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The Not So Sweet Truth: A deep dive into diabetes

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30 October 2020

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Research briefs on non-communicable diseases in South Africa

We have developed a series of briefs aiming to explain, explore and quantify the burden of non-communicable diseases (NCDs) in South Africa. Throughout the briefs, we draw together both existing quantitative data as well as emerging qualitative data. The primary qualitative data presented in the form of vignettes, has been collected by Dr Beth Vale, through in-depth ethnographic research.

These briefs are timely, given the rising global burden, and particularly the rising burden in low- and middle-income countries (LMICs), of NCDs. Given South Africa's high prevalence of HIV, there has also been a recent focus on the link between HIV and NCDs as the population living with HIV grow increasingly older with the successful uptake of antiretrovirals. An ageing population is more at risk for NCDs as we will explain in our briefs. As we move towards universal health coverage (UHC) it is imperative that we understand the needs of our population now and how these may change going forward. We have produced twelve briefs in this series.

This work was funded by the following partners, although the views are the authors' own:

- Actuarial Society of South Africa (ASSA): ASSA has an interest in being part of the development of high-quality evidence to support resource allocation and decision-making and the interplay between the supply and demand sides of the health system.
- RGA Reinsurance Company of South Africa Ltd (RGA): RGA has an interest in the ways in which life insurance can be responsive to the changing burden of disease and the ways in which we can use data to drive decision-making.
- Board of Healthcare Funders (BHF): BHF has an interested in an affordable, accessible, and high-quality private health sector.

1. Introduction

Diabetes was once considered an uncommon disease primarily affecting the wealthy, with low-income countries largely unaffected.[1] However, the combination of an ageing population and a rapid demographic and economic transition seen in LMICs, such as South Africa, has resulted in a substantial increase in prevalence, from 4.5% in 2010[2] to 12.8% in 2020.[3] Whilst diabetes is classified as an NCD, it is often "communicable" in nature due to environmental, lifestyle, and genetic factors such as nutrition, physical exercise, and hereditary predispositions, which are often not a choice for individuals.[4]

In this brief we explore the lifestyle and environmental factors that put South African households at an increased risk of developing diabetes. We also discuss the lack of communication between patients, the health system and government, which has resulted in many people remaining undiagnosed or at high risk of developing diabetes. Finally, we evaluate the need for a cascade of care that is individualized and results in long-term behaviour change, and thus avoids the costly consequences of diabetes-related complications. Some information from earlier briefs is reproduced here with a focus on diabetes.

2. What is diabetes?

Diabetes is a disease in which a person is susceptible to high blood glucose (or "blood sugar") levels, called hyperglycaemia, which damages the body. Those with diabetes are at risk of premature mortality. Diabetes causes damage to the blood vessels nerves hence it is closely associated with cardiovascular disease, with coronary heart disease recognized as the cause of death in 80% of diabetics.[5] Over time, if left undiagnosed or uncontrolled, it leads to complications such as blindness, kidney failure, stroke and lower-limb amputation.[6] The cost associated with type 2 diabetes in the public sector is estimated to reach ZAR 35 billion in diagnosed patients by 2030, with approximately 49% of costs attributed to complications.[16]

Diabetes is typically considered to be linked to diet and exercise, because glucose comes from the food we eat. As food is digested, glucose moves into the blood so that it can be transported to our cells and used for energy. If the energy is not immediately needed, the glucose lingers in the blood. The hormone insulin, made in the pancreas, takes some of the glucose into storage or allows glucose to enter the cells so that the blood glucose level returns to normal. However, when the body experiences regular episodes of high blood glucose levels, the pancreas takes strain. It becomes less and less able to produce sufficient and/or effective insulin, which increases the risk of future episodes of hyperglycaemia.

