## Review Article

# The Healthy Aging Adult South Africa report card: a systematic review of the evidence between 2013 and 2020 for middle-aged South African men and women

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## Abstract

Due to the increasing non-communicable disease burden in Africa, several strategies that target the major lifestyle and physiological risk factors have been implemented to combat such diseases. The Healthy Aging Adult South Africa report card systematically reviews national and regional prevalence data of middle-aged South African adults (45–65 years) published between 2013 and 2020 on diet, physical activity, tobacco use and alcohol consumption, obesity, hypertension, dyslipidaemia and diabetes mellitus. Each indicator was assigned two grades, (1) based on the availability of prevalence data, and (2) based on whether policies have been proposed and implemented for the respective indicators. Alcohol consumption, obesity, hypertension and diabetes received an A grade for the availability of prevalence data. Tobacco use and diet received an A grade for policy and implementation. Gaps have been identified that need to be filled by future research focusing on continued surveillance of all indicators in order to inform and implement effective policies.

**Keywords:** diet, physical activity, tobacco, alcohol, obesity, hypertension, dyslipidaemia, diabetes

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The burden of non-communicable diseases (NCDs) in sub-Saharan Africa is nearly equal to the total burden from communicable, maternal, neonatal and nutritional diseases combined.[1] The growing NCD burden is expected to continue to increase with increasing urbanisation, life expectancy and population size, with models estimating that the sub-Saharan population will expand from 13% of the global population in 2017 to 35% in 2100.[2]

The Sustainable Development Goal (SDG) target of 3.4 is to reduce premature mortality from NCDs by a third by 2030 (relative to 2015), and to promote mental health and wellbeing.[3] The implementation of the Strategic Plan for the Prevention and Control of NCDs 2013–2017, in order to achieve certain targets by 2020, and the adoption of the South African Declaration on the Prevention and Control of NCDs, demonstrate South Africa's commitment to the fight against NCDs.[4,5]

While being in line with the World Health Organisation's (WHO) global action plan for the prevention and control of NCDs 2013–2020, the South African strategic plan identifies various areas to be the focus of a multisectoral approach, with the ultimate aim of ensuring 'a long and healthy life for all'. While recognising the social determinants of health, the strategic plan highlights four major lifestyle risk factors (unhealthy diets, physical inactivity, harmful use of alcohol and tobacco use), as well as four physiological risk factors (overweight and obesity, hypertension, dyslipidaemia and poor glucose control) that can be targeted through NCD prevention strategies to achieve the 10 goals and targets:

- reduce relative premature mortality by 25% by 2020
- reduce tobacco use by 20% by 2020
- reduce the per capita consumption of alcohol by 20% by 2020
- reduce the mean population intake of salt by 5 g per day by 2020
- reduce the percentage of people who are obese or overweight by 10% by 2020
- reducing the prevalence of people with raised blood pressure by 20% by 2020
- increase the prevalence of people meeting physical activity recommendations by 10%
- reduce the prevalence of cervical cancer
- increase the percentage of people controlled for hypertension, diabetes and asthma by 30% by 2020
- increase the number of people screened and treated for mental disorders by 30% by 2030.

The unforeseen arrival of the COVID-19 pandemic in South Africa in 2020 has highlighted the risk of NCDs, particularly in settings with high social and economic inequality. One in five people who become infected with COVID-19 are at an increased risk of hospitalisation and mortality, largely as a result of underlying NCDs.[6] Furthermore, the restrictions that have been implemented in order to reduce the spread of COVID-19 have implications for health behaviours that are directly associated with NCD risk, such as diet and physical activity. The interruption of NCD services, as well as public health and surveillance activities, add to the challenge of this pandemic, but the response by governments in rapidly urbanising cities in low- and middle-income countries (LMICs) may also provide opportunities for whole-of-society approaches that can be employed to improve health.[7]

Data from two recent national surveys have shown that middle-aged adults (45–65 years) are at highest risk for many of the NCD risk factors.[8,9] Within the life course, middle adulthood is critical, as individuals in this age group are still working and contributing to the economy and society, and in many cases, particularly in LMICs, are also supporting the extended family.[10] Healthy aging needs to be prioritised to not only ensure an optimal quality of life, but also to minimise the strain on the health system.

The Healthy Aging Adult South Africa (HAASA) report card provides a systematic review of evidence on middle-aged South African adults (45–65 years), published between 2013 and 2020 on diet, physical activity, tobacco and alcohol use, obesity, hypertension, dyslipidaemia and diabetes. Only national and regional prevalence data are reported and data were included when (1) the mean age was between 45 and 65 years; or (2) the majority of participants were between these ages; or (3) if age-specific data between 45 and 65 years were reported.

Each of the risk factors reviewed in the sections below have been assigned a grade based on the availability of data and whether national policies have been proposed and implemented. A similar grading system to the Healthy Active Kids South Africa (HAKSA) report card was utilised,[11] and the criteria presented in Table 1 were employed.

## Methods

This review was registered in the PROSPERO registry for systematic reviews (registration number: CRD42018093064) and was conducted in accordance with the PRISMA guidelines (see Fig. 1).[12]

The search for articles was conducted in May 2018 and then again in April 2019 and May 2020, according to the participants, intervention, comparator and outcomes (PICO) model of formulating a clinical question in the healthcare setting. Restrictions to articles were based on age of participants (between 45 and 65 years), study population (South African) and date of publication (from 1 January 2013 until 30 May 2020). The following databases were used in the search: PubMed, Scopus, Web of Science, EBSCOhost (including Africa Wide, CINHAL, academic search premier and health source). A sample of the PubMed search strategy is available as Table 2.

Meta-analyses, systematic reviews, randomised control trials, cohort studies, case studies, longitudinal and cross-sectional studies, were included. Animal and genetic studies as well as studies not written in English were excluded.

The results were screened and duplicates were removed, followed by title and abstract screening. After the first search in May 2018, full-text screening was completed by a research assistant who excluded 185 of the 284 full texts (Fig. 1). For the second and third searches in April 2019 and May 2020, respectively, a total of 588 titles and abstracts were screened

**Table 1. Criteria used to grade each risk factor**

| *Grade* | *Prevalence data* | *Policy and implementation* |
|---|---|---|
| A | Published national and regional prevalence data available for this age group | National policy/ies have been implemented for more than 10 years |
| B | Published national and regional prevalence data available, not specific to age group | National policy/ies have been recently (less than 10 years) implemented |
| C | Only regional prevalence data for this age group | National policy/ies have been proposed but not implemented |
| D | Only regional prevalence data but not specific to this age group | No national policy/ies |
| E | No prevalence data | |

