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Prevalence of Suspected Dementia in a Sample of Adults Living in Kinshasa-Democratic Republic of the Congo

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Abstract

Background: The prevalence of dementia in Sub-Saharan Africa, particularly French-speaking countries, has received limited attention. This study investigates the prevalence and risk factors of suspected dementia in elderly adults in Kinshasa, Democratic Republic of the Congo (DRC).

Methods: A community-based sample of 355 individuals over 65 years old was selected using a multistage probability sampling in Kinshasa. Participants were screened using the Community Screening Instrument for Dementia (CSID), Alzheimer's Questionnaire (AQ), Geriatric Depression Scale (GDS), Beck Anxiety Inventory (BAI) and Individual Fragility Questionnaire followed by clinical interview and neurological examination. Suspected dementia diagnoses were made based on DSM-5 criteria including significant cognitive and functional impairments. Prevalence and odd ratios with 95% confidence interval were calculated using respectively regression and logistic regression.

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Results: Among 355 participants (mean age 74, SD = 7; 51% male), the crude prevalence of suspected dementia was 6.2% (9.0% in women and 3.8% in men). Female sex was a significant factor associated with suspected dementia [OR=2.81, 95% CI (1.08–7.41)]. The prevalence of dementia increased with age (14.0% after 75 years and 23.1% after 85 years), with age being significantly associated with suspected dementia [OR = 5.42, 95% CI (2.86–10.28)]. Greater education was associated with lower prevalence of suspected dementia [OR = 0.36, 95% CI (0.14–0.94), comparing those with   7.3 to <7.3 years of education]. Other factors associated with the prevalence of suspected dementia included being widowed (OR = 1.66, 95% CI (1.05–2.61), being retired or semi-retired (OR = 3.25, 95% CI (1.50–7.03)], a diagnosis of anxiety [OR = 2.56, 95% CI (1.05–6.13)] and death of a spouse or a relative after age 65 [OR = 0.73, 95% CI (0.58–0.92)]. In contrast, depression [OR = 1.92, 95% CI (0.81–4.57)], hypertension [OR = 1.16, 95% CI (0.79–1.71)], BMI [OR = 1.06, 95% CI (0.40–2.79)], and alcohol consumption [OR = 0.83, 95% CI (0.19–3.58)] were not significantly associated with suspected dementia.

Conclusions: This study found a prevalence of suspected dementia in Kinshasa/DRC similar to other developing countries and Central African countries. Reported risk factors provide information to identify high-risk individuals and develop preventive strategies in this setting.

Introduction

As the population ages in Sub-Saharan African (SSA) countries, we expect the burden of dementia to increase. There are an estimated 2.1 million individuals with dementia in SSA countries and it is projected that this number will triple by the year 2040 [1]. While the prevalence of dementia has been estimated in research in most world regions [2], such data from French speaking Sub-Saharan Africa (SSA) countries is very limited [3]. According to existing publications, prevalence of dementia among older adults in SSA ranges between 2.3% to 21.6 % [4, 5]. Some of these studies have reported variations in prevalence according to geographical regions [3]. In North Africa for example, the prevalence of dementia ranges between 2.3% among those over 50 years old [6] and 5.1% among those over 60 years old [7]. In the West Africa, studies have estimated the prevalence rates of dementia between 2.3% [8] and 10.0 % among those over 65 years old [9]. In East Africa, the prevalence of dementia ranges between 6.4% among those over 70 years old [10] and 20.0% among those over 60 years old [11]. In Central Africa, the prevalence varied from 6.7% to 8.1% among those over 65 years old [12]. In South Africa, studies have found the prevalence ranging from 7.9% among those over 60 years old [13] to 11.0% among those 65 years old and over [14].

Many of these studies have reported geographic differences and lower prevalence of dementia compared to Europe and America [3]. These variation and lower reported prevalence rates have been explained based mostly on quality of research methods (cross-sectional, longitudinal), the types of study setting (community vs clinical or hospitals) [3] diagnostic criteria [The Diagnostic and Statistical Manual of Mental Disorders (DSM) III-R, DSM-IV-TR, International Classification of Diseases (ICD 10), or community screening instrument for dementia (CSID) [15] and screening tools (Brief CSID, section of CSID, use of 10 Word Recall Test,). Notably, many of these investigations lack neuropsychological tests developed and validated in SSA populations.

These studies have examined risk factors of dementia in SSA which have been grouped into non-modifiable and modifiable risks [3]. Among non-modifiable risk factors, studies found that older age and female sex [8] Bottom of Form were associated with dementia. Studies of modifiable risk factors have reported significant association between low educational attainment [16] and dementia. Low social network [17] and poor social engagement [18] were also risk factors of dementia. Pilleron and colleagues (2015) [19] have reported a significant correlation between death of one parent during childhood and dementia in the Central Africa region. While other studies have shown limited evidence on the association between lifestyle factors (diet, physical activity and alcohol) and dementia in SSA, others found significant association between undernutrition [20] and low body mass index (BMI; [21]). Finally, cardiovascular factors such as systemic hypertension and type 2 diabetes have been reported as significant risk factors of dementia in SSA [22] and Central Africa [20].

