



Conference on ‘Nutrition dynamics in Africa: opportunities and challenges for meeting the sustainable development goals’

Exploring the health status of older persons in Sub-Saharan Africa

Keiron Audain¹, Michelle Carr², Derya Dikmen³, Francis Zotor⁴ and Basma Ellahi^{2*}

¹*Department of Food Science and Nutrition, University of Zambia, Kalundu, Lusaka, Zambia*

²*Faculty of Health and Social Care, University of Chester, Parkgate Road, Chester CH1 4BJ, UK*

³*Department of Nutrition and Dietetics, Hacettepe University, Ankara, Turkey*

⁴*Office of the Vice-Chancellor, University of Health and Allied Sciences, Volta Region, Ghana*

Sub-Saharan Africa (SSA) has traditionally had a low life expectancy due to the onslaught of the HIV epidemic, high levels of chronic diseases, injuries, conflict and undernutrition. Therefore, research into public health concerns of older persons has largely been overlooked. With a growing population, the roll-out of antiretroviral treatment, and the effects of globalisation, SSA is experiencing an increase in the number of people over 50 years of age as well as an increase in the prevalence of non-communicable diseases (NCD). The aim of this review is to highlight available research on the health status of older persons in SSA, and to identify the current gaps that warrant further investigation. A literature search was conducted across multiple databases to identify studies in SSA on older persons (aged 50 years and older) related to health indicators including nutritional status, NCD and HIV burden. While it was concluded that older persons are at an increased risk of poor health, it was also determined that significant gaps exist in this particular area of research; namely nutrient deficiency prevalence. Resources should be directed towards identifying the health concerns of older persons and developing appropriate interventions.

Elderly: Geriatric: Nutrition: Dementia: Obesity: Malnutrition: HIV

Owing to the perception of Africa being the youngest continent with regard to age structure⁽¹⁾ along with a traditionally low life expectancy as a result of the HIV epidemic⁽²⁾, research into public health concerns associated with old age including dementia and other non-communicable diseases (NCD) have been largely under-prioritised. However, with a growing population in Sub-Saharan Africa (SSA) and the roll-out of anti-retroviral treatment, the number of older persons is expected to increase, inevitably leading to a rise in prevalence of age related such diseases.

In Africa, the population of older persons is predicted to grow by 3.3 % per annum between 2015 and 2050⁽¹⁾. This translates to an expected figure of 103 million people over the age of 55 years living on the continent by 2030, and 205 million people by 2050⁽¹⁾.

Yet despite this predicted growth, at present SSA still has the lowest life expectancy at birth of 57 years of age⁽²⁾. Over the years, many countries in SSA have shown a reduction in the number of people who survive to the age of 65 years, particularly women. For example, the number of people living up to the age of 65 in Botswana decreased from 64 % in 1990 to 23 % in 2013; while in Swaziland it decreased from 59 % in 1990 to 33 % in 2013⁽²⁾. While this has largely been attributed to the high prevalence of HIV in both countries^(2–4); the decline in life expectancy in Swaziland has not been to the extent seen in Botswana, despite Swaziland having double the HIV prevalence⁽²⁾. Hence this reduction could be attributed to the rise in NCD risk that stems from the growing prevalence of obesity^(5–8).

Abbreviations: NCD, non-communicable diseases; SSA, Sub-Saharan Africa.

***Corresponding author:** B. Ellahi, email b.ellahi@chester.ac.uk

Thus, even though people across Africa are expected to eventually start living longer, it is likely they may face a poor health status. The rising double burden of communicable diseases and NCD is largely attributed to the nutrition transition observed throughout SSA⁽⁹⁾. Interestingly, the link between obesity and NCD is not always made in the general population, as exemplified by 52 % of obese Botswanan women still perceiving their body weight to be 'too low'⁽⁷⁾. Yet with the doubling of the obesity prevalence throughout SSA, the threat of NCD has dramatically increased, even in older populations⁽¹⁰⁾. Older persons are also more likely to be underweight, thus leaving them susceptible to communicable diseases and other health complications.

The public health impact of this demographic transition in SSA is currently not yet known and limited research has been done in this area; however it is predicted that the NCD burden may increase, which may result in a double burden of communicable and NCD epidemics^(11,12). It is important to highlight the health status of older persons in order for early interventions to be developed. This review aims to highlight the current health status of older persons in SSA, with particular emphasis on nutritional status, NCD and HIV.