This reinforcing loop describes diabetes mellitus or type 2 diabetes, but there are two other types. The first is gestational diabetes which presents in pregnant women and is often a precursor to type 2 diabetes in mothers.[7] The second is type 1 diabetes, which is caused by genetic factors that result in an autoimmune reaction. This autoimmune reaction causes the body to attack its own insulin-producing cells. Affected people require daily insulin injections to survive.[8] It usually presents in children and young adults and accounts for about 1 in 10 diabetics.[3] The term "diabetes" generally refers to diabetes mellitus because it is the most common form, accounting for 90% of all diabetes cases both globally[3] and in sub-Saharan Africa.[9] Therefore, these briefs focus on type 2 diabetes.

Diabetes can be treated and even reversed.[10] The problem is that the symptoms may be subtle, so the disease may progress until it leads to a diabetic complication or health crisis, such as a diabetic coma.

Figure 1: Symptoms of diabetes[3]

Even with these observable symptoms, as shown in Figure 1, and risk factors diabetes is clinically diagnosed with a blood test. This hurdle possibly contributes to the high proportion of undiagnosed diabetics, who have an increased risk of adverse outcomes.[11]

The primary test analyses the HbA1c level, which refers to the haemoglobin in the blood that is bound to glucose.[12] It provides information about the average blood glucose level over the three months preceding the test.[12] A result of 6.5% or higher is categorised as diabetes, and 5.7% - 6.4% indicates insulin resistance –

where the disease is in the process of developing but can be treated and reversed without medication.[13] The HbA1c test is also used to check how well a diabetic person's condition is being managed and to adjust medications accordingly.

2.1 Complications and multimorbidity

As discussed in Brief 5, NCDs seldom come alone. Diabetes clusters with other chronic inflammatory diseases[14] and conditions as part of metabolic syndrome.[15] Even after adjusting for age and sex, diabetics are at higher risk for many diseases as indicated in Table 1 – with an almost 10 times higher risk of lower-limb amputation and retinopathy (loss of vision).

Table 1: Diabetes comorbidity with six other conditions[10]

	Alzheimer's & Dementia	Chronic Renal Failure	Cardio-vascular Disease	Lower-limb Amputation	Non-alcoholic Fatty Liver Disease	Retinopathy
Prevalence in non-diabetics	0.43%.	0.16%	15.6%	0.02%	0.49%	0.06%
Prevalence in diabetics	1.30%	1.89%	78.16%	0.33%	2.50%	1.10%
Ratio of diabetic to non-diabetic	3.05	11.51	4.99	13.86	5.08	17.21
Age and gender adjustment	2.32	2.03	1.99	1.45	1.67	2.08
Risk adjusted ratio	**1.32**	**5.68**	**2.51**	**9.56**	**3.03**	**8.29**

3. Risk factors

3.1 Diabetes can start in the womb

In 1980, an endocrinologist, Dr. Norbert Freinkel, first described the theory of "fuel-mediated teratogenesis", which highlighted the long-term negative consequences of maternal high blood sugar levels that are passed to the infant while in utero.[18] This has since led to extensive research which has found that, in mothers with gestational diabetes, infants can be born with macrosomia which is when the infant is considered too "large for their gestational age".[19] Macrosomia places infants at a higher risk of being overweight or obese during childhood and an increased lifetime risk of metabolic syndrome from as early as adolescence.[20,21]

3.2 Epigenetics

Epigenetic factors refer to environmental factors that modify the expression/physical presentation of various inheritable genes, without altering the genetic material itself, from as early as conception.[22] This may explain the increased risk observed in the case of gestational diabetes. Pregnancy-related factors and both maternal and paternal factors, such as dietary intake, may affect the uterine environment and result in the increased intergenerational risk of diabetes.[23] Further, the process of ageing, obesity, low physical fitness, nutrition and metabolism are epigenetic factors associated with type 2 diabetes.[24]

Emphasis is often placed on glycaemic control, which refers to maintaining the blood glucose level within the normal non-diabetic range.[25] However, in some individuals, complications may occur despite being well controlled as a result of "metabolic memory", which causes the genes to be expressed despite the removal of the external factor.[26] Metabolic memory provides an explanation as to how the course of the disease is determined by the initial environmental exposure.

