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The prevalence of type 2 diabetes in South Africa: a systematic review protocol

Carmen Pheiffer,[1,2] Victoria Pillay-van Wyk,[3] Jané D Joubert,[3] Naomi Levitt,[4] Mweete D Nglazi,[5] Debbie Bradshaw[3,6]

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[1]Biomedical Research and Innovation Platform, South African Medical Research Council, Tygerberg, South Africa
[2]Division of Medical Physiology, University of Stellenbosch, Tygerberg, South Africa
[3]Burden of Disease Research Unit, South African Medical Research Council, Cape Town, South Africa
[4]Division of Endocrinology and Diabetic Medicine, University of Cape Town, Cape Town, South Africa
[5]Centre for Evidence-based Health Care, Division of Epidemiology and Biostatistics, University of Stellenbosch, Tygerberg, South Africa
[6]School of Public Health and Family Medicine, University of Cape Town, Cape Town, South Africa

Correspondence to
Dr Carmen Pheiffer;
carmen.pheiffer@mrc.ac.za

ABSTRACT

Introduction Type 2 diabetes mellitus is a major source of morbidity and mortality in South Africa, spurred by increased urbanisation and unhealthy lifestyle factors. Local epidemiological data are required to inform health planning and policy. The purpose of this systematic review is to identify, collate and synthesise all studies reporting the prevalence of diabetes in South Africa. A secondary aim is to report the prevalence of impaired glucose tolerance and impaired fasting glucose, conditions which are associated with an increased risk of progression to overt diabetes, and the prevalence of undiagnosed diabetes.

Methods and analysis Multiple databases will be searched for diabetes prevalence studies conducted in South Africa between 1997 and 2018. Two authors will independently select studies that meet the inclusion criteria, extract data and appraise studies using a risk of bias tool for prevalence studies. Studies with low or moderate risk of bias will be included. Sources of heterogeneity will be explored using subgroup analysis.

Ethics and dissemination The systematic review does not require ethics clearance since published studies with non-identifiable data will be used. This review will provide best estimates to inform the Second National Burden of Disease study which can guide health and policy planning.

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Strengths and limitations of this study

- The first ever systematic review of type 2 diabetes prevalence in South Africa.
- A comprehensive synthesis of all available diabetes prevalence data in South Africa using a standardised risk of bias tool.
- The protocol adheres to Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols guidelines.
- The quality of the review will be assessed using the Grading of Recommendations Assessment, Development and Evaluation.
- The heterogeneity in diagnostic criteria, study dates, age of study participants and population groups may limit comparison across studies.

INTRODUCTION

Diabetes mellitus, a condition characterised by raised blood glucose levels, is a major source of morbidity, mortality and health costs worldwide. The International Diabetes Federation estimates that in 2017, 451 million adults worldwide had diabetes, with projections of 693 million cases by 2045.[1] Globally, approximately 50% of diabetes cases are undiagnosed, with the majority of these occurring in low-income and middle-income countries. In Africa, the proportion of undiagnosed diabetes is 69.2%. Furthermore, 77% of deaths due to diabetes in Africa occurred in individuals younger than 60 years of age,[1] emphasising the magnitude of the diabetes epidemic. In Africa, as in other parts of the world, type 2 diabetes represents over 90% of diabetes cases.[2 3]

The prevalence of diabetes is rapidly increasing in South Africa. In 2009, approximately 2 million (9%) people aged 30 years and older had diabetes,[4] increasing almost twofold since 2000 when Bradshaw *et al* reported a prevalence of 5.5%.[5] Several factors such as the ageing population, economic transition and urbanisation associated with nutrition transition and obesity have contributed to the increased diabetes prevalence.[6–9] In 2000, it was estimated that 87% of diabetes cases in South Africa were attributed to excess body weight.[10] This is concerning since in 2013 ~38% of men and ~69% of women in South Africa were considered overweight or obese.[11] In 2015, the global burden of disease study estimated that high body mass index and hyperglycaemia, ranked as the second and third leading risk factors, respectively, after unsafe sex, for early death and disability in South Africa.[12]