For the purpose of this review, the term 'older persons' refers to individuals aged 50 years and over. A number of search terms were used across multiple databases in order to identify relevant studies, including combinations of 'older persons', 'Sub-Saharan Africa', 'health', 'nutrition' and 'disease'. Studies were included if they contained disease prevalence or nutritional status data on older persons in SSA. Studies were excluded if they solely targeted age groups other than older persons; did not report segregated data for the age groups of interest, or were conducted outside of SSA. Available data were sourced from electronic reference libraries including: PubMed, The Cochrane Library, Medline, Google and Google Scholar. Cross-sectional and longitudinal studies with a comparison group were included. Titles and abstracts were searched and the relevant studies were selected.

Nutritional status

Despite enduring a lifetime of poverty, disease exposure and inadequate access to healthcare, many older persons in SSA are overlooked with regard to interventions to improve nutritional status. Nutritional intervention in SSA predominantly targets pregnant and lactating women, infants and young children, with limited research focusing on older persons. Poor nutritional status among older persons in SSA is largely determined by household food security levels, civil conflict, as well as HIV/AIDS. In a study to assess the nutrition situation of older persons attending a centre in Accra, Ghana it was reported that 60.9 % of attendees were food insecure at various levels⁽¹³⁾.

Undernutrition

As a general rule, the functionality of crucial organs such as the kidney and gastrointestinal tract deteriorates with

increase in age and may have an impact on nutrient absorption. In addition, food intake in older persons can be affected by issues related to muscular and skeletal changes that may impact on ability to prepare food, appetite, taste acuity and dental use. These as well as social issues including loneliness and bereavement can lead to older people becoming undernourished. Older persons are also at a higher risk of impaired immunity and susceptibility to infection which can be exacerbated by undernutrition⁽¹⁴⁾.

Undernutrition in many cases is classified as having a BMI <18.5. In a summary of research findings by HelpAge International in 2004, the undernutrition prevalence across several countries in SSA was observed to range from 62.2 and 44.6 % in Ghana for men and women, respectively, to 7.6 % in Tanzanian men and 2.2 % in South African women⁽¹⁴⁾. When faced with emergency situations, the prevalence may be considerably higher, as exemplified by Sierra Leone, where 75 % of older persons were classified as underweight.

Older populations in rural areas were observed to suffer from poor nutritional status, particularly underweight⁽¹⁵⁾. A small number of studies report this issue. In a cross-sectional survey conducted in rural Ghana, 41 % of fifty-nine women aged 60–92 years were categorised as underweight (BMI <18.5 kg/m²), whereas 16.9 % were categorised as overweight or obese⁽¹⁵⁾. A cross-sectional study in Burkina Faso indicated that age was a significant factor for undernutrition, noting that 50 % of participants over 70 years were undernourished compared with 31 % between the ages of 60 and 69 years. In addition, approximately 65 % of participants, all of whom were over 60 years were suffering from multi-morbidity, most commonly being hypertension (82 %), malnutrition (39 %) visual impairments (28 %) and diabetes (27 %)⁽¹⁶⁾.

It was noted that obesity was more prevalent in urban areas, whereas in contrast undernutrition was more prevalent in rural areas. This was suggested to be due to the impact of the nutrition transition in urban areas where a higher intake of sugar, saturated fat and low nutrient density foods may encourage obesity. Another possible reason given was due to the high energy expenditure of rural inhabitants who were more likely to source their food directly from the land and have a more physical lifestyle compared with their urban counterparts who have become accustomed to a more modern sedentary way of life. This observation presents a potential research opportunity to establish whether undernutrition in rural areas and/or low BMI is due to low energy intake or high energy expenditure.

Undernutrition is also present in older persons residing in urban areas. Underweight prevalence in the urban areas of Lake Victoria Basin in East Africa was 24.1 % among older men and 12.3 % among older women⁽¹⁷⁾. Only 22 % of older men and 28 % of older women met their daily energy requirements; This was attributed to inadequate access to food, improper eating patterns and poor health and living arrangements. Similar observations of high prevalence of undernutrition were made in a study conducted to assess nutritional status of

older persons in urban setting in Central Africa (The EDAC study). The study concluded that eating only one meal was the sole factor associated with older persons⁽¹⁸⁾.