Most of these epidemiological studies have been conducted in English speaking countries of SSA (Nigeria [8, 23], Ghana [24], Tanzania [10], Uganda [11], South Africa [13]). Researchers in these countries have therefore used screening and diagnostic tools from either the United Kingdom (UK) or the United States of America (USA), which could be easily applied to English-speaking individuals in these countries. In addition, screening tools from the UK or USA are more plentiful and easily available than those in French. There are only very few studies done in French speaking countries in SSA (e.g., Benin, Central African Republic, Republic of Congo) [12, 25].

Therefore, this project investigated the prevalence of suspected dementia in a sample of adults over 65 years old screened and interviewed in Kinshasa, the capital city of the second biggest country of Africa and in the most populous French speaking country in SSA, the Democratic Republic of the Congo (DRC). Like other SSA countries, the DRC has seen a drastic increase in the aging population (3.7 millions of those over 60 years old, 22% of the population) and in life expectancy (59 years in 2019 and will be expected to be 67 years in 2040) [26].

We hypothesized that the prevalence of suspected dementia in the DRC to be similar to the rates reported in Central African Republic, Bangui (8.1%) and Republic of Congo, Brazzaville (6.7%). We also predict that being older, female, less educated, widow, retired and having depression, hypertension, and low BMI to be significant predictors of suspected dementia. Overall, should our hypotheses be correct, our results would provide first evidence of the prevalence of suspected dementia in this large SSA country, and potentially suggest predictors of dementia to aid future dementia's studies.

Methods

Participants

Participants were randomly selected in Kinshasa, the capital of the Democratic Republic of the Congo (DRC). We have chosen Kinshasa because it mirrors most aspects of life in DRC. Kinshasa has 19% of the population of the DRC (i.e., 15 million inhabitants out of a population of 80 million in the DRC). Like the rest of the country, over 90% of the city is rural in nature and 70% of its inhabitants are employed informally [13]. The level of

literacy is 70% with gender disparity (male 88% and female 67%) [12]. Kinshasa inhabitants speak the four official national languages of the country (Lingala, Kikongo, Swahili, and Tshiluba), and 3% of each population is over 65 years old. We used a multistage random sampling method to select the study population (see Figure 1). In the first step, 33 districts were selected out of 330 districts of Kinshasa. Then, an exhaustive list of all the households in the 33 districts was obtained and 35 households from each district were randomly selected equating to 1155 households in total. For this study, only households with individuals 65 years old and over were randomly selected to participate to the study which yield 512 individuals. We ascertained age by requesting an official document (e.g., driver's license, the elector card), from the informant, or through a local event calendar (Independence Day of DRC). Out of the 512 individuals, 355 agreed to participate in the study and met criteria for the study. Participants were individuals who met the following criteria: (1) age 65 or older (to increase likelihood of recruiting individuals with dementia) and currently living in the study area, (2) fluent in French and/or either in one of the four national languages, (3) no significant auditory or visual deficits which would hinder task performance; (4) the subject or the family have to be able to give informed consent.

Procedure: Participants or their informants were contacted door by door or by phone. Demographic, medical history, screening measures, and questionnaires were obtained by investigators. Investigators also measured cardiometabolic factors (blood pressure, height, and weight) with sphygmomanometer during the same session.

Field investigators: Data collection was performed by trained neurology and psychiatry fellows of the University of Kinshasa. They were chosen for their familiarity with the designated districts. There was a briefing after each week of field work, and a trained neuropsychologist (Jean Ikanga) checked the missing data and the discrepancies. The whole screening was supervised by Dr. Ikanga and Dr. Pierre Akilimali, who is a Congolese epidemiologist.

Sample size considerations: We recruited 355 participants from current contact lists developed by the Kinshasa School of Public Health. This number of subjects is enough to detect a prevalence of cognitive impairment in DRC with a margin of error at 2.5 at 95% confidence interval based on the prevalence study conducted on suspected dementia of 6% in elderly participants over 65 years old from Brazzaville [12].

Instruments: The following instruments were completed on paper and pencil.

<u>**Community Screening Instrument for Dementia (CSID) [27]:**</u> In the absence of established diagnostic screening in SSA, we utilized the CSID. While not the gold standard in diagnosis of dementia in SSA, this approach has been used in developing countries in which better validated clinical criteria are not available. The CSID has been used in developing countries in many international dementia studies in SSA to screen cognitive functioning [12, 28, 29]. This measure comprises the cognitive assessment section and the informant section. The cognitive section evaluates cognitive domains such orientation, attention, language, constructional apraxia, learning and memory (3 trials of 10 words each and a delayed recall trial). This screening measure has a strong interrater reliability (0.99).

The score of the cognitive section varies between 0 and 55. Lower score indicates worse cognition.

Alzheimer's Questionnaire (AQ): The AQ assesses orientation, functional ability, language, visuospatial, and memory of the participants from informant. The AQ is a yes/no questionnaire, with scores ranging between 0 and 26 and higher scores indicating more impairment [30–32]. Studies have found a sensitivity of 98.55 and specificity of 96 for AD [32].