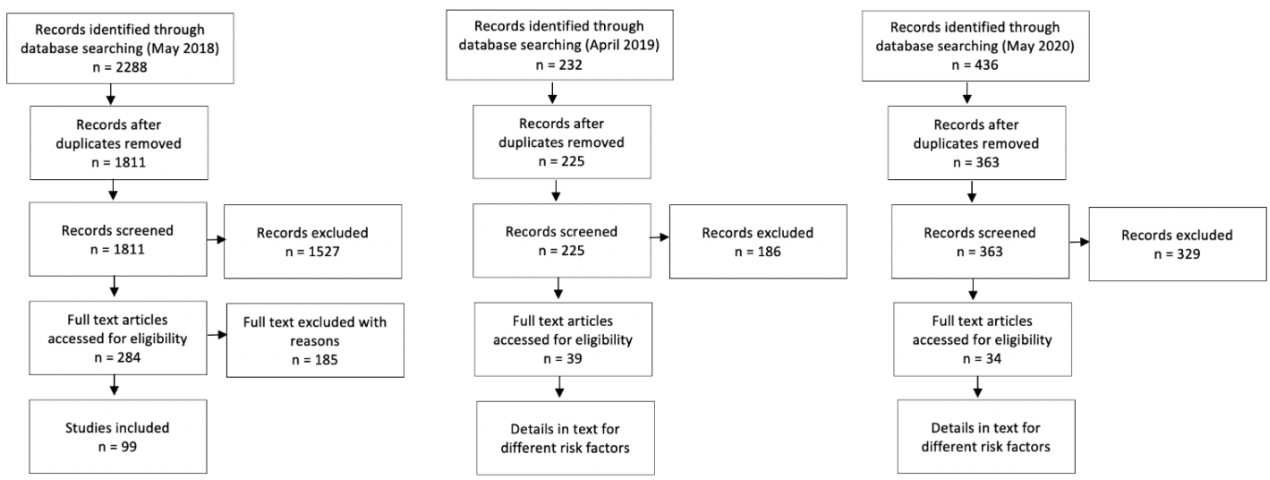


**Fig. 1.** PRISMA flow diagram

**Table 2. PubMed Search strategy, modified as needed for other electronic databases**

| | | |
|---|---|---|
| *Population: middle-aged adult South Africans* | | |
| MeSH terms: | #1 | Middle aged [MeSH] |
| All fields | #2 | Middle age |
| | #3 | middle aged |
| | #4 | midlife |
| | #5 | middle adulthood |
| | #6 | #2 OR #3 OR #4 OR #5 |
| | #7 | #1 OR #6 |
| MeSH term: | #8 | South Africa [MeSH] |
| All fields | #9 | 'South Africa' OR |
| | #10 | 'South African' |
| | #11 | #8 OR #9 |
| | #12 | #7 OR #10 |
| *Intervention: modifiable lifestyle risk factors* | | |
| MeSH terms: | #13 | Alcohol drinking [MeSH] |
| All fields | #14 | Alcohol consumption |
| | #15 | #13 OR #14 |
| MeSH terms: | #16 | Exercise [MeSH] |
| All fields | #17 | Physical activity |
| | #18 | Exercise |
| | #19 | Physical exertion |
| | #20 | Physical training |
| | #21 | Physical fitness |
| | #22 | #17 OR #18 OR #19 OR #20 OR #21 |
| | #23 | #16 OR #22 |
| MeSH terms: | #24 | Feeding behavior [MeSH] |
| | #25 | Diet, food, and nutrition [MeSH] |
| | #26 | #24 OR #25 |
| All fields: | #27 | Food habits |
| | #28 | Dietary habits |
| | #29 | Eating behavior |
| | #30 | Dietary behaviour |
| | #31 | Feeding patterns |
| | #32 | Food preferences |
| | #33 | Dietary fat |
| | #34 | Dietary fats |
| | #35 | Dietary protein |
| | #36 | Dietary carbohydrates |
| | #37 | Food consumption |
| | #38 | #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 |
| | #39 | #26 OR #38 |
| MeSH terms: | #40 | Tobacco use [MeSH] |
| All fields: | #41 | Smoking |
| | #42 | Tobacco |
| | #43 | #41 OR #42 |
| | #44 | #40 OR #43 |
| *Outcome: metabolic risk factors* | | |
| MeSH terms: | #45 | Diabetes mellitus [MeSH] |
| | #46 | Insulin resistance [MeSH] |
| | #47 | #45 OR #46 |
| All fields: | #48 | Diabetes |
| | #49 | Insulin resistance |
| | #50 | insulin sensitivity |
| | #51 | Metabolic syndrome |
| | #52 | Syndrome X |
| | #53 | Glucose intolerance |
| | #54 | Hyperglycemia |
| | #55 | #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 |
| | #56 | #47 OR #55 |
| MeSH terms: | #57 | Overnutrition [MeSH] |
| | #58 | Overweight [MeSH] |
| | #59 | Body mass index [MeSH] |
| | #60 | #57 OR #58 OR #59 |
| All fields: | #61 | Obesity |
| | #62 | Overnutrition |
| | #63 | Overweight |
| | #64 | Hypernutrition |
| | #65 | Body mass index |
| | #66 | BMI |
| | #67 | #61 OR #62 OR #63 OR #64 OR #65 OR #66 |
| | #68 | #60 OR #67 |
| MeSH terms: | #69 | Hypertension [MeSH] |
| All fields: | #70 | Hypertension |
| | #71 | High blood pressure |
| | #72 | #70 OR #71 |
| | #73 | #69 OR #72 |
| MeSH terms: | #74 | Dyslipidaemias [MeSH] |
| All fields: | #75 | Dyslipidaemia |
| | #76 | Dyslipidaemias |
| | #77 | Hypercholesterolemia |
| | #78 | Hypercholesteremia |
| | #79 | High cholesterol |
| | #80 | Elevated cholesterol |
| | #81 | Raised cholesterol |
| | #82 | Triglycerides |
| | #83 | Lipid profile |
| | #84 | #75 OR #76 OR #77 OR #78 OR #79 OR #80 OR #81 OR #82 OR #83 |
| | #85 | #74 OR #84 |
| | #86 | #15 OR #23 OR #39 OR #56 OR #68 #73 OR #85 AND #7 AND #12 |

by one researcher (LM). Full texts of all eligible articles (a total of 73 for both 2019 and 2020) were then accessed and divided among reviewers who were identified as experts in their respective sections. It is worth noting that many of the articles were relevant to more than one risk factor, which is why details of how many of these were included are described in the different sections representing each of the eight risk factors below.

Prevalence data for each of the four lifestyle and four physiological risk factors were extracted by reviewers as follows: AP, physical activity; MM, alcohol consumption; RSM, tobacco use; SW, diet; GM, obesity; AR, dyslipidaemia; LW, hypertension; LM, diabetes. Each reviewer was provided with a standardised data-extraction form with the following headings: reference, study population/sample/setting/design, intervention/exposure or barriers/facilitators/correlates (brief description of the purpose of the study), outcomes of interest (which included how the risk factor was measured) and main findings (prevalence of the risk factor), and instructed to complete the form for all the studies allocated to their risk factor. The quality of the evidence and risk of bias was not assessed.

Although PRISMA guidelines were closely followed when selecting the articles to be reviewed, the results are presented as a narrative review of the eight different risk factors. Each of the sections is presented separately and structured in such a way to include a brief introduction outlining the global prevalence of the risk factor, as well as the prevalence in LMICs, if available. Each reviewer then briefly described the global and national targets, as well as the contribution of the specific risk factor to the South African NCD burden, where applicable. This is followed by a description of how articles were included or excluded, and then national and regional prevalence data are described for the selected articles.

If national data have not been published in any of the selected articles, the data were obtained from the respective reports, and include, where appropriate, the South African Demographic and Health Survey (SADHS) 2003 and 2016, as well as the South African National Health and Nutrition Examination survey (SANHANES), the report of which was published in 2013.[8,9,13] Each of the sections ends with a brief description of whether there are national policies, and if available, whether these have been shown to be effective. Each section then concludes with a grade and some recommendations.

## Results

Several studies have made an important contribution to this literature, including the World Health Organisation's Study on global AGEing and adult health (WHO-SAGE),[14] the National Income Dynamics Study (NIDS)[15] and the Prospective Urban Rural Epidemiology (PURE) study.[16] WHO-SAGE is a multinational longitudinal study examining the health and wellbeing of adult populations. The study takes place in six LMICs (Mexico, Russia, India, Ghana, South Africa and China) with wave 1 having taken place in South Africa in 2007–2010, and subsequent waves in 2015–2016 (wave 2) and 2018–2019 (wave 3). Data have been collected in a nationally representative sample of over 50-year-old adults, with a smaller reference group aged 18–49 years, and the sample size for the South African cohort for wave 1 = 4 233, wave 2 = 4 085 and wave 3 = final numbers to be released.[17]

NIDS was the first national household panel study to be completed in South Africa, the first wave of which took place in 2008, with the last wave taking place in 2017. The core survey has been repeated every two to three years with a nationally representative sample of 28 000 individuals from 7 300 households.

The PURE study is a large epidemiological study of approximately 225 000 individuals between the ages of 35 and 70 years (enrolled between 2003 and 2013) from urban and rural sites in 18 low-, middle- and high-income countries (South Africa, Tanzania, Zimbabwe, Bangladesh, Pakistan, Indian, occupied Palestinian territory, China, Colombia, Iran, Malaysia, Argentina, Turkey, Brazil, Poland, Chile, Saudi Arabia and United Arab Emirates). The aim of the PURE study was to examine the impact of urbanisation, modernisation and globalisation on health behaviours and the development of risk factors for cardiovascular disease (CVD) and NCDs, such as diabetes and cancer.

## Physical activity

In 2010, the WHO published Global Recommendations on Physical Activity for Health, which detailed the science of primary prevention of NCDs through physical activity at the population level, and recommended that adults complete at least 150 minutes of moderate- to vigorous-intensity physical activity per week.[18] Global estimates show that 27.5% of adults are insufficiently active, and that women are less active than men in most countries.[19] Furthermore, physical inactivity has been shown to be responsible for 6% of deaths globally.[20] The recently released WHO Guidelines on Physical Activity and Sedentary Behaviour for Children and Adolescents, Adults and Older Adults (2020) have included sedentary behaviour recommendations as well as specific sub-population guidelines, including for those with chronic conditions.[21]

Increasing the prevalence of people meeting physical activity recommendations by 10% is one of the 10 goals of the South African Strategic Plan for the Prevention and Control of NCDs.[4] The SADHS 2003 reported a physical inactivity prevalence of 56% in men and 64% in women aged 45–54 years; and 67% in both men and women aged 55–64 years.[13] Physical activity data were not reported in the 2016 SADHS,[9] and while the SANHANES[8] reports on cardiovascular fitness, physical activity is not included. Therefore, the only national data available report that physical inactivity prevalence is higher in women and increases with age.

Twenty-three studies were selected for title and abstract screening. Of those, 10 studies reported data from WHO-SAGE, and five reported data from the PURE study. Nine of the 23 studies were excluded due to the age range of participants not falling within the selection criteria. Of the remaining 14 studies, a further seven were excluded due to one or more of the following: they did not report data by age group and therefore we could not extract data for the 45- to 65-year age group ($n$ = 5); they reported on multi-country data and did not separate data by country ($n$ = 2); or they did not report physical activity data and only used it as a covariate in analyses ($n$ = 2). Therefore, this narrative discusses the data from the remaining seven studies.[22-28]

All studies reviewed, except two that included only women participants,[22,23] and one that did not compare by gender,[24] found that women were less likely than men to use active travel,[25] were less physically active than men,[25-28] and were therefore less likely to meet physical activity recommendations. Data from the Dikgale Health and Demographic Surveillance System (HDSS) site reported that the prevalence of physical inactivity was significantly higher in women compared to men (70.8 vs 40.7%, respectively),[26] while differences between genders were around 10% in other studies.[27,28] Furthermore, in all but one study,[28] physical activity levels decreased with age.

The prevalence of adults meeting physical activity guidelines across all the studies included in this review ranged from 34 to 75%, with the wide range possibly being attributable to the large variation in age and socio-economic variables. The WHO-SAGE study compared South African data to data from other LMICs (China, Ghana, India, Mexico and the Russian Federation) and found that South African participants (only data for participants over 50 years old included) had the highest prevalence of low physical activity (59.7%), while in the other countries, this ranged from 23 to 38%.[25,27] Two studies found that a higher socio-economic status was associated with lower ambulatory physical activity (walking).[22,25] Furthermore, in various cross-sectional studies, physical activity was associated with lower fasting blood insulin and cholesterol levels,[22] higher fat-free soft tissue mass,[22] lower blood pressure and/or prevalence of hypertension,[23,24,28] lower body mass index (BMI)[25] and lower waist circumference.[25]

Five studies used self-reported questionnaires to assess physical activity, while two used objective measurements of physical activity.[23,24] The two studies that employed objective measurements tended to show low participation in moderate- to vigorous-intensity physical activity (between two and 20% of the day), yet did not quantify adherence to WHO guidelines.

The newly formed African Academic Consortium on Physical Activity for Health has recently released a number of policies in an attempt to reach the targets set out in the strategic plan, specifically focusing on guidance during the COVID-19 pandemic and beyond.[29] Focus is placed on improving safety in order to allow for exercise for all, and on targeting and providing services at the individual, environmental and societal level. Furthermore, the Strategy for the Prevention and Control of Obesity in South Africa (2015–2020) has highlighted that the high prevalence of physical inactivity in South Africa can be attributed to a lack of an inclusive environment and community networks, increased use of technology and time challenges.[30]

The International Society for Physical Activity and Health has recently released a call to action for policy makers globally, which includes eight areas for investment in order to boost physical activity.[31] These include school programmes, active travel, active urban design, healthcare, public education and the media, sport and recreation for all, and workplace and community-wide programmes. Ultimately, in all cases a multisectoral approach to improving physical activity is required.