Obesity

Obesity is currently a worldwide epidemic that has almost doubled between 1980 and 2008, and now attributes to 2.8 million deaths each year. In SSA, women have been observed to be almost twice as likely to be obese than men⁽¹⁰⁾. Studies by Kimokoti and Hamer⁽¹⁹⁾ show that up to half (6–48 %) of older people aged 60 years and over in SSA were underweight and nearly a quarter (2.5–21 %) were overweight; while 56 % of older South Africans alone were obese⁽¹⁸⁾.

Nutrient deficiencies

To date, very little published data is available on micronutrient deficiencies in older persons. In a related study conducted in Sharpeville, South Africa, deficiencies in calcium, magnesium, zinc, copper, selenium, iodine, vitamins A, B₁, B₂, B₃, B₁₂, C, D, E, folate and biotin were recorded, with women having higher nutrient deficiencies than men. A total of 58.6 % of the adults older than 60 years consumed three meals daily, while 28.9 % consumed two meals daily⁽²⁰⁾. The dietary diversity scores in the study were as follows: 55.1 % had low dietary diversity (0–3 food groups), 37.6 % had medium dietary diversity (4–5 food groups) and 7.4 % had high dietary diversity (6–9 food groups). The vast majority of foods consumed were carbohydrates. Nutrient adequacy increased in line with the dietary diversity. It could be hypothesised that the prioritising of children's needs before their own was responsible for their reduced nutritional status, as 43.8 % of grandmothers were responsible for feeding the family children.

A follow up study in the same area recorded a positive increase in dietary diversity (98.1 %) subsequent to intervention. Further research could be looked at in different areas in SSA.

Non-communicable diseases

Hypertension

Hypertension is a precursor for a number of NCD including stroke, dementia and CVD. Its prevalence is believed to be on the rise as a result of increased urbanisation and the associated nutrition transition. The prevalence of hypertension is also known to increase with age, as a disproportionate number of older persons are affected by hypertension⁽²¹⁾. In a study conducted among SSA adults, where close to 25 % of the study population were over 50 years of age, it was observed that hypertension prevalence was significantly higher among older persons than adults from other groups, particularly adults aged 18–29 years (prevalence ratio: 2.20 (95 % CI 1.49, 3.25)). This concluded that age was strongly associated with increase prevalence of hypertension, alongside BMI, level of education and tobacco

use⁽²²⁾. In a South African study, a cross-sectional survey among 3840 adults aged 50 years and over revealed a prevalence rate of 77.3 %, with 38.1 % aware of their condition⁽²¹⁾.

Using household survey data (2007–2010) from the WHO study on Global Ageing and Adult Health; researchers revealed a hypertension prevalence among adults aged 50 years and over of 57.1 and 77.9 % in SSA countries Ghana and South Africa, respectively⁽²³⁾. In addition, it was shown that hypertension was associated with overweight/obesity, women and those in the lowest wealth quintile. Among those who were hypertensive, only 38 % in South Africa and 23.3 % in Ghana were aware of their condition⁽²³⁾.

Despite urbanisation being considered a risk factor, hypertension may also be an issue in rural settings. In rural Tanzania, blood pressure measurements were taken from 2223 adults aged 70 years and over. It was observed that 69.9 % of participants were hypertensive; with only 37.7 % aware of their condition and 6.1 % receiving treatment⁽²⁴⁾.

It has been predicted that an increased NCD burden among older persons may pay a significant toll on the health services in SSA. NCD were responsible for 81.0 % (708/874) of hospital admissions among older patients in Nigeria, Sudan and Tanzania, while tuberculosis, malaria and HIV accounted for only 4.6 % (40/874)⁽²⁵⁾. Interestingly, it was observed that hypertension rates were similar in these three countries to the rates in the UK (40.2 % compared with 45.8 % in the UK). In a national cross-sectional survey of 3840 participants aged 50 years or older in South Africa, it was shown that 19.7 % consumed tobacco daily, while 68.5 % did not consume an adequate amount of fruit and vegetables. In addition, 60.5 % did little physical activity, which went up to 63.1 % in women and 71.2 % in those over the age of 70 years. Unsurprisingly, 68.2 % of participants were overweight or obese (71.9 % in women) and 75.3 % were suffering from hypertension⁽²⁶⁾.