Geriatric Depression Scale (GDS): The 15-item GDS is a self-report questionnaire used to evaluate depression, which is common in late life among adults [33]. Total scores range from 0 to 15, with higher scores indicating greater levels of depressive symptoms. A cutoff score > 5 suggests the presence of depression [34, 35]. The GDS has 92% sensitivity and 89% specificity in its diagnosis of depression [36].

Beck Anxiety Inventory (BAI): The BAI is used as a measure of anxiety with its somatic symptoms [37]. This psychiatric self-inventory test has 21 items and each symptom is rated on a 4-point Likert scale ranging from 0 to 3. The BAI has a total score which varies from 0–63. The score of < 9 indicates normal anxiety while the score of >10 indicate anxiety disorder [38]. The BAI has a high internal consistency (Cronbach's alphas between 0.90 and 0.94) [39]. The test-retest reliability revealed reasonable coefficients ranging from 0.62 (7-week interval) to 0.93 (1-week interval) [39–41].

Individual Fragility Questionnaire: This questionnaire is an adaptation of the "Short Emergency Geriatric Assessment " which is a frailty instrument for elderly people [50]. In this study, we used this questionnaire which was adapted by the University of Reims Champagne Ardennes in France [50]. This instrument is divided into two sections which include geriatric profile and complementary section. Geriatric profile is comprised of 13 items which assess frailty in elderly subjects. This section measures risk factors resulting in functional decline such as age, place of origin, mood, medication, perception of health, number of falls the last 6 months, nutrition, activities of daily living, comorbidity, mobility, urinary incontinence, meal intake, and cognitive functions. Second section evaluates 11 complementary areas of frailty in elderly people. This section assesses the number of hospitalizations in the last 6 months, vision, auditory, social support, professional home help, caregiver, perception of the burden by relatives, housing, financial situation, perception of future by the patient and relatives. Each gerontological aspect is rated on a 3-point Likert scale ranging from 0 to 2. The score ranges between 0–48 points (i.e., 26 points for the first section and 22 points for second section), with higher score indicating greater individual fragility [50]. Only the total score was computed and item level data were not analyzed.

Diagnosis of Dementia

Guerchet and colleagues using CSI-D in Brazzaville [12] reported the mean score of 28.4 (SD=1.5) for those without cognitive impairment, 23.9 (SD 2.5) for cognitive impairment with no dementia, and 18.6 (SD=5.6) for suspected dementia. Based on previous studies conducted in Brazzaville and Bangui, we used a score of <25.5 in CSID as cutoff for

those cognitively impaired or with suspected dementia to undergo clinical assessment. This score has shown a sensitivity of 93% and specificity of 82% in the diagnosis of suspected dementia [12].

On the other hand, a cutoff of <13 in the AQ has been used for functionally unimpaired individuals and cutoff of >13 for suspected dementia subjects [32]. In this project, we limited ourselves to classifying participants into normal cognitive aging, subjective cognitive complaints, mild neurocognitive disorder, and major neurocognitive disorder. We made these diagnoses based on the DSM-V diagnostic criteria for mild or major neurocognitive disorders which are cognitive and functional impairment. These diagnoses followed the diagram in Figure 2.

Normal cognitive aging was classified based on criteria of AQ <13 (functionally unimpaired) and CSID >25.5 (cognitively unimpaired). Mild neurocognitive disorder was diagnosed based on the criteria of CSID <25.5 and AQ<13. Subjective memory impairment is assigned to those who were cognitive unimpaired (CSID >25.5) but functionally impaired (AQ >13). Major neurocognitive disorder subjects were those who are cognitively impaired (CSID < 25.5) and functionally impaired (AQ>13) (Figure 2). Diagnosis and criteria are presented in Figure 2.

Subjects who were screened and diagnosed with major neurocognitive disorder underwent cognitive evaluation (List memory Test), clinical interview and assessment (Geriatric Depression scale for depression, hypertension, BMI), and other psychiatric and neurological evaluations to determine the etiology of their cognitive deficits. Information from the clinical interview and these additional assessments were used in conjunction with the group membership to ascertain suspected dementia diagnosis. An expert panel (neurologist, psychiatrist, and neuropsychologist) utilized all these clinical data to classify the participants as having suspected dementia or other cognitive status.

Data analyses

Frequency and prevalence of normal cognitive aging, subjective cognitive complaint, and suspected cognitive impairment overall and by age and gender with 95% confidence interval (CI) were calculated. Analysis of variance were conducted to test differences in measures across demographic (age, education) subgroups. Logistic regression was conducted to calculate the odd ratios of risk factors.

Results

Sample characteristics:

We recruited 355 individuals 65 years of age or older ranging from 65 to 98 years (mean=73.6 years; SD= 6.7 years) in Kinshasa. The sample comprised even number of male and female divided with a mean year of education of 7.3 (SD=4.7 years) ranging from 0 to 20 years. All participants were Black and were born and raised in the DRC and there were no immigrants in the sample. The majority of the participants completed the evaluation in Lingala (61.9%) and 30.5% were allowed to respond in either Lingala or French. Characteristics of the sample are represented in table 1.

