COGNITIVE IMPAIRMENT, DEPRESSIVE SYMPTOMS AND TOOTH LOSS AMONG ATTENDEES AT THE OUTPATIENT CLINIC OF A GERIATRIC CENTRE IN IBADAN

By

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DECLARATION
I declare that this work is original unless otherwise acknowledged. The work has not been presented in part or whole to any other college for a fellowship or diploma nor has it been submitted elsewhere for publication.

___________________________

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CERTIFICATION BY THE HEAD OF DEPARTMENT

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DEDICATION

This book is dedicated to Almighty God, my source of strength who has led me this far and has made it possible for this work to be done.
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<td>Diagnostic Statistical Manual 4th Version</td>
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<td>F.E</td>
<td>Fisher’s Exact Test</td>
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SUMMARY

BACKGROUND

There is worldwide demographic shift to the ageing population and this has associated mental health implications which include Depression and Cognitive Impairment. Cognitive impairment, late life depression and its relationship to tooth loss is highly prevalent, disabling with long term outcome. The increase of cognitive impairment in aging populations is progressing worldwide and creating a significant burden on health systems. Better insight into the nature and extent of the association between tooth loss and cognitive function is of great importance since it could lead to preventive interventions for cognitive performance.

AIM: The study was designed to determine the association between cognitive impairment, depressive symptoms and tooth loss among attendees in an outpatient clinic of a geriatric centre in Ibadan.

METHODOLOGY: This was a cross sectional study that was carried out at the Chief Tony Anenih Geriatric Centre, University College Hospital, Ibadan. Three hundred attendees were recruited from the Geriatric centre. A structured questionnaire was used to collect information on sociodemographic characteristics and other study related variables. The cognitive status was grouped into three- Normal cognitive function, Mild Cognitive Impairment and Dementia. The diagnosis of mild cognitive impairment was made using Petersen’s criteria while diagnosis of dementia was made using ICD 10 diagnostic criteria. The cognitive status of patients was substantiated using Mini Mental State Examination, Word List Learning, Word List Learning Delayed Recall and Animal Fluency. Functioning of patients was assessed using Instrumental Activities of Daily Living. Dementia severity was
assessed using Blessed Dementia Rating Scale. Depressive symptoms were assessed using Geriatric Depression Scale. The number of teeth was counted in each quadrant of the mouth. Data were analysed using SPSS-21, descriptive and inferential statistics were reported. Level of significance was set at 0.05.

**RESULT:** The prevalence of mild cognitive impairment in attendees of the Chief Tony Annenih Geriatric Centre was 8.0% while the prevalence of dementia was 4.0%. The prevalence of depression was 19.3%, with 17.0% having mild depression and 2.30 % having severe depression. The mean (SD) tooth loss was 2.53(4.87). Patients with cognitive impairment had higher number of teeth lost, mean (SD) 2.69(4.55) compared to those with normal cognition 2.40(4.66). For dementia, mean (SD) tooth loss was 4.42(6.99) compared with 2.40(4.66) with normal cognition. This was not statistically significant. There was a significant relationship between tooth loss and parameters such as older age, (p=0.001), history of hypertension (p=0.04), Instrumental Activities of Daily Living (p=0.007) and Blessed Dementia Rating Score (p=0.001).

**CONCLUSION:** Mild cognitive impairment and dementia showed a higher number of tooth loss compared to those without mild cognitive impairment and dementia, though not statistically significant. However, Blessed Dementia Rating Scale and Instrumental Activities of Daily Living which are measures functioning for dementia showed a statistically significant association with tooth loss. Blessed Dementia Rating Scale and Instrumental Activities of Daily Living may be better instruments to substantiate the association between tooth loss and dementia. The present findings have implications for elder health care to help improve clinical practice by increasing the index of suspicion for cognitive impairment and serve as a basis for development of standard operating procedures for caring for the elderly.
It will also develop multidisciplinary approach in management of patients which may form a link between psychiatry and dental care for the elderly. Early detection and treatment of these mental health problems will ultimately improve the quality of life of the elderly.

CHAPTER ONE

1.1 INTRODUCTION

The public health implications of depression and cognitive impairment in late life are enormous. The proportion of the population aged 60 years and above continues to steadily increase from 2% of the total Nigerian population in 1998 to 3% in 2010 (1). With the increase ageing population, it has been projected that by 2030, the population of elderly aged 60 years and above in Nigeria will be 16million out of a total population of 258million. It will also increase to 47 million out of a total population of 402 million by 2050(1). With the increasing ageing population, more elderly people will present with health issues which include cognitive impairment, depressive symptoms and tooth loss.

Cognitive impairment in late-life depression is highly prevalent, disabling and likely related to long-term outcome. In those with depression and cognitive impairment, the two syndromes may have a common cause (e.g., vascular disease)(2) or simply co-exist and have distinct causes (e.g. a recurrence of early-onset depression in an older patient with early stage Alzheimer’s disease)(3). Age related cognitive impairment may be an early sign of clinical dementia and has been reported to contribute to morbidity, mortality and disability(4–6). The Indianapolis Ibadan study showed that the overall age adjusted prevalence rates for dementia and Alzheimer disease were 2.29% and 1.41% respectively in the Ibadan group(7). The rates were lower than African Americans who had 8.24% for dementia and 6.24% for Alzheimer disease in the Indianapolis group(7).The prevalence of cognitive impairment in the Indianapolis Study of Health and Aging was 23.4%(8).
Cognitive Impairment can be subdivided into mild cognitive impairment and dementia. Mild cognitive impairment during depressive episodes in late-life does not progress to dementia in most cases. Instead, it is often a stable disturbance that either persists or improves only when depressive symptoms are ameliorated\(^9,10\). However, severe cognitive symptoms in geriatric depression patients do appear to result in an increased risk for developing dementia\(^11\). The variability in the cognitive abnormalities seen in geriatric depression suggests that this syndrome represents heterogeneous disorders. Many depressed older adults do not have significant cognitive impairment.

Depression increases the risk for suicide in older adults, aggravates existing medical conditions, increases functional disability, and impairs cognition\(^12\). Depression also has negative effects on information processing speed, executive function, attention and inhibition, working memory, and visuospatial memory in the elderly\(^12\). Major depressive disorder in the elderly is accompanied by structural and functional abnormalities in the frontal lobes and their connections with limbic and striatal systems\(^13\).

Sokoya et al found the prevalence of geriatric depression in Nigerian Primary Health Care attendees to be 7.4\% with severe depression accounting for 1.5\% \(^{14}\). Very low income and subjective report of poor health were significantly associated with depression in the cohort. The diagnosis of depression was based on ICD 10 criteria as well as Geriatric Mental Scale-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT). The AGECAT recognition of depression was comparable to the ICD 10. Olutoki et al found the prevalence to be 26.4\% in a mixed urban community while Baiyewu et al found the prevalence of depression to be 45.3\% among those with cognitive impairment\(^{15,16}\).

Baiyewu et al carried out a study among community dwelling elderly persons of two rural areas in Nigeria. They were interviewed using Mini-Mental State Examination (MMSE) and
Geriatric Depression Scale (GDS-30). Diagnosis of depression was based on the ICD-10 and GMS-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT). About 12.9% and 12.7% had depression based on ICD-10 criteria and GMS-AGECAT respectively.

Clinically, cognitive control network disruption results in symptoms of executive dysfunction, including a tendency to attend to irrelevant information, impaired concentration, disorganization, difficulty shifting attention, and perseveration, or the inability to disengage from earlier behavioral responses (13,17). Other executive functions, including planning and semantic organization, may account for observed deficits in select aspects of episodic memory and visuospatial abilities (18).

Some older adults with late-life depression may develop a dementia syndrome (previously termed “pseudodementia”), i.e. a cognitive impairment reaching the severity of dementia but subsides upon remission of depression (19). These patients usually present with a severe, late-onset depression and a mild dementia syndrome. Patients with depression and “reversible dementia” exhibit more psychic and somatic anxiety, early morning awakening, and loss of libido when compared with depressed patients who have Alzheimer’s Disease (19).

Depressive symptoms may also be a prodrome (early symptom) of a dementing disorder. Depressive disorder with onset in early life can be a risk factor for both Alzheimer’s disease and vascular dementia (9). Evaluation of depressive syndromes in cognitively impaired patients is complicated by the symptom overlap with dementia, the instability of depressive symptoms over time, and the poor ability of elderly patients to report their symptoms (9,20).

Tooth loss in the elderly may also be associated with poor cognitive function as the tooth loss may be due to an inflammatory process (21) which also occurs in the brain leading to cognitive impairment. Tooth loss may reflect a long term history of periodontal disease and
poor dental health status which is a source of chronic infection in humans. Chronic inflammation, as measured by serum interleukin 6 and C reactive protein levels, are risk factors for mild cognitive impairment and dementia. The identification of clinical markers predicting cognitive impairment in the elderly may be considered useful in easing the public health burden of poor cognition. Tooth loss has been implicated to be associated with poor cognitive functions in some studies of elderly population. In a cross sectional health survey in England, it was found that tooth loss was associated with cognitive impairment after adjusting for covariates in a community population(22). The Nun study from the USA showed that the patients with lower number of teeth(0-9) had increased risk of dementia based on longitudinal dental records(23). This was linked to the inflammatory process that occurs during the process of tooth loss and cognitive impairment.

Importantly, there is no study in SubSaharan Africa that has examined the relationship between cognitive impairment, depressive symptoms and tooth loss in the elderly population. With the prevalence rate of cognitive impairment, depression and relationship with tooth loss, there is need to carry out the study in the Nigerian elderly population in order to derive data capable of influencing clinical practice. Such findings from this study are expected to be useful to professional health care providers, in managing elderly patients who have cognitive impairment, depressive symptoms and tooth loss by early detection and treatment of symptoms; thereby improving the quality of life in the elderly.

To the best of the researcher’s knowledge, this current research is the first cross sectional study in Nigeria on the relationship between cognitive impairment, depressive symptoms and tooth loss in the elderly population. The relevance of this study is in its expected contribution to improving clinical care to the elderly population. Evaluation of the correlates associated with cognitive impairment, depressive symptoms and tooth loss should be part of comprehensive assessment of the elderly people. The findings of this study will also help
Clinicians identify patients who are at high risk of developing mental health problems and will provide a basis for intervention.

1.2 RATIONALE FOR THE STUDY

Affective and cognitive symptoms are common in the older population. About 15% to 30% of older adults have significant depressive symptoms and 17% to 23% of non-depressed older persons have cognitive impairment short of dementia (8). Major depression in the elderly often presents with cognitive impairment. Mild cognitive deficits in memory, processing speed and executive functioning are particularly common in late-life depression (24). Executive functions are control mechanisms that modulate aspects of emotion and cognition, and disruption to these processes is associated with poor course of illness and worse clinical outcomes of late-life depression (10,25,26). In some cases, depression may present concomitantly with or even precede-dementing disorders characterized by diffuse cognitive deficits (3).

There are studies to show the relationship between cognitive impairment, depression and tooth loss in the elderly in developed countries. However, these studies in the elderly have received very little attention in Nigeria despite the increasing ageing population and the direct association this may have. Tooth loss, one of the mediators of periodontal disease may be associated with cognitive impairment in the elderly as a result of the inflammatory process that occurs in periodontal disease as well as cognitive impairment. Also, elderly patients may have an increased deterioration in their dental health due to cognitive impairment which ultimately affects their quality of life. The variability in the cognitive impairment and geriatric depression suggests this syndrome represents a heterogeneous group of disorders requiring careful treatment planning and close neuropsychiatric follow-up. The study will add to the body of knowledge in psychiatry and neurosciences, stressing the need for
consultation-liaison work with psychiatry and give the health care providers adequate information which will serve as a baseline for intervention. This will ultimately influence patient’s wellbeing and quality of life positively.

CHAPTER TWO

LITERATURE REVIEW

2.1 COGNITION AND COGNITIVE IMPAIRMENT

The term cognition is defined as the process of obtaining, organizing and using intellectual knowledge. Cognition refers to mental processes which include attention, memory, producing and understanding language, solving problem and decision making(19).

Cognitive functioning assessments involve the evaluation of memory, visuospatial and constructional abilities, reading, writing and mathematical ability. Assessment of abstraction ability is also valuable. Although patient’s performance on task such as proverb interpretation may be a useful bedside projective test, the specific interpretation may result from a variety of factors such as poor education, low intelligence and failure to understand the concept of proverbs(19). Cognition is impaired by conditions like brain injuries, cerebral tumor, Acquired Immunodeficiency Syndrome (AIDS), alcohol, medication, infection, chronic pulmonary disease and inflammatory diseases(27).

Cognitive impairment is one of the most common geriatric neurological symptoms, and involves memory loss, judgment impairment, and abnormal behaviour(28). It reduces an individual quality of life and increases their social and familial burden(28). Many factors may contribute to cognitive impairment which includes hypertension, diabetes mellitus, heart disease, stroke and health behaviours such as smoking status and alcohol consumption(29).
The study of prevalence of cognitive impairment in the Indianapolis Study of Health and Aging showed that the overall rate of cognitive impairment among community-dwelling elderly was 23.4% (8). Age-specific rates indicate increasing prevalence with increasing age: 19.2% for ages 65 to 74 years, 27.6% for ages 75 to 84 years, and 38.0% for ages 85 years and above (8). The most frequent cause of cognitive impairment was medically unexplained memory loss with a community prevalence of 12.5%, followed by medical illness-associated cognitive impairment (4.0% prevalence), stroke (3.6% prevalence), and alcohol abuse (1.5% prevalence) (8). Cognitive impairment may manifest as amnesia (recent memories are lost before remote memories), aphasia (common language problems are nominal dysphasia, decrease fluency, perseveration & echolalia), agnosia (autoprosopagnosia is a form in which recognition of one’s own face is lost), apraxia (causing difficulty in complex motor tasks) and visuospatial difficulties (resulting in topographical disorientation) (19).

The criteria for Mild Cognitive Impairment as defined by Petersen et al include memory problems, objective memory disorder, absence of other cognitive disorders or repercussions on daily life, normal general cognitive function and absence of dementia (30).

The International Classification of Diseases and Related Health Problems, tenth edition (ICD-10) requires the following criteria to make diagnosis of mild cognitive disorder. The main feature is a decline in cognitive performance. This may include memory impairment, learning or concentration difficulties. Objective test usually indicate abnormality. The symptoms are such that a diagnosis of dementia, organic amnestic syndrome or delirium cannot be made (31). The disorder can be differentiated from postencephalitic syndrome and post concessional syndrome by its different aetiology, more restricted range of generally milder symptoms, and usually shorter duration (31).
The Diagnostic and Statistical Manual of Mental Disorder fifth edition (DSM V) criteria for Mild Neurocognitive Disorder requires the following to make a diagnosis. Evidence of modest cognitive decline from a previous level of performance in one or more cognitive domains (complex attention, executive function, learning and memory, language, perceptual-motor, or social cognition. The cognitive deficits do not interfere with capacity for independence in everyday activities (complex instrumental activities of daily living). The cognitive deficits do not occur exclusively in the context of a delirium. The cognitive deficits are not better explained by another mental disorder (eg major depressive disorder, Schizophrenia)(32).

Assessment of cognitive function in the elderly is complicated by frequent presence of physical ill health, notably sensory deficit and by the need to carefully distinguish normality from early phase of dementia(33).

2.2 DEMENTIA

Dementia is a chronic generalized brain disease characterized by cognitive deficits, behavioural problems and functional impairment with progressively dependent living. It is a progressive impairment of cognitive function occurring in clear consciousness(19).

Global impairment of intellect is the essential feature manifested as difficulty with memory, attention, thinking and comprehension. Other mental functions can often be affected, including mood, personality, judgment and social behaviour. The disorder can be progressive or static, permanent or irreversible(34).

Depending on the methodology, various estimates in Europe and North America put the prevalence rate of dementia at between 5% and 10%(35). In a comparative study of African
Americans in the Indianapolis and Nigerians in Ibadan, Nigerians had lower rates; environmental factors were thought to be responsible for the differences (35). The prevalence for dementia in Ibadan south western Nigeria was 2.29% as at 1996 (7), and 2.79% in Zaria, northern Nigeria in 2010 (36). With the global ageing population, the prevalence of dementia is rising.

The International Classification of Diseases and Related Health Problems, tenth edition (ICD-10) requires the following criteria to make diagnosis of dementia in general: decline in memory, initially short term memory and may become global memory problem as the illness advances (31). Other features include decline in other cognitive abilities characterized by deterioration in judgment, planning and organizing, deterioration from the previous level of performance; preservation of consciousness and behavioral problems; and the symptoms must have lasted 6 months (31).

The Diagnostic and Statistical Manual of Mental Disorder, fourth edition (DSM IV) requires memory impairment, impairment in at least one other cognitive domain; significant disturbance of work or social functioning; disorders of executive functioning and intact consciousness to make diagnosis of dementia (37).

The Diagnostic and Statistical Manual of Mental Disorder, fifth edition (DSM V) requires clear evidence of decline in memory, learning and at least one other cognitive domain; steadily progressive, gradual decline in cognition and cognitive deficits interfere with independence in everyday activities (32).

The two commonest types of dementia are Alzheimer’s disease and vascular dementia. Of all patients with dementia, 50-60% have Dementia of Alzheimer’s type while vascular dementia accounts for 15-30% (19). Approximately 10-15% of patients have coexisting vascular dementia and Alzheimer’s disease (19). Other etiological factors include
Degenerative/Parenchyma type; Lewy Body Dementia which accounts for 15-20%, Frontotemporal dementia, Dementia in Huntington’s and Parkinson’s disease(34).

Clinical features include memory impairment which starts with short term and progresses to long term. They also have social withdrawal, lability of affect, disinhibition, fatigue, deteriorating executive functioning, catastrophic reaction and sun-downer syndrome(34). They may have difficulty in finding words or naming objects and impairment in ability to construct fluent and informative sentences(37). Visuospatial skills may be affected with difficulties in task such as copying pictures.

In the early stages of Alzheimer’s disease, the clinical features are modified by the person’s premorbid personality and their traits tend to be exaggerated(19). In the middle and later stages of the illness, the cognitive impairment increasingly predominate together with neurological and behavioural features(19). Behavioural and psychological symptoms include; mood changes (depression and mania/hypomania), psychosis (delusions, hallucinations and disorganization), personality changes, wandering, agitation, aggressiveness, altered sleep, change in eating habit, incontinence and inappropriate vocalization (grunting and screaming)(38).

Functional abilities decline with worsening cognitive abilities. More complex instrumental activities of daily living are lost first. Personal activities of daily living are more basic, relate to self-care, and preserved in early stage of the disease.

Besides pharmacological intervention, persons with dementia also benefit from environmental adjustment measures and suggestion to implement structured compensatory strategies in everyday matters(39). Non pharmacological methods of treatment include behavioural therapy, Art therapy, Music therapy, Activity therapy, Aromatherapy, Bright
light therapy, and multisensory approaches(40). Regardless of these measures, the progressive nature of the disease makes support from others inevitable(39).

2.3 DEPRESSIVE SYMPTOMS AND COGNITIVE IMPAIRMENT

Current conceptions of cognitive impairment, no dementia (CIND) (8) and mild cognitive impairment (MCI) are very similar in describing a borderland syndrome between normal cognitive aging and dementia that encompasses a broad array of cognitive and behavioral symptoms that are presumed to have multi-factorial causation (38).

Depression was found to be significantly more frequent among subjects with CIND/MCI and dementia than among older adults with normal cognition. The most frequent symptoms among subjects with CIND/MCI were depression (45.3%) and apathy (37.7%) with about 1 in 5 displaying delusions and 1 in 6 agitation(38).

Two diagnostic criteria may be used in diagnosis of depression. International Classification of Diseases and Related Health Problems, Tenth edition(ICD10) diagnostic criteria for depressive episode can be classified as mild, moderate, severe without psychotic symptoms, and severe with psychotic symptoms. The depressive episode should last for at least two weeks; there have been no hypomanic or manic episode; not attributable to psychoactive substance use. Symptoms include depressed mood that is abnormal for the individual, present for most of the day and almost every day and sustained for two weeks; loss of interest or pleasure in activities that are normally pleasurable; decreased energy or increased fatigability. Additional symptoms are loss of confidence and self-esteem; unreasonable feelings of self-reproach or excessive guilt; recurrent thoughts of suicide; diminished concentration; psychomotor retardation or agitation; sleep disturbance; change in appetite with corresponding weight change(31).
The Diagnostic and Statistical Manual of Mental Disorder Fourth edition (DSM IV-TR) criteria for major depressive episode include the following: Five or more of the following symptoms have been present during the same two week period and represent a change from previous functioning; (at least one of the symptoms is either depressed mood or loss of interest or pleasure) depressed mood most of the day nearly every day, marked or diminished interest or pleasure in all or almost all activities most of the day nearly every day, significant weight loss or weight gain, Insomnia or hypersomnia nearly every day, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or inappropriate guilt feelings, diminished ability to concentrate, recurrent suicidal ideation (37).