Given the current available evidence, a grade B has been assigned to physical activity for the availability of prevalence data (Table 3). While national data are available, albeit between 2003 and 2012 only, there are few regional studies in this age group and not all data clearly define age group. Given the available data, it is unclear whether South Africa has reached the national target of increasing physical activity by 10% in 2020, as newer prevalence data do not exist, and previous national reports seem to show worsening of adherence to physical activity guidelines over time, rather than improvement. A grade C has been assigned for policy and implementation as the recent policy brief prepared by the African Physical Activity Network provides recommendations and an implementation framework aligned to the WHO Global Action Plan for Physical Activity, which is promising, although specific implementation plans for aging adults are not clear (Table 3).

## Alcohol consumption

In 2016, the Global Burden of Disease (GBD) study estimated three million deaths [95% uncertainty intervals (UI) 2.6–3.6] and 131 (119.4–154.4) million disability-adjusted life-years (DALYs) were attributable to harmful alcohol consumption globally. It estimated harmful alcohol consumption to be the seventh leading risk factor for DALYs.[32] In 2017, the global prevalence of harmful alcohol use was 6.4% for women and 18.5% for men.[33] Data from sub-Saharan Africa report that alcohol was responsible for 6.4% of all deaths and 4.7% of all DALYs lost.[34]

There are a series of global initiatives focusing on alcohol consumption, including the WHO's global strategy to reduce harmful alcohol use[35] (targets contained within the NCDs global monitoring framework[36]) and alcohol use has been addressed in the sustainable development goals (SDG).[3] The aims of these initiatives, as is the aim of the South African Strategic Plan for the Prevention and Control of NCDs,[4] are to reduce harmful alcohol consumption by at least 10%. In 2000, the burden of disease and injury attributed to misuse of alcohol was 7.1% in South Africa, more than double that of the global mortality average, which was 3.2%.[37,38]

The 2016 SADHS reported that 10.5% of women between 45 and 54 years of age and 11.2% of women between 55 and 64 years of age consumed alcohol (drank alcohol in the last seven days before the survey) compared to 36.7 and 45.1% of men for the same age categories.[9] It also reported that 4.4% of women and 27.8% of men between 45 and 54 years of age consumed five or more drinks on a single occasion in the 30 days prior to the survey (defined as risky drinking), and this decreased slightly in the older age group (55–64 years: 3.7% of women, 25.7% of men).[9] The 2012 SANHANES did not report a prevalence of problem drinking in this age group,[8] while the 2016 SADHS, using the CAGE test, reported problem drinking in approximately 15% of men and approximately 2.5% of women between the ages of 45 and 64 years.[9] Data from the WHO-SAGE study (wave 1) reported a 3.7% prevalence of risky alcohol use, defined as heavy drinkers (more than drinks/week) and binge drinkers (more than three drinks/one occasion/week).[39]

Recent South African data published between 2013 and 2020 regarding alcohol consumption ($n$ = 30) include national surveys ($n$ = 8), regional studies ($n$ = 7) and a global study ($n$ = 1). Of these, 16 studies were excluded due to the lack of focus on alcohol consumption and/or prevalence. Therefore, 14 studies were included in this narrative.

Self-reported alcohol use is the most common method of assessment due to the cost associated with measuring biological biomarkers;[40] however, there are concerns with the accuracy of participants' recall.[41] Carbohydrate-deficient transferrin and gamma-glutamyltransferase are suitable biomarkers for identifying alcohol use or abuse in most populations as they are sensitive to high alcohol consumption;[41,42] however, these can be misinterpreted in patients with liver conditions.[40,42] The definition of hazardous alcohol consumption may also result in differences in the reported prevalence between studies but is typically defined as a regular average consumption of 20 to 40 g of alcohol a day for women and 40 to 60 g a day for men.

Data from the WHO-SAGE study (wave 1) reported that 13.7% of the 3 840 participants over 50 years of age were current users of alcohol, with the prevalence being higher in men compared to women (15 vs 6.9%).[43] The Cardiovascular Risk in Black South Africans (CRIBSA) study reported an increase in self-reported alcohol use in both men and women over the age of 45 years between 1990 and 2008/2009, with the prevalence being significantly higher in men at both time points. The prevalence of problem drinking was also significantly higher in men than women in the age group 45 to 54 years (46.6 vs 16.2%) and 55 to 64 years (29.4 vs 15.8%).[44]

Data from the South African Panel Study of Small Business and Health, a longitudinal study conducted in African townships ($n$ = 2 213), reported a prevalence of problem drinking in 14.5% of the sample over the age of 50 years, and a further 8.9% who reported problem drinking and daily tobacco use.[45] Although there was an increase in problem drinking only from baseline to follow up at 12 months in the whole sample (19.6 to 21.1%), longitudinal data are not reported separately for those over 50 years of age.

A study of farm workers in the Western Cape does not report current and problem drinking prevalences for the age group 45 to 65 years. However, their results show that this age group had

**Table 3. Grades for the major risk factors in South Africans**

| *Risk factor* | *Prevalence data* | *Policy and implementation* |
|---|---|---|
| Physical activity | B | C |
| Alcohol consumption | A | C |
| Tobacco use | B | A |
| Diet | C | A |
| Obesity | A | B |
| Dyslipidaemia | C | B |
| Hypertension | A | B |
| Diabetes | A | C |

a similar preference for *papsak* wine consumption to people between 35 and 44 years of age, and that this was significantly higher than those in the younger age groups.[46] Although banned in 2007, *papsak* refers to cheap white wine packaged in a soft bag, consumed widely by poorer South African communities. This study also noted that alcohol use shifted to misuse as people grew older.

A study in rural Limpopo reported a 9.2% prevalence of alcohol consumption (having had a drink in the last 12 months) in participants between the ages of 45 and 54 years, and a 12.6% consumption in those between 55 and 64 years of age.[26] Home-brewed alcohol is also common among poorer communities.[47,48]

Policy developments over the last 10 years have included the drafting of the Control of Marketing of Alcoholic Beverages Bill and its approval by the national cabinet in 2013. To date the draft bill has still not been gazetted for public comment or tabled in parliament.[49] This proposed legislation would ban alcohol advertisements in all places except where alcohol is sold. Other proposals have included reducing the blood alcohol level allowed for drivers to zero, an increase in the legal age of drinking to 21 years of age as part of the draft Liquor Amendment Bill, and stricter regulations around the marketing and sale of alcohol.[50]

In order for alcohol policies to be implemented and effective, they need government support, which is also critical in continuing to resist industry. There should be a focus on peer influences, and interventions should be multi-pronged, focusing on enforcing laws that prohibit alcohol sales to minors, and ensuring that advertising campaigns that target young people are stopped.[51] The COVID-19 pandemic and the impact of subsequent lockdowns on alcohol consumption has highlighted the harmful effects of alcohol, resulting in an increase in trauma cases presenting at hospitals, gender-based violence and non-natural deaths. Government's response is to re-visit the Liquor Amendment Bill drafted in 2017, and there has been a recent increase in alcohol tax.

As there is recent national and regional prevalence data on alcohol consumption for this age group, the grade assigned for the availability of prevalence data is an A (Table 2). As several policies have been proposed but not implemented, a grade C is assigned to the policy and implementation component for alcohol (Table 3).

## Tobacco use

In 2019, the WHO reported that there were 1.3 billion tobacco users in the world, of which 80% lived in LMICs.[52] In line with the Global Action Plan for the Prevention and Control of NCDs,[53] the fifth target of the NCDs Global Monitoring Framework established in 2011 aims by 2025 to reduce by 30% the prevalence of current tobacco use in persons of 15 years of age and older.[36] In South Africa, it is estimated that 75% of trachea, bronchus and lung cancer deaths, 65% of chronic obstructive pulmonary disease deaths, 18% of CVD deaths and 15% of tuberculosis deaths are attributable to tobacco use.[54]

In 2013, the South African Declaration for Prevention and Control of NCDs committed to reduce the prevalence of tobacco use, estimated in 2009 at 23.7% (36.7% of men and 10.3% of women), by 20% by 2020.[5] Following global trends, national data from South Africa has reported that the prevalence of tobacco smoking among persons aged 15 years and older declined between 2005 and 2015.[55] However, high rates of tobacco usage were observed among persons in the 40- to 69-year age range, and particularly in men.[8,9,56] The prevalence of tobacco smoking among men and women in the 45 to 65 years age ranges was higher than the adult national prevalence, at approximately 20% in 2012 and approximately 22% in 2016.[9,57] In addition, SANHANES 2012 and SADHS 2016 reported gender differences in the prevalence of tobacco smokers in the 45- to 54-year age group (SANHANES 2012: men 35.8% vs women 8.5%; SADHS 2016: men 44.7% vs women 9.1%) and the 55- to 65-year age group (SANHANES 2012: men 29.4% vs women 11.3%; SADHS 2016: men 37.3% vs women 10.1%).[57]

South African data pertaining to tobacco use, which includes smoke and smoke-free products, published between 2013 and 2020 can mainly be found in cross-sectional surveys including: secondary analyses of nationally representative surveys ($n$ = 6),[8,9,57-63] large standardised multi-wave cross-country surveys ($n$ = 19) comprising WHO-SAGE[27,39,43,61-66] and the PURE study,[23,40,41,47,67-72] a public dataset ($n$ = 1)[73] and regional studies ($n$ = 11).[26,74-81] Of those, only a few surveys ($n$ = 7) specifically reported information in the 45- to 65-year age group[27,28,39,57,73,74,77] and the majority ($n$ = 30) were not designed to focus primarily on tobacco use, its prevalence and aetiology, but rather to investigate the role of tobacco use in NCD risk in broad adult populations, which were only collected using self-reported questionnaires such as the WHO STEPwise questionnaire[82] or other tools designed for survey purposes.