Additionally, Table 1 includes aspects of psychological functioning of the participants. Regarding primary stressors at various points in their life, death of the parents was the most common stressing factor of many subjects before age of 16 years. Death of a child or spouse, and sickness of children were primary stressors between the ages of 17 to 64 years old. Later in life (65 years old), several major stressors were common, including the death of family members/spouse, serious illness, and change in financial status. Diagnoses of geriatric depression and anxiety were high in the sample. Some participants had harmful alcohol consumption while some developed alcohol use disorder.

Cerebrovascular risk factors (CVRF) were present with many participants reporting history of clinical hypertension, diabetes, stroke, and heart attacked. The majority of the sample had normal body mass index, with only few participants being underweight, overweight, and obese (See Table 1).

Differences in CSID scores across groups

The average performance on the CSID of the group 25.2 (SD = 4.2). Males had higher scores on the CSID ($M = 26.2$, $SD = 3.5$) compared to females ($M = 24.2$, $SD=4.6$), p=< .001. There was a significant statistical difference in mean among difference age groups (see Table 2). Participants highly educated (> 7.3 years of education) scored higher than those less educated. Although there was statistical difference in mean between different levels of education (p=< .001), post hoc multiple comparisons did not show significant difference between those with 7–12 years of education and 13 years old of education and over (see Table 2).

Differences in AQ scores across groups

We also compared group in terms of their functional activities. The average score of the sample on AQ was 5.9 (SD=5.8). Females had higher scores on the AQ (M= 7.4, SD=6.4) compared to males (M=4.5, SD=4.8), p < .001. Older participants had higher AQ scores than younger ones, p < .001. Post hoc multiple comparisons using Bonferroni showed statistical mean difference between all the age groups (see table 3). Participants with lower education had higher AQ score compared to highly educated. Although there was statistical difference in means between different levels of education, $p<.001$, post-hoc comparisons using Bonferroni did not show any statistical mean difference between those 7–12 years and 13 years and over (See Table 3).

Classification

Based on the flow diagram of participants diagnostic classification using CSID and AQ, 53.1% of the sample was cognitively impaired (188 subjects), 34.7% had mild neurocognitive disorder (123 subjects), 1.7% were diagnosed with subjective memory complaint (6 subjects) while 10.4% had major neurocognitive disorder (37 subjects).

After clinical evaluation, the prevalence of suspected dementia in the overall sample was 6.2%. Women had a higher prevalence of dementia than men. The prevalence of dementia increased with age and was higher among those with fewer years of education (see Table 4).

The rate of suspected dementia in our sample was not statistically different from the rates reported in Bangui (χ^2= 1.101, p=0.293) and Brazzaville (χ^2= 0.087, p=0.768).

Risk factors for dementia

We calculated the odd ratios of suspected dementia for some demographic, psychiatric, and CVRF. Gender (being female), age (being >75 years), occupation (being semi-retired or retired), educational attainment (having less than <7.30 years of education), social stress after 65 years old (death of relative or spouse), and anxiety were significantly associated with higher odds of suspected dementia. Alcohol consumption, depression, systemic hypertension, and BMI were not significant risk factors for dementia in this sample. The results are presented in Table 5.

Discussion

This paper is the first population-based study to estimate the prevalence of suspected dementia in Kinshasa, the Democratic Republic of Congo, among individuals 65 years of age and older. The overall prevalence of suspected dementia in this setting was 6.2%. This prevalence estimate is similar to the global prevalence of dementia [42] which ranged between 5–8% in the general population of individuals over 60 years old and other SSA countries (Republic of Congo: 6.7%, Central African Republic: 8.1%, Tanzania: 6.4%, South Africa: 7.9%) [12, 13, 28]. This estimate, however, differs from that provided by other studies conducted in SSA countries (e.g. Nigeria: 2.3% [8], Benin: 3.7% [25], Uganda: 20.0% [11]). A recent review article on dementia in Africa suggests this variation can be explained by differences in the quality of methods, types of research setting, diagnostic criteria, and screening measures used [3].

We also examined the association of sociodemographic risk factors with the prevalence of suspected dementia. Female sex, older age and lower education level were significantly associated with higher prevalence of suspected dementia. Females are more likely to be diagnosed with dementia than males due in part to their greater longevity and poorer education opportunity than males in SSA [3]. The prevalence of dementia also increased with age and low educational attainment. Although limited evidence supports the educational attainment as a risk factor of dementia in SSA, it is most likely that the majority of older Africans have less than 7 years of formal education and have low cognitive reserve to protect them to dementia [3]. Finally, being widow, semi-retired and retired were also significant predictors of suspected dementia. These findings were unexpected in this multigenerational culture which builds strong relationship among family members making it easier for one aging family member to request or receive care whenever needed [43].

The present study also reports high frequency of a death in the family (child, spouse, parent or relative) and serious physical illness as the most prevalent psychological factors. While these psychological stressors were not significant risk factors of suspected dementia if they occurred before age 65, death of a spouse or a relative was a significant predictor after age 65. These findings support previous studies which considered psychological stress as a risk factor for the development of amnestic mild cognitive impairment and dementia [44, 45]. Although there was high percentage of geriatric depression and anxiety in this sample, only

anxiety was a significant risk factor of suspected dementia. It is difficult to distinguish if anxiety is a prodrome or consequence or risk factor for dementia [46] in this post-conflict country. Finally, the findings of this study did not support previous studies which reported significant association between alcohol consumption and suspected dementia [47].