The symptoms do not meet criteria for a mixed episode; Symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. The symptoms are not due to direct physiological effects of a substance or general medical condition and are not accounted for by bereavement. The criteria for severity can be classified as mild, moderate, severe without psychotic symptoms and severe with psychotic symptoms (31).

The Diagnostic and Statistical Manual of Mental Disorder fourth edition (DSM V) criteria for major depressive episode include the following: Five or more of the following symptoms have been present during the same two week period and represent a change from previous functioning; (at least one of the symptoms is either depressed mood or loss of interest or pleasure) depressed mood most of the day nearly every day, marked or diminished interest or pleasure in all or almost all activities most of the day nearly every day, significant weight loss or weight gain, Insomnia or hypersomnia nearly every day, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or inappropriate guilt feelings, diminished ability to concentrate, recurrent suicidal ideation (32).
Symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. The symptoms are not due to direct physiological effects of a substance or general medical condition. The episode is not attributable to the physiological effects of a substance or to another medical condition (32).

Depressive symptoms are associated with cognitive decline in the elderly people. Some studies have shown an association between depressive symptoms and dementia or cognitive decline (41).

Depressive symptoms have been found to precede cognitive decline (42) or to follow the onset of dementia (43). However, Dufouil et al did not report any significant association (44). Bassuk et al (45) found that depression predicted cognitive decline over 3-year and 6-year follow-up periods for people with medium, but not high, cognitive scores at baseline. Geerlings et al (46) found that depression was associated with an increased risk of Alzheimer's disease and cognitive decline only in people with higher levels of education.

Depression may be a psychological reaction to perceived cognitive loss. Schmand et al (47) found that depressive symptoms at baseline did not predict future dementia when memory complaints were accounted for. However, depressive symptoms preceded cognitive decline, in the absence of previous loss of cognitive performance (48). On the other hand, it is possible that the Mini Mental State Examination does not permit the evaluation of finer cognitive losses. Cognitive deficits usually associated with depression may be responsible for an earlier onset of cognitive decline or dementia. Somatic symptoms such as fatigue or concentration disorders may be early symptoms of dementia; they are also symptoms of depressive disorders and are included as items of depression rating scales. A high depression score may thus reflect early symptoms of dementia.
People with depressive symptoms often suffer from cognitive impairment, which may be severe (pseudo-dementia) but is generally transitory and resolves on treatment of the depression (49). The fact that initially high levels of depressive symptoms predict subsequent persistent low cognitive functioning may suggest that a chronic mechanism is responsible for the observed association. Depressive symptoms may be a prodrome of cognitive decline, the early manifestation of a neurodegenerative process, causing depression and dementia. Depressive symptoms and cognitive decline are linked to modifications in activity of temporal cortex of the hippocampus (50).

Alternatively, depression might represent a causal factor in cognitive decline. Some studies indicate that early-onset depression or depression that has a history of 10 years or more are stronger risk factors for dementia. Some authors have proposed that chronic depression causes cognitive decline by the release of adrenocorticotropic hormone and the consequent secretion of glucocorticoids (51). According to the glucocorticoid hypothesis, stressors trigger the pituitary gland to release adrenocorticotropic hormone which in turn triggers the secretion of glucocorticoids from the adrenal glands. There are glucocorticoid receptors in the hippocampus which play an important role in inhibiting further glucocorticoid secretion. The degeneration of the hippocampus with ageing causes a gradual impairment of glucocorticoid feedback inhibition (51,52).

Furthermore, hypersecretion of glucocorticoids damages the hippocampus leading to a cascade of further impairment of feedback inhibition and yet more hippocampal damage. Because depression often involves disregulation of the hypothalamic-pituitary-adrenal (HPA) axis and the hippocampus is atrophied in Alzheimer’s dementia, the glucocorticoid cascade hypothesis provides a potential mechanism by which depression contribute to the development of dementia (51,52).
Depression treatments may be risk factor for dementia. A potential mechanism was suggested by the anticholinergic effect of some antidepressants and the well-known cholinergic deficit in Alzheimer’s dementia. Other case-control studies of Alzheimer’s dementia have also shown no trend for an association of dementia with history of antidepressant use (53).

Dementia and depression may share a common risk factor. Comparison of the likely risk factors for depression on the one hand (41), and Alzheimer’s dementia and Vascular dementia on the other (54) reveals little overlap. The common factor is that pre-existing vascular disease increases risk for Vascular dementia and depression is more common in people with chronic physical diseases including vascular disease (41,54,55). The possibility of depression being a prodrome to dementia is supported by clinical series in which patients initially diagnosed to be depressed progress to clear dementia (56). A possible biological mechanism by which Alzheimer’s dementia could give rise to depression is through loss of noradrenergic neurons (56).

A number of neuropathological studies have reported that patients suffering from both Alzheimer’s dementia and depression have greater loss of noradrenergic cells from the locus coeruleus than non-depressed Alzheimer’s dementia patients (57,58). However, a study failed to replicate this association and the authors attributed the earlier positive findings to methodological limitations, such as poor matching of depressed and non-depressed Alzheimer’s dementia groups on severity of dementia (57,58). If loss of noradrenergic neurons is invoked to explain depression as a prodrome of Alzheimer’s dementia, then such loss would need to be one of the earliest features of Alzheimer’s dementia, at least in a subgroup of patients. However, noradrenergic cell loss is most likely to be found in early-onset cases with more severe dementia so it is unlikely to explain prodromal depression in mainly late-onset cases (59). Magnetic resonance imaging (MRI) of the brains of patients with severe depression has shown a higher frequency of white-matter hyperintensities.
Depressed patients with hyperintensities are also more likely to have cognitive impairments (60).

Depression may be an early reaction to cognitive decline. Such a reaction might occur if people in the earliest stage of a dementing disease had an awareness of their declining cognitive abilities (45). According to this hypothesis, depression would follow early cognitive decline, but would appear to precede diagnosis of dementia. This interpretation was put forward to explain the findings from one of the longitudinal studies of cognitive decline which found that depressive symptoms only predicted cognitive decline in people who already had some cognitive impairment (45).

Depression involves cognitive deficits which may cumulate with those in early dementia to bring a person to earlier clinical recognition. Comorbid depression may also cumulate with some of the early behavioral manifestations of dementia (47). Dementing diseases involve a continuum of pathology, with dementia being diagnosed when a threshold is reached where the pathology begins to significantly impair daily life. Individuals who have less cognitive reserve will tend to reach this threshold at an earlier stage of pathology (59).

Although it is not possible to define causal mechanisms in an epidemiological study, the fact that depression may predict cognitive decline in elderly people has practical and clinical implications. The detection of depressive symptoms in these people is important because early treatment of depression may improve prognosis. In addition, depressive symptoms, especially when they are persistent, may be the first sign of the decrease in cognitive functioning, carrying not only a higher risk of dementia, but also a higher mortality (61). People with cognitive decline may benefit from drugs that might slow the progression of the disease.

Nevertheless, diagnosis of depression is more difficult in elderly people, in whom symptoms such as fatigue, loss of libido and sleep disturbances occur more frequently even in the
absence of depression. A possible consequence is that chronic depression in this age group may be under diagnosed, because somatic symptoms are attributed to physical rather than psychiatric causes and this may affect prompt treatment of the patient (62).

2.4 TOOTH LOSS.

Tooth loss is a process in which one or more teeth come loose and falls out. Tooth loss occurs when no part of teeth is visible in the gum and when confirmed it was lost(63). Tooth loss may be due to failure to retain teeth as a result of disease or injury (20). According to German National Surveys on Oral Health, most frequently lost teeth are molars followed by maxillary premolar and front teeth(64).

A number of reasons have been associated with tooth loss which includes caries, periodontal disease, trauma and pain(65). Teeth are commonly lost as a result of periodontal infection and dental caries both of which are caused by exposure to bacteria(63). In the study of the pattern of tooth loss in an elderly population from Ibadan, Taiwo et al found that 0.7% of the tooth loss were due to caries, 0.6% as a result of trauma and 98.7% as a result of periodontal disease(63).

Dental caries is a destructive process causing decalcification of tooth enamel and leading to continued destruction of enamel, dentin, and cavitations of the tooth(66,67). Factors that cause dental caries may include poor hygiene, poor diet, malnutrition and diseases. Dental trauma refers to trauma to the face, mouth, teeth, lips and periodontium which may cause tooth loss. Dental plaque is a soft non mineralized bacteria deposit formed on tooth surface(68,69). Dental calculus is a form of hardened dental plaque caused by continual accumulation of minerals from saliva on plaque on the teeth. The rough surface provides an ideal medium for further plaque formation, threatening the health of the gums(68,69).
Periodontal disease is a group of conditions that cause inflammation and destruction of gums, alveolar bones and other structures that support the teeth (65). Causes of periodontal disease include gingivitis, periodontitis, dental plaque, and calculus. Periodontal disease typically occurs as people grow older and is most common after age 35 years (70–72). Symptoms typically progresses over time and may include red swollen gums, gum bleeding, bad breath, gum recession and loose teeth (70–72). Periodontal disease involves the presence of pathogenic bacteria found in dental plaque and individual variation in host immune response (65). The bacteria most strongly implicated in chronic periodontal disease are Porphyromonas gingivalis, Tannerella forsythensis, Treponema denticola (73).

Periodontal disease is a cause of chronic systemic infection in humans. Chronic inflammation is associated with increased risk for cognitive decline and dementia (74). Elevated levels of Interleukin 1 have been found in patients who have gingivitis and active periodontal disease due to inflammatory process (74, 75). Gingivitis advances to periodontal disease when bacteria evade clearance by neutrophil and penetrate the deeper tissues (74). Severe periodontal disease can induce chronic inflammation and immune reactions that result in loss of bone and soft tissue that supports teeth in the jaws. Loos et al found that blood leukocytes and plasma level of C Reactive Protein were consistently higher in patients with periodontal disease than controls (76). Other inflammatory proteins such as Interleukin 6, Interleukin 1, Tumor necrosis factor alpha (TNFα) have been found to be elevated in advanced periodontal disease (76).

Periodontal disease may be associated with increased risk of Alzheimer’s disease due to the inflammatory protein produced. In Swedish twins, participants who were members of the Swedish Twin Registry aged 65 and older and alive in 1998, were screened and assessed clinically for dementia. Analyses done included a case-control design to evaluate the risk factors and a co-twin control design that permits testing non genetic risk factors while
controlling for genetic influences(77). Gatz et al in that Swedish twins study, found that those
who had lost half or more of their teeth had 1.7 fold greater risk for Alzheimer’s disease, after
controlling for other factors(77). A case control study found that adults who lost more than
half of adult teeth were 2.6 times more likely to develop Alzheimer’s disease(75) while Kim
et al found that persons with fewer teeth remaining (0-10), in a Korean population, were 1.6
times more likely to develop dementia(78).

2.5 COGNITIVE IMPAIRMENT AND TOOTH LOSS

Perceptions and behaviours regarding oral health can be adversely affected if cognitive ability
is impaired and may be accompanied by potential harm to oral health(27). In studies of
people who had already developed cognitive impairment(65,79–82), participants had more
dental caries, fewer teeth and poorer oral health than adults without cognitive impairment.
Poor oral health may be due to functional decline, poor oral hygiene care and less use of
dental services(65). Interventions to prevent oral disease would begin prior to manifestation
of cognitive impairment when change in cognitive function could be assessed (83,84).

Kondo et al found that periodontal disease occurring 20-30 years prior to dementia onset was
the most frequent cause of tooth loss(75).Therefore, oral health care providers will be
challenged with preserving oral and nutritional health in these patients, to reduce pain and
pathology and to maintain the dignity and quality of life of people with dementia.

Oral health problems may be caused by multiple factors including specific systemic diseases,
sensory and motor deficit, impairment of cardiovascular, pulmonary and muscle
functions(85–87). Other factors include educational status, social class, income, social
relations, behavioural factors such as irregular dental visit and smoking(88,89). Consequently, the causes of oral health problems are complex and often due to multiple
interrelated factors(65).
Therefore in the primary prevention of oral health problems among older people, it is important to be aware of the general signs among well-functioning older adults that may indicate risk of oral health problems. Such indicators may be early signs of cognitive problem(65).

2.6 RELATIONSHIP BETWEEN COGNITIVE IMPAIRMENT AND TOOTH LOSS.

Cognitive impairments are characterized by decline in memory, learning ability, comprehension, attention, judgment and orientation(19). Cognitive impairment and concomitant inability to maintain personal hygiene in people with cognitive problems makes them more susceptible to oral health problems, deterioration of oral health and function as the disease progresses(65).

Impairment in cognitive capabilities and activities of daily life expose patients with dementia to oral problems(82). Cognitive impairment has been found to be associated with poor oral(79,90,91) and denture hygiene(92), dental caries(65,81,92,93), periodontal problems(90,91), fewer teeth(65), poor denture stability(94) and lack of denture usage(95). Individuals with poor cognitive functions may more likely develop poor oral health because of the lower ability to perform proper tooth brushing, manage dentures and use dental related medications(96). As a result of poor oral health, cognitively impaired elderly people have other problems including impaired quality of life, poor nutritional status and systemic diseases such as aspiration pneumonia(97,98).

Some cross-sectional studies and longitudinal studies have shown that patients with dementia are more likely to have poor oral health (79,99–102). In the study on a Swedish population of individuals aged 35 to 85 years, edentulous individuals showed lower MMSE scores than those with natural teeth(103). They compared the performance of 1,351 participants with natural teeth to 487 edentulous participants in cognitive tests. The natural teeth group had a
lower mean age, fewer women, more years of education, higher mini-mental state (MMSE), and performed significantly higher on several cognitive tests(103). The results suggested that functional natural teeth relate to relatively preserved cognitive functioning in older age. Even after adjusting for gender, age, social variables, disease, stress, and MMSE scores, the cognitive disadvantage of the edentulous group was still apparent(103).

In a cross sectional study of very old Swedish people,(159 people included in the study)(65), older adults with low MMSE(<23) tended to have a higher risk of coronal caries than those with higher scores(65). Participants with mild cognitive impairment (MMSE 24-26) and with decrease in functional ability had a significant higher risk of root caries. In addition, people with a low MMSE (0-23) had four times higher risk of not using dental services regularly(65). The small sample size is the weakness of the study but despite the size of the study sample, meaningful associations were observed between cognitive, physical function and oral health in a generally healthy, very old population (65).

Okamoto et al, in a community based survey revealed that the prevalence of a low MMSE score was significantly increased in association with the decrease in the number of remaining teeth(104). The prevalence of low MMSE (23 or lower) was 2.7 % in subjects with 22-32 remaining teeth, 5.0% in those with 11-21 remaining teeth and 6.8% in those with 0-10 remaining teeth in the 65-74 years category. Prevalence of low MMSE were 4.0%, 8.0% and 11.0% in the 75 years or more category respectively(104). The study also found that older adults with low MMSE score do not regularly use dental services. In addition, older adults with dementia have increased plaque accumulation(104).

However, Saiito et al, in the cross sectional study of the relationship between tooth loss and cognitive function in a community dwelling Japanese population (105) found that the prevalence of cognitive impairment was 5.6%. Severe tooth loss (0-10 teeth remaining) was
found to be significantly associated with poor cognitive function after adjusting for confounders. The number of teeth lost was significantly correlated with age, education level, current smoking status, positive history of diabetes and MMSE total score in a community dwelling population in Japan (105). Subjects with cognitive impairment were older, less educated with fewer numbers of teeth remaining (105).

Stein et al, in the Nun study (longitudinal study), noted there was association between presence of a low number of teeth and the risk of a higher prevalence and incidence of dementia(23). This was carried out using longitudinal dental records from 10 annual cognitive assessments of 144 participants in the Nun study aged 75 to 98 years (23). Cognitive function was measured using Mini Mental State Examination and Activities of Daily Living(23). They found that approximately 33% of the participants with no teeth or very few teeth (one to nine) had dementia at the first cognitive examination. In those with ten or more teeth, the percentage of dementia was 17% or less(23).

Park et al also reported there was significant association between cognitive impairment and tooth loss in adults aged 50 years and above with no previous history of dementia or stroke(28). In the unadjusted analysis, odds ratios (OR) of cognitive impairment based on MMSE score were 2.46 and 2.7 for subjects who had lost 6-10 teeth and those who had lost more than 10 teeth, respectively, when compared with subjects who had lost 0-5 teeth(28). After adjusting for age, education level, hypertension, diabetes, hyperlipidemia, and smoking, the relationship remained significant(28).

Finnish national survey showed that cognitive impairment was associated with poor oral health status including higher number of carious teeth, edentulousness, without denture and poor denture hygiene(92). The study population comprised 2320 persons aged 55 years or older who participated in a nationally representative Health Examination Survey in Finland.
Cognition was assessed using a shortened version of the Mini-Mental State Examination (score 0–16). The Finnish data (92) showed that individuals with low MMSE scores (0-9) often have no teeth or dentures and less frequently have good denture hygiene than those with high MMSE score (12-16). Among the several possible explanations for the high prevalence of caries were deterioration of abilities, knowledge, and understanding concerning oral health behaviour and consequent poor hygiene and inadequate use of health services, but also medication and diet(92). The authors also noted that dementia is associated with depression, anxiety, delusion, agitation, insomnia, and hallucination that are medicated by anxiolytics, antidepressants, and antipsychotics which have anticholinergic side effects, including hyposalivation that may increase the prevalence of caries that leads to tooth loss(92).

The study of oral diseases and conditions in a community living older adults with and without dementia also found that participants with dementia had significantly higher experiences of oral diseases and conditions at baseline and 1 year compared with participants without dementia(95) while Stewart et al, in a nationally representative cross-sectional population survey of Dental health and cognitive impairment (English National Survey), found that poor dentition was associated with cognitive impairment(22).

Takata et al found that there was association between cognitive function and number of sound and decayed teeth after adjusting for confounding factors in the study of cognitive function and number of teeth in a community dwelling elderly population without dementia in an elderly Japanese population (106). Kim et al, in a cross-sectional study of community dwelling elderly residents in South Korea also found that fewer teeth were significantly associated with dementia and Alzheimer’s disease(78). Findings of the study indicated that having fewer teeth was associated in a cross-sectional analysis with dementia, and this association was strongest in people who did not use dentures(78).
Therefore to establish a relationship, periodontal disease may precede dementia and must be correlated with Alzheimer’s disease. The studies have reported tooth loss as a risk factor for dementia with some of the studies that measured periodontal disease as a possible cause for the tooth loss. All the other possible confounding factors might contribute to both tooth loss and dementia separately such as viral infection in different body system, head injury, low socioeconomic status, malnutrition, or an exaggerated inflammatory profile which should be controlled for (27).

Potential mechanism include inflammatory mediators produced in response to periodontal pathogens which produce chronic systemic inflammation and neuropathology(76,107,108). Periodontal disease which is the cause of 50% of all extractions in the elderly may be associated with cognitive impairment through systemic inflammation(109). It has been hypothesized that inflammatory cytokines induced by periodontal disease can enter and influence the brain via neuronal pathway(110–112). Riviere and colleagues suggested that oral bacteria may use branches of the trigeminal nerve to reach the brain(113). In their postmortem examination of brain tissues, they detected antigens of oral treponemes more in the sample of people with Alzheimer disease (14 of 16) than in controls (4 of 18).

Tooth loss may reflect a long term history of periodontal disease and poor dental health status which is a common source of chronic infection in humans(22). Chronic inflammation, as measured by serum interleukin 6 and C reactive protein levels are risk factors for cardiovascular disease, cognitive impairment, and Alzheimer’s disease(22,114). The presence of interleukin 6, a cytokine that is elevated in periodontal disease has been demonstrated in and around senile plaques(115). These cytokines may regulate production of beta-amylloid protein found in senile plaques in dementia.
The genetic risk factors related to periodontal disease and cognitive function may also be present, which includes interleukin 1 gene polymorphism and has been reported to be associated with the severity of periodontal disease and risk of dementia(116). Although these polymorphisms are found at different loci, one might consider the possibility that these polymorphism reflect hyper inflammatory genotype that could be an underlying trait common to people with periodontal disease and people with dementia(117–119).

A decrease in the number of periodontal mechanoreceptors due to tooth loss, which are sensory receptors, may result in cognitive impairment(120). Also, other risk factors which includes low socioeconomic status, negative events earlier in life, head trauma with maxillofacial injury and limitations on the choice of a healthy diet may be related to tooth loss and cognitive function(78).