In addition to obesity, it is being theorised that undernutrition may increase the risk of some NCD such as stroke in older persons. As well as having the highest stroke prevalence, older persons in Tanzania also have the lowest mean BMI compared with the rest of the SSA⁽¹⁹⁾. Given this combination of factors it could be theorised that undernutrition or low BMI may be an influence of stroke, either solely or combined with a third feature. A further study supports this theory by showing the risk of haemorrhagic stroke in individuals with BMI <18 kg/m² is equal to those with BMI 26 kg/m²⁽²⁷⁾. It was noted that due to the high rate of mortality in SSA, the occurrence of stroke among older persons may be less common; however the prevalence in persons over 70 years in Tanzania was relatively high (23/1000) compared with rest of SSA. In fact, stroke incidence could be as high, if not higher than in high-income countries, with risk increasing with age. To date there has been an absence of adequate community-based stroke incidence studies. Hospital-based incidence was observed to be lower than in high-income countries, but higher in young people, possibly due to hospital admission bias.

There has been no community-based data on case fatality⁽²⁸⁾.

Little is known of the direct mechanism behind the link between undernutrition and NCD. However, it is proposed that poor prenatal nutrition and resulting low birth weight can genetically predispose individuals to NCD risk in later life; in particular CVD. Based primarily on animal model data, the theory postulates that fetal exposure to maternal glucocorticoids, as well as stimulation of the fetal renin-angiotensin system may lead to vascular resistance and hypertension, which are precursors for NCD⁽²⁹⁾.

During the period of 1999–2003, 7074/100 000 deaths in persons over 65 years were recorded in Burkina Faso as a result of CVD, which was the fourth leading cause of death in adults over 40 years. In terms of uncommon NCD such as peripheral artery disease, the stark reality is that many older persons go largely undiagnosed, and in cases where they are, patients rarely have access to affordable, quality health care⁽³⁰⁾. A systematic door-to-door survey among 976 persons over 65 years in the Central African Republic and Congo Brazzaville measured the prevalence of peripheral artery disease and observed a 15 % prevalence in Central African Republic and a 32.4 % in Brazzaville, which increased with age. Researchers also noted that this prevalence was higher than in some North American studies. In addition, hypertension was associated with peripheral artery disease in women, while diabetes was associated with men⁽³⁰⁾.

Diabetes

Globally, diabetes mellitus is the fourth most common chronic disease within multi-morbidity at 27 %, with the prevalence of multi-morbidity among older persons at 65 %⁽³¹⁾. In addition to environmental factors such as obesity and sedentary behaviour, a growing ageing population has been associated with the increase in prevalence of diabetes in SSA⁽³²⁾. Currently, the highest global age-specific mortality rate for diabetes is in Africa⁽³²⁾. Diabetes appears to have been well researched in SSA, either solely or as a factor of multi-morbidity; however, little has been done with regard in terms of research related to older persons.

Dementia

In many SSA countries dementia has become a significant economic burden. Yet in spite of this, the condition is largely perceived to be a normal part of ageing, leaving many patients to suffer undiagnosed⁽³³⁾. As a general observation, epidemiology data on dementia in SSA has been limited; however, it is suggested that prevalence rate may in fact be parallel with that of high-income countries⁽³³⁾. In a systematic review investigating dementia and cognitive impairment in older persons in SSA, eleven identified studies highlighted a wide variation in prevalence across different countries. A lower overall prevalence compared with global reports was observed, possibly due to the fact that there are a higher number of persons aged 66–80 years and a smaller number aged 81 years and older⁽¹²⁾. However, similar to global reports, older age

and female sex was associated with dementia⁽¹²⁾. Other studies indicate the highest prevalence of dementia was found in ages 60–69 in women and in men over the age of 70 years⁽³³⁾. In 2010, dementia prevalence in adults aged 50 years and older was estimated at about 2.1 million people (2.4 %), which was highest in women aged 80 and over (19.7 %). Alzheimer's disease was found to be responsible for 57.1 % of all dementia cases, followed by vascular dementia at 26.9 %⁽³³⁾. Apart from increasing age and sex, the main risk factor appeared to be CVD, which in itself is associated with overweight and obesity⁽³³⁾.

Dementia epidemiology is believed to be influenced by several factors including both communicable and NCD such as HIV/AIDS, CVD, hypertension and diabetes, as well as illiteracy. The traditional underreporting of dementia and other age-related conditions such as stroke and Parkinson's disease in SSA may have been as a result of the low life expectancy at birth and low utilisation of health-care facilities⁽³⁴⁾. The prevalence of dementia among rural populations in SSA has been observed to be double that of urban populations (40.7 v. 21.9/1000), which has been attributed to lower socioeconomic status⁽³⁵⁾.