Diabetes, due to its association with several microvascular and macrovascular complications, places a significant burden on the South African health system. In 2009, it was estimated that diabetes caused about 8000 new cases of blindness and 2000 new cases of amputations annually.[4] A national

burden of disease study in 2000 reported that diabetes accounted for approximately 14% of cases of ischaemic heart disease, 10% of stroke, 12% of hypertensive disease and 12% of renal disease.[5] Furthermore, the indirect costs of diabetes are high. Diabetes in Africa affect mainly working-aged people between 40 and 60 years of age[9] placing an added burden on the economy due to work absenteeism and decreased productivity. South Africa is battling a quadruple burden of disease due to high rates of infectious diseases, non-communicable disease, maternal and child mortality, and injury-related disorders, thus have limited resources to meet the increased health and economic costs of diabetes.[13]

Rationale

Urgent action is required to halt the burgeoning diabetes epidemic in South Africa. The feasibility of population-level interventions, particularly those aimed at prevention is widely reported.[14] However, such initiatives are hampered by the lack of epidemiological data, a challenge faced by all countries in Africa.[15] Several studies have measured the prevalence of diabetes in South Africa,[16–26] although they were conducted in different geographical areas (urban vs rural), among different population groups and are generally too small to individually give generalisable prevalence data. Pooling of existing data is considered an effective strategy to generate representative and robust prevalence figures.[8] Bertram *et al* calculated the national prevalence of diabetes in 2009[4]; however, their estimate included only four studies measuring the diabetes prevalence in black South Africans in two rural, one urban and one metro urban population.[21–24] The study did not account for population variation in diabetes prevalence in South Africa,[16 19 20 23] and focused on estimating the disability burden of diabetes rather than characterising the different levels of hyperglycaemia in these populations. This review explores availability and quality of diabetes prevalence data for South Africa.

Objective

The purpose of this systematic review is to identify, collate and synthesise all studies reporting the prevalence of diabetes in South Africa. A secondary aim is to report the prevalence of impaired glucose tolerance and impaired fasting glucose, conditions which are associated with an increased risk of progression to overt diabetes, and the prevalence of undiagnosed diabetes. These findings will be used to inform the Second National Burden of Disease study which can guide health and policy planning.

METHODS

Study selection

Published population-based surveys, cross-sectional studies and prospective or retrospective cohort studies that report the prevalence of diabetes in South Africa.

Inclusion criteria

Studies will be included if they were published between January 1997 and February 2018, include more than 100 participants regardless of age, gender, ethnicity, socioeconomic and educational background and study setting, and report the primary outcome using a case definition according to the 2006 WHO diagnostic criteria,[27] where type 2 diabetes is diagnosed either by a physician, fasting blood glucose concentrations ≥7.0 mmol/L, 2-hour oral glucose tolerance test values ≥11.1 mmol/L or self-reported use of oral diabetes drugs. In addition, glycated haemoglobin ≥6.5% (48 mmol/mol) will also be used for case definition.[28] Due to limitations that hamper the differentiation between type 1 diabetes and type 2 diabetes, diabetes in individuals older than 25 years of age will be classified as type 2 diabetes. Impaired glucose tolerance will be defined by fasting blood glucose concentrations <7.0 mmol/L and 2-hour oral glucose tolerance values ≥7.8 mmol/L, but <11.1 mmol/L. Impaired fasting glucose will be defined as fasting blood glucose concentrations between 6.1 mmol/L and 6.9 mmol/L, and, if available, 2-hour oral glucose tolerance values <7.8 mmol/L.[27]

Exclusion criteria

Studies will be excluded if they were not conducted in South Africa, do not report the primary outcome, have no clear description of the case definition and contain data for refugees in camps since they may not be representative of the South African population.

Primary outcome

Prevalence of type 2 diabetes.

Secondary outcome

Prevalence of impaired glucose tolerance, impaired fasting glucose and undiagnosed type 2 diabetes.

Search strategy

A search of articles written in English and indexed in PubMed, Scopus, Web of Science and African Index Medicus between January 1997 and February 2018 will be conducted. An experienced information scientist and disease content experts will be consulted to ensure that the search terms are relevant and optimally arranged, and will include keywords and medical subject headings . An example of the search strategy in PubMed is illustrated in table 1. The search will be modified to each database. References will be managed in EndNote.