Reduced number of teeth and cognitive impairment may be due to nutritional deficit especially in relation to vitamin B(80,121). Hendrie et al, in a longitudinal study of two community dwelling cohorts of elderly Yoruba and African American, found that increased homocysteine levels were associated with a similar but no significant increase in dementia risk for both groups despite significant differences in folate levels between the two sites(122). There were no significant relationships between levels of Vitamin B12, folate and incident dementia in either site, although folate levels were lower and Vitamin B12 higher in Yoruba than the African American(122).

One of the mechanism for an association between periodontal disease and Alzheimer’s disease proposed by Chalmers et al was that oral infection and inflammation may contribute to, exacerbate, and share risk factors with Alzheimer’s disease(91,93). Several preventive measures and treatment strategies would be implied as systemic infection and inflammation may be contributors to Alzheimer's disease.
CHAPTER THREE

3.1 AIMS AND OBJECTIVES

The aim of the study was to determine the association between cognitive impairment, depressive symptoms and tooth loss among attendees in an outpatient clinic of a geriatric centre in Ibadan.

3.2 SPECIFIC OBJECTIVES
1. Determine the prevalence of cognitive impairment and dementia among attendees with and without toothloss, in an outpatient clinic of a geriatric centre in Ibadan.

2. Determine the prevalence of depressive symptoms among attendees with and without toothloss, in an outpatient clinic of a geriatric centre in Ibadan.

3. Describe the sociodemographic characteristics of attendees with and without toothloss, who had cognitive impairment and depressive symptoms in an outpatient clinic of a geriatric centre in Ibadan.

4. Determine the sociodemographic and clinical relationship (relationship with neurocognitive tests) between cognitive impairment and tooth loss among attendees in an outpatient clinic of a geriatric centre.

CHAPTER FOUR

METHODOLOGY

4.1 STUDY DESIGN

This was a cross-sectional observational study designed to determine the prevalence of cognitive impairment, depressive symptoms and tooth loss among attendees in a geriatric centre in Ibadan as well as their sociodemographic and clinical relationship.

4.2 STUDY LOCATION
The study was conducted in geriatrics outpatient clinic (Chief Tony Anenih Geriatric Centre) University College Hospital, Ibadan. This is an all-inclusive facility which allows the elderly patients to have easy access to health care services through a smooth flow of activities within the same hall. It has different service areas which include outpatient services, inpatient services, physiotherapy, dietetics, surgical unit, recreational day unit.

The geriatrics outpatient clinic (Chief Tony Anenih Geriatric Centre) is a walk in clinic, established in 2012 and has subspecialty units including psychiatry, dental, eye, family medicine and surgery. The patients are seen by the consultants in the specialist clinic which runs during the week. The geriatric clinic is usually run every day of the week (Monday to Friday) with an average of 30 to 40 patients in a day for different specialties.

The University College Hospital, Ibadan is a premier health institution in Nigeria located in the South Western region, and was established in 1957 primarily for both undergraduate and postgraduate medical and allied professional training and secondarily for service delivery. The University College Hospital is a tertiary health facility with a full complement of surgical and medical subspecialties. The hospital serves people in Ibadan, Oyo state and receives referral from other states in Nigeria.

4.3 STUDY POPULATION

The study was conducted on consecutive elderly patients who presented to the geriatrics outpatient clinic (Chief Tony Anenih Geriatric Centre), University College Hospital, Ibadan and were aged 60 years and over. Consecutive patients who met the inclusion criteria were recruited at the reception after the nurses had checked their vital signs and the patients were waiting to see the medical practitioner. The patients were recruited over 6 months between 1st August 2016 and 13th January 2017.
4.4 SAMPLE SIZE

The sample size was determined using the formula below.
\[ n = \frac{z^2pq}{d^2} \]

Where: 
- \( n \) = the desired sample size.
- \( z \) = the standard normal deviate set at 1.96 which corresponds to the 95% confidence level.
- \( p \) = the proportion in the target population
- \( q = 1.0 - p \)
- \( d \) = degree of accuracy set at 0.05

The prevalence of 23.4% was reported in the study of prevalence of cognitive impairment in the Indianapolis-Ibadan study of Health and Aging (8).

Since Cognitive impairment is central to the depressive symptoms and tooth loss in the study, the prevalence of 23.4% was used to calculate the sample size.

Thus, the sample size was calculated utilizing the prevalence and at a confidence interval of 95% as follows:

\[ n = \frac{1.96^2 x 0.234 x (1 - 0.234)}{(0.05)^2} \]
\[ = 3.842 \times 0.234 \times 0.766 \]
\[ = 0.0025 \]
\[ = 275.5 \]
However in order to increase the precision of the estimate, an adjustment was made by increasing calculated sample size. Since sample size increment would show more representative sample of the sample population, the sample size was rounded up to 300

4.5 SAMPLING TECHNIQUE

The estimated sample size was 300. Consecutive patients who presented to the Chief Tony Anenih Geriatric Centre were recruited during the study period (1st August 2016 to 13th January 2017) provided they gave their informed consent.

4.6 SELECTION CRITERIA

INCLUSION CRITERIA.

1. Patients 60 years and over who presented at the study site during the period.

2. Patients who speak Yoruba or English language.

EXCLUSION CRITERIA.

1. Severe medical illness eg. Fever, vomiting, diarrhea.

2. Severe visual or hearing impairment.

4.7 STUDY INSTRUMENTS

The questionnaires were administered to the participants.

1. Socio-demographic Questionnaire.

2. Mini Mental State Examination (MMSE)

3. Animal Fluency
4.  Word List Learning
5.  Word List Learning Delayed recall
6.  Instrumental Activities of Daily Living (IADL)
7.  Blessed Dementia Rating Scale (BDRS)
8.  Geriatric Depression Scale (GDS)

4.7.1 Sociodemographic questionnaire

This section comprised of 11 questions. It collected information on socio-demographic characteristics of the respondents including age, gender, marital status, years of education and employment status.

4.7.2 Mini-Mental State Examination (MMSE)

The Mini Mental State Examination (MMSE) is a tool that can be used to evaluate global cognitive function. The MMSE is among the most widely used measures of global cognitive status. It is a part of the neuropsychological battery; Consortium to Establish a Registry for Alzheimer’s disease (CERAD) used in the Indianapolis-Ibadan Dementia study. The MMSE is a screening tool for cognitive impairment in older, community dwelling, hospitalized and institutionalized adults. MMSE has been used in both clinical practice and research.

Scores on MMSE range from 0-30 with lower scores indicating more impaired cognitive functioning. The version of MMSE that was used in this study consist of 20 items. Assessments include Orientation to time and place, registration and recall, calculation, abstraction, language and judgment.

Age and education specific norms of this version have been established in Yoruba speaking Nigerians, as part of the Consortium to Establish a Registry for Alzheimer’s disease,
Neuropsychological test battery, Ibadan (CERAD-IB). A cut off of 15 and below was established among healthy community dwelling Yorubas without formal education while a cut off of 22 and below has been established for subject with formal education. This was administered to all participants to measure their global cognitive status(124).

4.7.3. Animal Fluency Test.

This is a measure of executive functioning and semantic fluency. It is the ability to retrieve members belonging to a specified category within a limited time period. They assess language functions, speed of response, mental organization, search strategies and long term memory(125). It is one of the instruments in the Consortium to Establish a Registry for Alzheimer’s disease (CERAD) for dementia. It has been used in some studies in Nigeria along with other instruments for cognitive assessment. It is easy to administer, does not require reading or writing and sensitive to cognitive impairment. It involves patient naming as many animals possible within 60second time period. Farm animals, birds and fish were all considered animals(126). A score of less than 12 in educated individuals and less than 9 in individuals with no formal education, may indicate early signs of dementia or the development of cognitive impairment(124).

4.7.4 Word List Learning.

This is a test of verbal new learning ability. This free recall task assesses newly learned information. A 10-item word list was presented to the subject three times. Although the same words were used, the order of the item was varied at each(127). On the first trial, 10 printed words were presented at the rate of 1 every 2seconds. The subject was asked to recall as many as possible within 90seconds. On each of the 2 subsequent trials, the 10 words were
presented in a new random order and the subject will try to recall all 10. The maximum number of correct responses is 30 for the 3 trials(128). Sum recall will be the total number of words recalled across all three trials. Educated patients who recalled 15 or less words and non-educated who recalled 11 or less words may suggest cognitive impairment(124).

4.7.5. Word List Learning Delayed Recall

This test assesses the delayed memory for the 10 words presented in the word list learning over the 3 trials. Free recall of word list learning was assessed following a brief filled interval with administration of animal fluency test which is an interference task. It is designed to maximize the likelihood of poor performance in patients with dementia and minimize the likelihood of poor performance in normal elderly subject.(124). This is a test of short-term memory. The Delayed Word Recall score is the number of words recalled from the 10-word list after completing a brief interference task(127). The delayed word recall test required elaborative processing of to-be remembered words. The patient was asked to recall the 10 words given in the word list learning within 90seconds and delayed recall was assessed by the number of words that were correctly recalled out of the 10 word list after this time interval. The maximum score is 10. The cut-off score of 5 or less for educated and 4 or less for non-educated on delayed recall of word list may indicate memory impairment(124,129).

4.7.6 Instrumental Activities of Daily Living (IADL)

This instrument is used to assess the functional ability of older people. The instrument measures the complex activities of daily living including ability to use the telephone, shopping, housekeeping, ability to handle finances, mode of transportation, laundry and
responsibility for their medication. A summary score ranges from 0 (low function, dependent) to 8 (high function, independent)(130).

Participants with difficulties in at least one of all the eight IADL domains were regarded as being overall impaired in IADL if they had been involved in all domains assessed prior to assessment while for males, difficulty in at least one of the other five domains (excluding food preparation, housekeeping and laundering) was regarded as impaired if the male patient had not been involved in all the eight domains(130,131).

4.7.7 The Blessed Dementia Rating Scale

The Blessed Dementia Rating Scale was used to assess the progress and severity of dementia. The scale registers changes in managing daily activities such as misplacing and forgetting things, loss of cognition for people, and loss of bodily and toilet functions. First developed by British psychogeriatrician Gary Blessed in 1968. The Blessed Dementia Rating Scale (BDRS) assesses an elderly person's ability to perform activities of daily living(132). This was administered to the caregivers of patients.

This was used to evaluate the degree of functional impairment and to qualify participant’s level of independence or dependence. The Blessed Dementia Rating Scale is an 11 item scale that was used to measure participant’s dependence in instrumental and basic activities of daily living. Scores on the scale can range from 0-17 (Mild-0-5, Moderate-6-11, Severe-12-17) with higher scores indicating greater impairment(133). The higher the scores on the Blessed Dementia Rating Scale, the greater the degree of functional impairment in the patient(132).

4.7.8. Geriatric Depression Scale
This is a self-report scale for depressive disorders in the geriatric population. This is a 30 item questionnaire. The Geriatric Depression Scale (GDS) is a 30-item scale developed specifically for use in the elderly populations. It has been used extensively in the United States(134) as well as in other countries. This instrument has been used in Nigeria by a number of authors(14,15). It has been validated and used for screening of depression among elderly in both primary health care setting and in the community. It is a 30 item instrument and each of the questions has a yes/no answer. Scoring is dependent on the answer given with the highest possible score of 30 points. Scores on the scale can range from 0-30 (Normal -0-9, Mild-10-19, Severe-20-30). A previous study in Ibadan, Nigeria, observed the sensitivity of 84% and specificity of 95%(14).

4.8 ETHICAL CLEARANCE.

Ethical clearance for the study was obtained from the Joint Ethical Committee of the University of Ibadan and University College Hospital Ibadan. Informed consent was obtained from all participants. In a situation where participants were not able to give consent, proxy consent was taken from the care givers. The aims, objectives as well as the procedure was explained to them.

Anonymity was maintained as serial numbers and not names were used during the entire study period, form period of data collection to period of data analysis. The questionnaires were safely kept and only accessible to members of the research team.

The study was beneficial to the patients as those that were found to have cognitive impairment and depression were informed of the finding and appropriately referred for further assessment and treatment.
4.8.1 PROCEDURE

The interviewers in this study were the researcher and two research assistants. One of the research assistants is a resident doctor in psychiatry while the other is a dental practitioner. The project supervisor trained the researcher and research assistant on how to administer and interpret the questionnaires. The training was done for the researcher and research assistant in both English and Yoruba language. It was a week training consisting of an initial 2-day training by the supervisor, followed by a review with the researcher and research assistant after conducting interview in the field. Data collection was by the researcher and a research assistant after training by the study supervisor. The researcher and research assistant are proficient bilingual persons of Yoruba extraction with good command of both English and Yoruba languages. The research assistant is undergoing postgraduate training as a resident doctor in psychiatry. Field checks were made to ensure correct implementation of the protocol and full adherence to the interview format.

The participants were recruited at the reception after the nurses had checked their vital signs and while they were waiting to see the medical practitioner. Every consecutive patient who met the inclusion criteria was recruited into the study. The whole procedure was explained to the participants and informed consent taken. The researcher administered the Sociodemographic questionnaire, Mini Mental State Examination, Instrumental Activities of Daily Living, Blessed Dementia Rating Scale and Geriatric Depression Scale. The research assistant administered the Word List Learning, Word List Learning Delayed Recall and Animal Fluency.

After the patients had their vital signs checked, they were directed to a room where the researcher administered the questionnaire. They also moved to the second room to be interviewed by the research assistant who also administered the other questionnaires. The
dental practitioner was in the third room to count the number of teeth. The inter rater reliability was determined using kappa statistics and it was 0.8.

The sociodemographic questionnaire was used for sociodemographic and other related information. History of Diabetes, Hypertension and Musculoskeletal disease was by patient’s recollection. The cognitive status was assessed using Mini Mental State Examination (cognitive function), Word List Learning (Verbal New Learning Ability), Animal Fluency (Executive function), Word List Learning Delayed Recall (Delayed Memory). Functioning was assessed using Instrumental Activities of Daily Living, severity of dementia was assessed using Blessed Dementia Rating Scale while Geriatric Depression Scale was used to measure depression in the study. These instruments have been used and validated in previous Nigerian studies.

The cognitive function was assessed and grouped into normal cognition, dementia and mild cognitive impairment. A diagnosis of dementia was made using the International Classification of Diseases 10th Edition (ICD 10) Classification of Mental and Behavioural Disorders, Diagnostic Criteria for research. A diagnosis of Mild Cognitive Impairment was made using Peterson criteria, if there was impairment in memory with particular emphasis on Delayed Word List Learning and Mini Mental State examination Score, objective memory disorder, memory problem corroborated by informant, no impairment in Instrumental Activities of Daily Living scale and the patient does not meet criteria for dementia (Peterson criteria)(30).

Mild Cognitive Impairment and Dementia are clinical diagnosis which were substantiated by the questionnaires. The questionnaires were used to substantiate presence of symptoms and the cut off points were considered in diagnosis. Diagnosis of dementia include impairment in Instrumental Activities of Daily Living as well as impairment in Blessed Dementia Rating
Scale. However, mild cognitive impairment is a less severe form and had no impairment in Instrumental Activities of Daily Living as well as Blessed Dementia Rating Scale. The severity of dementia was assessed and graded using the scores on Blessed Dementia Rating Scale (Mild, Moderate, and Severe). Depressive symptoms were assessed using Geriatric Depression Scale which is a 30 item questionnaire.

Dental examination was carried out in the geriatric outpatient clinic by the dental practitioner. This was done in a separate room with patient properly screened during the procedure. The patient sat comfortably in a reclined position so that the examiner was able to view the upper jaw and lower jaw when patient’s mouth was open. Dental examination was done under artificial light using sterile gloves and wooden spatula with patient’s mouth opened to assess the number of teeth present in the mouth and the number of missing tooth or teeth. The mouth was divided into four quadrant - upper right and left quadrants in the upper jaw and lower right and left quadrants in the lower jaw. The examination commenced from midline backwards starting from upper right quadrant then proceeding in a clockwise manner to view the other quadrants sequentially. The number of teeth present or missing were counted. Dental examination lasted 5 minutes. Missing tooth occurs when no part of tooth is visible in the gum and when confirmed it is lost. A tooth is regarded as present when part of it is visible in the gum. The patient was subsequently taken back to the clinic reception.

The study spanned six months from 1st August 2016 to 13th January 2017.

4.8.2 PILOT STUDY

All instruments of data collection used were pretested among 30 (10% of the sample size) patients from the Adeoyo Hospital, Ibadan. The aim of this pilot study was to determine ease of application of instruments, the inter-rater reliability between the researcher and the research assistant administering the questionnaires, appropriateness of the questions, time to
completion of interview and to know how comfortable the patient will be bearing in mind the peculiarity of this age group. It was also used to identify potential difficulties and other issues that may warrant adjustment in the questionnaire.

The pilot study revealed that the average time required for administration of all the questionnaires and this was approximately 45-50 minutes. The inter-rater reliability was determined using kappa statistics and it was 0.86. The study revealed that over half of the participants had normal cognition compared with those who had mild cognitive impairment and dementia. It also revealed that over half of the patients had lost at least one tooth.

4.9 DATA MANAGEMENT AND STATISTICAL ANALYSIS.

Data entry and analysis was done using Statistical Package for Social Sciences (SPSS) version 21. The results are presented using descriptive and inferential statistical methods.

Summary statistics such as means, frequency tables and standard deviations are also produced. The prevalence of mild cognitive impairment, dementia and depression were determined.

The variables were grouped into dependent and independent variables. The dependent variables were mild cognitive impairment, dementia and tooth loss. The independent variable was sociodemographic characteristics. Continuous variables were analysed using t test or ANOVA as appropriate. Sociodemographic variables were analysed by chi square statistics. Association between categorical variables were calculated using chi square test and mean values were compared using t test and ANOVA.

Patients’ sociodemographic correlates with mild cognitive impairment, depression and dementia were analysed by chisquare statistics. Relationship between number of tooth loss
and sociodemographic characteristics was measured using independent t test and the ANOVA where applicable. Relationship between number of tooth loss and clinical characteristics of patients was measured using t test. Level of statistical significance was set at p < 0.05.

Continuous variables were analysed using t test to compare mean difference of neurocognitive test scores for patients with mild cognitive impairment and those with normal cognition. T test was used to compare mean difference of neurocognitive test scores for patients with dementia and those with normal cognition.

Correlation analysis was done between neurocognitive test scores and tooth loss. This was done to determine the relationship between the neurocognitive test and tooth loss. Logistic regression analysis was used to identify independent and confounding factors for tooth loss.
RESULTS

5.1 Sociodemographic and Clinical Characteristics of patients (Table 1)

A total of 300 patients who met the criteria and gave consent were interviewed for this study. The age of the patients ranged from 60 to 98 years with mean (SD) 70.17 (7.22) years. In all, 64% of the patients were females compared with 36% who were males.

About 60% of the patients were married compared with 40% that were not currently married (35% were widowed and 5% were separated (see Table 1). About 6 in 10 of the patients were living with their spouses compared with 2 in 10 living with the children. A total of 20.3% had no formal education compared with 79.7% that had at least primary education. About 73.7% of patients were not currently employed compared with 26.3% who were currently employed. The clinical characteristics showed that six in ten of the patients had a past medical history of hypertension compared with a quarter who had musculoskeletal disease, as shown in Table 1

The mean (SD) number of tooth loss was 2.53 (4.87) for the patients. About 94% of patients had at least 10 teeth remaining compared with 6% that had less than 10 teeth remaining.

Table 1: Sociodemographic and Clinical Characteristics of patients
<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency (N = 300)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 -69 years</td>
<td>153</td>
<td>51.0</td>
</tr>
<tr>
<td>70 – 79 years</td>
<td>114</td>
<td>38.0</td>
</tr>
<tr>
<td>≥ 80 years</td>
<td>33</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>108</td>
<td>36.0</td>
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<tr>
<td>Female</td>
<td>192</td>
<td>64.0</td>
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<td></td>
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<tr>
<td>Currently married</td>
<td>180</td>
<td>60.0</td>
</tr>
<tr>
<td>Not currently married</td>
<td>120</td>
<td>40.0</td>
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<td>(Separated/Widowed/Divorced)</td>
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<td></td>
</tr>
<tr>
<td><strong>Living conditions</strong></td>
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<td></td>
</tr>
<tr>
<td>Alone</td>
<td>55</td>
<td>18.3</td>
</tr>
<tr>
<td>With spouse</td>
<td>171</td>
<td>57.0</td>
</tr>
<tr>
<td>Children</td>
<td>65</td>
<td>21.7</td>
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<tr>
<td>Others</td>
<td>9</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Years of education</strong></td>
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<td></td>
</tr>
<tr>
<td>No formal Education</td>
<td>61</td>
<td>20.3</td>
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<tr>
<td>Primary</td>
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<td>31.7</td>
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<tr>
<td>Secondary</td>
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<td>17.7</td>
</tr>
<tr>
<td>Tertiary</td>
<td>91</td>
<td>30.3</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
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<td></td>
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<tr>
<td>Currently employed</td>
<td>79</td>
<td>26.3</td>
</tr>
<tr>
<td>Not currently employed</td>
<td>121</td>
<td>73.7</td>
</tr>
</tbody>
</table>
5.2 Prevalence of Mild Cognitive Impairment and Dementia (Table 2).