The WHO-SAGE wave 1 survey reported smaller gender differences than the national surveys, as well as a lower prevalence in men (25.8% for 50 to 59 years old and 21.4% for 60 to 69 years old), and a higher prevalence in women (17.3% for 50 to 59 years old and 14.9% for 60 to 69 years old)[27,39] compared to national data. The use of other tobacco products (hand-rolled cigarettes, pipes, cigars, water-pipes, electronic cigarettes, snuff, chewing tobacco and smokeless tobacco) was also reported to be higher among men than women within the 45- to 65-year age group (~7% in men and 4–6% in women).[57]

Regional data has reported ethnic disparities in tobacco use in the 45- to 65-year age range. A study of persons who self-identified as Indians living in Durban reported a 20 to 30% prevalence of tobacco use, and a study of self-identified African men and women from a socio-economically deprived neighbourhood in Cape Town reported a prevalence of 35 to 44% in men and approximately 10% in women.[74] A case–control study of 481 640 deaths in the South African population reported that the highest smoking-attributed mortality rate was observed in persons who self-identified as coloured (of the 45- to 64-year-old deaths, 60 to 71% were of smokers) and the lowest in persons who self-identified as African (of the 45- to 64-year-old deaths, 42 to 53% were of smokers).[73]

In South Africa's Strategic Plan for the Prevention and Control of NCDs (2013–2017),[4] which is in line with the six MPOWER measures,[83] and the practical and cost-effective interventions of the WHO Framework Convention on Tobacco Control implementation,[84] it has been recommended that South Africa monitor tobacco use and tobacco-prevention policies; protect people from tobacco smoke in public places and workplaces; offer help to people who want to stop using tobacco; warn people about the dangers of tobacco; enforce bans on tobacco advertising, promotion and sponsorship; and raise tobacco taxes and prices.[4]

As members of a household, 45- to 64-year-old adults are likely to be exposed to second-hand smoke, with data from SANHANES reporting that more than half of this age group said that a member of their household smoked inside their homes.[57] SANHANES data also reported that 35 to 41% of 45- to 64-year-olds were advised to quit smoking by a healthcare provider, and 49 to 52% of smokers tried to quit smoking.[57] In addition, more than 80% of smokers aged 45 to 64 years acknowledged having read health warnings on tobacco packages, but only 47 to 56% of smokers then tried to quit smoking.[57] Middle-aged adults are often the head of the household, and tobacco use may significantly reduce their household budgets for food, particularly healthy food.[60]

Given the evidence available and according to our grading criteria, a grade B is attributed to prevalence data on tobacco use (Table 3). While regular national surveys allow us to track national progress, published national and regional data are needed for the 45- to 65-year age group in order to identify geographical areas and communities needing attention. A grade A is attributed to policy and implementation as since the Tobacco Products Control Act in 1993, South Africa has continuously promulgated and implemented policies to reduce tobacco product consumption, which have proven successful (Table 3).[85]

To align with the WHO Framework Convention on Tobacco Control, which South Africa ratified in 2005,[86] South Africa has committed to complete its legislation on tobacco by developing and implementing evidence-based measures to regulate marketing activities and sales reach, reduce the demand for tobacco, and provide alternatives to agricultural actors involved in the tobacco industry. Overall, the consistent use of WHO tools, indicators and definitions across surveys and studies for the reporting of tobacco use is key in order to track progress towards achieving a 30% reduction in the prevalence of tobacco users.[36,82]

## Diet

The WHO recognises diet as one of the key contributors to several major risk factors for NCDs.[87] The diet-specific target for the Global NCD Action Plan and the Global Monitoring Framework for the prevention and control of NCDs is to achieve a 30% relative reduction in salt/sodium intake by the population by 2025.[36,53] Alongside this, many of the other NCD targets rely heavily on substantial dietary behavioural change.[36] In LMICs such as South Africa, rapid urbanisation and the transition to energy-dense diets high in saturated fat, sugar and salt, and low in micronutrients has been identified as a major driver of obesity and higher rates of NCDs.[87] In South Africa, the Strategic Plan for the Prevention and Control of NCDs highlights the need for dietary change to tackle high obesity burdens and micronutrient deficiencies, with a specific focus on reducing the consumption of salt, fried foods and snacks, hard margarines, and sugary foods and beverages, while promoting consumption of whole grains, fruit, vegetables, legumes, lean meat and low-fat dairy products.[4]

In South Africa, data examining dietary intakes were predominantly from cross-sectional surveys, which used subjective recall-based dietary assessment tools (such as 24-hour recall and food-frequency questionnaires) to report on overall macro- and micronutrient intakes and/or intakes of specific dietary components or food items (e.g. salt intakes). This is an important point to be cognisant of when interpreting dietary data as these approaches may not account for the fact that individual dietary components are consumed in combination, within an overall diet.[88] In addition, subjective dietary assessment tools have documented limitations related to the accuracy of portion-size estimation by participants, the varying contribution of individual food items to composite dishes, and the conversion of food items to their individual nutrient components, which may lead to inaccurate quantification of dietary intakes as well as under- and over-reporting, and must be considered when interpreting the dietary data reviewed.[88,89]

In addition, the adequacy or quality of dietary intakes is often assessed by comparing population mean or median energy, and macro- and micronutrient intakes with national or international guidelines. Since there are no guidelines specific to the South African population, studies most commonly use the USA's Institute of Medicine's dietary reference intakes (DRIs);[90] however, other guidelines on specific nutrients are also used, for example, the WHO guidelines on added sugar or salt intake. This can add to the complexity of comparing and interpreting dietary intakes and adequacy across studies.

Overall, 27 studies were identified in the review. However, nine studies were excluded due to the age range of participants being outside the selection criteria (45 to 65 years). In addition, three studies were excluded as they presented only pooled multi-country data: one was a methods article with no dietary data presented, one was a review, and one used dietary data in covariate analyses only. Data from the remaining 12 studies are therefore discussed below.[27,28,39,91-99] These studies focused on two main areas: namely, (1) overall dietary intakes (macro- and micronutrients and/or food items/groups) and comparison with DRIs or recommendations where applicable; and (2) salt consumption. The results are, therefore, presented according to these categories.

### *Dietary intakes and adequacy*

Macro- and micronutrient intakes of middle-aged men and women were reported in three cross-sectional studies. One included adults living in rural KwaZulu-Natal,[92] one included urban adults from the CRIBSA study in the Western Cape,[91] and the last involved secondary analysis of data from the PURE study.[93] These studies showed that, in both the rural and urban settings, energy intakes were either close to, or in excess of, those recommended for middle-aged men and women.[91-93] While only two of these studies assessed under- and over-reporting of dietary intake, only one subject was excluded as an 'over-reporter' by Kolahdooz *et al*. (2013),[92] and only 'under-reporters' were excluded by Steyn *et al*. (2016).[91]

One recent interventional study showed that women from peri-urban communities in the Free State consumed, on average, substantially lower (3 678–4 504 kJ per day) levels of energy than the estimated average requirement.[94] This study also did not clarify whether under- and over-reporting were taken into account during their analyses.

Three studies reported that, overall, carbohydrate intakes exceeded the recommended dietary allowance of < 130 g per day, while fibre intakes were low (< 25 g per day) and total or added sugar intakes were in excess of recommendations (> 25% and > 10% total energy, respectively).[91,92,94] This suggests that middle-aged adults are likely to be consuming high amounts of refined carbohydrates[91,92,94] While the proportion of energy consumed as protein fell within the recommended range in these studies (between 10 and 35% of total energy), it was at the lower end of this range and as much as half of the protein consumed came from plant sources.[91,92,94] Rural adults consumed a higher proportion of energy from carbohydrates and a lower proportion of energy from fat compared to their urban counterparts, with urbanisation being linked to higher total, saturated and mono-unsaturated fat intakes.[91,92]

In a study by Peer *et al*. (2018), which used cross-sectional data on semi-urban and urban adults from five of South Africa's nine provinces, 47 to 55% of men and 38 to 48% of women regularly consumed high-fat foods, with more regular consumption in those between 45 and 54 years of age than those between 55 and 64 years of age.[28] Steyn *et al*. (2016) also showed that, while the proportion of energy consumed as fat fell within the recommended range of 20 to 35% for urban adults from Cape Town, saturated fat intakes exceeded recommendations (> 7% total energy).[91]

Data from the PURE study assessed dietary intakes of urban adults according to alignment with the South African Food-Based Dietary Guidelines.[90] The PURE data showed that higher intakes of dairy products, fruit and vegetables, legumes and fish, and lower intakes of meat and meat products (a dietary profile more aligned with the South African Food-Based Dietary Guidelines) was associated with lower energy, fat (saturated, mono-unsaturated and polyunsaturated fat) and sodium, but not fibre, carbohydrate and protein intakes.[93]

As demonstrated by Kolahdooz *et al*. (2013) and the CRIBSA study, national fortification of staple foods (maize and wheat flour) with key micronutrients (vitamin A, iron, zinc, folic acid, thiamine, riboflavin, niacin, and vitamin $B_6$) since 2003 has contributed to adequate intakes of some, but not all of these vitamins and minerals.[91,92] In a cross-sectional study of peri-urban middle-aged adults in KwaZulu-Natal, the most commonly consumed food items were identified as sugar, maize meal porridge, bread, tea, rice, hard margarine, legumes, cordial squash, non-dairy creamer and milk.[96] Both this study and cross-sectional data on urban and rural adults from the Western Cape showed the variety and frequency of fruit and vegetable consumption to be low, with apples and bananas being the most commonly consumed fruit, and cabbage and mixed vegetables being the most commonly consumed vegetables.[96,97]

Data from Peer *et al*. (2018),[28] as well as from the WHO-SAGE study,[17] showed that between half and two-thirds of middle-aged adults consumed inadequate amounts of fruit and vegetables (less than five portions a day).[27,28,39] Lower daily fruit and vegetable intakes were also associated with daily or weekly purchasing of sugar-sweetened beverages (SSBs) in one study of rural and urban adults from the Western Cape, with urban adults purchasing SSBs, snacks and sugar more commonly than those living at the rural site.[97] In one study exploring seasonality in dietary intakes of women farm workers in the Western Cape, seasonal fluctuations in employment were associated with lower dietary diversity in the autumn and winter months, that is, the non-farming season.[98]

## Salt consumption

Using data collected from the food labels of packaged foods one year prior to implementation of salt regulations in 2016,[91] research showed that approximately two-thirds of foods covered by the regulations were either below or meeting the upper limit of sodium content by the time the regulations were implemented[100] Despite this, data collected from self-identified white, black and Indian South Africans prior to the implementation of the regulations demonstrated that 65% of adults consumed salt in excess of the WHO's < 5 g/d recommendation[101] In addition, findings from the WHO-SAGE study on salt-related knowledge and behaviour indicated that approximately 30% of South African middle-aged adults were not aware that high salt consumption could have an impact on their health, and 73% perceived the amount that they consumed to be 'just the right amount'.[109] In addition, discretionary salt intake was found to be high, with 79.9% of middle-aged adults adding salt to food during cooking either 'often' or 'always', and 32.9% regularly adding salt to their meals at the table.[109]

Peer *et al*. (2018) showed that in semi-urban and urban settings across South Africa, high intakes of salty foods were evident, with 41.8 to 54.7% of middle-aged men and 38.6 to 49.8% of women regularly consuming high-salt foods[8] In addition, a higher percentage of those in the 45- to 54-year age group consumed high-salt foods than those in the 55- to 64-year age group.[103] Data from WHO-SAGE has also shown that 91% of all adults fail to meet the daily dietary potassium requirements, and that dietary sodium-to-potassium molar ratios of > 2 are more strongly related to blood pressure as adults age than sodium intakes alone.[104] This further emphasises the need for a greater focus on improving overall dietary patterns, rather than limiting research and interventions to single dietary components in isolation.