Several studies in the SSA and Central Africa Region have demonstrated the association between cardiovascular risk factors (e.g., systemic hypertension) and dementia [3]. However, this study did not find any significant association in this sample. This may be due to a high prevalence of adequate hypertension control. Additionally, both low and high BMI have been shown to be risk factors of dementia respectively in Nigeria and developing countries [48]. Most individuals in this sample had a normal BMI with only less 18% of the sample having low BMI and 9.5% being obese.

We based our suspected dementia diagnosis on the DSM-5 criteria. We considered cognitive deficits in neurocognitive tests and functional impairments in daily life as criteria for major neurocognitive disorder or dementia. We have used DSM criteria to estimate the crude prevalence of dementia in this sample to maintain comparability with other studies done in Sub-Saharan Africa [12].

Limitations

The following represent limitations to our current study. First, this study is cross-sectional and has provided us a snapshot of the burden and risk factors of suspected dementia in Kinshasa/DRC. However, it is difficult to estimate incident cases and some measures of effects including risk and rate difference/ratio. Second, we used primarily screening tests to recruit and classify our sample, which have in general worse diagnostic performance to detect dementia than more extensive neurocognitive testing [49]. Future research should consider replicating these findings using a comprehensive neuropsychological battery. Third, etiologic diagnosis of dementia requires blood tests, neuroimaging, detailed clinical features and genetic tests. Future studies should use these tests to obtain more precise diagnoses. Fourth, similar to other populations where neuropsychology or neurology is not well developed, the population in this study lacked familiarity with Western-based cognitive testing regardless of years of education. Given this, some individuals particularly those with fewer years of education had some difficulties with drawing tasks. However, to the best of our knowledge, there are few cognitive screeners available that were developed and validated in an illiterate population of the low-income countries. Among them are cognitive screening used in the longitudinal study of families and health in Malawi [52], and cognitive function study in low-income and low literacy countries in Africa [51]. Thus, this study has faced the same issue of low education as a biasing factor in assessing cognition among illiterate elderly adults in the SSA. The efforts of this work matched previous ongoing efforts to use these tests reliably among people who are illiterate by minimizing language and culture confounding effects in those screening tests [51]. Fifth, we did not have information on informal forms of education/training such as apprenticeship which may be more common in countries such as the DRC. Studies focused on quantifying apprenticeships and other forms of informal education/training and examining its equivalence to formal education are needed, particularly to examine their impact on the risk for dementia as most

studies, to the best of our knowledge, have focused on more formal forms of education. Sixth, data of this study were only collected in Kinshasa. Therefore, future studies recruiting from multiple regions are needed to generalize to the entire region of the DRC. These results are more related to Kinshasa. This study identified participants mostly based on their cognitive and functional impairments. Sixth, we did not assess the interaction between age, sex, and education as well as with other covariates. We did not also include the language of administration as a covariate in our analysis. Finally, although the tests were appropriately translated and adapted, they were not validated in Lingala and in French. Future studies should validate these screening measures in local languages.

In conclusion, despite some limitations, the current study provides valuable estimates of the crude prevalence of suspected dementia in Kinshasa/DRC and preliminary data about risk factors for suspected dementia in this population. Future research should build on the methods and findings provided by this study to clarify the burden of and risk factors for overall dementia and dementia subtypes in SSA.

FUNDING

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Research in context

Systematic Review:

As the population ages in Sub-Saharan African (SSA) countries, we expect the burden of dementia to increase. There are an estimated 2.1 million individuals with dementia in SSA countries and it is projected that this number will triple by the year 2040 [1]. While the prevalence of dementia has been estimated in research in most world regions [2], such data from French speaking Sub-Saharan Africa (SSA) countries is very limited [3]. According to existing publications, prevalence of dementia among older adults in SSA ranges between 2.3% to 21.6 % [4, 5]. Some of these studies have reported variations in prevalence according to geographical regions [3]. In North Africa for example, the prevalence of dementia ranges between 2.3% among those over 50 years old [6] and 5.1% among those over 60 years old [7].

In the West Africa, studies have estimated the prevalence rates of dementia between 2.3% [8] and 10.0 % among those over 65 years old [9]. In East Africa, the prevalence of dementia ranges between 6.4% among those over 70 years old [10] and 20.0% among those over 60 years old [11]. In Central Africa, the prevalence varied from 6.7% to 8.1% among those over 65 years old [12]. In South Africa, studies have found the prevalence ranging from 7.9% among those over 60 years old [13] to 11.0% among those 65 years old and over [14].

Interpretation:

Among 356 participants (mean age 74, SD = 7; 51% male), the crude prevalence of suspected dementia was 6.2% (9.0% in women and 3.8% in men). Female sex was a significant factor associated with suspected dementia [OR=2.81, 95% CI (1.08–7.41)]. The prevalence of dementia increased with age (14.0% after 75 years and 23.1% after 85 years), with age being significantly associated with suspected dementia [OR = 5.42, 95% CI (2.86–10.28)]. Greater education was associated with lower prevalence of suspected dementia [OR = 0.36, 95% CI (0.14–0.94), comparing those with ≥7.3 to <7.3 years of education].