A total of 24 out of 300 had mild cognitive impairment compared with 264 out of 300 that had normal cognitive function. The prevalence of mild cognitive impairment in the study was 8.0% (see Table 2).

A total of 12 out of 300 had dementia compared with 264 out of 300 that had normal cognitive function. The prevalence of dementia in this study was 4.0% (see Table 2). The mean (SD) Blessed Dementia Rating Score (BDRS) was 4.20 (1.23). Figure 1 shows 25.0% of the patients had mild dementia, 66.7% had moderate dementia, while 8.3% had severe dementia. Score range for Mild dementia (0-5), Moderate dementia (6-11), severe dementia (12-17).
Table 2: Prevalence of Mild Cognitive Impairment and Dementia

<table>
<thead>
<tr>
<th>Cognitive status</th>
<th>Frequency (N=300)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>264 (n)</td>
<td>88.0</td>
</tr>
<tr>
<td>Mild Cognitive Impairment</td>
<td>24 (n)</td>
<td>8.0</td>
</tr>
<tr>
<td>Dementia</td>
<td>12 (n)</td>
<td>4.0</td>
</tr>
</tbody>
</table>
SEVERITY OF DEMENTIA (FIGURE 1)
Figure 1: Severity of dementia

Mild Dementia = BDRS Score 0-5

Moderate Dementia = BDRS Score 6-11

Severe Dementia = BDRS Score 12-17

5.3 Prevalence of Depressive symptoms
A total of 58 out of 300 had depressive symptoms compared with 242 out of 300 who had no depressive symptoms. The prevalence of depressive symptoms in the study was 19.3%. The mean (SD) score for depressive symptom was 14.19(4.08) compared with 3.28(2.45) for those without depressive symptom.

PREVALENCE OF DEPRESSIVE SYMPTOMS AMONG PATIENTS (FIGURE 2)
Figure 2: Prevalence of Depressive symptoms among patients.

Score 0-9 Normal
Score 10-19 Moderate
Score 20-30 Severe

5.4 Relationship between mild cognitive impairment, sociodemographic and clinical characteristics (Table 3)
A total of 24 patients had mild cognitive impairment compared with 264 patients with normal cognition. About 6.7% of patients with mild cognitive impairment were aged 60 to 69 years compared with 8.3% aged 70 to 79 years and 16.1% aged ≥ 80 years, p = 0.23 (see Table 3). About 9.2% of the patients who had mild cognitive impairment were females compared with 6.7% who were males, p = 0.46. Also 10.5% of those with cognitive impairment were not currently married compared with the 6.9% of the currently married group.

Among patients with mild cognitive impairment, 14.5% of the patients were living with children compared with 5.9% living alone and 7.2% living with the spouse. About 7.2% of those with mild cognitive impairment were not currently employed compared with 11.4% that were currently employed, p= 0.85, as shown on Table 3.

There was a significant relationship between mild cognitive impairment and educational status. About 14.1% of patients with mild cognitive impairment had primary school education compared with 10.3% with no formal education, 6.0% with secondary education and 2.3% with tertiary education, p=0.03

Regarding the clinical characteristics, there was a significant relationship between mild cognitive impairment and past history of musculoskeletal disease. About 13.8% of those with mild cognitive impairment had past history of musculoskeletal disease compared with 6.2% with no past history, p=0.04. However, there was no significant relationship between mild cognitive impairment, past history of diabetes (p=0.50) and past history of hypertension (p=0.75), as shown on Table 3.

About 8.9% of those with mild cognitive impairment had ≥10 teeth remaining compared with 0.0% having < 10 teeth remaining, p=0.20.

Table 3: Relationship between mild cognitive impairment, sociodemographic and clinical characteristics.
<table>
<thead>
<tr>
<th>Variables</th>
<th>No impairment</th>
<th>Mild Cognitive Impairment</th>
<th>X²</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=264 n (%)</td>
<td>N=24 n(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age( years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 – 69</td>
<td>139 (93.3)</td>
<td>10 (6.7)</td>
<td>2.98</td>
<td>0.23</td>
</tr>
<tr>
<td>70 – 79</td>
<td>99 (91.7)</td>
<td>9 (8.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 80</td>
<td>26 (83.9)</td>
<td>5 (16.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>97 (93.3)</td>
<td>7 (6.7)</td>
<td>0.55</td>
<td>0.46</td>
</tr>
<tr>
<td>Females</td>
<td>167 (90.8)</td>
<td>17 (9.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not currently married</td>
<td>102 (89.5)</td>
<td>12 (10.5)</td>
<td>1.19</td>
<td>0.28</td>
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<tr>
<td>Currently Married</td>
<td>162 (93.1)</td>
<td>12 (6.9)</td>
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<td>Living conditions</td>
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</tr>
<tr>
<td>Alone</td>
<td>48 (94.1)</td>
<td>3 (5.9)</td>
<td>4.59</td>
<td>0.21</td>
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<tr>
<td>With spouse</td>
<td>154 (92.8)</td>
<td>12 (7.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>53 (85.5)</td>
<td>9 (14.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>9 (100.0)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Education</td>
<td>52 (89.7)</td>
<td>6 (10.3)</td>
<td>8.92</td>
<td>0.03</td>
</tr>
<tr>
<td>Primary</td>
<td>79 (85.9)</td>
<td>13 (14.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>47 (94.0)</td>
<td>3 (6.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>86 (97.7)</td>
<td>2 (2.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently employed</td>
<td>70 (88.6)</td>
<td>9 (11.4)</td>
<td>1.33</td>
<td>0.25</td>
</tr>
<tr>
<td>Not currently employed</td>
<td>194 (92.8)</td>
<td>15 (7.2)</td>
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</tr>
<tr>
<td>Clinical characteristics</td>
<td></td>
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</tr>
<tr>
<td>Past history of Diabetes</td>
<td></td>
<td></td>
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<td>61 (89.7)</td>
<td>7 (10.3)</td>
<td>0.45</td>
<td>0.50</td>
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<tr>
<td>No</td>
<td>203 (92.3)</td>
<td>17 (7.7)</td>
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<tr>
<td>History of Hypertension</td>
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<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
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<tr>
<td>----------------</td>
<td>--------------</td>
<td>-------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>History of Musculoskeletal disease</strong></td>
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</tr>
<tr>
<td>Yes</td>
<td>156 (87.2)</td>
<td>15 (8.8)</td>
<td>0.11</td>
<td>0.75</td>
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<td>108 (89.3)</td>
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<td><strong>Tooth Present</strong></td>
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<tr>
<td>≥ 10</td>
<td>247 (91.1)</td>
<td>24 (8.9)</td>
<td>1.64</td>
<td>0.20</td>
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<tr>
<td>&lt; 10</td>
<td>17 (100.0)</td>
<td>0 (0.0)</td>
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<td></td>
</tr>
</tbody>
</table>

p value significant at p < 0.05

**5.5 Logistic Regression for Mild Cognitive Impairment (Table 4)**

Variables such as educational status and history of musculoskeletal disease that were significantly associated with mild cognitive impairment in patients on univariate analysis (Chi square) were modelled into logistic regression model to ascertain their association with mild cognitive impairment.

On regression analysis, the odds that those having primary education would have mild cognitive impairment when compared to those with tertiary education was 6.57 (CI 1.43-30.21), p=0.02. The odds that those having no formal education would have mild cognitive impairment when compared to those with tertiary education was 4.72 (CI 0.91-24.41), p=0.06.
Table 4: Logistic Regression for Mild Cognitive Impairment

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td><strong>Educational status</strong></td>
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</tr>
<tr>
<td>No formal education</td>
<td>4.72</td>
<td>0.92-24.41</td>
<td>0.06</td>
</tr>
<tr>
<td>Primary education</td>
<td>6.57</td>
<td>1.43-30.21</td>
<td><strong>0.02</strong></td>
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<tr>
<td>Secondary education</td>
<td>2.91</td>
<td>0.47-18.11</td>
<td>0.25</td>
</tr>
<tr>
<td>Tertiary Education</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td><strong>Musculoskeletal disease</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.48</td>
<td>0.20-1.13</td>
<td>0.09</td>
</tr>
</tbody>
</table>
5.6 Relationship between sociodemographic, clinical characteristics and dementia (Table 5)

About 2.8% of patients with dementia were aged 60 to 69 years compared with 5.7% in those aged 70 to 79 years and 7.1% in those aged ≥ 80 years, p= 0.40 (see Table 5). About 4.6% of the patients with dementia were females compared with 4.0% who were males. A total of 5.6% of patients with dementia were not currently married compared with 3.6% that were currently married, p=0.43.

However, there was a significant relationship between employment status and dementia. About 6 in 10 of those with dementia were not currently employed, compared with 0 in 10 that were currently employed, p=0.04.
There was no statistically significant relationship between dementia, and clinical characteristics such as history of hypertension (p=0.61), history of diabetes (p=0.91), history of musculoskeletal disease (p=0.68). About 4.3% of patients with dementia had $\geq 10$ teeth remaining compared with 5.6% who had $<10$ teeth remaining, p=0.56 (see Table 5).

Table 5: Relationship between sociodemographic, clinical characteristics and dementia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Absent</th>
<th>Present</th>
<th>$X^2$</th>
<th>P value</th>
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<td>N=264</td>
<td>N=12</td>
<td></td>
<td></td>
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<tr>
<td>n(%)</td>
<td>n(%)</td>
<td></td>
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</tr>
<tr>
<td>Age(years)</td>
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<td></td>
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<tr>
<td>60 – 69</td>
<td>139 (97.2)</td>
<td>4 (2.8)</td>
<td>1.82</td>
<td>0.40</td>
</tr>
<tr>
<td>70 – 79</td>
<td>99 (94.3)</td>
<td>6 (5.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\geq 80$</td>
<td>26 (92.9)</td>
<td>2 (7.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>97 (96.0)</td>
<td>4 (4.0)</td>
<td>0.06</td>
<td>0.81</td>
</tr>
<tr>
<td>Females</td>
<td>167 (95.4)</td>
<td>8 (4.6)</td>
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</tr>
<tr>
<td>Marital Status</td>
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<td>Currently Married</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>102 (94.4)</td>
<td>162 (96.4)</td>
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<table>
<thead>
<tr>
<th>Living conditions</th>
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</thead>
<tbody>
<tr>
<td>Alone</td>
<td>48 (92.3)</td>
<td>154 (96.9)</td>
</tr>
<tr>
<td>With spouse</td>
<td>4 (7.7)</td>
<td>5 (3.1)</td>
</tr>
<tr>
<td>Children</td>
<td>53 (94.6)</td>
<td>3 (5.4)</td>
</tr>
<tr>
<td>Others</td>
<td>9 (100.0)</td>
<td>0 (0.0)</td>
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<table>
<thead>
<tr>
<th>Years of education</th>
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</tr>
</thead>
<tbody>
<tr>
<td>No Education</td>
<td>52 (94.5)</td>
<td>79 (96.3)</td>
</tr>
<tr>
<td>Primary</td>
<td>3 (5.5)</td>
<td>3 (3.7)</td>
</tr>
<tr>
<td>Secondary</td>
<td>47 (94.0)</td>
<td>3 (6.0)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>86 (96.6)</td>
<td>3 (3.4)</td>
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<table>
<thead>
<tr>
<th>Employment status</th>
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</thead>
<tbody>
<tr>
<td>Currently employed</td>
<td>70 (100.0)</td>
<td>194 (94.2)</td>
</tr>
<tr>
<td>Not currently employed</td>
<td>194 (94.2)</td>
<td>12 (5.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical Characteristics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>History of Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>61 (95.3)</td>
<td>203 (95.8)</td>
</tr>
<tr>
<td>No</td>
<td>3 (4.7)</td>
<td>9 (4.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History of Hypertension</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>156 (95.1)</td>
<td>108 (96.4)</td>
</tr>
<tr>
<td>No</td>
<td>8 (4.9)</td>
<td>4 (3.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History of Musculoskeletal disease</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>69 (94.5)</td>
<td>195 (96.1)</td>
</tr>
<tr>
<td>No</td>
<td>4 (5.5)</td>
<td>8 (3.9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tooth Present</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 10</td>
<td>247 (95.7)</td>
<td>11 (4.3)</td>
</tr>
<tr>
<td>&lt; 10</td>
<td>17 (94.4)</td>
<td>1 (5.6)</td>
</tr>
</tbody>
</table>
p value significant at p < 0.05

5.7 Relationship between and sociodemographic, clinical characteristics and depressive symptoms (Table 6)

Table 7 shows the relationship between the sociodemographic characteristics of patients and depressive symptoms. A total of 58 patients had depressive symptoms compared with 242 out of 300 who had no depressive symptoms. Among the patients with depressive symptoms, 20.9% of them were aged 60 to 69 years, 20.2% were aged 70 to 79 years while 9.1% were aged ≥ 80 years. Also 20.3% of those with depressive symptoms were females compared with 17.6% who were males (see Table 7).

There was a significant relationship between depressive symptoms and clinical characteristics such as history of hypertension, p= 0.01. Similarly, there was a significant relationship between depressive symptoms and history of musculoskeletal disease, p<0.001. About 19.5% of patients with depressive symptoms had ≥ 10 teeth remaining compared with 16.7% who had <10 teeth remaining, p=0.77 (see Table 7).
Table 6: Relationship between sociodemographic, clinical characteristics and depressive symptoms

<table>
<thead>
<tr>
<th>Variables</th>
<th>Absent</th>
<th>Present</th>
<th>(X^2)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=242</td>
<td>N=58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n(%)</td>
<td>n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 – 69</td>
<td>121 (79.1)</td>
<td>32 (20.9)</td>
<td>2.52</td>
<td>0.28</td>
</tr>
<tr>
<td>70 – 79</td>
<td>91 (79.8)</td>
<td>23 (20.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥80</td>
<td>30 (90.9)</td>
<td>3 (9.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>89 (82.4)</td>
<td>19 (17.6)</td>
<td>0.33</td>
<td>0.57</td>
</tr>
<tr>
<td>Females</td>
<td>153 (79.7)</td>
<td>39 (20.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not currently married</td>
<td>93 (77.5)</td>
<td>27 (22.5)</td>
<td>1.29</td>
<td>0.26</td>
</tr>
<tr>
<td>Currently Married</td>
<td>149 (82.8)</td>
<td>31 (17.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Living conditions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>46 (83.6)</td>
<td>9 (16.4)</td>
<td>1.69</td>
<td>0.64</td>
</tr>
<tr>
<td>With spouse</td>
<td>139 (81.3)</td>
<td>32 (18.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With children</td>
<td>51 (78.5)</td>
<td>14 (21.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>6 (66.7)</td>
<td>3 (33.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Years of education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>49 (80.3)</td>
<td>12 (19.7)</td>
<td>0.84</td>
<td>0.84</td>
</tr>
<tr>
<td>Primary</td>
<td>74 (77.9)</td>
<td>21 (22.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>44 (83.0)</td>
<td>9 (17.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>75 (82.4)</td>
<td>16 (17.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Employment status       |              |              |         |         |

73
<table>
<thead>
<tr>
<th>Currently employed</th>
<th>Not currently employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 (79.7)</td>
<td>179 (81.0)</td>
</tr>
<tr>
<td>16 (20.3)</td>
<td>42 (19.0)</td>
</tr>
</tbody>
</table>

**Clinical Characteristics**

**History of Diabetes**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 (77.5)</td>
<td>187 (81.7)</td>
</tr>
<tr>
<td>16 (22.5)</td>
<td>42 (18.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>136 (76.0)</td>
<td>106 (87.6)</td>
</tr>
<tr>
<td>43 (24.0)</td>
<td>15 (12.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 (59.5)</td>
<td>192 (88.9)</td>
</tr>
<tr>
<td>34 (40.5)</td>
<td>24 (11.1)</td>
</tr>
</tbody>
</table>

**Tooth Present**

<table>
<thead>
<tr>
<th>≥ 10</th>
<th>&lt;10</th>
</tr>
</thead>
<tbody>
<tr>
<td>227 (80.5)</td>
<td>15 (80.8)</td>
</tr>
<tr>
<td>55 (19.5)</td>
<td>3 (16.7)</td>
</tr>
</tbody>
</table>

p value significant at p < 0.05

**5.8 Logistic Regression for Depressive symptoms (Table 7)**

Variables such as history of hypertension and history of musculoskeletal disease that were significantly associated with depressive symptoms in the participants on univariate analysis (Chi square) were modelled into the logistic regression model to ascertain their association with depressive symptoms.

On regression analysis, the odds that those having history of hypertension would have depressive symptoms when compared to those without history of hypertension was 0.53 (CI: 0.27-1.04), p=0.06. The odds that those having history of musculoskeletal disease would have
depressive symptoms when compared to those without history of musculoskeletal disease was 0.19 (CI: 0.11-0.36), p=< 0.001(see Table 7).

Table 7: Logistic Regression for Depressive symptoms.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypertension</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.53</td>
<td>0.27 – 1.04</td>
<td>0.06</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Musculoskeletal disease</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.19</td>
<td>0.11 – 0.36</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
5.9 Relationship between mild cognitive impairment and depressive symptoms

There was a significant relationship between mild cognitive impairment and depressive symptoms, p<0.001. Among the patients with mild cognitive impairment, 13.8% had depressive symptoms compared with 6.7% without depressive symptoms, p<0.001.
5.10 Relationship between number of tooth loss and sociodemographic characteristics (Table 8)

Table 8 shows the relationship between the number of tooth loss and the sociodemographic characteristics of the patients. The mean (SD) of tooth loss for patients aged 60 to 69 years was 1.95(4.26) compared with patients aged 70 to 79 years with mean (SD) 2.32(3.89) and 7.27 (7.27) for patients aged ≥ 80 years. There was significant relationship between number of tooth loss and the advancing age, p=0.001. Post-hoc multiple pairwise comparison shows that the significant difference was due to a higher number of tooth loss among patients ≥ 80
years compared to those aged 60-69 years, p< 0.001, and those aged 70-79 years, p<0.001. Patients who were not currently employed had mean (SD) tooth loss of 2.54(4.39) compared with the patients who were currently employed 2.15(5.28), p= 0.53.

There was no significant relationship between number of tooth loss and medical history of diabetes or musculoskeletal disorder. However there was significant relationship between number of tooth loss and medical history of hypertension, p=0.04 (see Table 8).

Table 8: Relationship between number of tooth loss and sociodemographic characteristics.

<table>
<thead>
<tr>
<th>Age(years)</th>
<th>Number of tooth loss Mean (SD)</th>
<th>t / F</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 – 69</td>
<td>1.95 (4.26)</td>
<td>6.66f</td>
<td>0.001</td>
</tr>
<tr>
<td>70 – 79</td>
<td>2.32 (3.89)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 80</td>
<td>7.27 (7.27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Females</td>
<td>Marital Status</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Gender</td>
<td>2.59 (4.85)</td>
<td>2.35 (4.53)</td>
<td>Not currently married</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Currently married</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>1.47 (2.67)</td>
<td>2.02f</td>
<td></td>
</tr>
<tr>
<td>With spouse</td>
<td>2.41 (4.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>2.97 (4.81)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>5.00 (8.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of education</td>
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<td></td>
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<tr>
<td>No formal Education</td>
<td>3.23 (5.67)</td>
<td>1.12f</td>
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</tr>
<tr>
<td>Primary</td>
<td>2.07 (4.38)</td>
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<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>2.83 (5.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>2.05 (3.29)</td>
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<td></td>
</tr>
<tr>
<td>Employment status</td>
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<td></td>
</tr>
<tr>
<td>Currently employed</td>
<td>2.15 (5.28)</td>
<td>-0.64</td>
<td></td>
</tr>
<tr>
<td>Not currently employed</td>
<td>2.54 (4.39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical Characteristics</td>
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</tr>
<tr>
<td>History of diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.96 (3.49)</td>
<td>-0.99</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.59 (4.94)</td>
<td></td>
<td></td>
</tr>
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<td>History of Hypertension</td>
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<td></td>
</tr>
<tr>
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<td>3.07 (5.14)</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.01 (4.23)</td>
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<td></td>
</tr>
<tr>
<td>History of Musculoskeletal disease</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.99 (3.21)</td>
<td>-1.05</td>
<td>0.29</td>
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<tr>
<td>No</td>
<td>2.61 (5.08)</td>
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<td></td>
</tr>
</tbody>
</table>

$F = \text{ANOVA}$

p value significant at p< 0.05
5.11 Relationship between number of tooth loss and other clinical characteristics of patients

Table 9 shows the relationship between number of tooth loss and the clinical characteristics of patients. Patients with mild cognitive impairment had mean (SD) tooth loss 2.69 (4.55) compared with 2.40 (4.66) for those with normal cognition, p=0.72.