Study selection

The titles and abstracts of articles from the electronic search outputs will be screened independently by two reviewers to identify eligible studies. Disagreements or uncertainties will be resolved by discussion and consensus between the two reviewers, or with a third reviewer if disagreement persists. Full-text copies of the eligible articles will be retrieved and reviewed by two independent reviewers for inclusion. Additional information will be

Table 1 PubMed search strategy

Search	Query
#4	Search ((#3 NOT (animals[mh] NOT humans[mh]))) AND ('1997/01/01'[Date-Publication]: '2018/02/28'[Date-Publication])
#3	Search (#1 AND #2)
#2	Search (South Africa[mh]OR"South Africa*"[tiab] OR RSA[tiab] OR Africa, Southern[mh:noexp] OR Southern Africa[tiab])
#1	Search (Diabetes[Mesh] OR Diabetes mellitus[Mesh] OR Type 2 diabetes mellitus[Mesh] OR Type 2 diabetes[Mesh] OR Diabetes mellitus, type 2[Mesh] OR Diabetes, type 2[Mesh] OR hyperglycemia[Mesh] OR Blood glucose[Mesh] OR Hemoglobin A, glycosylated[Mesh] OR Glycosylated hemoglobin OR Impaired glucose tolerance OR Impaired fasting glucose OR Undiagnosed diabetes

requested from the study authors if required. Reasons for exclusion will be recorded.

Data extraction

After the final decision to include studies into the review, two authors will independently extract and record data using the Burden of Disease (BOD) Review Manager developed by the South African Medical Research Council.[29] The following data will be extracted:

- Study details: date of publication, study title, study design, study period and study purpose.
- Study population: province/district of study, study setting (community or health facility based), setting (urban or rural) and sample size.
- Response rate.
- Case definition as reported in the study.
- Prevalence of type 2 diabetes, impaired glucose tolerance, impaired fasting glucose and undiagnosed type 2 diabetes.
- Characteristics of study population: age, sex, population group (ethnicity) and comorbid disease (tuberculosis (TB) or HIV status).

After completion, data will be compared and discrepancies will be resolved through consensus between the two reviewers, or in consultation with a third reviewer.

Risk of bias assessment

Two reviewers will independently appraise the study quality and risk of bias using a checklist for observational epidemiological studies that was adapted from the risk of bias tool for population-based studies[30] and the Newcastle-Ottawa Scale for assessing the quality of non-randomised studies,[31 32] and standardised in the BOD Review Manager.[29] Parameters assessed will include: external validity (whether the target population is representative of South Africa, representativeness of sample, selection criteria and non-response bias) and internal validity (case definition, validity and reliability of test instruments, consistency of case measurement, appropriateness of time period and appropriateness of numerators and denominators in estimation). Disagreements between the reviewers over the risk of bias will be resolved by discussion with a third reviewer where necessary.

Data synthesis

A narrative description will be conducted for studies with a low or moderate risk of bias. Clinical heterogeneity will be investigated by looking at the characteristics of participants, method of diagnosis and case definitions in the study.

Subgroup analyses for study population (province/district, community or health facility based, urban or rural) and characteristics of cases (age, sex, population group and comorbid disease TB or HIV) will be done if sufficient data exists. If possible, a meta-regression to explore possible sources of variability in prevalence reported between studies will be conducted. Review findings will be displayed using tables and forest plots as appropriate.

Confidence in cumulative evidence

The strength of evidence will be assessed using the Grading of Recommendations Assessment, Development and Evaluation method[33] which scores studies as very low, low, moderate or high based on methodological flaws within the included studies, consistency of results across diverse studies, precision of estimates and publication bias.

Patient and public involvement

Patients and public were not involved.

ETHICS AND DISSEMINATION

The systematic review does not require ethics clearance since published studies with non-identifiable data will be used. This review is the first to collate and synthesise all the available studies reporting the prevalence of diabetes in South Africa and will provide local epidemiological data to inform the Second National Burden of Disease study which can guide health and policy planning. Findings from the review will be disseminated in a peer-reviewed journal article and academic reports according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[34]

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Contributors CP, VP-vW, JDJ and DB conceived the idea and design of the study, and drafted the protocol. NL and MDN helped to draft the protocol. All authors wrote and approved the final manuscript.

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Competing interests None declared.

Patient consent Not required.

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