In a cross-sectional epidemiological survey in rural Tanzania, the age-adjusted prevalence of neurological disorders among the 2232 participants was calculated at 154.1/1000, which included tremors, headaches, stroke, peripheral polyneuropathy, upper limb mononeuropathy and Parkinson's disease⁽³⁵⁾. The authors concluded that neurological disorders does and will continue to contribute significantly to the NCD epidemic⁽³⁵⁾. In addition to socioeconomic status, nutritional status is also believed to play a role in susceptibility to neurological disorder, with individuals with BMI <18.5 kg/m² are considered to be at greater risk of developing dementia. Individuals aged 65 years and older in Central African Republic reported that 70 % of dementia sufferers were undernourished with BMI ≤18.5. Also, 67.5 % of dementia patients were observed to have hypertension⁽³⁶⁾.

In a study conducted in the Central African Republic and the Democratic Republic of Congo, dementia patients over the age of 65 years had a higher prevalence of undernutrition compared with healthy counterparts (32.0 v. 17.7 %, respectively). Such patients were less likely to eat with their family compared with healthy people (66.7 v. 90.6 %)⁽¹⁸⁾. Within the sample population of 1016 participants, dementia prevalence was 7.4 %, with an undernutrition prevalence of 19.2 %. Indeed dementia patients were more likely to be undernourished compared with healthy participants (32.0 v. 17.7 %, respectively)⁽¹⁸⁾.

HIV

To date there is little to no data available on HIV prevalence rates in older persons aged 50 years and over in SSA; thus the full burden of the epidemic on older populations is not really known⁽¹¹⁾. Data from 2008 stated that approximately three million adults aged 50 years and over in SSA were HIV positive, which was equivalent to 14.3 % of all people living with HIV. Of this, Mozambique, Nigeria, South Africa, Zambia and

Zimbabwe were believed to have the highest prevalence with a total of 54 % of all older person infections⁽¹¹⁾.

Access to antiretroviral therapy has largely improved in SSA, which has translated to increased life expectancy as HIV patients live up to 20 years following seroconversion^(11,37). Yet less is known regarding the overall management of disease within older populations⁽³⁷⁾. A study conducted in rural South Africa revealed limited data is available regarding the physical, mental and social well-being of older persons that were either infected with or affected by HIV⁽³⁸⁾. Research has largely focused on older persons as caregivers for those infected with HIV. Older persons in both urban and rural areas caring for children affected by HIV/AIDS had a more compromised diet than that of non-caregivers⁽³⁹⁾.

Little investigation however, has been done on their own risk of exposure to infection, or the impact of caregiving on their mental health status^(40,41). Approximately 42 % of 422 older persons in South Africa aged 50 years and over suffered a depressive episode, which made them two to three times more likely to report poor health perceptions⁽⁴⁰⁾. When compared with a Ugandan cohort consisting of 510 older people aged 50 years and over; in addition to their situation, the South African older people were more likely to be obese and suffer from hypertension⁽⁴²⁾. In addition, levels of stigma towards HIV and AIDS are likely to be higher among older persons; thus they may be less likely to get tested or to seek treatment/counselling if infected⁽⁴¹⁾.

It has been suggested that the risk of acquiring HIV may be high among older persons, as they are likely to engage in behaviour such as sexual relationships with younger people, multiple sexual partnerships, have a reluctance to use condoms and a general lack of concern as well as a lack of knowledge concerning how HIV is transmitted. One study observed that some older persons in South Africa held the belief that HIV was caused by poor nutrition and sharing facilities⁽⁴¹⁾.

Conclusion

There is limited data available on the health status of older persons in SSA. The older adult has been a particularly neglected segment of the population with regards to public health and nutrition research. This is significant given the growing population of older persons and the under-resourced health services available. Gaps in particular include nutritional status as well as co-morbidities with HIV and NCD. National policy directives and research resources should be directed towards this area, with a focus of identifying pertinent public health concerns of older persons and the development of sustainable interventions.

Acknowledgements

Amanda Aitken, Research Assistant, University of Chester is acknowledged for her assistance in collating reference lists.

Financial Support

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Conflicts of Interest

None.