In patients with dementia, the mean (SD) tooth loss was 4.42(6.99) compared with 2.40 (4.66) for those with normal cognition, p=0.13. Patients with depressive symptoms had mean (SD) tooth loss 2.28(4.12) compared with 2.48 (4.76) in those without depressive symptoms.
Table 9: Relationship between number of tooth loss and clinical characteristics of patients

<table>
<thead>
<tr>
<th></th>
<th>Number of tooth loss</th>
<th>t</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cognitive impairment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal cognition</td>
<td>2.40 (4.66)</td>
<td>-0.36</td>
<td>0.72</td>
</tr>
<tr>
<td>Mild Cognitive Impairment</td>
<td>2.69 (4.55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dementia</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal cognition</td>
<td>2.40 (4.66)</td>
<td>-1.51</td>
<td>0.13</td>
</tr>
<tr>
<td>Dementia</td>
<td>4.42 (6.99)</td>
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<td></td>
</tr>
<tr>
<td><strong>Depressive symptoms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>2.48 (4.76)</td>
<td>0.29</td>
<td>0.77</td>
</tr>
<tr>
<td>Present</td>
<td>2.28 (4.12)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p value significant at p<0.05
5.12 Neurocognitive Test for Mild Cognitive Impairment (MCI) (Table 10)

Table 10 shows the neurocognitive test for mild cognitive impairment. The Mini Mental State Examination (MMSE) score in patients with cognitive impairment with mean (SD) 17.47 (4.52) was significantly lower when compared to patients with normal cognition, mean (SD) 26.00 (3.32) with \( p < 0.001 \). Word List Learning Delayed Recall mean (SD) score 2.83 (1.86) was significantly lower in those with cognitive impairment compared with 4.44 (1.97) in those with normal cognition. The animal fluency mean (SD) 7.72 (4.95) was significantly lower in patients with cognitive impairment compared with 11.12 (4.42) in those with normal cognition (see Table 10).
Table 10: Neurocognitive Test for Mild Cognitive Impairment (MCI)

<table>
<thead>
<tr>
<th>MILD COGNITIVE IMPAIRMENT</th>
<th>NORMAL</th>
<th>MCI</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>26.00 (3.32)</td>
<td>17.47 (4.52)</td>
<td>10.94</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ANIMAL FLUENCY</td>
<td>11.12 (4.42)</td>
<td>7.72 (4.95)</td>
<td>4.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WORD LIST LEARNING</td>
<td>14.78 (4.75)</td>
<td>11.64 (5.40)</td>
<td>3.66</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WORD LIST LEARNING DELAYED</td>
<td>4.44 (1.97)</td>
<td>2.83 (1.86)</td>
<td>4.60</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>INSTRUMENTAL ACTIVITIES OF</td>
<td>7.77 (0.50)</td>
<td>6.05 (1.97)</td>
<td>5.19</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DAILY LIVING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

p value significant at p < 0.05
5.13 Relationship between neurocognitive test score and tooth loss (Table 11)

Table 11 shows the relationship between neurocognitive test score and the tooth loss.

Mini Mental State Examination (MMSE) score (mean (SD)) was 24.84 (4.73) for patients who have lost at least a tooth compared with 25.08 (4.26) in patients who haven’t lost any tooth, p= 0.64.

In the Blessed Dementia Rating Score (BDRS), patients who have lost at least one tooth had mean (SD) score of 0.49 (1.06) compared with 0.37 (0.97) in patients who haven’t lost any tooth, p=0.32.

In the Geriatric Depression Score (GDS), patients who have lost at least one tooth had mean (SD) score of 5.42 (5.29) compared with 5.35 (4.99) in patients who haven’t lost any tooth, p=0.91.
Table 1: Relationship between neurocognitive test score and tooth loss

<table>
<thead>
<tr>
<th></th>
<th>No tooth loss</th>
<th>≥1 tooth loss</th>
<th>t</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>25.08 (4.26)</td>
<td>24.84 (4.73)</td>
<td>0.47</td>
<td>0.64</td>
</tr>
<tr>
<td>ANIMAL FLUENCY</td>
<td>10.73 (4.45)</td>
<td>10.70 (4.74)</td>
<td>0.06</td>
<td>0.95</td>
</tr>
<tr>
<td>WORD LIST LEARNING</td>
<td>14.90 (4.76)</td>
<td>14.06 (5.03)</td>
<td>1.45</td>
<td>0.15</td>
</tr>
<tr>
<td>WORD LIST LEARNING DELAYED RECALL</td>
<td>4.39 (1.89)</td>
<td>4.14 (2.11)</td>
<td>1.05</td>
<td>0.29</td>
</tr>
<tr>
<td>INSTRUMENTAL ACTIVITIES OF DAILY LIVING</td>
<td>7.63 (0.91)</td>
<td>7.52 (1.05)</td>
<td>0.91</td>
<td>0.36</td>
</tr>
<tr>
<td>BLESSED DEMENTIA RATING SCALE</td>
<td>0.37 (0.97)</td>
<td>0.49 (1.06)</td>
<td>-1.00</td>
<td>0.32</td>
</tr>
</tbody>
</table>
5.14 Relationship between neurocognitive test score and number of teeth remaining (Table 12)

Table 12 shows the relationship between neurocognitive test score and the number of teeth remaining. Mini Mental State Examination (MMSE) score (mean (SD)) was 24.00(0.00) for those who had no teeth remaining compared to 24.94 (4.47) for those who had more than 20 teeth remaining, p=0.78.

Instrumental Activities of Daily Living (IADL) score (mean (SD)) was 7.00(0.00) for those who had no teeth remaining compared to 7.57 (0.99) for those who had more than 20 teeth remaining, p=0.20.

Blessed Dementia Rating Score (BDRS) (mean (SD)) was 2.50(0.00) for those who had no teeth remaining compared to 0.43(1.02) for those who had more than 20 teeth remaining, p=0.08
Table 12: Relationship between neurocognitive test score and number of teeth remaining

<table>
<thead>
<tr>
<th>Teeth remaining</th>
<th>Mean (SD)</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MMSE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>24.00 (0.00)</td>
<td>0.75</td>
<td>0.78</td>
</tr>
<tr>
<td>1-10</td>
<td>25.60 (3.91)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>26.57 (4.65)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;20</td>
<td>24.94 (4.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ANIMAL FLUENCY</strong></td>
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<td></td>
</tr>
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<td>0.66</td>
<td>0.90</td>
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<tr>
<td>1-10</td>
<td>25.60 (2.41)</td>
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<tr>
<td>11-20</td>
<td>26.57 (2.43)</td>
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<td></td>
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<tr>
<td>&gt;20</td>
<td>24.94 (4.68)</td>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>LEARNING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>1-10</td>
<td>11-20</td>
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<tr>
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<td>-----------</td>
</tr>
<tr>
<td><strong>WORDLIST</strong></td>
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<td>9.00 (0.00)</td>
<td>15.20 (5.02)</td>
</tr>
<tr>
<td><strong>LEARNING</strong></td>
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<td>4.00 (0.00)</td>
<td>4.80 (0.84)</td>
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<tr>
<td><strong>DELAYED RECALL</strong></td>
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<td>4.00 (0.00)</td>
<td>15.20 (5.02)</td>
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<tr>
<td><strong>INSTRUMENTAL</strong></td>
<td>None</td>
<td>7.00 (0.00)</td>
<td>7.00 (1.73)</td>
</tr>
<tr>
<td><strong>ACTIVITIES OF DAILY LIVING</strong></td>
<td>None</td>
<td>7.00 (0.00)</td>
<td>7.00 (1.73)</td>
</tr>
<tr>
<td><strong>BLESSED</strong></td>
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<td>2.50 (0.00)</td>
<td>1.00 (1.41)</td>
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<tr>
<td><strong>DEMENTIA RATING</strong></td>
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<td>3.00 (0.00)</td>
<td>4.80 (3.27)</td>
</tr>
<tr>
<td><strong>SCALE</strong></td>
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<td>2.50 (0.00)</td>
<td>1.00 (1.41)</td>
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<tr>
<td><strong>GERIATRIC</strong></td>
<td>None</td>
<td>3.00 (0.00)</td>
<td>4.80 (3.27)</td>
</tr>
</tbody>
</table>
Table 13 shows the Pearson correlation between the clinical characteristics of the patients and tooth loss. Pearson correlation was significant at p = 0.007 and p = 0.001. There was a negative correlation between tooth loss and instrumental activities of daily living score, Pearson correlation = -0.15, p = 0.007. There was however a positive correlation between tooth loss and blessed dementia score, Pearson correlation = 0.19, p = 0.001 (see Table 13).
Table 13: Correlation between Clinical characteristics and tooth loss

<table>
<thead>
<tr>
<th></th>
<th>Pearson Correlation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toothloss</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MMSE score</td>
<td>-0.05</td>
<td>0.36</td>
</tr>
<tr>
<td>AnimalFluency score</td>
<td>-0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>WordList Learning score</td>
<td>-0.02</td>
<td>0.70</td>
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<tr>
<td>DelayedRecall Score</td>
<td>0.02</td>
<td>0.73</td>
</tr>
<tr>
<td>IADL score</td>
<td>-0.15</td>
<td>0.007</td>
</tr>
</tbody>
</table>
BDRS score   Pearson Correlation   0.19
             p value              0.001

GDS score   Pearson Correlation   -0.03
             p value              0.66

Pearson Correlation significant at p value < 0.05

5.16 Linear Regression Analysis for Tooth Loss (Table 14)

In the univariate analysis, variables such as the age (p=0.001), history of hypertension (p=0.04), Instrumental Activities of Daily Living score (IADL) (p=0.007), Blessed Dementia Rating Score (BDRS) (p=0.001) were significantly associated with toothloss. Further analysis on the linear regression shows a significant relationship between tooth loss and age p=0.009, history of hypertension p=0.04 and BDRS p=0.001.
### Table 14: Linear Regression Analysis for Tooth Loss

<table>
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<tr>
<th></th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>95% CI</th>
<th>p value</th>
</tr>
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<tr>
<td></td>
<td>(B)</td>
<td>(B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.09</td>
<td>0.15</td>
<td>0.02 – 0.17</td>
<td>0.009</td>
</tr>
<tr>
<td>History of Hypertension</td>
<td>1.08</td>
<td>0.12</td>
<td>0.04 – 2.13</td>
<td>0.04</td>
</tr>
<tr>
<td>IADL Score</td>
<td>1.07</td>
<td>0.23</td>
<td>-0.39 – 2.53</td>
<td>0.15</td>
</tr>
<tr>
<td>BDRS Score</td>
<td>1.79</td>
<td>0.40</td>
<td>0.37 – 3.22</td>
<td>0.01</td>
</tr>
<tr>
<td>GDS Score</td>
<td>-0.05</td>
<td>-0.06</td>
<td>-0.16 – 0.05</td>
<td>0.31</td>
</tr>
</tbody>
</table>
p value significant at p < 0.05

CHAPTER 6
DISCUSSION

This was a cross sectional study on the association between cognitive impairment, depressive symptoms and tooth loss among attendees in a geriatric centre. This discussion follows the study objectives.

6.1 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE ATTENDEES
The age distribution of patients in this study showed that patients were between ages 60-98 years. The mean (SD) age of patient was 70.17 (7.22). This implies the age distribution of patients that attend the geriatric clinic.

However, a large proportion of patients were 60-69 years. About 6 in 10 of them were females. Over half of the patients were married and living with spouses as would be expected in this age bracket considering the cultural value placed on marriage in this environment.

The majority of the patients had at least primary school education. This level of educational attainment could be because of the location of the study centre, the University College Hospital, a tertiary centre, where middle social class of the society seek treatment. Also, increasing attention is paid to education over the years in the south-western part of Nigeria, with free education policy of the old western region. About 57.7% of patients were retired as would be expected as the retirement age for most civil servant is 60 years.

This study showed that 58.7% of the patients have lost at least a tooth. This is comparable with a prevalence of 52% reported by Taiwo et al al in a rural community in Ibadan (63). About 94% of the patients had least 10 teeth remaining compared to 6% who had less than 10 teeth remaining. A Japanese study showed a higher percentage (85.3%) of the elderly have less than 10 teeth remaining (23). This has been attributed to differences in diet and socioeconomic characteristics(23).

6.2 PREVALENCE OF MILD COGNITIVE IMPAIRMENT AND DEMENTIA

The cognitive status of the patients was assessed and substantiated using the neuropsychological instruments. Cognitive function of patients was grouped into three. Some patients had mild cognitive impairment as diagnosed by Petersen criteria while others had dementia as diagnosed
by ICD 10 diagnostic criteria. The third group had normal cognition. The prevalence of mild cognitive impairment in this study was 8.0% while prevalence of dementia was 4.0%. There are differences in prevalence rates which may be due to methodological differences with other studies. Mild cognitive impairment (MCI) is also referred to as Cognitive Impairment No Dementia (CIND) in some of the studies. The Ibadan study group studied mild cognitive impairment and found a prevalence of 6.3% using the Community Screening Interview for Dementia (CSI-D) tool. They were also assessed clinically to confirm diagnosis(135). While a study in Jos, central Nigeria, reported a prevalence of 6.4% (136) using similar instruments but no clinical assessment to confirm the diagnosis. A study in Benin Republic revealed a prevalence of cognitive impairment with no dementia (CIND) of 10.4%(137). However in Botswana, 9% prevalence of cognitive impairment was reported without measures of uncertainty, with no distinction made between cognitive impairment with or without dementia. Studies conducted in Bangui and Brazzaville reported CIND prevalence of 25% and 18.8%, respectively(138). In the US and Canada, 22.2% and 16.8% of elderly population have cognitive impairment without dementia(139,140).

Concerning dementia, two studies from Ibadan of a similar size reported prevalence of dementia as 2.3% in 1995 and 10.1% in 2006. Differences between the studies included use of a single validated screening tool, the adapted 10-Word Delay Recall Test, to define probable dementia in the 2006 study(141) and a combination of screening tools and clinical assessment, to define dementia in the 1995 study(7,142–146) The 2006 study also covered a wider region, including rural areas, while the earlier study was conducted in an inner-city region. However, the present study was conducted among hospital based sample. Guerchet et al reported a dementia prevalence of 2.6% in Benin republic(137). The Community Screening Interview for Dementia
(CSI-D) was used for detection of dementia and clinical dementia was diagnosed according to DSM-IV criteria. The diagnosis of dementia in the present study was made using the ICD 10 diagnostic criteria for dementia and diagnosis substantiated using neuropsychological instruments. The prevalence of dementia in Europe and the United States of America, was between 6.2% and 8%(7,35,143,147). The study sites had different sample population and different instruments. This may account for the differences. The DSM-IV and ICD-10 requires impairment in activities of daily living to confirm clinical dementia. The activities of daily living which measures functioning and participation of elderly individuals in the in African culture differ from those found in Western cultures. Factors associated with normal functioning in old people also differ between cultures (133).

6.3 SOCIODEMOGRAPHIC CHARACTERISTICS OF ATTENDEES WITH MILD COGNITIVE IMPAIRMENT AND DEMENTIA

In the sociodemographic characteristics, about 6.7% of patients were aged 60-69 years had mild cognitive impairment compared with 8.3% aged 70-79 years and 16.1% aged ≥ 80years. Similar to other studies,(148,149) the prevalence of cognitive impairment in this study increased with advanced age. A study conducted in Ibadan also showed that prevalence of cognitive impairment also increased with advanced age(135). Jorm and Jolley(150) revealed that the prevalence of cognitive impairment increased between the ages of 65 years and 85 years. Some studies have
also shown the prevalence of mild cognitive impairment to be higher in people 75 years of age and older than among those younger than 75 years. The mechanisms underlying this connection may include the fact that aging produces free radical damage, oxidative stress, alterations in calcium homeostasis, and endothelial damage, which coincide with the reduced efficacy of amyloid clearance and increases the likelihood of cerebrovascular disease. This causes synaptic damage, loss of transmitters and receptors, and inflammation, which results in neuronal death and subsequent clinical symptoms(149).

In this study, 9.2% of female patients had mild cognitive impairment compared with 6.7% of the male patients though not statistically significant. Some studies from developed countries have found no sex differences in the prevalence of cognitive impairment(151,152). In contrast, some studies revealed that females had higher prevalence of mild cognitive impairment than males (153,154). Regarding marital status, the study found that 10.5% of those not currently married were cognitively impaired compared with 6.9% of the married elderly individuals. This is in agreement with previous studies(155,156) which found that not currently married elderly individuals are at great risk of suffering dementia than married individuals. Marriage has protective benefits on cognitive function, which is consistent with the results from the previous studies in Asian(157) and Caucasian populations(158,159). It is possible that sharing one's life with a partner results in stimulating brain activities and the growth of neurons. As a result, married persons could have lower speed of cognitive decline. The engagement of married individuals in more social and cognitive activities than single individuals can protect them from mild cognitive impairment.
This study showed that there was a significant relationship between mild cognitive impairment and level of education. Some studies have revealed that education level does not have a protective effect on cognitive impairment(160,161). However, other studies(155,162,163) have shown that the lower educational level was associated with increased cognitive impairment. An association was found between education and cognitive impairment among a representative community-based sample of African Americans(164). One possible explanation is that lower education could lead to lower memory capacity. People with higher education levels could readily maintain or increase cognitive functional development as their brains are frequently stimulated to think during the daily lives(165).

The study showed no significant relationship between hypertension, diabetes but significant for musculoskeletal disease and mild cognitive impairment. However previous studies have shown relationship between cognitive impairment and hypertension(166). The variation in the sociodemographic correlates of cognitive impairment may be due to the differences in the characteristics of study samples, such as ages of participants, diagnostic criteria, evaluation tools, education level, and lifestyles when compared with other studies.

Concerning dementia, environmental factors reported to be associated with dementia in Subsaharan Africa include the increasing age, female sex, positive history of hypertension, diabetes mellitus, low level of education and diet (122,136,138,143,144). Education provides for a reserve of brain capacity that subsequently serves as a buffer against the later clinical effects of declining cognition and functional impairment due to dementia (7,144).

In the sociodemographic characteristics, 2.8% of patients aged 60-69 years had dementia compared with 5.7% of patients aged 70-79years and 7.1% in patients aged > 80 years. Similar
to other studies, the prevalence of dementia increased with age(143,144). In this study, 4.6% of the patients who had dementia were females compared with 4.0% who were male, this was however not significant. This is comparable to a Nigerian study where female gender was associated with dementia(144). Gender effects often depend on the oldest category where there are much fewer men than women, the small number of dementia in oldest men makes the estimated gender specific rates unstable(144).

This study showed that all the patients with dementia were currently unemployed. This will be expected as dementia usually impairs functioning and instrumental activities of daily living. These patients may not be able to function optimally at work and so may be retired. This study also revealed that 4.9% of those with dementia had hypertension compared with 3.9% without hypertension. A study among elderly Yoruba Nigerians showed that there was a significant association between dementia and hypertension(167). However, Ochayi et al found no relationship between hypertension and dementia(136). Hypertension results in dementia and cognitive decline through promotion of arteriosclerosis and lipohyalinosis of small cerebral vessels resulting in ischemic lesions and increased volume of white matter hyperintensities in later life. Hypertension is responsible for endothelial dysfunctions. Ischemic lesions tend to worsen cognitive performance(168)

6.4 PREVALENCE AND SOCIODEMOGRAPHIC CHARACTERISTICS OF ATENDEES WITH DEPRESSION

The prevalence of depression in this study was 19.3%. About 17% had mild depression and 2.3% with severe depression. Reported prevalence of mood disorders have varied between countries, with Nigeria having relatively low rates(169). Tomlinson et al in a review of affective disorders
in sub-Saharan Africa, including Nigeria, showed that depressive symptoms are relatively common with prevalence 12.3% (mild depression) and 2.2% (severe depression) in Indianapolis and 19.8% and 1.6% respectively in Ibadan(170). In this study, the prevalence of depression in this population is similar to that found by Uwakwe et al who reported a prevalence of depression of 19%(171) and also higher than the rate 7.4% reported by Sokoya et al(14). In the study by Sokoya et al, diagnosis of depression was based on ICD-10 criteria as well as the GMS-AGECAT (Geriatric Mental Scale-Automated Geriatric Examination for Computer Assisted Taxonomy) program. GMS-AGECAT is a computerized diagnostic system designed for use with the Geriatric Mental State (GMS) schedule in research of older people. Baiyewu et al found that the prevalence of depression in two rural communities compared using the ICD 10 and GMS-AGECAT was similar(172).