3.3 "Communicable" environmental factors and the metabolic-syndrome epidemic

Diabetes is often framed as the consequence of poor lifestyle or health choices, however many of the risk factors are more a function of environment than personal choice. Industrialisation, globalisation, economic development, and rising incomes in LMICs have changed the nature of work and food production. This has resulted in more sedentary lifestyles, leading to increased rates of obesity and its consequences, including diabetes.[28] The global increase in the prevalence of metabolic syndrome has meant that it is now an epidemic.[29] In South Africa, the high burden of NCDs, including metabolic syndrome, is compounded by the other three components of South Africa's quadruple burden of disease: the HIV/AIDS and TB epidemics, high maternal and child mortality and violence and injuries.

3.3.1 Urbanisation

Diabetes prevalence is predicted to increase in Africa due to an increase in population growth, resulting in increased urbanisation.[30] This is also true for South Africa, where many people move to urban areas to increase their earnings and improve their standard of living.[31] This has resulted in an increase in deprived urban areas characterized by over-crowding and poor living conditions.[32] Approximately two-thirds of individuals living with diabetes in South Africa reside in urban areas.[33]

The sedentary lifestyle associated with living in an urban environment has been linked to increased risk of obesity and metabolic syndrome, which are both risk factors of diabetes.[34] While a higher socioeconomic status is linked to a higher prevalence of diabetes overall, the rate of undiagnosed diabetes is greater in those of a lower socioeconomic status.[35]

Living in urban areas increases the exposure of impoverished individuals to "obesogenic environments",[36] through increased exposure to affordable unhealthy food, a lack of recreational space for physical activity, and stressful working lifestyles.[37] With the increased spread of urbanisation, peri-urban regions have been created in close proximity to rural areas. Therefore, these obesogenic environments are also spreading, leading to an increase in the incidence of diabetes in rural areas too.[38]

There is also strong evidence to suggest that diabetes is socially determined. Diabetes clusters in homes and neighbourhoods that share similar socio-psychological features. In previous briefs, we explored the literature on syndemics[a]. Researchers have shown a synergistic relationship between diabetes, violence and depression in South Africa.[41] In a South African study[41] with diabetic women in Soweto, many participants attributed their diabetes to psychological and social distress – linked to violence, grief and family pressures. This distress also affected participants' ability to manage their diabetes.

These social environments often lead to metabolic syndrome. The greater the number of components of metabolic syndrome an individual has, the greater the risk of developing diabetes.[43] This risk is heightened further if glucose intolerance develops.[43] These components have similar lifestyle-related risk factors.

[a] At a population level, a syndemic is the co-occurrence of two or more epidemics (whether social or biological) that interact synergistically and are therefore mutually reinforcing.

3.3.2 Nutrition and exercise

Conventionally, the primary target of interventions has been diet. This is likely due to the link between diabetes and food. Diets that are high in sugary, high glycaemic index foods, which cause a rapid increase in blood sugar, have been associated with an increased risk of type 2 diabetes.[44,45] Conversely, high fibre plant-based foods, which are low glycaemic foods, have been seen to lower the risk of diabetes.[39]

In overweight or obese individuals, lower calorie diets resulting in weight loss have also been found to reduce the occurrence of diabetes.[46] Low total physical activity, including active exercise and general movement, has been found to increase the relative risk of developing diabetes by up to 40%.[39]

These risk factor indicate the need to target behaviour change. However, they also indicate that a large proportion of individuals who are susceptible to developing diabetes lack the ability to prevent it due to factors beyond their control. Furthermore, due to the geographic legacy of apartheid, many South Africans live in impoverished, densely populated, urban areas, with few green spaces, high crime rates and limited access to affordable fresh produce.[47,48] While diet and exercise, which are modifiable, are often targeted through interventions, agency needs to be carefully considered in relation to these, often choiceless, lifestyle choices. Vignette 1 explores these themes in more depth.