We calculated the odd ratios of suspected dementia for some demographic, psychiatric, and CVRF. Gender (being female), age (being >75 years), occupation (being semi-retired or retired), educational attainment (having less than <7.30 years of education), social stress after 65 years old (death of relative or spouse), and anxiety were significantly associated with higher odds of suspected dementia. Alcohol consumption, depression, systemic hypertension, and BMI were not significant risk factors for dementia in this sample.

Future directions:

The following represent limitations to our current study. First, this study is cross-sectional and has provided us a snapshot of the burden and risk factors of suspected dementia in Kinshasa/DRC. However, it is difficult to estimate incident cases and some measures of effects including risk and rate difference/ratio. Second, we used primarily screening tests to recruit and classify our sample, which have in general worse

diagnostic performance to detect dementia than more extensive neurocognitive testing [49]. Future research should consider replicating these findings using a comprehensive neuropsychological battery. Third, etiologic diagnosis of dementia requires blood tests, neuroimaging, detailed clinical features and genetic tests. Future studies should use these tests to obtain more precise diagnoses. Fourth, similar to other populations where neuropsychology or neurology is not well developed, the population in this study lacked familiarity with Western-based cognitive testing regardless of years of education. Given this, some individuals particularly those with fewer years of education had some difficulties with drawing tasks. However, to the best of our knowledge, there are no cognitive screeners available that were developed and validated in an illiterate population, thus, the lack of cognitive screeners for those without any formal education or fewer years of education presents with a significant limitation of the field. Fifth, we did not have information on informal forms of education/training such as apprenticeship which may be more common in countries such as the DRC. Studies focused on quantifying apprenticeships and other forms of informal education/training and examining its equivalence to formal education are needed, particularly to examine their impact on the risk for dementia as most studies, to the best of our knowledge, have focused on more formal forms of education. Sixth, data of this study were only collected in Kinshasa. Therefore, future studies recruiting from multiple regions are need to generalize to the entire region of the DRC. These results are more related to Kinshasa. Finally, this study identified participants mostly based on their cognitive and functional impairments.

In conclusion, despite some limitations, the current study provides valuable estimates of the crude prevalence of suspected dementia in Kinshasa/DRC and preliminary data about risk factors for suspected dementia in this population. Future research should build on the methods and findings provided by this study to clarify the burden of and risk factors for overall dementia and dementia subtypes in SSA.
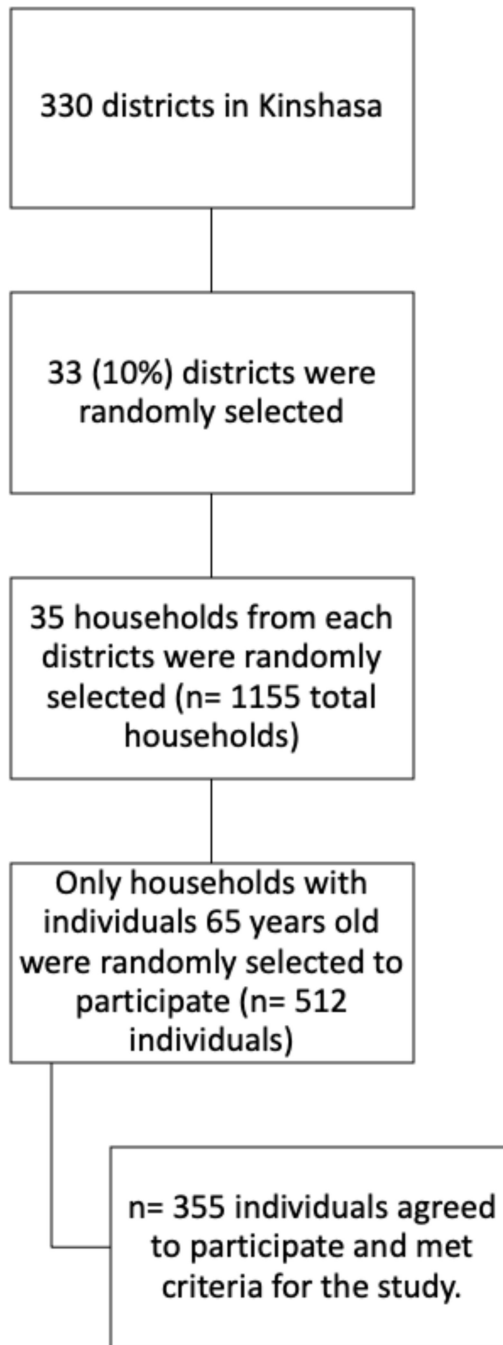
Figure 1:
Flowchart of recruitment procedures.