The comparative study of the prevalence of late-life depression among populations of African origin in both a developed and developing country setting indicated that depression, particularly mild depression, is common in the two African American and Yoruba communities. The prevalence of mild depression is somewhat higher although not significantly so among Yoruba than African Americans (19.8% and 12.3%, respectively)(15). The results from the WHO cross-national study showed that the prevalence of depression for Nigerians was amongst the lowest recorded and much lower than the prevalence in the United States (9.6%) (169). It is difficult to compare the prevalence with those of other studies which use differing assessments tools but they do seem comparable with other population rates from Europe and the United States(173,174). They are also similar to the rates of depression (12%) reported from an elderly Greek population using the Geriatric Depression Scale(175). The finding that mild depression is
much more common than severe depression is consistent with the findings of most other surveys (43,175).

In this study, there was no significant relationship between the age of the patients and depression. In contrast to other studies (176,177) which shows a higher prevalence of depressive symptoms with increasing age. Age and cognitive impairment have been associated with increased risk of depression in the elderly in some reports for age and cognitive impairment (177–179). Baiyewu et al noted that age was not significantly associated with increased prevalence of depression in either Yoruba or African Americans, although elderly African Americans did have somewhat higher rates of severe depression (15). According to Blazer and Williams (174,180) the difference in rates of depression in old-aged females and males is progressively smaller and may disappear among members of older age groups. It might be due to relative decrease of depression in postmenopausal females. In some studies, women are reported to have a higher prevalence of depression than men (181,182).

Baiyewu et al noted that (15) while African American women had a higher prevalence of depression than African American men (significantly so for mild depression) this was not the case for the Yoruba where the prevalence of both mild and severe depression was similar for men and women. When the gender-associated prevalence of depression between the two sites was compared (Indianapolis and Ibadan), it was notable that the prevalence estimates of depression in the two groups of women were similar while Yoruba men had much higher rates of mild depression than African American men (15). In this study, 22.5% of those who had depression were not currently married compared to 17.2% who were currently married, though not statistically significant. Some studies have shown that marital status (single/divorced) is a
risk factor for depression in the elderly population (183–185). Some studies have opposite findings (186). Among the geriatric population in Pakistan and India, marital status, increasing age, and cognitive impairment were associated with high risk of late-life depression (187, 188). The findings of Yan et al. (189) suggest that marital status is a significant predictor of depressive symptoms in the older Chinese population. Specifically, single/divorced elderly individuals are more likely to have higher depressive symptoms than married individuals because they may experience more loneliness, poorer social support, lower self-confidence and are more likely to be living alone (189).

It has been suggested that international comparisons of psychiatric disorders, including depression, conducted by questionnaires are suspect because of cultural differences which may influence responses to specific items in these questionnaires (190). End of life behaviour may influence elderly responses to items involving emotional responsiveness and activation (191).

In this study, there was a significant relationship between mild cognitive impairment and depressive symptoms. This finding is consistent with other studies (175, 187). In Mexican Americans, the presence of depressive symptoms was associated with mild cognitive impairment (192). According to Wilson et al. (193), depression represents an independent risk factor for cognitive impairment. Depression is linked to cognitive impairment, and elderly people with cognitive impairment may exhibit increased risk of depression (194, 195). Depression has also been shown to increase conversion rate from mild cognitive impairment to dementia (179). However, another study found that the presence of depressive symptoms does not predict later change in memory (196). There was some evidence from the study by Baiyewu et al. supporting the link between poor cognitive performance and depression (15). Yoruba participants in the poor
cognitive performance category had significantly higher rates of any depression than participants in the good performance category. In African Americans there was no significant relationship between cognitive performance and rates of mild or severe depression but poor cognitive performers did have somewhat higher rates of mild depression than did good cognitive performers(15). Richard et al stated that vascular factors have been linked to late life depression and cerebrovascular disease might be an important contributor to mild cognitive impairment, dementia and depression in late life(197).

There are many socio-demographic and medical risk factors for depression including levels of poverty, access to health care, social engagement, medical comorbidity, functional disability, and pain(174). Sokoya et al noted that subjective report of poor health were significantly associated with depression(14). In this study, there was significant relationship between depression and hypertension. Medical comorbidity, functional impairment, and comorbid dementing disorders all adversely influence outcome of depression(170). Depression, in turn, adversely affects the outcome of the comorbid problems. Depression is frequently associated with chronic medical illnesses such as cardiovascular disease, and it can complicate the course of these illnesses(198). Depression in late life was an independent risk factor for heart failure among elderly women but not among elderly men in another study(199). There was a significant relationship between musculoskeletal disease and depression in this study. Depressive symptoms have been reported in the elderly with musculoskeletal disease(200). In another study, depression was associated with a decrease in bone mineral density in controlled analyses in people aged 65 years or older (risk factors for osteoporosis)(201,202). Late-life depression may also be a risk for poor self-rated health over time(203).
6.5 RELATIONSHIP BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS, CLINICAL CHARACTERISTICS AND TOOTH LOSS

The mean (SD) for tooth loss in ages 60-69 years, 70-79 years, 86-98 years were 1.95(4.15), 2.32(3.89), 7.27(7.27) respectively, p=0.001. In this study, tooth loss was significantly higher in the older age group. This age related changes may not be unconnected with the deteriorative physiological changes noticed after adolescence and which gets worse with increase in age, a situation which is changing rapidly in the developed countries due to improved social infrastructure and functional health system(204).

Most studies have also shown significant gender difference in tooth loss with more males than females. This has been attributed to the fact that males are more active than females and do not pay much attention to oral care(205). This study showed no significant gender difference. Esan et al also reported similar findings(204). In this study, patients with no formal education (no school education) had more number of tooth loss compared with the other categories though not statically significant. This is because those with higher level of education are more informed about their health needs and may seek dental treatments earlier and more often than those of lower educational status who may only seek dental treatment when there is apparent morbidity. In addition, those of higher educational status are likely to be richer than those of lower educational status. Hence, they are able to afford the cost of dental treatments from time to time(204).

In this study, the mean number of teeth missing was 2.53(4.47) compared to 10.2(9.7) in another study(206). This is due to the large proportion (94.0%) of the elderly in this study having tooth loss less than 10. In a Japanese study, 83.5% of the patients had tooth loss more than 10. This
has been attributed to differences in diet and socioeconomic characteristics. Yoruba diet is low in calorie, fat and salt but high in fibre and ascorbic acid(207). This may account for the large difference in the mean number of tooth loss. About 41.3% of the patients have not lost any tooth in this study. This is comparable to study by Taiwo et al that recorded a prevalence of 48.0% within the community(63).

Patients with dementia had a higher number of teeth missing compared to those with mild cognitive impairment and those with normal cognitive function. Luo et al had similar findings. In the dementia group, more patients had less than 10 teeth remaining compared to greater than 10 teeth, though not statistically significant. Similarly, Saito et al, in the cross sectional study of the relationship between tooth loss and cognitive function in a community dwelling Japanese population (105), severe tooth loss (0-10 teeth remaining) was found to be significantly associated with poor cognitive function after adjusting for confounders. Stewart et al, in a nationally representative cross-sectional population survey of Dental health and cognitive impairment found that poor dentition was associated with cognitive impairment(22). People who had already developed cognitive impairment(65,79–82), had more dental caries, more tooth loss and poorer oral health than adults without cognitive impairment. The hospital cohort used for this study rather than the general population may account for some of the differences. Thus, the cognitive function and tooth number of members of the community who were not in the study may vary from those of the study participants.

In this study, patients who have lost at least a tooth had lower MMSE score mean (SD) 24.84 (4.73) compared with the patients who haven’t lost any tooth 25.08(4.26), although this was not statistically significant. A study on Swedish population reported that edentulous individuals showed lower MMSE scores than those with natural teeth(103). The natural teeth group had a
lower mean age, fewer women, more years of education, higher mini-mental state (MMSE), and performed significantly higher on several cognitive tests (103). Okamoto et al, in a community based survey revealed that the prevalence of a low MMSE score was significantly increased in association with the decrease in the number of remaining teeth (104). In this study, patients with dementia had mean (SD) tooth loss 4.42(6.99) compared with 2.35(4.51) in those without dementia. Similarly, Stein et al, in the Nun study (longitudinal study), noted there was association between presence of a low number of teeth and the risk of a higher prevalence and incidence of dementia (23). They found that approximately 33% of the participants with no teeth or very few teeth (one to nine) had dementia at the first cognitive examination (23). Kim et al, in a cross-sectional study of community dwelling elderly residents in South Korea also found that fewer teeth were significantly associated with dementia and Alzheimer’s disease (78). All the other possible confounding factors might contribute to both tooth loss and dementia separately such as viral infection in different body system, head injury, low socioeconomic status, malnutrition, or an exaggerated inflammatory profile which should be controlled for (27).

In multivariate analysis, age, history of hypertension and Blessed Dementia Rating Score (for severity of dementia) were associated with tooth loss in this study. The link between tooth loss and risk of hypertension is based on the premise that local chronic bacterial infection in the oral cavity that precedes tooth loss may influence systemic levels of inflammatory mediators which contribute to endothelial dysfunction (208). Oral health problems may be caused by multiple factors including specific systemic diseases, sensory and motor deficit, impairment of cardiovascular, pulmonary and muscle functions (85–87). Chronic inflammation, as measured by serum interleukin 6 and C reactive protein levels are risk factors for cardiovascular disease, cognitive impairment, and Alzheimer’s disease (22,114). Individuals with poor cognitive
functions may develop poor oral health because of the lower ability to perform proper tooth brushing, manage dentures and use dental related medications (96).

There was a significant relationship between tooth loss and Blessed Dementia Rating Scale as well as Instrumental Activities of Daily Living. This finding is similar to other studies that also found significant relationship (23, 104, 206). In addition to ICD 10 diagnosis of Dementia, higher scores on Blessed Dementia Rating Scale and lower scores of Instrumental Activities of Daily Living was used to substantiate diagnosis of dementia. Although, the remaining instruments used to determine relationship between tooth loss and cognitive status in this study had lower scores in the patients with dementia compared with those who had normal cognitive function, this was however not statistically significant. Also, the number of tooth loss was higher among patients with mild cognitive impairment and dementia compared with those who had normal cognitive function, this was however not significant. A larger sample size may show statistical significance between the groups. The diagnostic criteria for dementia requires impairment in functioning which is measured by Instrumental Activities of Daily Living and Blessed Dementia Rating Scale. Blessed Dementia Rating Scale and Instrumental Activities of Daily Living scale may be better instruments to substantiate association between tooth loss and dementia.

CHAPTER SEVEN

CONCLUSION
Patients with mild cognitive impairment had more tooth loss than those with normal cognitive function, also patients with dementia had more tooth loss than those with normal cognitive function, though not statistically significant.

However, there is a significant relationship between tooth loss, older age, history of hypertension, Blessed Dementia Rating Score and Instrumental Activities of Daily Living. The diagnosis of dementia requires impairment in functioning which is measured by Instrumental Activities of Daily Living and Blessed Dementia Rating Scale. Larger studies are needed to corroborate associations found in this study and perhaps determine causality.

CHAPTER EIGHT

RECOMMENDATIONS
Mild cognitive impairment, dementia and depression in the elderly are major mental health challenges, especially in developing countries like Nigeria. With the increasing life expectancy worldwide, a broad public health approach is needed to improve the care and quality of life of the elderly with depression, cognitive impairment and tooth loss.

The present findings have implication for the elderly mental health care to help improve clinical practice by increasing index of suspicion for cognitive impairment among people with toothloss and serve as basis for development of standard operating procedure for caring for the elderly with cognitive impairment and tooth loss. This will promote consultation liaison between psychiatry and dentistry in the care of the elderly. This will promote interventions such as early diagnosis and treatment for the elderly.

The findings underscore a need for a national care plan for the elderly. The policy makers in Nigeria are encouraged to be responsive to the mental health needs of the elderly. This policy can be integrated into the existing health policies. There is need for holistic care in patients with mild cognitive impairment, dementia, depression and tooth loss.

In consideration of the relationship between Blessed Dementia Rating Score, Instrumental Activities of Daily Living and tooth loss provided in this study, the training and practice of psychiatry should be sensitive to the need for collaboration with other medical subspecialties. This will be important for collaborative research. Interventions may include early diagnosis and care among the elderly with cognitive impairment and tooth loss. This could improve the quality of life in the elderly.

CHAPTER NINE

LIMITATIONS OF THE STUDY
1. The crosssectional design of the study was adequate for detecting associations of variables involved in cognitive impairment and depressive symptoms, it precludes any conclusion on the causality of the observed associations. Further longitudinal studies are needed to examine the causal links and more predictive value of factors investigated.

2. The results of this study conducted in the outpatient clinics in the hospital settings and, so it is not representative of the geriatric population in our society.

REFERENCES


17. Alexopoulos GS, Hoptman MJ, Kanellopoulos D, Murphy CF, Lim KO, Gunning FM. Functional
costuctivity in the cognitive control network and the default mode network in late-life

and visuospatial ability among depressed elders in a community setting. Arch Clin Neuropsychol.


20. Rosenberg PB, Mielke MM, Appleby BS, Oh ES, Geda YE, Lyketsos CG. The Association of
Neuropsychiatric Symptoms in MCI with Incident Dementia and Alzheimer Disease. Am J Geriatr

with mild memory impairment in the elderly: The Fujiwara-kyo study. Brain Res. 2010
Aug;1349:68–75.

Sep;55(9):1410–4.

23. Stein PS, Desrosiers M, Donegan SJ, Yepes JF, Kryscio RJ. Tooth loss, dementia and


25. Alexopoulos GS, Meyers BS, Young RC, et al. EXecutive dysfunction and long-term outcomes of


Cognitive Function in Community-Dwelling Adults without Dementia or Stroke: The PRESENT


Sep;256(3):183–94.


68. Paul F, David Z. Dental plaque identification. Florida Institute for Periodontics and Dental Implants; 2012.


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156. Helmer C. Dementia and marital status at midlife and late life. BMJ. 2009 Jul 2;339:b1690.


APPENDIX 1

INFORMED CONSENT FORM

IRB approval number __________________

This approval will lapse on______________

TITLE OF RESEARCH: Cognitive impairment, depressive symptoms and tooth loss in attendees of the Outpatient Clinic of a Geriatric Centre in Ibadan

This study is being conducted by Dr. Majekodunmi M.E. of the Department of Psychiatry University College Hospital, Ibadan.

The purpose of the study is to find out the association between cognitive impairment, depressive symptoms and tooth loss in patients attending geriatric outpatient clinic in Ibadan. In the course of this study, you will be asked some personal questions. In all, eight different questionnaires will be presented to you, possible responses are stated clearly and you are expected to answer as appropriate. At some point, you will be asked to open your mouth for oral examination to count the number of remaining teeth. You will only be interviewed once. This exercise will take about 45-50 minutes. In total, we expect to recruit 300 participants all from the outpatient geriatric clinic at the University College Hospital, Ibadan.

There is minimal risk of anticipated physical injury in the course of the study. However some of the questions are personal and intimate in nature which may upset you. Your participation in this research will not cost you anything, but if we discover any sign of mental health problems in the course of the study, you will benefit from free consultation with the researcher. If the need arises, you may be referred to the appropriate specialist.

All information collected in this study will be given code numbers and no names will be recorded. This cannot be linked to you in any way and your name or any identifier will not be used in any publication or reports from this study.

Your participation in this study is entirely voluntary and if you choose not to participate, it will not affect the services you receive in this establishment in any way. You can also choose to withdraw from the research at any time. Please note that some of the information that has been
obtained about you before you withdraw may have been modified or used in reports and publications. This cannot be removed anymore but the researcher promises to make good effort to comply with your wishes as much as it is practicable. During the course of the study you will be given any information that may affect your continued participation on your health.

I have fully explained this research to____________________________________ and have given sufficient information, including risks and benefits to make an informed decision.

Date_________________________________ Signature__________________________________

Name______________________________________________________________

I have fully read the description of the research and I have also talked it over with the doctor to my satisfaction. I understand that my participation is voluntary. I know enough about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I have received a copy of consent form to keep for myself.

Date_________________________________ Signature__________________________________

Name______________________________________________________________

This research has been approved by the Ethics Committee of the University of Ibadan and the Chairman of this committee can be contacted at Biode Building, Room T10, 2nd floor, Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, Ibadan. E mail; uiuchirc@yahoo.com. In addition, if you have any question about your participation in this research, you can contact the investigator, DrMajekodunmi at the department of psychiatry, University College Hospital, Ibadan. Email: mailfoluke@yahoo.co.uk.
LETTER OF CONSENT

I have had the description of this research explained to me thoroughly.

The purpose, methods, risks, and benefits, have also been explained in such a manner that I understand, and I am satisfied with the explanation.

I have been made to understand that my participation is voluntary and I can choose to withdraw from the research at any time.

If at any time during the course of the study I need further explanation or clarification, I have been told that I can freely enquire from the researcher.

Hence, I willingly give consent to the researcher to proceed with the study.

DATE____________________________________

NAME_________________________________________

THUMB PRINT/ SIGNATURE____________________________________

WITNESS_________________________________________
IFIKUN KIINI

IWE IFOWOSI ALASOTELE

AKORI ISE IWADI: Isoro laakaye, apeere irewesi okan ati eyin kika, laarin awon to wa n gba itoju lati ile ni eko to n toju awon arugbo ni ile iwosan nla ti Orita mefa.

Ise iwaadi yii lo n waye lati owo Onisegun Majekodunmi M.E ti eka to n toju arun opolo ni ile iwosan nla ti ile iwe giga julo ni ile Ibadan.

Eredi ise iwadi yii ni lati topipin ibasepo laarin isoro laakaye, irewesi okan ati eyin kika laarin awon olugbatoju to n wa si eka to n toju awon arugbo to n wa latita ni ile Ibadan. Bi ise iwadi yii ti n tesiwaju, a o bere awon ibeere ara eni. Ninu gbogbo re, awon ibeere mejo lolokan ojokan la o gbe fun o awon idahun to to la se alaye re yekeyeke, a si fe ki o dahun bo ti ye. Ni awon agbon kan, a o so fun ki o la enu re fun idanwo afenuuso nipα kika awon eyin to ku lenu re.

Leekan soso pere la o fi oro wa o lenu wo, ise yii yoo gba to bii iseju marundinlaadota si aadota. Ni aropo, a n gbero lati ni oodunrun awon olukopa ti gbogbo won je olugbatoju to n wa latita si eka itoju awon arugbo ti ile iwosan nla ti ile iwe to ga julo ni ile Ibadan.

Awon ewu die nipα ifarapa ni a lero pe o see se ko waye lakoko ise iwadii yii; bo ti wu ko ri, die ninu awon ibeere naa je tara eni to sunmoni pekipeki to si le bi o ninu. Kikopa re ninu ise iwadii yii ko ni na o ni ohunkan, sugbon ti a ba kefin awon ifarahan isoro ilera opolo bi ise iwadii yii se n tesiwaju, wa a je anfaani apero ofe lodo Oluwadii. O seese ki a so fun o lati ri akosemose bi o ba pe fun sise bee.

Gbogbo awon oro ti a ba gba lenu re ninu ise iwadii yii, la o pa aroko awon onka fun ti awon oruko ko si ni je kiko sile. Eleyii ko ni se atona si o ni ona Kankan ati pe oruko re tabi ohun idanimo re ko ni di mimulo ninu iwe tilejade kankan tabi awon abajade lati inu ise iwadii.

Gbefe ni kikopa re je ninu ise iwadii yii ati pe ti o ba pinnu lati ma kopa mo eyi ko ni se akoba fun awon itoju ti o n gba ninu ile iwosan yii lona kankan. Igbakuugba to ba wu o lo le yowo kuro ninu ise iwadii yii. Jowo je ko di mimo fun o wi pe die lara awon oro ti a ti gba nipa re ki o to yowo lale ti y i pada tabi mulo ninu awon abajade ati iwe atejade. Eleyii ko ni se yo kuro mo sugbon Oluwadii yii n se ileri lati gbiyanju lati faramo ipe re ni gbogbo ona toba le gba seese. Ni akoko ti ise iwadii yii ba n tesiwaju, a o fun o ni ilana yoowu to le se idiwo fun kikopa ninu ilana re.