As mentioned above, in 2003, national fortification of staple foods was introduced in South Africa to reduce the prevalence of micronutrient deficiencies at a population level.[105,106] Since then, regulations aimed at minimising trans fatty acid intakes and reducing salt intakes were drafted and published in 2011 and 2013, respectively.[101,107] The new regulations[108,109] particularly focused on limiting the amount of trans fatty acids and salt in commercially prepared food products.[30,110] In 2015, the Strategy for the Prevention and Control of Obesity in South Africa was introduced by the National Department of Health, with goals related to diet particularly focused on improving food environments (including ensuring availability and access to healthy food), as well as educating and mobilising communities and supporting obesity prevention in childhood.[30]

## Sugar-sweetened beverage intake

An SSB tax (the Health Promotion Levy or HPL) was implemented in 2018 at a rate of R0.021 per 1 g of sugar, over an initial tax-free threshold of 4 g/100 ml, in order to reduce the sugar content of SSBs and discourage consumer purchasing.[103] In a recent longitudinal study, SSB and added sugar intakes of adolescents and adults ($n$ = 617) living in Soweto, Johannesburg, were assessed before, at the time of, and one year after implementation of the HPL.[111] Study findings showed that substantial reductions in SSB consumption occurred between 2017 (at the time the intention of an SSB tax was announced) and 2018 (at the time the SSB tax was implemented), particularly by those who consumed higher levels initially. These reduced intakes were maintained in the following year. This is confirmed by data from a sample of South African households, which reported reductions in the sugar, calories and volume of SSB purchases with the implementation of the HPL.[112] This is promising, as it supports both supply and demand level benefits of the HPL on SSB and added sugar consumption.

However, data also suggested that the benefits of reduced SSB intake may be mitigated through high sugar consumption from other sources and that improving dietary patterns as a whole is critical to improving health outcomes. While national legislation and fiscal policies are important and documented progress is commendable, there is little evidence of progress on interventions, which would enable improved overall dietary patterns at a population level. This is important as targeting individual dietary components may have a limited impact on overall dietary patterns and, therefore, on obesity and NCD rates. It is increasingly being recognised that there is a need for changes to food environments that simultaneously stimulate demand for, and access to, healthier foods such as fruit and vegetables.

Given the evidence currently available, a grade C is attributed to prevalence data for diet (Table 3). While regional data exist for the 45- to 65-year-old age group, more nationally representative data is needed. Specifically, routine monitoring of salt intakes at national and regional levels in this age group is necessary to track progress towards achieving the target of a 30% reduction in population salt/sodium intakes. In addition, data exploring dietary patterns, as well as their determinants, in this age group are needed to inform interventions and achieve progress towards other NCD targets, which are reliant at population-level dietary behavioural change. For policy and implementation, diet receives a grade A due to the number of national policies that have been implemented since 2003 (Table 3). In future, routine follow-up data to track effectiveness of these policies should be prioritised in order to build on and complement current initiatives.

## Obesity

Obesity has become a global epidemic and a major health challenge in both low- and high-income countries.[113] Once associated with only developed countries, the prevalence of obesity, along with urbanisation and changes in lifestyle and environment, has increased rapidly in LMICs.[114] According to the WHO global estimates, in 2014 more than 1.9 billion adults (39%) were overweight, of whom over 600 million (13%) were obese (BMI > 30.0 kg/m$^2$).[115] In the year 2019, it was reported that more than five million people died worldwide as a result of a high BMI.[116]

While being in line with the WHO's Global Action Plan for the Prevention and Control of NCDs 2013–2020,[53] the South African Strategic Plan targets a reduction in the prevalence of obesity by 10% by 2020.[4] The first South African National Burden of Disease study ranked high BMI as the fifth highest risk factor for early death and years of life lived with disability,[117] and national statistics reporting trends in the prevalence of overweight and obesity in South Africa between 1980 and 2014 showed that 64% of adult women and 30.7% of adult men were overweight or obese, with the numbers differing quite significantly between the ethnic groups.[118] Currently, South Africa's overweight and obesity prevalence is the highest in sub-Saharan Africa.[119]

Comparing cross-sectional data from a multi-country study, Ajayi *et al*. (2016) reported South Africa's prevalence of obesity (54%) to be the highest compared to Nigeria, Tanzania and Uganda, with age being significantly associated with higher BMI.[119] Obesity trends in South Africa have shown an increase between 2003 (SADHS) and 2012 (SANHANES), with the prevalence in women between the ages of 45 and 54 years increasing from 40 to 55%.[120,121] The latest SADHS figures reported that the highest prevalence among women was between 45 and 64 years (81–82%), while the prevalence in men of this age group was 42.8% (45–54 years) and 53.2% (55–64 years).[9]

Forty-two studies were originally selected from the title and abstract search. Fifteen were excluded due to the age range of participants being outside the selection criteria (45–65 years) and because they reported pooled data from other countries. In addition, eight studies were excluded because obesity was not the outcome of interest examined and they did not include prevalence data. Data from the remaining 19 studies are discussed below.[26,27,39,62,65,69–71,79,119,121–129]

A study by Maimela *et al*. (2016), in a rural South African community found obesity to be highest in women between 45 and 64 years, with the prevalence showing an increasing trend from 13.6% in 15- to 25-year-olds to 41.9% in 55- to 64-year-olds, while being 45 years or older was associated with a twice as great risk of overweight/obesity among South African adults.[26] In addition, as well as reporting age-standardised rates of overweight/obesity of 676 and 686 per 1 000 in adult men and women, respectively, the WHO-SAGE study reported that age was also associated with an increase in the prevalence of central obesity.[124]

The PURE study reported abdominal obesity in men (mean age 51.9 years) and women (mean age 51.8 years) and although there was no significant change in the rural men, central obesity increased in urban men from 6.1 to 11.7% over five years.[71] Furthermore, at baseline, 63.6% of urban women were identified with abdominal obesity compared to 50.5% of rural women and this increased to 69.7% in urban and 55.1% in rural women at follow up.[71]

The gender difference in obesity prevalence in rural (27.8% women vs 10.6% men, $p < 0.001$) and urban (43.7% women vs 25.7% men, $p < 0.001$) South Africans between the ages of 45 and 65 years has been highlighted by several studies.[26,69,123] In the study by Ajaya *et al*. (2016), the BMIs of the South African women were higher than those of the men. As a result, 60% of the women were obese, while only 33% of the men were obese.[119] In addition, being a woman was associated with twice the odds of being obese [adjusted odds ratio (AOR) = 2.17; 95% confidence interval (CI): 1.19–4.00] compared with men.[119]

Although self-identified black South African women are the most affected by obesity, data from Soweto has shown that they are content with their body size or accepting of being obese, which is also aligned with what has been described as the preferred and/or ideal body size in several African populations.[71,125] The SADHS 2016 report found that among women who perceived themselves as underweight or normal, 44 and 65%, respectively, were overweight or obese.[130]

Sociodemographic and socio-economic factors must be considered when trying to understand the aetiology of obesity in South Africa.[39,71,79,130] Several studies have shown that living in an urban area, having a higher socio-economic status and being married or cohabiting (married under common law) were significant predictors of obesity in men, but not in women.[30,39,71,79,130] However, another study among urban South

Africans reported that adults with a low socio-economic status who were overweight/obese were more likely to be older (38.6%), women (84.9%), unemployed (82.9%), non-smokers (45.4%) and 51.0% of them used alcohol.[121] The same study showed thar other social determinants of health within South Africa include neighbourhood safety, as it found perceived slow speed from traffic [odds ratio (OR) = 0.41; 95% CI: 0.23–0.72] to be associated with being less likely to be overweight/obese, and high crime during the day (OR = 2.20; 95% CI: 1.04–4.64) to be associated with overweight/obesity in women.[121] Living in a household with greater resources or having a higher socio-economic status in adulthood was significantly associated with obesity in women, while the same was not true for men, as reported by Case and Menendez.[131]

Findings from the 2016 SADHS report a range in the prevalence of overweight or obesity in adult women of different ethnicities, with the lowest prevalence in white women (67.4%) and the highest in Indian/Asian women (70%).[9] In men, the prevalence of overweight or obesity was highest in self-identified white men (75%) and lowest in self-identified black African men (27%).[130]

It is widely accepted that obesity is a risk factor for cardiometabolic risk, and this has been shown by various studies in South African middle-aged adults.[65,69,70,123,126] Data from a study in a self-identified urban black Free State community showed that overweight/obese adults older than 44 years had 25% greater risk of being hypertensive compared to adults with normal or underweight BMI. In order to identify South African men and women at risk of cardiometabolic diseases, Kruger *et al.* (2017) proposed new BMI cut-off points. These show that a cut-off point of 28 kg/m$^2$ in women and 22 kg/m$^2$ in men is associated with increased odds of various cardiometabolic risk outcomes, including elevated blood pressure, dyslipidaemia and type 2 diabetes.[89]

In an attempt to reduce the growing prevalence of obesity and raise awareness, the South African government adopted the 2015–2020 Strategy for the Prevention and Control of Obesity, introduced by the National Department of Health. This strategy recognises the need for a population-based approach to tackling obesity and acknowledges the importance of context and an enabling environment. It also emphasises the need to communicate with communities in order to educate and mobilise them.[30]

Given the current available evidence, a grade A is assigned to the availability of obesity data based on the prevalence grading criteria; however, grade B is assigned to policy and implementation as current policies have only been in place within the last 10 years (Table 3). Although national and regional evidence exists for this age group, it remains to be seen if the current policies will be effective in reducing obesity.

