and dementia, there is dearth of studies addressing this largely neglected field in Nigeria. There is no comprehensive report on the burden of cognitive impairment and dementia in Nigeria. This article reviews existing studies on cognitive impairment and dementia in Nigeria and brings perspectives on research possibilities in this area.

## INTRODUCTION AND TERMINOLOGY

These terms are related - memory loss, age-related memory loss, amnesia, mild cognitive impairment, dementia; and what they share in common is cognitive impairment. Memory loss is a general term that implies some deterioration in our ability to recall what we already know. Age-related memory loss (cognitive aging) is commonly seen in many individuals during aging and should be distinguished from memory loss due to brain injury or diseases such as Alzheimer's disease (AD). Age-related memory loss is not an early form of AD, they are distinct pathologies.

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Amnesia (amnestic syndrome, forgetfulness) is a partial or total loss of memories such as information and experiences (MFMER, 2020). People with amnesia have difficulty learning and retaining new information but usually maintain knowledge of their own identity as well as motor skills. Recent memories (short-term memories) are mostly affected – they may remember childhood memories in detail but may not remember a message left by a guest yesterday, or what they had for lunch today. They can learn new skills such as swimming or playing ping-pong. A person with amnesia may not be able to identify his or her location or have the presence of mind to seek medical care.

Cognition (or cognitive function) is the process of consciously using one's brain. It involves higher brain functions such as learning, memory, attention, executive function, problem solving and thought (Yarube et al., 2019a). Cognitive impairment (or mild cognitive impairment, MCI) is a condition when cognition (i.e. the ability to process thought) is appreciably decreased. It represents cognitive deficits in memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgement. It is similar to dementia, but much less severe, and daily functioning and independence are generally maintained (Albert et al., 2011; Mavrodaris et al., 2013). This condition is a precursor to dementia in up to one third of cases (Albert et al., 2011). About 16% of subjects with MCI developed dementia in a study in southwest Nigeria (Baiyewu et al., 2002).

Dementia includes memory loss in addition to other cognitive problems that lead to decline in daily functioning (MFMER, 2020). Dementia is a syndrome in which there is deterioration in memory, thinking, behaviour and the ability to perform everyday activities (World Health Organization [WHO], 2019). Consciousness is not affected. In dementia, there is deterioration in cognitive function beyond what might be expected from normal ageing. Alzheimer's disease is the most common form of dementia and may contribute to 60-70% of cases. Dementia is one of the major causes of disability and dependency among older people worldwide. It has a physical, psychological, social, and economic impact, not only on people with dementia, but also on their care givers, families, and society at large (WHO, 2019; Ricci, 2019).

*The burden of cognitive impairment in Nigeria*
An estimated 50 million people are living with dementia worldwide (WHO, 2017). These numbers are projected to reach 82 million by the year 2030 and 152 million by 2050, with the majority of individuals coming from low- and middle-income countries (Alzheimer's Disease International [ADI], 2015; WHO, 2017), Nigeria inclusive. An estimated 5-8% of general population aged 60 and above is living with dementia (WHO, 2019).There are nearly 10 million new cases of dementia every year making it one of the major causes of disability and dependency among older people worldwide (WHO, 2019). In both developed or developing countries, the morbidity and mortality rates of dementia are both quickly growing (Keogh-Brown et al., 2016).

Apart from dementia in its various forms such as Alzheimer's disease and vascular dementia, several other disease conditions may present with cognitive impairment, and many of these conditions have a high prevalence in Nigeria. These conditions form the sources and ramifications of cognitive impairment. They include aging population, diabetes mellitus (both type 1 and type 2), hypertension, stroke, Parkinson's disease, depression, pregnancy and HIV/AIDS; and possibly other unconfirmed conditions associated with cognitive impairment such as sickle cell disease – due to vascular dementia (Kumari and Heese, 2010), head injury, nutritional deficiencies (Kang et al., 2017), communal conflict and internal displacement (for internally displaced persons [IDPs]). When the contributions of these different conditions add up, the prevalence figure for cognitive impairment and dementia will be staggering.

There is no good estimate of the nationwide burden of cognitive impairment in Nigeria. This is due to the dearth of reported studies in literature on cognitive impairment and dementia. The few available literature sources suggest that the burden of dementia in Nigeria is poorly understood.

Mavrodaris and co-workers in their work published in the Bulletin of World Health Organization (2013) conducted a systematic review of 19 cross-sectional population-level studies which enrolled about 10,500 participants in the Sub-Saharan African countries of Benin, Botswana, the Central African Republic, the Congo and Nigeria. They reported a prevalence range for dementia from 0%, in Nigeria, to 10.1% (95% confidence interval, CI: 8.6–11.8), also in Nigeria. The prevalence of cognitive impairment ranged from 6.3%, in Nigeria, to 25% (95% CI: 21.2–29.0) in the Central African Republic (Mavrodaris et al., 2013).