Authorship

The review was conceived and developed by B. E. M. C. and D. D. undertook the literature searches and critique of the literature. K. A. lead on paper writing with B. E. All authors contributed to the editing of the final manuscript.

References

1. Naidoo N, Abdullah S, Bawah A *et al.* (2010) Aging and adult health status in eight lower-income countries: the INDEPTH WHO-SAGE collaboration. *Glob Health Action* **11**, Suppl. 2, 11–22.
2. World Bank (2013) *World Development Indicators*. Washington, DC: The World Bank. <http://databank.world-bank.org/data/download/WDI-2013-ebook.pdf>.
3. UNAIDS (2014) Global HIV statistics fact sheet. http://www.unaids.org/sites/default/files/en/media/unaids/content-tassets/documents/factsheet/2014/20140716_FactSheet_en.pdf
4. Kandala NB, Campbell EK, Rakgoasi SD *et al.* (2012) The geography of HIV/AIDS prevalence rates in Botswana. *HIV AIDS (Auckl)* **4**, 95–102.
5. Dalal S, Beunza JJ, Volmink J *et al.* (2011) Non-communicable diseases in sub-Saharan Africa: what we know now. *Int J Epidemiol* **40**, 885–901.
6. Kapiga S (2011) Commentary: non-communicable diseases in sub-Saharan Africa: a new global health priority and opportunity. *Int J Epidemiol* **40**, 902–903.
7. Letamo G (2011) The prevalence of, and factors associated with, overweight and obesity in Botswana. *J Biosoc Sci* **43**, 75–84.
8. Reid MJ, Haas MK, Sedigeng P *et al.* (2016) Leveraging HIV programming to enhance access to noncommunicable disease care in southern Botswana. *J Int Assoc Provid AIDS Care* **15**, 7–10.
9. Steyn NP & McHiza ZJ (2014) Obesity and the nutrition transition in Sub-Saharan Africa. *Ann N Y Acad Sci* **1311**, 88–101.
10. World Health Organisation (2015) Non-communicable diseases progress monitor 2015. Available at <http://www.who.int/nmh/publications/ncd-progress-monitor-2015/en/>
11. Mutevedzi PC & Newell ML (2011) A missing piece in the puzzle: HIV in mature adults in sub-Saharan Africa. *Future Virol* **6**, 755–767.
12. Mavrodaris A, Powell J & Thorogood M (2013) Prevalences of dementia and cognitive impairment among older people in sub-Saharan Africa: a systematic review. *Bull World Health Organ* **91**, 773–783.
13. Steiner-Asiedu M, Mombo Pelenah J, Bediako-Amoa B *et al.* (2010) The nutrition situation of the elderly in Ghana: a case study. *Asian J. Med. Sci.* **2**, 103.