Vignette 1: Diabetes and 'communicability'

In February 2019, I observed a consultation at a public clinic in the small town of Somerset East. A young woman, perhaps in her thirties, had been newly-diagnosed with diabetes. Her mother was also diabetic. The doctor tried to explain, in as simple terminology as possible, how diabetes affected the body. The woman was prescribed two pills per day. She sat silently, nodding intermittently, as the doctor explained her diagnosis and treatment. At the end, she only had one question: 'Will I give it to my child?'

Answering this question is complicated, precisely because diabetes' 'communicability' is complicated. Of course, the mother's diabetes is not transmissible through touch or breath or body fluids: in this respect she cannot 'give' diabetes to her child. But there are certainly ways that mothers could 'give' diabetes to their children. For this patient, diabetes certainly seems to 'run in the family.' This predisposition to diabetes might be hereditary, or it might be the result of shared living conditions, food environment and eating practices — or both. Either way, the patient's child would be considered at greater risk of developing diabetes than a child without diabetic relatives.

The mother's question also speaks to a much larger social milieu around illness and mothering in South Africa.

For many patients, particularly mothers, HIV has become an important frame of reference for understanding lifelong illness. It has been important to say that illnesses like diabetes are not transmitted through birth, or breastmilk, or blood, like HIV. Mothers whose children have contracted HIV perinatally have often been blamed and stigmatized. Despite diabetes not being directly transmissible, mothers also find themselves at risk of blame and shame in the context of a diabetes epidemic. Because mothers are often tasked with feeding their families, and diabetes is strongly associated with diet, mothers' risk being held responsible for diabetes in the family. All of this means that when mothers are diagnosed with illness, many worry over whether they are a real and/or perceived threat to their child.

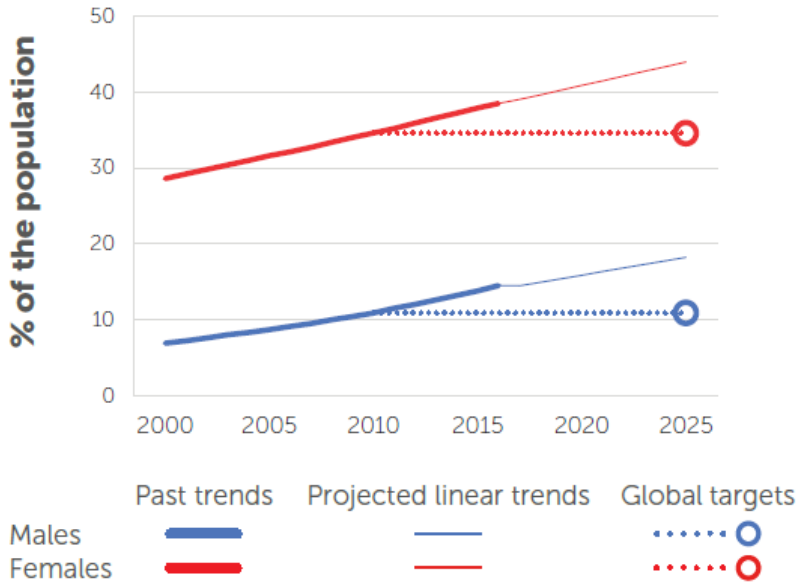
It is important that we communicate carefully the ways in which diabetes is and is not communicable. This communication should be accurate and protective, but also sensitive to how stigma and gender discrimination operate.