Mo ti se ekunrere alaye ise iwadii yi fun _____________ mo si ti fun un ni ilana tokun pelu awon ewu ati awon anfaani lati le se ipinnu.

Ojo___________________________ Ifowosi___________________________

Oruko __________________________________________________________

xxx
Mo ti ka alaye ise iwadii yi yekeyeke mo si ti tun ba Onisegun naa soro lori re pelu iteloron. O ye mi pe gbefe ni kikopa mi. Mo ni imo to kun nipa idi awon ilana, ewu ati awon anfaani to wa ninu ise iwadii naa lati gba pe mo fe kopa ninu re. Mo ti gba iwe ifowosi fun kikopa lati toju fun ara mi.

Ojo___________________________  Ifowosi________________

Oruko __________________________________________________________________________

Ise iwadii yi loti je fifowosi lati owo igbimo ilana aatele ti ile iwe giga julo ti Ilu Ibadan ati pe a le kan si alaga igbimo yii ni.

Gbongan biode oju ti o aja keji ile ekose iwadii imo isegun ati ikoni, ti eka eko isegun Oyinbo ti ile iwe giga julo ti Ilu Ibadan, Ibadan.

Ate ifiwe ran ayara bi asa; uiuchirc@yahoo.com. Ni afikun ti o ba ni ibeere kan to je mo kikopa re ninu ise iwaadi yi, o le kan si Oluwaddi onisegun oyinbo Majekodunmi ni eka to n toju arun opolo, ti ile iwosan nla ti Ile iwe giga julo Ibadan. Ate ifiwe ranse ayara bi asa; mailfoluke@yahoo.co.uk.

Iwe ifowosi

Alaye to peye la ti se fun un lekunrere nipa ise iwadi yii.

Idi, awon ilana, awon ewu ati awon anfaani lati salaye lona to yen, awon alaye naa si temi loron.

A ti je ko ye mi wi pe gbefe ni kikopa mi ati pe mo le yowo ninu ise iwadii naa nigbakuugba.

A ti so fun mi wi pe ti mo ba nilo alaye tabi imo sii ni akoko ti ise iwadii yi n tesiwaju, mo ni anfaani lati beere ibeere lowo Oluwaddi.

Nitori naa, mo fara mo o tokantokan fun Oluwaddi lati tesiwaju pelu ise iwadii naa.

Ojo_______________

Oruko_______________

Ika tite_______________

Elerii_______________


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APPENDIX II

SOCIODEMOGRAPHIC DATA

1. Identification number_______________________
2. Name (Initials)___________________________
3. Age last birthday______________
4. Date of Birth__________
5. Gender : Male ( ) Female( )
6. Marital status :i. Single ( ) ii. Married ( ) iii. Separated / Divorce ( )
   iv. Widow/ Widower ( )
7. Current Living condition  i. Alone ( ) ii. Spouse ( ) iii. Relative ( ) iv. Son ( )
   v. Daughter( ) vi. Others ____________
8. Years of education______________
9. Employment status: i. Working (employed or self employed) ( ) ii. Retired ( )
   iii. Unemployed ( )
10. Past medical history :
    i. Diabetes mellitus Yes ( ) No ( ) ii. Hypertension Yes ( ) No ( ) iii. Musculoskeletal diseases Yes ( ) No ( )
    iv. Others(Pls Specify) ____________________________
11. Drug history: ____________________________________________

**IPIN KEJI**

1. Nomba Idanimo____________________
2. Oruko (ibere oruko)_____________________
3. Ojo ori ti ojo ibi to koja__________________
4. Ojo Ibi _______________________________
5. Akonbabo: Ako ( ) Abo ( )
6. Ipo igbeyewo: I Apon ( ) ii Abileko/oniyawo ( ) iii Ilemosu/kiko aya ( ) iv Opobinrin/Opokunrin ( )
7. Ipo Ilegbee i Dagbe ( ) ii Oko/Iyawo ( ) iii Ebi ( ) iv Awon miiran ( )
8. Awon odun eko_____________________
9. Ipo Ise: i O n sise (gba sise, ise adani) ( ) ii Fehinti ( ) iii Alainise ( )
10. Ipo ilera latehinwa
    i Ito suga beeni ( ) rara ( ) ii Eje riru beeni ( ) rara ( ) iii Aisan aromoleegun beeni ( ) rara( ) iv Awon miiran (jowo fi iyato sii) _____________
11. Itan Irufe Oogun _______________________

cxxiii
APPENDIX III

MINI MENTAL STATE EXAMINATION

“Now I would like to ask you some questions to check your memory and concentration. Some of them will be easy and some of them will be hard”  

Nisinsinyi, mofe beere awon ibereee kokan lati mo bi e n nranti nkan a ti bi e se n fi okan ba nkan lo. E le mo awon kan e situn le ma mo awon kan” (Read items exactly as they are written. Record any incorrect responses in the space provided.)

<table>
<thead>
<tr>
<th>Question</th>
<th>Subject response</th>
<th>Score</th>
</tr>
</thead>
</table>
| 1.  What is the year?”  
Odun wo ni a wayi?                                                        |                  | 1     |
|                                                                        |                  | 0     |
| 2.  “What is the season of the year?”  
Iru asiko tabi saa wo ni a wa ninu odun?                                 |                  | 1     |
|                                                                        |                  | 0     |
| (Mar=W/Sp; Jun=Sp/Su; Sep = Su/F; Dec – F/W                              |                  |       |
| 3.  “What is the month”  
Osu wo ni a wayi?                                                          |                  | 1     |
|                                                                        |                  | 0     |
| 4.  “What is the date (day of month);”  
Ojo kelo ninu osu ni oni je?                                              |                  | 1     |
|                                                                        |                  | 0     |
| 5.  “What is the day of the week?”  
Ojo wo ninu ose ni oni je?                                                |                  | 1     |
|                                                                        |                  | 0     |
| 6.  “What state are we in?”  
Ipinle woni a wayi?                                                          |                  | 1     |
|                                                                        |                  | 0     |
| 7.  “What council are we in?                                             |                  | 1     |
|                                                                        |                  | 0     |
Inu ijoba ibile wo ni a wayi?

8. “What city are we in?”
   ________________ 1 0
   Ilu wo ni wa yì?

9. “What floor of the building are we on?”
   ________________ 1 0
   Aja kelo ni a wa yì?

10. “What is the name of this place? Or it at home
    “What is your address?”
    ________________ 1 0
    Kini oruko agbo ile tabi ibi ti a wa yì?

11. “I am going to name 3 objects. After I have said them, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes. Please repeat these names for me:
    Ma so oruko awon nkan meta. Ti mo ba so won tan, ma fe ki e pe won tele mi. Mo fe ki e ranti won o, nitori wipe ma tun ni ki e daruko won fun mi lehin iseju melo si sinsinyi. E jowo mo fe ki e pe won tele me”

    Trial 1  “orombo” 1 0
    “tabili” 1 0
    “kobo” 1 0

    If Trial is perfect (3/3 objects recalled), skip to item #12. If it is
    No perfect (2/3, 1/3, or 0/3 objects recalled) say “That's not quite
    Right, please repeat these names for me:”

    Trial 2  orombo” + -
    “tabili” + -
    “kobo” + -

    If Trial 2 is not perfect say “That’s not quite right, please repeat
    These names for me”

    Trial 3  orombo” + -
    “tabili” + -
    “kobo” + -
12. “Now I want you to say the days of the week, from Monday to Friday” (Repeat if needed, assist as needed).

Days Forward on first attempt + -  (circle one but do not add to score)

“Now I want you to say the days of the week backwards, in reverse order, start with Friday and go backwards” (No further assistance. Score is number correct before first error. Record subject’s responses). “Nisinsi ni mo fe ki e so awon ojo ti o wa laarin ose lati ojo Aje titi di ojo Jimoh. (repeat if needed, assist as needed). Nisinsi ni mo fe ki e so awon ojo larin ose ti aka sehin, ki e bere pelu ojo Jimoh.

Fri  Thur  Wed  Tue  Mon

13..“What were the 3 objects I asked you to remember?”

Kini awon nkan meta ti mo so wipe ki e ranti leekan?

(DO NOT say the object names to the subject)

orombo” 1 0
“tabili” 1 0
“kobo” 1 0

14.“What is this called? (show wrist watch)

Kini a n pe eleyi? _______________________ 1 0

15.“What is this called?” (Show pencil)

“Kini a n pe eleyi? _______________________ 1 0

16.“I would like you to repeat a phrase after me: NO IFS, ANDS, OR BUTS”.

(Do not repeat. Allow only one trial. Must be perfect to receive credit) 1 0

Mo fe ki e so gbolohun yi tele me: OKE GBOKE GOPE”

17.“Read the words on this page, then do what it says” (code as correct only if subject closes eyes. Verbal response is not what is scored.

If the subject reads it only, tell him/her to “do what is says” and score the response).

“E ka gbolohun oju ewe yi ki e se ohun ti e ka”

18.“I am going to give you a piece of paper. When I do, take the paper in your right hand, fold the paper in hand with both hands and put the paper down on your lap” (Hand the paper midline. Do not repeat or coach)

“Ma fun yin ni iwe pelebe kan. Ti nba fu yin ki e fi owo otun yin gba, ki e ka si ogbogba pelu owo mejeji, ki e fi iwe na le ori itan yin”

(right hand) _______________________ 1 0
19. Write any complete sentence on this piece of paper” (spelling and grammar are not important. Must have a subject, real or implied, and a verb:

E ko gbolohun oro kan si ori iwe pelebe yi”  

1 0

20. “Here is a drawing. Please make a copy of it in this area”

Score as correct if two five sided figures overlap to form a four-sided figure  

1 0

“Aworan kan niyi, E jowo e ya iru re gangan si aye ibiyi:

CLOSE YOUR EYES

E DI OJU YIN
Word List Learning

"I am going to read a list of 10 words. Listen closely. When I am finished, I will ask you to tell me all ten words”. Read the words at the rate of one every 2 seconds. Record the serial position of each word recalled. After Trials 1 and 2 say: “We are going to try that again. Listen closely as I read each word. Later I will ask you to recall all 10 words.”

“Mo ma ka awon ohun mewa, ki e tetisile daada. Ti mo ba se tan ma bi yin ki e so awon ohun mewewa naa fun mi. “Read the words at the rate of one every 2 seconds. Record the serial position of each word recalled. After Trials 1 and 2 say: “A tun gbiyanju eleyi leekan si. E teti sile daada bi mo ti pe won ni kankan laipe, ma bi yin ni gbogbo oro mewewa.”

<table>
<thead>
<tr>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
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<tbody>
<tr>
<td>1. Ori</td>
<td>1. Iso</td>
<td>1. Ayaba</td>
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<tr>
<td>2. Owo</td>
<td>2. Ahere</td>
<td>2. Eweko</td>
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<tr>
<td>3. Okun</td>
<td>3. Ori</td>
<td>3. Owo</td>
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<tr>
<td>5. Ayaba</td>
<td>5. Engine</td>
<td>5. Igi</td>
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<tr>
<td>10. Engine</td>
<td>10. Eweko</td>
<td></td>
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</tbody>
</table>

#Correct -
by Trial:   ____/10   ____/10   ____/10

Grand Total   ____/30

Record Intrusions Here:

# Intrusions -
by Trial:   ____  ____  ____

Grand Total   ____
Animal Fluency

"I am going to give you a category and I want you to name, as fast as you can, all of the things that belong in that category. For example, if I say 'Articles of Clothing', you could say shirt, tie, or hat. Can you think of other articles of clothing?"

"Mo ma so awon akojopo nkan kan fun yin mo si fe ki e daruko awon nkan ti o jemo akojopo naa n kikia. Fun apeiujue, ti mo ba so wipe "awon nkan ti o jemo aso" E le so wipe "yeri" "agbada" tabi "fila". Nje e le ronu si nkan miran nipa aso. (After you are satisfied that the subject understands the task and has given 2 words naming articles of clothing, say).

"That's fine. I want you to name all of the things that belong to another category. That is 'Animals'. Any type of animal is OK: farm animals, birds, fish, any kind of animal will do. You will have one minute. Ready, go." Keep trying to tell me as many animals as you can."

"O dara. Mo fe ki e daruko gbogbo awon nkan ti o je mo awon akojopo nkan miran. Eyi ni 'Eranko' orisirisi awon eranko ni o dara; eran oko, awon eye, eja, orisirisi awon eranko le le daruko. Iseju kan pere ni mo ma gba yin laye, oya o, e bere." (Record answers in appropriate 15 second intervals. If the subject says he/she is done before time is up, encourage the subject to continue responding by saying; keep trying to tell me as many animals as you can). "E tu bo gbiyanju lati daruko gbogbo awon eranko ti e ba mo"

<table>
<thead>
<tr>
<th>Time Intervals</th>
<th>0-15 sec</th>
<th>16-30 sec</th>
<th>31-45 sec</th>
<th>46-60 sec</th>
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<tr>
<td>Grand Total --------</td>
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Scoring Notes:
1. Do not give additional credit for repeated words or obvious redundancies (e.g., black dog, brown dog).
2. A species and any accompanying breeds within a species each get credit (e.g., dog, terrier, poodle).
3. Separate names for male and female or a species each get credit (e.g., bull and cow).
4. Anything not vegetable or mineral is animal.

APPENDIX VI

cxl
Delayed Recall of Word List

A few minutes ago, I read you a list of 10 words several times. Now I want you to recall as many of these words as you can “Ni iseju melo kan sehín, mo ka awon ohun mewa ni opo igba, Nisinsinyi mo fe ki e so gbogbo awon eyi ti e ba le ranti ninu awon oro naa”. Record serial position of each word recalled. Allow 90 seconds. Record intrusions in the space to the right of the list. DO NOT READ THE WORDS TO THE SUBJECT.

1. Ori __________
2. Owo __________
3. Okun __________
4. Letter __________
5. Ayaba __________
6. Ahere __________
7. Igi __________
8. Iso __________
9. Eweko __________
10. Engine __________

<table>
<thead>
<tr>
<th>Total Correct <em><strong>/</strong></em>/10</th>
<th>Total Intrusions <em><strong>/</strong></em>_</th>
</tr>
</thead>
</table>

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APPENDIX VII

Blessed Dementia Rating Scale (BDRS)

Name:__________________________ Subject ID__________________________

Date:________/_______/__________

Ma fe bi yin ni awon ibere kan nipa awon isoro ti (____________) ni lowolowo bayi. Ki se gbogbo ibere wonyi lo ni nkan se pelu (____________). Nitoripe a ni la ti ni imo ti o kun nipa aisan yi, o se pataki lati se awon ibeere wonyi. E gbe idahun yin lorí bi (____________) se n se si lowolowo bayi (eyi jasi pe be e se ri won si larín osu mefa sehin) ki a fi we iru ipoti won wa ki aare yi to bere. Ma koko fe bere awon ibere kan lori bi akitiyan (__________) se ri lori ise pepepe ojojumo.

“I would like to ask you some questions regarding (subject’s name). not all of these questions will apply to (subject’s name). However, in order to gain a better understanding of his/her illness, we need to ask about these symptoms. You should base your answers on (subject’s name) current ability (as you have observed them during the past 6 months) compared to his/her pre-illness ability. I would first like to ask you some questions about (subject’s name) performance of daily activities”. For subjects in nursing homes, score in terms of informant’s best estimate of subject’s capabilities. Check only I option per item; do not leave any item blank.

1. Nje (____________) ni isoro lati se ise ile?

   Does (subject) have difficulty in performing house hold task?

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ko si isoro</td>
<td>No Difficulty</td>
</tr>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
<tr>
<td>Isoro pupo wa</td>
<td>Great Difficulty</td>
</tr>
<tr>
<td>Emi komo</td>
<td>Don’t Know</td>
</tr>
<tr>
<td>Koba mu</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

2. Nje (____________) ni isoro lati mo iye owo ti o ye ki won gba pada lori awon nkan kekeke?

   Does (subject) have difficulty figuring out the amount of change due back on small items or bills?

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ko si isoro</td>
<td>No Difficulty</td>
</tr>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
<tr>
<td>Isoro pupo wa</td>
<td>Great Difficulty</td>
</tr>
<tr>
<td>Emi komo</td>
<td>Don’t Know</td>
</tr>
<tr>
<td>Koba mu</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
3. Nje (__________) ni isoro lati ranti akosile kekere (bi awon nkan ti won fe ra loja tabi lati mu awon nkan meta lati yara miran lai koo si inu iwe)?

Does (subject) have difficulty remembering a short list of items (e.g. shopping list or retrieving three items from another room without writing it down)?

<table>
<thead>
<tr>
<th>Ko si isoro</th>
<th>No Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
<tr>
<td>Isoro pupo wa</td>
<td>Great Difficulty</td>
</tr>
<tr>
<td>Emi komo</td>
<td>Don’t Know</td>
</tr>
<tr>
<td>Koba mu</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

4. Nje (__________) ni isoro lati mo ibi ti won ba wa larin ile bi ki won le mo ona de ile iwe tabi ile idana?

Does (subject) have difficulty finding his/her way about at home, e.g. can he/she find his/her way to the bathroom or kitchen?

<table>
<thead>
<tr>
<th>Ko si isoro</th>
<th>No Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
<tr>
<td>Isoro pupo wa</td>
<td>Great Difficulty</td>
</tr>
<tr>
<td>Emi komo</td>
<td>Don’t Know</td>
</tr>
<tr>
<td>Koba mu</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

5. Nje (__________) si mo ona kakiri adugbo bi ki won lo si oja, ile ijosin tabi ile awon molebi ati awon ore tabi ile ifiweranse?

Does (subject) have difficulty finding his/her way around the neighbourhood, e.g. can he/she find his/her way to the post office, market, church or other relatives/friends homes?

<table>
<thead>
<tr>
<th>Kosi isoro</th>
<th>No Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
<tr>
<td>Isoro pupo wa</td>
<td>Great Difficulty</td>
</tr>
<tr>
<td>Emi komo</td>
<td>Don’t Know</td>
</tr>
<tr>
<td>Koba mu</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

6. Nje (__________) ni isoro lati fokan si ati ni oye ohun ti eniyan n ba won so?

Does (subject) have difficulty following and understanding conversations?

<table>
<thead>
<tr>
<th>Ko si isoro</th>
<th>No Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoro die wa</td>
<td>Slight Difficulty</td>
</tr>
</tbody>
</table>
7. Nje (____________) nje isoro lati ranti awon nkan ti o ba sele ti ko ti pe, bi igbati won ri yin gbehin, tabi, nkan ti o sele ni ana?

Does (subject) have difficulty remembering recent events, e.g. when he/she last saw you, or what happened the day before?

- Ko si isoro: No Difficulty
- Isoro die wa: Slight Difficulty
- Isoro pupo wa: Great Difficulty
- Emi komo: Don’t Know
- Koba mu: Not Applicable

8. Nje isesi ati ihuwasi (____________) jo ti igbati o koja?

Does (subject) tend to live in the past?

- Ko si isoro: No Difficulty
- Isoro die wa: Slight Difficulty
- Isoro pupo wa: Great Difficulty
- Emi komo: Don’t Know
- Koba mu: Not Applicable

9. Nje won ni isoro lati ma jeun fun ra won?

Does he/she have difficulty feeding him/her self?

- Won le da jeun
  Feeds self without assistance

- Won le jeun pelu iranlowo die
  Feeds self with minor assistance, requires prompting to sample all foods or prepare a plate of food

- Won le da jeun pelu opolopo iranlowo
  Feeds self with much assistance, has difficulty managing utensils, often uses fingers

- A ni lati maa fi ounje nu won
  Has to be fed
10 Nje won ni isoro lati wo aso?

Does he/she have difficulty dressing?

**Won le wo aso lai si iranlowo**

Unaided

**Lekookan won ni ilo iranlowo die nitori lekookan won n wo odi aso tabi ki won ko oju ewu sehìn**

Occasionally misplaced buttons etc., requires minor help

**Won ni ilo iranlowo to po nitori nigba miran won le mura lodi lodi bi ki won wo singleti sori buba tabi wo tobi lori iro**

Wrong sequence, forgets items, and requires much assistance

**Won ko le woso fun ra won**

Unable to dress

11 Nje won ni isoro lati se imototo ara won?

Does he/she have difficulty taking care of his/her personal hygiene

**Won maa n tamba won si ma n se itoju ara**

Clean, cares for self at toilet

**A nilati ran won leti nitori won ma n to sara lekookan**

Occasional incontinence, or needs to be reminded to toilet

**Won ni lo iranlowo ti o po nitoripe won ma n to tabi ya igbe si ara ni opolopo igba**

Frequent incontinence, or needs much assistance

**Won ma n to tabi ya igbe si ara ni igba gbogbo**

Little or no control
### GDS

Listed below are several questions that describe how a person can sometimes feel. I'd like you to answer these with a ‘yes’ or ‘no’ based on how you have felt over the past two weeks.