Adeloye et al. (2019) conducted a systematic review of 9 publications (1990 – 2018) involving 1,082 participants, mostly from the southwest Nigeria. They reported a pooled crude prevalence of dementia in Nigeria as 4.9% (95% CI: 3.0-6.9) with prevalence significantly higher in women (6.7%, 3.6-9.9) compared to men (3.1%, 1.2-5.0). Using their epidemiologic model, they estimated that the number of dementia cases increased by over 400% over a 20-year period, increasing from 63,512 in 1995, to 318,011 in 2015 among persons aged ≥60 years. One wonders if this reported increase is real or a manifestation of the 'iceberg phenomenon', that is to say, in 2015, compared to 1995, there was a bit better awareness of dementia, and better facilities and more health personnel with the appropriate training to diagnose the disease, hence the increase in the number of cases. Olayinka and Mbuyi (2014) reviewed 41 hospital-based and population studies on epidemiology of dementia in Sub-Saharan Africa. They reported prevalence of dementia to vary widely (range: 2.29%–21.60%); and Alzheimer's disease as the most prevalent type of dementia.

Yusuf et al. (2011) conducted a study involving 322 community-dwelling elderly persons in Zaria, northwest Nigeria. They reported a prevalence of dementia to stand at 2.79 % (CI 1.0 – 4.58%); Alzheimer's disease constituted 66.6% of all the cases of dementia in that community. Ogunniyi et al. (2003) reported community-based prevalence of dementia and Alzheimer's in Ibadan to stand at 2.29% and 1.41%, respectively. They reported higher figures of 8.24% and 6.24 obtained for African Americans living in Indianapolis, which were studied simultaneously. Ochai and Thacher (2006) found a prevalence rate of 6.4% (95% CI 3.3-9.9%) in a community study in central Nigeria.

Yarube and co-authors published results of hospital-based studies in Kano that examined the prevalence of MCI in different physiological and disease states. These studies reported that majority of the patients with type 2 diabetes mellitus (T2DM) had impaired cognitive function (Yarube and Gwarzo, 2019). Similarly, MCI was observed in 79% of stroke survivors (Hassan and Yarube, 2018), 96.7% of stroke survivors in the first three months after stroke (Baba and Yarube, 2021) and 88.3% of *primigravidae* (Yarube et al., 2019a). At the same time, normal cognitive function was reported among apparently healthy adults (Yarube et al., 2019b). This high local burden of memory loss and dementia is a source of concern and a call to find a local solution to the problem through research and innovation.

It is argued here, that despite the good quality of the published studies, the prevalence figures reported are estimates that may not stand for the whole of Nigeria for a number of reasons. First, the spread of the sampling is more localized to a few regions of Nigeria, because of the absence of studies from the other regions. High heterogeneity of the sampled populations, differences in the cognitive screening tools, and the small sample sizes of the reviewed constituent studies are other deficiencies of the presented figures. A standardized, large-sample, multi-centred, country-wide study is necessary to obtain more accurate prevalence figures for cognitive impairment, and a good estimate of its burden in Nigeria. Finding the burden of cognitive impairment is necessary for policy making and healthcare delivery planning regarding cognitive impairment and dementia in the country.

*Prospects for Research*
The current status of research into cognitive impairment in Nigeria is quite low. Very few researchers are involved, with virtually no funding, resulting into a correspondingly low output. The fact that much is still yet to be discovered about the biology of cognitive impairment and dementia, and that the epidemiology and socio-economic state of these conditions in Nigeria is poorly understood, is in itself a prosperous research opportunity for Nigerian scientists. Many different studies such as physiological, biochemical, pharmacological, histopathological, genetic, clinical, epidemiological and fMRI studies can be carried out, with multidisciplinary collaborations.

Investigations are still ongoing to learn more on the biology of dementia, including molecular mechanisms involving receptors, proteins, and neural pathways. How do we modifying the course of these diseases – delay the onset, slow the progression or achieve cure?

It will be interesting to find any and how genetic variations affect the aetiology and course of these conditions in African populations. Biomarkers and therapeutic targets can be actively researched into. Investigation into phytotherapeutic potentials of local herbs, leading to development of new drugs is a worthy prospect to pursue. How effective food therapy, lifestyle modalities and cognitive stimulation therapy can be in managing these conditions is still largely unknown. Health economics studies can be undertaken to determine the social and economic impact of cognitive impairment and dementia in Nigeria.

In the local context, researchers can test their various hypotheses or answer their research questions, using neurobehavioural studies for memory in animal models, employing Morris's water maze, Barnes maze, Y maze, elevated plus maze, novel object recognition tests and the likes. There are mazes for humans as well. Naive animals such as rats and mice, as well as animal models of diseases such as genetically modified animal models of Alzheimer's disease, diabetes and obesity can be used.