## Dyslipidaemia

Raised cholesterol (total cholesterol > 5 mmol/l) is a major cause of CVD and disease burden in both high-income countries and LMICs.[132] In 2016, the Global Burden of Disease study reported that high concentrations of total cholesterol caused 4.4 million deaths and over 93 million DALYs, representing the seventh and eight leading risk factors in terms of attributable DALYs globally for women and men, respectively.[133] Furthermore, there has been a 15% increase in the deaths (either from ischaemic heart disease or stroke) due to high total cholesterol levels since 2006.[133]

Global targets to reduce the prevalence of dyslipidaemia are included in the WHO 25 × 25 goal (25% reduction in risk of premature death from NCDs by 2025) and focus on lowering total cholesterol levels to < 5 mmol/l and low-density lipoprotein (LDL) cholesterol to < 3 mmol/l.[134] Although the Strategic Plan for the Prevention and Control of NCDs 2013–2017 adopted by South Africa aims to reduce premature mortality by 25% by 2020, it does not include a specific goal targeted at dyslipidaemia.[4] In South Africa, it is estimated that since 2000, more than half of all ischaemic heart disease and more than one-quarter of all ischaemic stroke cases were associated with high serum cholesterol levels.[38]

Following international trends, the SADHS in 2003 reported that more than 5.7 million South Africans had an abnormal lipid profile, of whom less than 50% were on treatment.[13] Self-reported high cholesterol levels among women aged over 15 years has increased from 1% (from SADHS 1998) to 4% in 2016 (SADHS 2016).[9,135] In contrast, the SANHANES, completed in 2012, revealed that 28% of women and 19% of men older than 18 years had elevated total cholesterol levels, and 52 and 44% of men and women, respectively, had low levels of high-density lipoprotein (HDL) cholesterol.[56] Although the national surveys reported the prevalence of abnormal lipid levels in South Africa, it was not specific to the 45- to 65-year age group, but rather included all adult ages from over 18 years.

Dyslipidaemia is characterised by the presence of non-optimal levels of blood lipids. In clinical practice guidelines, dyslipidaemia is defined by elevated total cholesterol (> 5 mmol/l) and/or LDL cholesterol (> 3 mmol/l) levels. However, the definition is often extended to include non-optimal levels of HDL cholesterol (< 1.2 mmol/l ) and elevated circulating triglycerides (> 1.7 mmol/l).[136] Of the 18 articles identified on dyslipidaemia, from the title and abstract screening, all were cross-sectional studies, including several articles from the PURE (*n* = 6)[23,40,41,47,68,137] and regional studies (*n* = 12).[26,67,69,76,78,122,123,138-142] Of the 18 studies, three reported limited information in the 45- to 65-year age group,[67,122,139] while five studies were not designed to focus primarily on dyslipidaemia but rather to investigate various CVD risk factors in the broad adult population.[41,47,68,76,137] This narrative therefore discusses the data from the remaining 10 studies.

The prevalence of dyslipidaemia within middle-aged adults reported by various regional South African studies ranges from 31.7 to 67.3%.[23,78,140,141] Dyslipidaemia affects both men and women; however, data from the CRIBSA and Dikgale HDSS studies show that lipid irregularities contributing to the overall diagnosis of dyslipidaemia differ between men and women.[26,138] In the CRIBSA study, although the prevalence of high total cholesterol levels (> 5 mmol/l) was the same in men and women (38% for both), women had a higher prevalence of low HDL cholesterol (61.3 vs 55.7%) and high LDL cholesterol (62.5 vs 51.6%) compared to men in the 45- to 54-year age range.[138] Furthermore, men had a higher prevalence of triglyceride levels > 1.5 mmol/l compared to women in the same age range (28.6 vs 19.0%).

This differed from a study in Limpopo, where the 45- to 54-year-old women had a higher prevalence of high total cholesterol > 5 mmol/l (32.6 vs 21.7%) and raised triglyceride levels > 1.7 mmol/l (27.1 vs 21.7%) compared to men.[26] When comparing the two age groups (45–54 vs 55–64 years) in the CRIBSA study, Peer *et al.,* (2014) observed a decrease in the prevalence of high total cholesterol (38–26%), low HDL cholesterol (55.7–55.5%), high LDL cholesterol (51.6–31.1%) and high triglycerides (28.6–26.6%) with age in men; while an increase in all lipid indicators was observed in women: high total cholesterol (38.9– 45.8%), high LDL cholesterol (62.5–66.1%) and high triglycerides (19–25.1%).[138]

In contrast, the Dikgale HDSS data observed a 7.1% decrease in men and a 15.5% decrease in women in the prevalence of high total cholesterol levels in the 55- to 64-year group compared to the 45- to 54-year group.[26] Therefore, dyslipidaemia appears to affect middle-aged men and women differently. Although the prevalence of dyslipidaemia in men and women differs across regions in South Africa, the same factors are strongly associated with dyslipidaemia in both genders, including age, overweight or obesity and waist circumference.[23,26,78,138,140,141]

In addition to observed gender differences in the prevalence of dyslipidaemia, ethnic differences are evident within South Africa. A regional cross-sectional study showed that self-identified black African men and women were less likely to have hypercholesterolaemia compared to their self-identified white counterparts (men, OR: 0.64, 95% CI: 0.49–0.84; women, OR: 0.52, 95% CI: 0.43–0.62).[123] In addition, self-identified Indian men were more likely to have hypercholesterolaemia than white men (OR: 1.47, 95% CI: 1.05–2.08).[123] A general linear pattern was observed for the association between hypercholesterolaemia and BMI category in self-identified black Africans and self-identified white participants, while no discernible pattern in self-identified Indian or self-identified coloured participants was found. Compared with normal-weight participants, the odds for hypercholesterolaemia were significant for overweight self-identified white participants (OR: 1.51, 95% CI: 1.18–1.94), and obese self-identified white participants (OR: 1.55, 95% CI: 1.19–2.03) and self-identified black Africans (OR: 1.63, 95% CI: 1.25–2.12).[123]

Of particular concern when reviewing this literature and highlighted by data from the Health and Aging in Africa Longitudinal study (HAALSI) in Agincourt, Mpumalanga, is that only a small proportion of individuals (1.05%) were aware of their dyslipidaemic condition and, of those who were aware, less than 1% (0.73%) are currently on treatment.[141] The WHO has reported that a 10% reduction in serum cholesterol level in men aged 40 years and over is associated with a 50% reduction in heart disease within five years.[132] Low-cost methods for identifying at-risk individuals exist and treatment with cholesterol-lowering medications in the form of statins is cost effective and is known to have a positive effect. The most recent content review by the Heart and Stroke Foundation South Africa in 2017[143] confirmed the current guidelines from the 2016 European Society of Cardiology and European Atherosclerosis Society Guidelines for the Management of Dyslipidaemia, in which the desired lipid targets are a total cholesterol level < 5 mmol/l; LDL cholesterol < 3 mmol/l; HDL cholesterol > 1.2 mmol/l for women and > 1.0 mmol/l for men, and a fasting triglyceride level < 1.7 mmol/l.

Given the current evidence available and according to our prevalence and policy and implementation grading criteria, a grade C and B are attributed to dyslipidaemia, respectively (Table 3). More recent published national data are needed (particularly for the 45- to 65-year age group) in order to highlight the prevalence of dyslipidaemia in middle-aged South African adults, and the consequences thereof. Current guidelines for the management of dyslipidaemia have been updated and currently implemented since 2017, however, regional studies have shown that regardless of this, less than 1% are currently on treatment.

## Hypertension

In 2019, the Global Burden of Disease Study estimated that high systolic blood pressure (SBP > 140 mmHg) resulted in approximately 10.8 million deaths globally. However, this estimate excludes individuals with hypertension through elevated diastolic pressure or who are on antihypertensive treatment with an SBP of less than 140 mmHg.[116] In 2015, the WHO estimated that the total number of individuals living with hypertension was 1.13 billion, two-thirds of whom lived in LMICs.[144] This is of great concern as awareness, treatment and control remain problematic in these regions.[145,146]

As part of the WHO 25 × 25 target, the United Nations set a target for 25% reduction in the prevalence of SBP > 140 mmHg between 2010 and 2025.[147] The South African target as part of the Strategic Plan for the Prevention and Control of NCDs 2013–2017 adopted the broader definition of hypertension, setting a goal of 20% reduction in the prevalence of raised blood pressure by 2020 (by medication and lifestyle), and a 30% increase in individuals controlled for hypertension.[4] South African blood pressure data from the Global Burden of Disease study (2015, *n* = 13 580) showed a > 60% increase in estimated death and disability due to elevated blood pressure between 1990 and 2015.[148] Across these 25 years, SBP increased in both men and women and across all older age groups (45–49, 50–54, 55–59 and 60–64 years).

Hypertension is most commonly classified as SBP of 140 mmHg or above, and/or diastolic blood pressure (DBP) of 90 mmHg or above, and/or on hypertension medication. Of 58 articles identified from the title and abstract screening, 18 presented data on hypertension prevalence specifically for South African adults, with results presented for age groups within the 45- to 64-year age range.[26-28,43,61,64, 65,148-158] Reasons for exclusion of articles were: hypertension data were combined across countries (*n* = 5), data were not presented by age group within the target age range (*n* = 33), or data were presented from selected groups, such as teachers or adults with normal blood pressure only (*n* = 2).

With the exception of the WHO-SAGE study, which used wrist blood pressure measurement, most other studies presented blood pressure data from automated measurements taken at the brachial artery. The majority of articles reported conducting three measures and blood pressure data were most commonly presented as the average of the second and third readings. However, several studies used methods that could potentially lead to over- or underestimates of blood pressure or hypertension prevalence (averaging all blood pressure measurements taken, using the highest or lowest blood pressure value recorded, or using self-reported data only on hypertension status).

A report produced by the Health Systems Trust in 2015 compares the NIDS hypertension prevalence data between 2008 and 2012, showing that hypertension prevalence remained fairly static in this time period,[159] although prevalence had increased since the 1998 SADHS survey.[135] However, the 2016 SADHS data[9] report that hypertension prevalence overall has nearly doubled since the 1998 survey, with 55% of men and 63% of women aged 45–54 years, and 74 and 78% of men and women aged 55–64 years living with hypertension.

WHO-SAGE wave 1 (2007–2010) data published in 2013 reported that the odds of having hypertension were significantly higher in 40- to 59-year-olds (OR: 2.98, 95% CI: 0.569–15.58; $n$ = 1 134) and in 60- to 79-year-olds (OR: 38.89, 95% CI: 5.549–272.6; $n$ = 360) compared to < 40-year-old adults ($n$ = 569; $p$ < 0.001).[150] An analysis of the same dataset but including only those South African adults over 50 years ($n$ = 3 840) showed that around three-quarters of adults had hypertension (overall prevalence 77.3%, men 74.4%, women 79.6%) with the highest prevalence observed in women aged 60 to 69 years (81.6%).[43] In this nationally representative sample, 38.1% of the adults with hypertension were aware of their hypertension, 32.7% were being treated and 17.1% had their hypertension under control, with four out of five hypertensive older adults showing uncontrolled blood pressure.