*Awon ibere ti o kan bayi je eyi ti a fe fi mo bi ipo ti okan yin se wa larin ose meji sehin. Mo fe ki e so beni tabi beko lori ibere kookan.*

1. Are you basically satisfied with your life?  
   *Nje ịghesi aye yin te yin lorum bi?*  
   Yes | NO  
   Beni | Beko

2. Have you dropped many of your activities and interests?  
   *Njẹ ẹ nọ i wọn ise yin ati awọn ọkan ẹ nọ nocking e nfe si sile?*  
   YES | No  
   Beni | Beko

3. Do you feel that your life is empty?  
   *Se ọ nọ ero wipe aye yin so fo?*  
   YES | No  
   Beni | Beko

4. Do you often get bored?  
   *Njẹ nkan tete ma nsu yin?*  
   YES | No  
   Beni | Beko

5. Are you hopeful about the future?  
   *Njẹ ọ nọ ere fun ojọ ola/ọja awaju?*  
   YES | NO  
   Beni | Beko

6. Are you bothered by thoughts you can’t get out of your head?  
   *Njẹ ọ ma ọ nọ ojarọ ola oja agbara ojọ?*  
   YES | No  
   Beni | Beko

7. Are you in good spirits most of the time?  
   *Njẹ ọ ma ọ nọ oyaya ni ọghọgho ọgha?*  
   YES | NO  
   Beni | Beko

8. Are you afraid that something bad is going to happen to you?  
   *Njẹ ọ nọ nke ọya wipe nkan buhuru ka fe sele si yin?*  
   YES | No  
   Beni | Beko

9. Do you feel happy most of the time?  
   *Njẹ ọ nọ nke ọya wipe nkan buhuru ka fe sele si yin?*  
   YES | NO  
   Beni | Beko

10. Do you feel helpless?  
    *Njẹ ọ ma ọ nọ ojarọ ola oja aghara lori awọn ọkan ọkan?*  
    YES | No  
    Beni | Beko

11. Do you feel restless and fidgety?  
    *Njẹ ọ ma nni ọghọgho ara ni ọghọgho ọgha?*  
    YES | No  
    Beni | Beko

12. Do you prefer to stay home, rather than going out and doing new things?  
    *Njẹ ọ ma ọ nke ọya lori ku ki ọgha lori ọgha ọgha?*  
    YES | No  
    Beni | Beko

13. Do you frequently worry about the future?  
    *Njẹ ọ nọ ọja ọja ma nma ọkan ọkan yin?*  
    YES | No  
    Beni | Beko

14. Do you feel you have more problems with memory than most people?  
    *Njẹ ọ ni ọghọgho ola ko ọgha ọkan ọkan ti o ti koja ọgha ọgha eniran yoko ti ma nran?*  
    YES | No  
    Beni | Beko
15. Do you think it is wonderful to be alive now?
Nje inu yin dun wipe e wa laye titi di insininyi?

YES
Beni

NO
Beko

16. Do you often feel downhearted and blue?
Nje okan yin ma nba je, ki o si reyin la ti inu wa?

YES
Beni

NO
Beko

17. Do you feel pretty worthless the way you are now?
Se e ni ero wipe e ko jamo nkankan bi e se wa yi?

YES
Beni

NO
Beko

18. Do you worry a lot about the past?
Nje awon nkan ti o ti se le si ehin ma ndamu okan yin?

YES
Beni

NO
Beko

19. Do you find life very exciting?
Nje ile aye.landun pupo?

YES
Beni

NO
Beko

20. Is it hard for you to get started on new projects?
Se o ma nje nkan inira fun yin lati dawole ohun tuntun lati se?

YES
Beni

NO
Beko

21. Do you feel full of energy?
Nje e lagbara lati se nkan ti e fe se?

YES
Beni

NO
Beko

22. Do you feel that your situation is hopeless?
Nje e lero wipe igbesi aiyi yin buru jayi ti o fe je pe ko si ona abayo?

YES
Beni

NO
Beko

23. Do you think that most people are better off than you are?
Nje e ni ero wipe awon opolopo enyan san ju yin lo?

YES
Beni

NO
Beko

24. Do you frequently get upset over little things?
Nje awon nkankan kekekeke ma ntete bi yin ninu?

YES
Beni

NO
Beko

25. Do you frequently feel like crying?
Nje o ma nse yin bi ki e ma sunkun?

YES
Beni

NO
Beko

26. Do you have trouble concentrating?
Nje e ma nie fokan tan nkan ti e ba nse, bi ti e ba nwo era tellifisan?

YES
Beni

NO
Beko

27. Do you enjoy getting up in the morning?
Se o ma ndun mo yin lati dide ti e ba ji ni owuro?

NO
Beni

YES
Beko

28. Do you prefer to avoid social gathering?
Nje o nte yin lorun lati yera kuro ni awujo awon enyan?

NO
Beni

YES
Beko

29. Is it easy for you to make decisions?
Se o rorun fun yin lati se ipinu?

NO
Beni

YES
Beko

30. Is your mind as clear as it used to be?
Nje okan yin mu gaara bi o ti ma mmo tele?

NO
Beni

YES
Beko

Total Score is number of items in which the response in BOLD CAPITAL letters is circled 

Testing Finish Time 

26
### Instrumental Activities of Daily Living Scale (IADL)

<table>
<thead>
<tr>
<th>A</th>
<th>Ability to use telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Operates telephone on own initiative – looks up and dials numbers, etc.</td>
</tr>
<tr>
<td>2.</td>
<td>Dials a few well-known numbers</td>
</tr>
<tr>
<td>3.</td>
<td>Answers telephone but does not dial</td>
</tr>
<tr>
<td>4.</td>
<td>Does not use telephone at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Takes care of all shopping needs independently</td>
</tr>
<tr>
<td>2.</td>
<td>Shops independently for small purchases</td>
</tr>
<tr>
<td>3.</td>
<td>Needs to be accompanied on any shopping trip</td>
</tr>
<tr>
<td>4.</td>
<td>Completely unable to shop</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Food preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plans, prepares and serves adequate meals independently</td>
</tr>
<tr>
<td>2.</td>
<td>Prepares adequate meals if supplied with ingredients</td>
</tr>
<tr>
<td>3.</td>
<td>Heats, serves and prepares meals, or prepares meals but does not maintain adequate diet</td>
</tr>
<tr>
<td>4.</td>
<td>Needs to have meals prepared and served</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Housekeeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Maintains house alone or with occasional assistance (e.g., &quot;heavy work domestic help&quot;)</td>
</tr>
<tr>
<td>2.</td>
<td>Performs light daily tasks such as dishwashing, undressing</td>
</tr>
<tr>
<td>3.</td>
<td>Performs light daily tasks but cannot maintain acceptable level of cleanliness</td>
</tr>
<tr>
<td>4.</td>
<td>Needs help with all home maintenance tasks</td>
</tr>
<tr>
<td>5.</td>
<td>Does not participate in any housekeeping tasks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Laundry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Does personal laundry completely</td>
</tr>
<tr>
<td>2.</td>
<td>Launders small items – linens, stockings, etc.</td>
</tr>
<tr>
<td>3.</td>
<td>All laundry must be done by others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F</th>
<th>Mode of transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Travels independently on public transportation or drives own car</td>
</tr>
<tr>
<td>2.</td>
<td>Arranges own travel via taxi, but does not otherwise use public transportation</td>
</tr>
<tr>
<td>3.</td>
<td>Travels on public transportation when accompanied by another</td>
</tr>
<tr>
<td>4.</td>
<td>Travel limited to taxi or automobile with assistance of another</td>
</tr>
<tr>
<td>5.</td>
<td>Does not travel at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G</th>
<th>Responsibility for own medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Is responsible for taking medication in correct dosages at correct time</td>
</tr>
<tr>
<td>2.</td>
<td>Takes responsibility if medication is prepared in advance in separate dosage</td>
</tr>
<tr>
<td>3.</td>
<td>Is not capable of dispensing own medication</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>H</th>
<th>Ability to handle finances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Manages financial matters independently (budgets, writes checks, pays rent, bills, goes to bank), collects and keeps track of income</td>
</tr>
<tr>
<td>2.</td>
<td>Manages day-to-day purchases, but needs help with shopping, major purchases, etc.</td>
</tr>
<tr>
<td>3.</td>
<td>Incapable of handling money</td>
</tr>
</tbody>
</table>

### Physical self-maintenance scale

<table>
<thead>
<tr>
<th>A</th>
<th>Toilets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Care for self at toilet completely, no incontinence</td>
</tr>
<tr>
<td>2.</td>
<td>Needs to be reminded, urinal is used, or淡 to void in clean self, or is rare (weekly at most) accidents</td>
</tr>
<tr>
<td>3.</td>
<td>Soiling or wetting while asleep more than once a week</td>
</tr>
<tr>
<td>4.</td>
<td>Soiling or wetting while asleep more than once a week</td>
</tr>
<tr>
<td>5.</td>
<td>No control of bowels or bladder</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eats without assistance</td>
</tr>
<tr>
<td>2.</td>
<td>Eats with minor assistance at meal times and/or with special preparation of food, or help in cleaning up after meals</td>
</tr>
<tr>
<td>3.</td>
<td>Needs self with moderate assistance and is unsteady</td>
</tr>
<tr>
<td>4.</td>
<td>Requires extensive assistance for all meals</td>
</tr>
<tr>
<td>5.</td>
<td>Does not feed self at all and avoids efforts of others to feed him</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Dressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dresses, undresses, and selects clothes from own wardrobe</td>
</tr>
<tr>
<td>2.</td>
<td>Dresses and undresses self, with minor assistance</td>
</tr>
<tr>
<td>3.</td>
<td>Needs moderate assistance in dressing or selection of clothes</td>
</tr>
<tr>
<td>4.</td>
<td>Needs major assistance in dressing, but cooperates with efforts of others to help</td>
</tr>
<tr>
<td>5.</td>
<td>Completely unable to dress self and resists efforts of others to help</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Grooming (toothbrushing, hair, nails, hands, face, clothing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Always neatly dressed, well-groomed, without assistance</td>
</tr>
<tr>
<td>2.</td>
<td>Grooms self adequately with occasional minor assistance, e.g., shaving</td>
</tr>
<tr>
<td>3.</td>
<td>Needs moderate and regular assistance or supervision in grooming</td>
</tr>
<tr>
<td>4.</td>
<td>Needs total grooming care, but can remain well-groomed after help from others</td>
</tr>
<tr>
<td>5.</td>
<td>Activity negates all efforts of others to maintain grooming</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E</th>
<th>Physical ambulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Moves about house or city, shows patience</td>
</tr>
<tr>
<td>2.</td>
<td>Ambulates within residence or about one block distant</td>
</tr>
<tr>
<td>3.</td>
<td>Ambulates with assistance of (check one) a) cane, b) walker, c) wheelchair, d) other</td>
</tr>
<tr>
<td>4.</td>
<td>Gets in and out without help</td>
</tr>
<tr>
<td>5.</td>
<td>Needs help in getting in and out</td>
</tr>
<tr>
<td>6.</td>
<td>Difficult to transport in chair or wheelchair but cannot propel self without help</td>
</tr>
<tr>
<td>7.</td>
<td>Needs more than half the time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F</th>
<th>Bathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bathes self (tub, shower, sponge bath) without help</td>
</tr>
<tr>
<td>2.</td>
<td>Bathes self with help in getting in and out of tub</td>
</tr>
<tr>
<td>3.</td>
<td>Washes face and hands only, but cannot bathe rest of body</td>
</tr>
<tr>
<td>4.</td>
<td>Does not wash self but is cooperative with those who bathe him</td>
</tr>
<tr>
<td>5.</td>
<td>Does not wash self and resists efforts to keep him clean</td>
</tr>
</tbody>
</table>
APPENDIX IX
Awon ohun elo ise ti osuwon gbigbe aye ojojumo

A. Agbara lati le lo ero ibani soro
1. O n lo ogbon ara eni lati lo ero ibara eni soro, O le gbe oju soke lati te awon nomba, abbl 1
2. O n pe awon nomba to je amo dunju die 1
3. O n gba ipe sugbon ko le pe. 1
4. Ko lo ero ibara eni soro rara 0

B. Rira nnkan
1. O n seto gbogbo nnkan rira funra re 1
2. O n da awon nnkan peepeepee ra 0
3. O nilo alabarin lati lo ra nnkan 0
4. Ko le lo da nnkan ra 0

D. Pipese ounje
1. O le seto, O le pese, O si le da ounje pin 1
2. O le pese ounje to to ti ohun elo ba wa ni sepe 0
3. O le gbe ounje kana, O le pin ounje ati tabi ko pese ounje, sugbon ko le se amulo ohun elo to peye 0
4. O nilo ki won se ounje ki won si gbe e fun un 0

E. Titoju ile
1. O n da ile toju tabi ki a se iranlowo fun un leekookan
   (f.a. iranlowo ise ile to po) 1
2. O n se awon ise ile ti ko po, bi aso fifo, titoju ibusun 1
3. O n se awon ise ile ti ko po, sugbon imototo re mehe 1
4. O nilo iranlowo fun gbogbo ise ile 1
5. O n kopa ninu ise itoju ile 0

E  
Aso fifo
1. O n da gbogbo awon aso re fo mo tonitoni 1
2. O n fo awon aso keekee, O n re ibose, abbl 1
3. Gbogbo aso ni awon elomiran maa n baa fo 0

F. Ilana lilobibo
1. O n da rin irin ajo ninu oko ero tabi o wa oko ayokele re 1
2. O maa n seto irin ajo re pelu oko akero ayokele sugbon ki i lo
   oko akero gbogbogboo 1
3. O maa n ba oko eloro gbogbogbo rin irinajo ti o ba ri eni tele e. 1
4. Irin ajo re ko ju pelu oko ero kekere tabi ohun irinna pelu elomiran lo. 0
5. Kii rin irin ajo rara 0

G. Igbekele fun lilo awon oogun eni
1. Oun lo n se abojuto bo se n lo oogun bo ti to ati akoko to tona 1
2. Oun lo n dahun fun siseto oogun sile lotooto siwaju lilo. 0
3. Ko ni agbara lati se amulo oogun re 0

GB  Agbara lati se akoso isuna
1. On da seto isuna (ilana inawo, kiko iwe sowodowo, sisan owo ile,
   sisan oye owo, lilo si ile ifowopamo gbigba ati titoju iwe bi owo se n wole) 1
2. O n se akoso awon nnkan rira ojoojumo, sugbon o nilo iranlowo nipa fifi
   owo pamo si ile ifowopamo, pelu awon nnkan rira to po ju, abbl. 1
3. Ko ni agbara lati kowo sowo. 0

Osuwon Afojuri fun itoju ara eni
A. Ile Iyagbe
1. O n bojuto ara re nile iyagbe daadaa, ko ni isoro ailemara duro 1
2. O nilo ki a ran an leti tabi ran an lowo lati toju ara eni, tabi ni ijanba leekookan (loosoose to ba poju) 0
3. O maa n yagbe tabi to sara ju eekan lose toba sun 0
4. O maa n yagbe tabi to sara ju eekan lose to ba ji 0
5. Ko si ikojanu igbe ati ito. 0

B. Ounjie jije
1. O n jeun laisi afinu 1
2. O n jeun pelu iranlowo ranpe ni awon akoko ounje ati/ tabi ona ara fun sise ounje, tabi se iranwon lati palemo lehin ounje. 0
3. O n jeun pelu iranlowo ti ko po pupo, ati pe ko ni imototo. 0
4. O nilo iranlowo to wayami fun gbogbo ounje. 0
5. Ko le da ounje je rara ko si nii gba ki enikeni fi ounje nu oun. 0

D. Aso wiwo
1. O n woso, O n bo aso, O si le se asayan aso ninu ibi ipasomosi 1
2. O n wso aso o si n bo aso funra re pelu iranwo ranpe 0
3. O nilo iranlowo niwonba fun wiwo aso tabi sise asayan aso 0
4. O nilo iranlowo to ga ju lati wo aso, sugbon o faramo igbiyanju elomiran lati ran an lowo 0
5. Ko le da aso wo fun ara re rara, ko si nii gba ki elomiran se iranwo fun un 0

E. Tito sara
(Imototo, irun, eekanna, owo, oju, aso)
1. O n mura daadaa nigbagbogbo, O n se finni laisi iranwo 1
2. O n toju ara re daadaa pelu iranlowo ranpe loorekoore f.a. Irun fifa 0
3. O nilo iranlowo niwonba nigbagbogbo, tabi itosona nipa itoju ara 0
4. O nilo gbogbo itoju to je mo ara, sugbon, O le wa ni imototo lehin
iranwo lati odo awon elomiran

5. O n yara lati tako ilakaka awon elomiran lati ri i daju pe O wa ni imototo

E. *Irin Rinrin*

1. O le rin layika tabi laarin ilu
2. O le rin laarin ile tabi iwon ibuso kan
3. O le rin pelu iranwo (se akiyesi okan)
   a ( ) opa b ( ) komonirin   d ( ) Ijoko ologeere
   1 O n jade, o n wole lai si iranlowo
   2 O nilo iranlowo lati jade ati lati wole

4. O le joko lori aga, lai fi owo mu un sugbon ko le ti ara re siwaju lai si iranwo
5. Ori ibusun lo ma n wa fun opolopo igba

E. *Iwe Wiwe*

1. O n we ara re (igi igbomi, fifi origbe omi, kanrinkan wiwe) laisi iranwo
2. O n we pelu iranlowo gbigbe opa igbomi
3. O le boju kosi fo owo lasan, sugbon ko le we ara yooky.
4. Ko le we ara re sugbon O fara mo awon to n we fun un
5. Ko le we ara re O si lodi si ilakaka lati le je ko wa ni imototo
APPENDIX X

DENTAL SHEET

NUMBER OF TEETH PRESENT

<table>
<thead>
<tr>
<th>RIGHT UPPER QUADRANT</th>
<th>LEFT UPPER QUADRANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>87654321</td>
<td>12345678</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>RIGHT LOWER QUADRANT</th>
<th>LEFT LOWER QUADRANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>87654321</td>
<td>12345678</td>
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TOTAL=______________

NUMBER OF TEETH MISSING

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<table>
<thead>
<tr>
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</table>

TOTAL=______________

THE NUMBERS 1 TO 8 REPRESENT THE TOOTH POSITION IN EACH QUADRANT OF THE MOUTH WITH A TOTAL OF 32 TEETH.
APPENDIX XI

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IAMRAT)
College of Medicine, University of Ibadan, Ibadan, Nigeria.

Director: Prof. Catherine O. Falade, MBBS (ib), M.Sc, FMCP, FWACP
Tel: 0803 326 4593, 0802 360 9151
e-mail: cfalade@comui.edu.ng lillyfunke@yahoo.com

UI/UCH EC Registration Number: NHREC/05/01/2008a

Notice of Renewal of Approval
Re: Cognitive Impairment, Depressive Symptoms and Tooth Loss among attendees at the Outpatient Clinic of a Geriatric Centre in Ibadan

UI/UCH Ethics Committee assigned number: UI/EC/14/0037
Name of Principal Investigator: Dr. Mofoluwake E. A. Majekodunmi
Address of Principal Investigator: Department of Psychiatry,
University College Hospital, Ibadan

Date of receipt of valid application for renewal of approval: 19/01/2016

Status: Renewal of Approval

This is to inform you that the UI/UCH Ethics Committee has received and reviewed your application for renewal of approval on the above titled research. The report states that the study has not started since it was approved. It also indicates a change of title as stated above.

The Committee notes the contents of the report and having found it satisfactory, hereby approves your request for renewal of approval for One Year of Study Only.

This renewed approval dates from 20/01/2016 to 19/01/2017. Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the UI/UCH EC assigned number and duration of UI/UCH EC approval of the study. It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC early in order to obtain renewal of your approval to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. No changes are permitted in the research without prior approval by the UI/UCH EC except in circumstances outlined in the Code. The UI/UCH EC reserves the right to conduct compliance visit to your research site without previous notification.

Professor Catherine O. Falade
Director, IAMRAT
Chairperson, UI/UCH Ethics Committee
E-mail: uuchec@gmail.com