N=355

First Step: Classify participants using CSI-D

Cognitively Impaired
- Based on CSI-D < 25.5 n=161

Cognitively Unimpaired
- Based on CSI-D ≥ 25.5 n=194

Second Step: Classify participants using AQ

Functionally Impaired
- Based on AQ > 13 n=37

Functionally Unimpaired
- Based on AQ ≤ 13 n=124

Functionally Impaired
- Based on AQ > 13 n=7

Functionally Unimpaired
- Based on AQ ≤ 13 n=187

Major neurocognitive disorder n=37

Mild neurocognitive Disorder n= 124

Subjective Cognitive Impairment n=7

Normal Cognition n=187
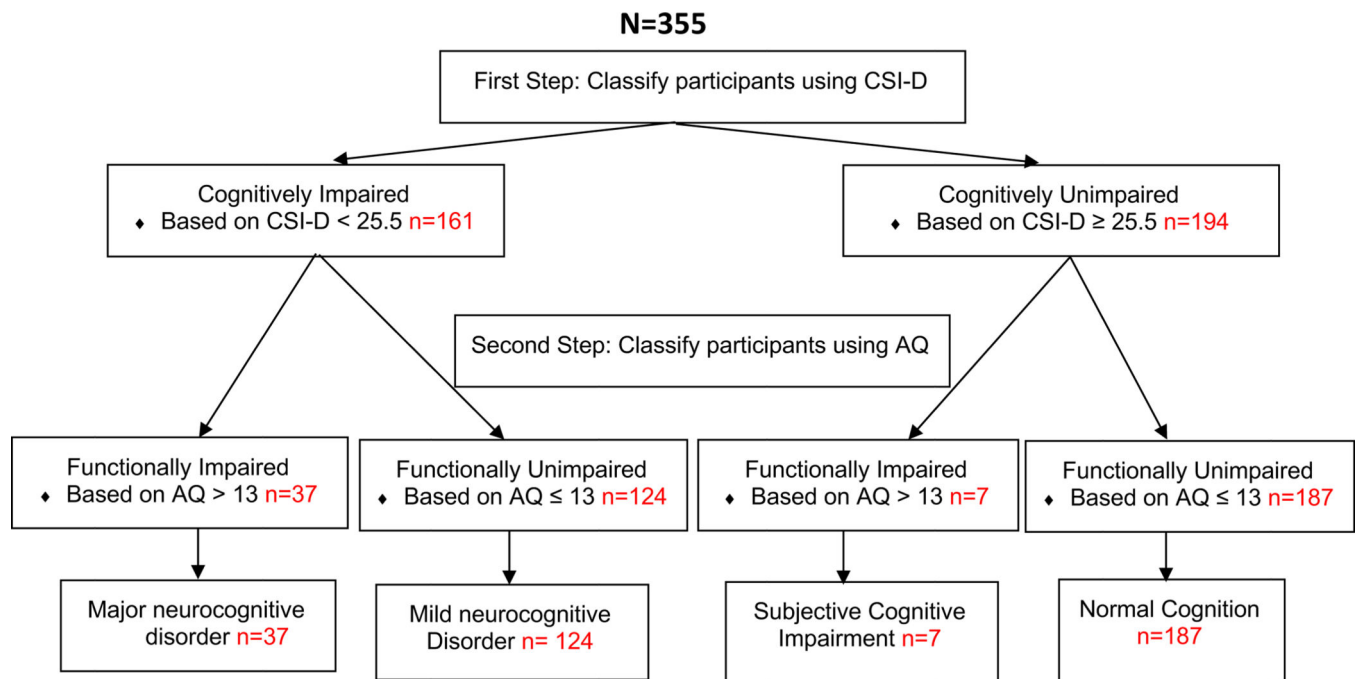
Figure 2.
Flow diagram of participants diagnostically classified using the CSI-D and the AQ in the current study.

Table 1:

Characteristics of the sample, means and standard deviations

Characteristic	N	Frequency (%)
Gender		
Male	177	49.9
Female	178	50.1
Age, years		
65–74	223	62.6
75–84	106	30.1
>85	26	7.3
Education		
0–6 years (Primary school)	166	47.0
7–12 years (Secondary school)	142	40.2
13–15 years (Bachelor degree)	42	11.9
>18 years	3	0.9
Language of evaluation		
French only	27	5.6
Lingala only	219	61.9
Both French/Lingala	109	30.5
Marital status		
Single	2	<1
Married	154	44.3
Divorce	26	7.5
Widowed	163	46.8
Free relationship	3	0.9
Occupation status		
Active	83	23.5
Semi-retired	131	37.0
Retired	140	39.5
Psychosocial factors before 16 years		
Death of one parent	69	27.8
Divorce of parents	16	6.5
Raised by one parent	34	13.7
Raised by another person	20	8.1
Raised in extreme poverty	6	2.4
Psychosocial factors between 16 and 64 years		
Death of a spouse	88	31.4
Death of child	99	35.4
Illness of a child	42	15.0
Exhausting job	13	4.6
Jobless	18	6.4
Psychosocial factors after 65 years		

Characteristic	N	Frequency (%)
Death of a spouse	66	22.9
Serious physical illness of a spouse	46	16
Death of a child	35	12.2
Serious illness of a child	8	2.8
Death of relatives or friends	85	29.5
Change in financial status	38	13.2
Depression		
Symptoms of depression	125	35.2
Anxiety		
Symptoms of anxiety	80	22.5
BMI		
<18.5	62	17.9
18.5–24.5	190	54.8
25.0–29.9	62	17.9
>30.0	33	9.5
Hypertension		
Hypertension	105	29.8
Alcohol consumption		
Low risk consumption	318	89.6
Harmful alcohol consumption	36	10.1
Alcohol use disorder	1	0.3
Physical exercises		
0–1 times per month	209	58.9
1–3 times per week	107	30.1
4–5 times per week	24	6.8
6–7 times	15	4.2
Reading		
No reading	175	49.2
1–3 per week	95	26.7
4–5 per week	35	9.8
6 times or more per week	47	13.2