Hypertension in the over 50-year-old group did not differ significantly between urban and rural populations in South Africa and was higher than any previous figures for African adults[27] and higher than all other WHO-SAGE countries (China, India, Ghana, Mexico, Russia),[61] with the lowest levels of hypertension diagnosis across all six countries.[64.]

In 2016, Irazola *et al*. reported the prevalence of hypertension from four urban South African communities at 61% in 45- to 54-year-olds and 70% in 55- to 64-year-olds.[154] A further 23 and 18% of 45- to 54-year-olds and 55- to 64-year-olds, respectively, were diagnosed with pre-hypertension (SBP between 120 and 139 mmHg and/or DBP between 80 and 89 mmHg in the absence of a diagnosis of hypertension or treatment).[154] Data from the CRIBSA study published in 2015 reported a similar prevalence of hypertension, with the highest levels observed in women in both age groups (45- to 54-year-olds: 60.6% in women vs 58.2% in men; and 55- to 64-year-olds: 77.1% in women vs 63.6% in men).[157]

In another regional study in Cape Town comparing two independent cross-sectional surveys in 2008–2009 and 2014–2016, results showed that in 2008–2009 screen-detected hypertension was highest in ≥ 70-year-olds, while in 2014–2016 the peak was in 40- to 49-year-olds.[152] The recorded prevalence of hypertension from the study cohort in 2008–2009 was 33% in 40- to 49-year-olds, 50% in 50- to 59-year-olds and 68% in 60- to 69-year-olds. In 2014–2016, this had increased significantly in all groups to 58% in 40- to 49-year-olds, 71% in 50- to 59-year-olds and 83% in 60- to 69-year-olds. Relying on self-reported hypertension status only, a 2015 survey conducted with 28 007 Gauteng adults reported a hypertension prevalence of 21% in 48-to 57-year-olds, and 32% in 58- to 67-year-olds.[155]

In 2013, a screening campaign in five of the nine South African provinces reported a hypertension prevalence in self-selected urban and peri-urban adults of 57.3 and 54.1% in 45- to 54-year-old men and women, respectively, and 74.8 and 68.3% in 55- to 64-year-old men and women, respectively.[28] Another screening campaign conducted in Zandspruit (outside of Johannesburg), Gauteng, in 2012–2014 reported a prevalence of elevated blood pressure (≥ 140/90 mmHg) as 55% in 45 to 54 year olds ($n$ = 889), and 63% in 55 to 64 year olds ($n$ = 109).[158]

Treatment use in studies recruiting volunteers as part of a screening campaign report higher prevalences of hypertension than most studies (53.0 and 57.4% in 45- to 54-year-old men and women, respectively; 60.8 and 70.2% in 55- to 64-year-old men and women, respectively), as well as the percentages of those who were controlled on treatment (42.1 and 44.5% in 45- to 54-year-old men and women, respectively; 41.8 and 47.2% in 55- to 64-year-old men and women, respectively).[28] These findings may suggest that such screening programmes disproportionately attract individuals who know their diagnosis and are actively seeking to monitor their treatment response.

When examining data for the different ethnic groups collected as part of the screening campaign described above, in comparison to self-identified black women, Indian women were more likely (OR: 1.31, 95% CI: 1.01–1.69) and self-identified white women were less likely (OR: 0.55, 95% CI: 0.44–0.69) to have hypertension. Other factors associated with having hypertension in both men and women were increasing age, being resident in the Eastern Cape or the Free State (compared with the Western Cape), and having multimorbidity (especially having a cardiac problem, stroke, diabetes or being overweight or obese).[28]

Data from two studies conducted at the Dikgale HDSS site in Limpopo and the Agincourt HDSS site in Mpumalanga have reported quite disparate hypertension prevalences. In Dikgale, a hypertension prevalence of 41% in 40 to 49 year olds, 48% in 50 to 59 year olds and 51% in over 60 year olds were reported.[156] While the prevalence of hypertension was similar between men and women in the 55- to 64-year-old group (47 and 46%, respectively), in the younger 45- to 54-year age group more women than men were hypertensive (43 vs 35%).[26]

Data collected during household visits in Agincourt, Mpumalanga, in 2014–2015 (the HAALSI study) showed hypertension prevalence rates of 45% in 40 to 49 year olds, 64% in 50 to 59 year olds, and 74% in 60 to 69 year olds.[151] Interestingly, rates of hypertension awareness were much higher than anywhere reported previously (80% at age 40–49 years, 86% at age 50–59 years, and 94% at age 60–69 years), possibly as a result of continued research and surveillance efforts in the region. However, while many had received antihypertensive treatment (47% at age 40–49 years, 64% at age 50–59 years and 75% at age 60–69 years), fewer adults were continuing to stay on and take their blood pressure medication, particularly in the younger groups (31% at age 40–49 years, 45% at age 50–59 years and 58% at age 60–69 years).

In an attempt to prevent hypertension and reduce population blood pressure, in June 2016 South Africa implemented legislation[101] mandating maximum sodium levels in a range of manufactured foods that contribute significantly to salt intake in a population, which was updated with a second level of sodium lowering in 2019.[108,109] The diet section in this report discusses the evidence on salt intake in South Africa and, as yet, there are few data to assess the impact of this legislation on population sodium intakes or on blood pressure.

Given the evidence and according to our grading criteria, grades A and B are attributed to the prevalence, and policy and implementation grading criteria for hypertension, respectively (Table 3). Adopting standardised methods of measuring blood pressure is recommended across studies, and as the more immediate changes in blood pressure anticipated as a result of the sodium legislation are expected to be relatively small,[160] this attention to measurement technique is critical to not miss these changes in blood pressure. However, the evidence reviewed suggests that, currently, South Africa is not on track to realise either the South African national or global target.

## Diabetes

The most recent *International Diabetes Federation Atlas* (9th edn) has reported an estimated global diabetes prevalence of 9.3%, which is predicted to rise to 10.2% in 2030 and 10.9% in 2045.[161] Of the 436 million people with diabetes, 19 million live in sub-Saharan Africa, 60% of whom do not know they have diabetes. The global prevalence is higher in urban compared to rural communities, with 67% of people with diabetes living in urban areas.[161] Globally, between the ages of 45 and 65 years, there is a higher prevalence of diabetes in men compared to women, with the prevalence increasing in both genders between these ages.

The latest Global Burden of Disease data (2019) shows that diabetes is one of only three conditions (the other two being HIV/AIDS and musculoskeletal disorders) that have shown large increases in age-standardised DALY rates since 1990, with an increase of 24.4% (95% UI: 18.5–29.7).[162] While being the fifth leading cause of global DALYs in 1990 in people between the ages of 50 and 74 years, this has increased to being the third leading cause in 2019.[162] The WHO global NCD target has set out to halt the rise in diabetes by 2025, while the diabetes goal outlined in South Africa's Strategic Plan for the Prevention and Control of NCDs 2013–2017 is to increase the percentage of people controlled for diabetes by 30% by 2020.[4]

In South Africa, type 2 diabetes was the leading cause of death in 2016 in women (7.2% of deaths).[163] SANHANES data published as part of a 12-country study reported the prevalence of diabetes as 14% in men and 17% in women between 40 and 54 years of age, and 23% in men and 30% in women in the 55- to 64-year-old age group.[164] The 2016 SADHS, which used adjusted haemoglobin $A_{1c}$ ($HbA_{1c}$) from dried blood-spot specimens in a sub-sample of nationally representative households, reported a similar prevalence of 12 and 21% in 45- to 54-year-old men and women, respectively, and 23 and 29% for 55- to 64-year-old men and women, respectively.[9]

Of the 42 articles that were selected based on title and abstract screening, only 19 met the inclusion criteria for this narrative.[26,28,63,76,122,123,151,152,155,165-173] Twenty-three articles were excluded and the reasons for exclusion included no diabetes-specific data (*n* = 8), out of age range (*n* = 9), only included continuous glucose data (*n* = 2), only included impaired fasting glucose prevalence (*n* =1) or diabetes was a correlate with no prevalence data available (*n* = 1). One reference was a conference abstract and one was a conference poster. Comparisons between the studies is sometimes difficult as various methods and cut-off points are used to define diabetes [self-report, random blood glucose (RBG), $HbA_{1c}$, fasting blood glucose (FBG)], and the study samples used in the various studies are often self-selected so do not represent a population.

The diabetes prevalence reported by regional studies ranges from 2% in a study by Senekal *et al.* (*n* = 517; mean age of 45 years; RBG > 11.1 mmol/l) to 21.4% in 58- to 67-year-old men and women using self-report.[122,155] Primary healthcare screening of adults in the Eastern Cape (*n* = 17 359, over 18 years, 50% older than 45 years) identified 14% of people over the age of 55 years with a RBG ≥ 7.8 mmol/l.[165]

Bailey *et al*. (2016), using RBG ≥ 11.1 and self-reported diabetes in a sample of 12 496 individuals from the Western Cape, reported a diabetes prevalence of 11.5% in adults between 40 and 49 years of age, and 18.1% between 50 and 59 years of age.[166] The Bellville South study includes of a self-reported coloured population (*n* =1 294; mean age 47.8 years) and reported a 7.3% prevalence using WHO criteria,[152] while another cohort study in South Africa, the HAALSI cohort, reported a 12% prevalence in their sample over the age of 40 years.[151] A small study of commercial taxi drivers (98.8% men, mean age 43.3 years) reported a 16% prevalence of diabetes defined as a FBG ≥ 7.0 mmol/l or self-report.[167]

It is clear from national data as well as regional studies that the prevalence of diabetes increases with age and BMI. This is well illustrated by Shen *et al*. (2016), who include data from the CRIBSA study as part of a multi-site study, and reported a diabetes prevalence of 13.8% in the whole sample (25–74 years) but a clear increase in prevalence with age and BMI.[76] Hird *et al*. (2016) compared the prevalence of diabetes using the WHO diagnostic criteria for FBG (≥ 7.0 mmol/l), two-hour plasma glucose level from an oral glucose tolerance test [two-hour postprandial glucose (PG) ≥ 11.1 mmol/l] and $HbA_{1c}$ ≥ 6.5%.[168] In men between 45 and 54 years, the prevalence was 9.3, 7.0 and 11.6% for FBG, two-hour PG and $HbA_{1c}$, respectively, and for women of the same age, these were 23.2, 17.2 and 27.2%, respectively. In slightly older adults (55–64 years) these increased to 25.8, 25.8 and 29% for FBG, two-hour PG and $HbA_{1c}$, respectively, in men, and 34.5, 30.1 and 32.7%, respectively, in women.