Some interesting research ideas on different conditions associated with cognitive impairment are being investigated currently. For example, the commonalities between T2DM and AD are currently receiving much attention. Aberrant insulin signalling in the brain makes a strong case for type 3 diabetes mellitus. Bedse et al. (2015) reported aberrant insulin signalling in Alzheimer's disease. Deregulation of insulin and insulin growth factor signalling in the brain increases myeloid beta (Ab) deposition, Tau phosphorylation, reactive species and decreases cerebral blood flow. Accumulation of Ab oligomers further worsen insulin deficiency by decreasing insulin's binding affinity to its receptors, reducing and desensitizing cell surface insulin receptors (IRs) and phosphorylating IRS-1.

Similarly, there are commonalities between T2DM and Parkinson's disease (PD). Priyadarshini et al. (2012) reported that a reduction in tyrosine hydroxylase (TH) in the brain has been found to occur in PD. T2DM, AD and PD share common risk factors like depression. Thus, whether TH is involved in the state of 'cognitive depression' that is the hallmark of AD and often accompanies PD and T2DM is also being explored. However, there remains a lack of conclusive evidence on the association of AD-PD-T2DM. Certain biochemical cascades, like the involvement of TH, impaired HPA axis function, AGEs, and insulin regulated acetylcholine synthesis, remain to be further resolved. Nevertheless, it appears that the multiple pathways leading to these three disorders are likely interwoven via at least several common threads (such

as insulin, IGF-1 and TH) yielding an overlapping network of alterations and providing novel targets for therapy and biomarkers. The convergence of research into the arenas of AD, PD and T2DM, all individually important diseases, is providing a rich vein to mine and warrants significant further research.

Furthermore, researchers are now exploring a possible connection among AD, vascular dementia (VD), T2DM and cardiovascular diseases (CD). Kumari and Heese (2010) reported that this correlation may be due to a strong association of cardiovascular risk factors with AD and VD, suggesting that these diseases share some biologic pathways. Since heart failure is associated with an increased risk of AD and VD, keeping the heart healthy may prove to keep the brain healthy as well. The risk for dementia is especially high when diabetes mellitus is comorbid with severe systolic hypertension or heart disease. In addition, the degree of coronary artery disease (CAD) is independently associated with cardinal neuropathological lesions of AD. Sickle cell disease may quite well be associated with cognitive impairment through vascular dementia; this speculation, however, remains to be investigated.

The parallel development of T2DM and CD is a compound risk factor for both VD and AD (Akomolafe et al., 2006). There are strong additional interactions with other risk factors, such as hypertension, hyperglycaemia and hyperinsulinaemia, hypercholesterolaemia, hyperlipidaemia, endothelial dysfunction, advanced glycation end-products (AGEs) formation and the ApoE4 genotype. A specific role of NGF as potential link of these diseases, however, remains elusive (Doyle et al., 1992; Alexinsky et al., 1997; Heese et al., 2006). Disturbances in insulin signalling pathways may contribute to cognitive decline such as that seen with AD (van den Berg et al., 2006). The link among insulin resistance, cholesterol metabolism, CD and VD represents an important arena for research in the field of cognitive functions affected by aging and related neurodegenerative diseases.

*Concluding remarks and way forward*
While recognising the dearth of a comprehensive nationwide multi-centre study on cognitive impairment and dementia in Nigeria, an important way forward is research into this largely neglected area. But research needs funding (and other support). Here, the National Research Fund will do well to consider cognitive impairment as a strategic research area for priority funding.

There is the need to improve access to care for people living with cognitive impairment and dementia by establishing memory clinics. Memory clinics are specialised centres that cater for people with memory-related problems including dementia. Memory clinic services have been in existence for over half a century in Europe and North America. Some objectives of memory clinics include early diagnosis and treatment of dementia; early diagnosis and treatment of other memory disorders; evaluation of therapies; and reassuring people who fear their memory is failing, when it is not (Jolley et al., 2006). In Nigeria, memory clinics may help drastically improve dementia-related healthcare, not least due to the avoidance of stigma attached to accessing service in psychiatric settings. In addition to specialised clinical service, the systematic collection of data will allow service research and audit to be conducted relatively easily. Memory clinics can also serve as avenues for education and training. There is the need to include memory clinics as part of routine patient care for people living with cognitive impairment and dementia. This will go a long way in improving the quality of life for the patients and mitigate the social and economic burden on the families and the nation at large.

There are non-governmental organisations for support for people living with cognitive impairment and dementia in Nigeria such as the Dementia Care International (based in Lagos and Ibadan), Nigeria – Dementia Friendly Communities (Alzheimer's Disease International) and Dementia Care Society of Nigeria; but more needs to be done in this regard.

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