Characteristic	N	Mean	SD
Age in years	355	73.6	6.7
Education years	355	7.3	4.7
Hours of sleep	353	8.2	2.0
Systolic blood pressure, mmHg	355	135.4	24.9
Diastolic blood pressure, mmHg	347	76.8	16.0
GDS	355	4.7	2.1
BAI	355	4.4	5.2
AUDIT	353	2.9	3.1
BMI (Kg/m^2)	347	23.2	4.1
CSID	355	25.2	4.2

Characteristic	N		Frequency (%)
AQ	355	5.9	5.8
FAQ	355	6.8	7.7

AQ: Alzheimer's questionnaire; AUDIT: Alcohol Use Disorders Identification Test, BAI: Beck Anxiety Inventory, BMI: Body Mass Index, CSI-D: Community Screening Instrument for Dementia, FAQ: Functional Activities Scale, and GDS: Geriatric Depression Scale.

Table 2A:

CSID Scores across age and education groups

	N	Mean	Std	ANOVA	p-value
Age Groups				25.1	<.001
60–69 years	109	26.9	3.3	--	--
70–79 years	178	25.4	3.8	--	--
80–89 years	61	22.7	4.0	--	--
Education Groups				17.1	<.001
1–6 Years	166	23.9	4.5	--	--
7–12 Years	143	26.4	3.3	--	--
13–17 Years	42	26.2	4.4	--	--

Table 2B:

Pairwise comparisons and Cohen's D effect sizes

	Mean Difference	p-value	Cohen's D
Age Groups			
60–69 vs 70–79	1.5	.002	0.435
60–69 vs 80–89	4.2	<.001	1.144
70–79 vs 80–89	2.6	<.001	0.675
Education Groups			
1–6 vs 7–12	−2.6	<.001	0.651
1–6 vs 13–17	−2.3	.002	0.531
7–12 vs 13–17	.20	1.00	0.054

Differences in AQ scores across groups

Table 3A:

AQ Scores across age and education groups

	N	Mean	Std	ANOVA	p-value
Age Groups				41.48	<.001
60–69 years	109	3.8	3.9	--	--
70–79 years	177	5.2	5.0	--	--
80–89 years	61	10.9	6.5	--	--
Education Groups				15.68	<.001
1–6 Years	165	7.6	6.2	--	--
7–12 Years	143	4.1	4.6	--	--
13–17 Years	42	5.2	6.2	--	--

Table 3B:

Pairwise comparisons and Cohen's D effect sizes

	Mean Difference	p-value	Cohen's D
Age Groups			
60–69 vs 70–79	−1.3	0.092	0.293
60–69 vs 80–89	−7.1	<.001	1.312
70–79 vs 80–89	−5.7	<.001	0.989
Education Groups			
1–6 vs 7–12	3.5	<.001	0.649
1–6 vs 13–17	2.4	0.043	0.382
7–12 vs 13–17	−1.2	0.710	0.212

Table 4:

Overall gender, age and education prevalence of dementia in Kinshasa/DRC

	Overall	Gender		Age			Education	
		Male	Female	65–74	75–84	>84	<7.30	>7.30
# cases with disease	22	6	16	1	15	6	16	6
Total # of the sample	355	177	178	222	107	26	178	175
Prevalence (%)	6.2	3.4	9.0	0.5	14.0	23.1	9.0	3.4
CI (95%)	3.9 – 9.2	1.3–7.2	5.2–14.2	0.01–2.5	8.1–22.1	9.0 – 43.6	5.2 – 14.2	1.3 –7.3

Table 5:

Odd ratios of suspected dementia for selected risk factors in Kinshasa/DRC

Risk factors	Odd ratio	95% CI	P-value
Gender (female vs male)	2.83	1.08 – 7.41	0.03[*]
Age (75–84 vs 85 or above)	5.42	2.86 –10.28	<.001[*]
Education (<7.30 vs >7.30)	0.36	0.14 – 0.94	0.04[*]
Marital status (Married vs divorced/widowed)	1.66	1.05 – 2.61	0.03[*]
Occupation status (employed vs retired)	3.25	1.50 – 7.03	0.001[*]
Social stress <16 yrs	0.95	0.82 – 1.09	0.46
Social stress 17–65 yrs	0.81	0.55 – 1.20	0.30
Social stress > 65 yrs	0.73	0.58 – 0.92	0.01[*]
Alcohol use	0.83	0.19 – 3.58	0.81
Depression	1.92	0.81 – 4.57	0.14
Anxiety	2.56	1.05 – 6.13	0.04[*]
Hypertension	1.16	0.79 – 1.71	0.45
BMI	1.06	0.40 – 2.79	0.91

[*]
Odd ratios significant at the 0.05 level