Ethnic differences in the prevalence of diabetes have been reported in several regional studies.[123,169] Peer *et al*. (2018) in a sample of 7 711 adults (mean age 47.6 years in men and 48.6 years in women) who attended a screening campaign, compared the prevalence of diabetes between self-identified white, coloured, black and Indian men and women. They showed that compared with self-identified white men and women, self-identified black men (OR: 2.66, 95% CI: 1.70–4.16) and women (OR: 2.10, 95% CI: 1.49–2.96), self-identified coloured men (OR: 2.28, 95% CI: 1.44–3.60) and women (OR: 2.15, 95% CI: 1.52– 3.05) and self-identified Indian men (OR: 4.38, 95% CI: 2.65–7.26) and women (OR: 3.64, 95% CI: 2.50–5.32) were more likely to have diabetes.[123]

The prevalence of diabetes was highest in self-identified Indian men and women (26.2 and 26.8%, respectively), followed by self-identified coloured adults (men 12.6 and women 12.2%), then by self-identified black men and women (9.6 and 9.7%, respectively) and then by self-identified white adults (men 9.5% and women 6.8%). A smaller study (*n* = 317, age 45 ± 9 years) by Malan *et al*. (2013), reported an $HbA_{1c}$ ≥ 5.7% in 68.8% in self-identified black men, 47.3% in self-identified black women, 44.1% in self-identified white men and 20.7% in self-identified white women.[169]

Few studies have compared prevalence data between urban and rural populations, with only data from the WHO-SAGE study (*n* = 3 280; > 50 years of age) reporting a prevalence of self-reported diabetes of 11.1% in urban and 5.6% in rural samples.[170] Data from the same study but including adults over 18 years of age (although 95.1% were over 40 years of age), reported a risk ratio for diabetes of 3.36 (1.92–5.74) in urban compared to a rural population.[63] The same study also compared a migrant population group to a rural group and found no significant differences in diabetes risk. Using self-reported diabetes data from the Quality of Life Survey from the Gauteng province (*n* = 280 087; over 18 years of age), Motlhale *et al*. (2019) showed that being a migrant (internal or external) was associated with a significantly lower risk of diabetes compared to people born in Gauteng.[155]

Several studies have reported diabetes prevalence data on the > 50-year-old sample from the WHO-SAGE (wave 1) study, all of which describe its association with other diseases or risks. Quashie *et al*. (2019) reported a diabetes prevalence of 8.9% and showed that diabetes was associated with a four times greater odds of angina. Stubbs *et al*. (2018) reported a 9.2% diabetes prevalence when examining the association between multimorbidity and stress. Werfalli *et al*. (2018) also reported a diabetes prevalence of 9.2% and showed that the prevalence was higher in 60- to 69-year-olds (10.6%) compared to 50- to 59-year-olds (7.1%).[63,171-173]

Gender differences in the prevalence of diabetes have been reported by various studies in middle-aged men and women; however, the findings of these studies differ, with some showing a higher prevalence in women and others showing a higher prevalence in men. Using a FBG cut off of ≥ 7.0 mmol/l, Maimela *et al*. (2016) reported a higher prevalence in women compared to men between the ages of 45 and 54 years (9.1 vs 4.3%) and 55 to 64 years (15.7 vs 12.2%).[26] The screening campaign by Peer *et al*. (2018) reported a prevalence of diabetes (known or RBG ≥ 11.1 mmol/l) in 13.8% in men and 12.8% in women, with age-specific prevalence also being higher in men than women (45–54 years: men 18.9% vs women 12.9%; 55–64 years: men 21.9% vs women 21.4%).[28]

As is recommended by various international diabetes organisations, the Society for Endocrinology, Metabolism and Diabetes of South Africa recommends a two-step targeted approach when screening for diabetes. This includes identifying individuals at high risk of diabetes: (1) individuals who are overweight with one or more risk factors for diabetes, such as physical inactivity, hypertension, family history of diabetes, dyslipidaemia, polycystic ovarian syndrome, high-risk ethnic group (South Asian descent), CVD history, gestational diabetes or baby > 4 kg, previous impaired fasting glycaemia or impaired glucose tolerance; or (2) adults ≥ 45 years old.[174] This ensures more targeted screening for diabetes, which should ensure that the number of individuals with undiagnosed diabetes is reduced. This guideline highlights that the optimal management should focus on obtaining glycaemic control and reducing other risk factors for macro- and microvascular disease. It advises lifestyle modification and that physical activity is an important component if there are no contra-indications.

Given the prevalence data available, which includes national and regional data highlighting populations most at risk, this section on diabetes should receive an A grading for the prevalence grading criteria (Table 3). However, a significant amount of work still needs to be done with regard to the development and implementation of policies for the management of diabetes in the South African population in order to reach the target outlined by the South African Strategic Plan. For this reason, the policy and implementation grade is a C (Table 3).

## Conclusion

It is clear from this systematic review that prevalence data for this age group, both national and regional, is available, with some risk factors, such as obesity, hypertension and diabetes, having more extensive data than others, such as physical activity and diet. What is also evident is the disconnect between the availability of prevalence data, and the proposal and implementation of policies. This is not consistent across the risk factors, with some having higher grades for the availability of prevalence data for this age group, compared to the policy grading (physical activity, alcohol, obesity, hypertension and diabetes) and others having higher grades for policy and implementation compared to grades for prevalence data (tobacco, diet and dyslipidaemia). Perhaps lessons can be learnt and shared in order to achieve full marks for all the risk factors for both grades.

Ensuring that harmonised methodologies are used to collect prevalence data for this age group in order to pool data and more clearly understand national and regional trends should be a priority in order to achieve an A prevalence grading for physical activity, tobacco, diet and dyslipidaemia, while some risk factors such as alcohol and diabetes have extensive prevalence data to draw on that can be used by government to prioritise and support the implementation of policies.

The countdown to achieving SDG 3.4 by 2030 has begun.[3] NCD Countdown 20[75] collaborators, using cause-specific mortality data from countries that have committed to this goal, show that no country will achieve this by addressing a single disease, and that a combination of multimorbidity prevention strategies and strengthening the health system are necessary.[175] Some high-income countries such as Denmark and New Zealand are on track to reach the SDG target if they maintain or improve the average rates of decline recorded between 2010 and 2016.

While these countries focus on the traditional four-by-four approach, which is four major disease groups (cancer, CVD, type 2 diabetes and chronic respiratory disease) linked to four behavioural risk factors (insufficient physical activity, poor diet, tobacco use and harmful use of alcohol), it is now clear that this is a lot more complex in sub-Saharan Africa. The mismatch between local strategic NCD policy agendas that align with global recommendation, and the reality of the local NCD burden and its determinants in the region has meant that many strategic plans may not be effective in meeting their NCD goals. Dover and Lambert stress the importance of recognising the social, environmental, political and economic influences on health behaviours, and that policies and interventions must be designed around an understanding of individual, household and community factors that may influence these behaviours.[176]

This report card is the first of its kind and clearly describes what is currently known about the prevalence and policy implementation of eight important indicators of NCD risk. It very briefly summarises and grades the prevalence data available, and grades whether policies exist and whether they have been implemented. Future report cards will also include whether current targets set out by the Strategic Plan for the Prevention and Control of NCDs 2013–2017 have been met.

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### *Primary or secondary prevention in patients with CKD?*

'Is this primary prevention in patients with CKD?' asked Gansevoort. 'I think that CKD is an ongoing process; everything we do (in these patients) is secondary prevention and that is the reason why they show benefit from aspirin, just as aspirin has shown benefit in all secondary prevention trials. We should not regard CKD as a risk factor; it is the disease.'

Mann countered that, despite having more advanced CKD, with eGFR levels of less than 60 ml/min/1.73 m$^2$, the patients in TIPS-3 still represented a primary prevention population by lacking a history of a cardiovascular disease event.

But Mann also agreed that 'CKD as a risk equivalent of cardiovascular disease was established consistently in several studies' dating back more than two decades to a report he published in 2001 from the HOPE study.

TIPS-3 enrolled 5 712 middle-aged or elderly adults in any of nine countries without a history of cardiovascular disease but with intermediate or high cardiovascular risk based on their INTERHEART Risk Score. The study prospectively randomised patients in a 2 × 2 factorial design to aspirin or placebo, or to a 'low-dose' polypill or placebo. The polypill included half doses of three different classes of blood pressure-lowering medications, plus 40 mg of simvastatin.

### *Primary results from TIPS-3*

The primary endpoint of TIPS-3, first reported in November 2020, was the combined rate of cardiovascular death, non-fatal myocardial infarction, non-fatal stroke, heart failure, resuscitated cardiac arrest and arterial re-vascularisation.

After a median follow up of 4.6 years, people who took the polypill had a 21% relative reduction in their combined event rate compared with those taking placebo, a difference of borderline significance. Those who received aspirin had a 14% relative risk reduction that was not significant. In an analysis of those who received both active agents compared with those who received neither, the combined regimen linked with a significant 31% relative cut in the combined cardiovascular disease endpoint.

The *post hoc* analysis now reported by Mann focused on the 17% of patients with an eGFR of less than 60 ml/min/1.73 m$^2$, a subgroup with a 36% prevalence of diabetes and an 84% prevalence of hypertension. In addition to showing a significant 43% relative risk reduction linked with aspirin use in this group, his analysis also showed essentially no effect on the primary endpoint in the remaining study participants with higher levels of renal function.

### *Hints of an additive polypill and aspirin effect*

Preliminary analysis of those with CKD who received both aspirin and the polypill showed evidence of an 'additive' effect of the two interventions, said Mann, which together, produced a significant 63% reduction in the primary endpoint, an outcome he said will be the focus of a future report.

Mann also highlighted the cost effectiveness of aspirin in the CKD subgroup, with an estimated cost of about €2 500 to prevent one event. That's a price tag that's markedly below the monetary cost of many other agents currently used to prevent cardiovascular disease events, he noted.

Source: *MedicalBrief* 2022