14. HelpAge International (2004) *Summary of Research Findings on the Nutritional Status and Risk Factors for Vulnerability of Older People in Africa*, pp. 7–31. Nairobi, Kenya: HelpAge International Africa Regional Centre.
15. Blankson B & Hall A (2012) The anthropometric status of elderly women in rural Ghana and factors associated with low body mass index. *J Nutr Health Aging* **16**, 881–886.
16. Hien H, Berthé A, Drabo MK *et al.* (2014) Prevalence and patterns of multimorbidity among the elderly in Burkina Faso: cross-sectional study. *Trop Med Int Health* **19**, 1328–1333.
17. Cheserek MJ, Waudo JN, Tuitok PJ *et al.* (2012) Nutritional vulnerability of older persons living in urban areas of Lake Victoria Basin in East Africa: a cross sectional survey. *J Nutr Gerontol Geriatr* **31**, 86–96.
18. De Rouvray C, Jesus P, Guerchet M *et al.* (2014) The nutritional status of older people with and without dementia living in an urban setting in Central Africa: the EDAC study. *J Nutr Health Aging* **18**, 868–875.
19. Kimokoti RW & Hamer DH (2008) Nutrition, health, and aging in sub-Saharan Africa. *Nutr Rev* **66**, 611–623.
20. Oldewage-Theron WH & Kruger R (2008) Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. *J Nutri* **27**, 101–133.
21. Peltzer K & Phaswana-Mafuya N (2013) Hypertension and associated factors in older adults in South Africa. *Cardiovasc J Afr* **24**, 66–72.
22. Guwatudde D, Nankya-Mutyoba J, Kalyesubula R *et al.* (2015) The burden of hypertension in sub-Saharan Africa: a four-country cross sectional study. *BMC Public Health* **15**, 1211–1218.
23. Lloyd-Sherlock P, Beard J, Minicuci N, *et al.* (2014) Hypertension among older adults in low- and middle-income countries: prevalence, awareness and control. *Int J Epidemiol* **43**, 116–128.
24. Dewhurst MJ, Dewhurst F, Gray WK *et al.* (2013) The high prevalence of hypertension in rural-dwelling Tanzanian older adults and the disparity between detection, treatment and control: a rule of sixths? *J Hum Hypertens* **27**, 374–380.
25. Akinyemi RO, Izzeldin IM, Dotchin C *et al.* (2014) Contribution of noncommunicable diseases to medical admissions of elderly adults in Africa: a prospective, cross-sectional study in Nigeria, Sudan, and Tanzania. *J Am Geriatr Soc* **62**, 1460–1466.
26. Phaswana-Mafuya N, Peltzer K, Chirinda W *et al.* (2013) Sociodemographic predictors of multiple non-communicable disease risk factors among older adults in South Africa. *Glob Health Action* **6**, 20680.
27. Song YM, Sung J, Davey Smith G *et al.* (2004) Body mass index and ischemic and hemorrhagic stroke: a prospective study in Korean men. *Stroke* **35**, 831–836.
28. Connor M (2007) Stroke in patients with human immunodeficiency virus infection. *J Neurol Neurosurg Psychiatry* **78**, 1291.
29. Langley-Evans SC (2001) Fetal programming of cardiovascular function through exposure to maternal undernutrition. *Proc Nutr Soc* **60**, 505–513.
30. Guerchet M, Aboyans V, Mbelesso P *et al.* (2012) Epidemiology of peripheral artery disease in elder general population of two cities of Central Africa: Bangui and Brazzaville. *Eur J Vasc Endovasc Surg* **44**, 164–169.
31. Hein C (2008) Scottsdale revisited: the role of dental practitioners in screening for undiagnosed diabetes and the medical co-management of patients with diabetes or those at risk for diabetes. *Compend Contin Educ Dent* **29**, 538–540.
32. Werfalli M, Musekiwa A, Engel ME *et al.* (2014) The prevalence of type 2 diabetes mellitus among older people in Africa: a systematic review study protocol. *BMJ Open* **4**, e004747.
33. Olayinka OO & Mbuyi NN (2014) Epidemiology of dementia among the elderly in Sub-Saharan Africa. *Int J Alzheimers Dis* **2014**, 195750.
34. Callixte KT, Clet TB, Jacques D *et al.* (2015) The pattern of neurological diseases in elderly people in outpatient consultations in Sub-Saharan Africa. *BMC Res Notes* **8**, 159.
35. Dewhurst F, Dewhurst MJ, Gray WK *et al.* (2013) The prevalence of neurological disorders in older people in Tanzania. *Acta Neurol Scand* **127**, 198–207.
36. Mbelesso P, Tabo A, Guerchet M *et al.* (2012) Epidemiology of dementia in elderly living in the 3rd borough of Bangui (Central African Republic). *Bull Soc Pathol Exot* **105**, 388–395.
37. Bendavid E, Ford N & Mills EJ (2012) HIV and Africa's elderly: the problems and possibilities. *Aids* **26**, Suppl. 1, S85–S91.
38. Nyirenda M, Chatterji S, Falkingham J *et al.* (2012) An investigation of factors associated with the health and well-being of HIV-infected or HIV-affected older people in rural South Africa. *BMC Public Health* **12**, 259.
39. Kruger A, Lekalakalamokgela SE & Wentzel-Viljoen E (2011) Rural and urban older African caregivers coping with HIV/AIDS are nutritionally compromised. *J Nutr Gerontol Geriatr* **30**, 274–290.
40. Nyirenda M, Chatterji S, Rochat T *et al.* (2013) Prevalence and correlates of depression among HIV-infected and -affected older people in rural South Africa. *J Affect Disord* **151**, 31–38.
41. Lekalakala-Mokgele E (2014) Understanding of the risk of HIV infection among the elderly in Ga-Rankuwa, South Africa. *Sahara J* **11**, 67–75.
42. Nyirenda M, Newell ML, Mugisha J *et al.* (2013) Health, wellbeing, and disability among older people infected or affected by HIV in Uganda and South Africa. *Glob Health Action* **6**, 19201.