4. Diabetes in South Africa: prevalence in the private vs public sector

In 2017, diabetes directly accounted for 25,255 (5.5% of) deaths in South Africa and was the leading cause of death among women.[49] Given the close link to hypertensive diseases, it could have indirectly contributed to a further 4.4% of deaths.[50] Amongst medical scheme beneficiaries registered as diabetic, the prevalence of diabetes increased by 28% over the period 2012 to 2017 from 25.66 to 31.28 cases/1000 beneficiaries – an average growth rate of 5% per annum.[51] However, a broader definition of prevalence suggests that 53 per 1000 beneficiaries are diabetic.[51]

Blood glucose levels tend to be higher in people who are older and/or overweight.[52] Obesity, especially around the abdomen (central obesity), is also recognized as a risk factor and is linked to metabolic disease. South Africa faces a high and growing obesity rate, with 27% of adults and 39% of adult women being obese.[53] Figure 2 shows the projected trends of obesity among both men and women. By 2025, South Africa will have far exceeded the global targets. South African child obesity rates are also increasing and are amongst the highest in the world.[54]

Figure 2: South African obesity rates, trend and global target[53]



Relative to men, a higher percentage of women have raised blood glucose levels[53] and die from diabetes.[49] As discussed in brief 3, the differences in NCD risk factors by sex are located within a broader context of South Africa being a developing country with large gender disparities.[55] Here, lifestyle "choices" are shaped by gender roles and norms cultivated by society, which may have a disproportionate impact on women.

The following sections compare the estimated diabetes prevalence in the public and private health sector populations using both household survey data, South African Health and Demographic Survey (SADHS) of 2016 and General Household Survey (GHS) of 2018, and aggregated medical scheme data from the South African Council for Medical Schemes (CMS) for 2018. Both the SADHS and the GHS are nationally representative surveys.

4.1 Public sector population[b]

Figure 3 shows estimates the self-reported prevalence of diabetes. The prevalence increases with age and is higher among women than men, up until approximately 70 years. Further, the increase in prevalence appears to be driven by the over-50 age group.

Figure 3: Self-reported diabetes prevalence by age and sex, 2010 vs. 2018 (GHS)[56]

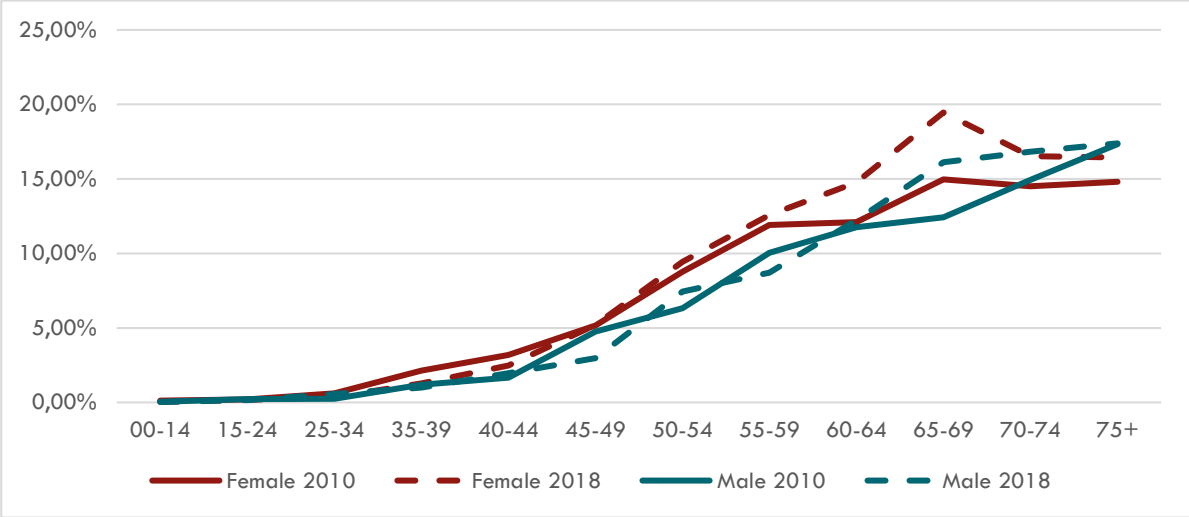
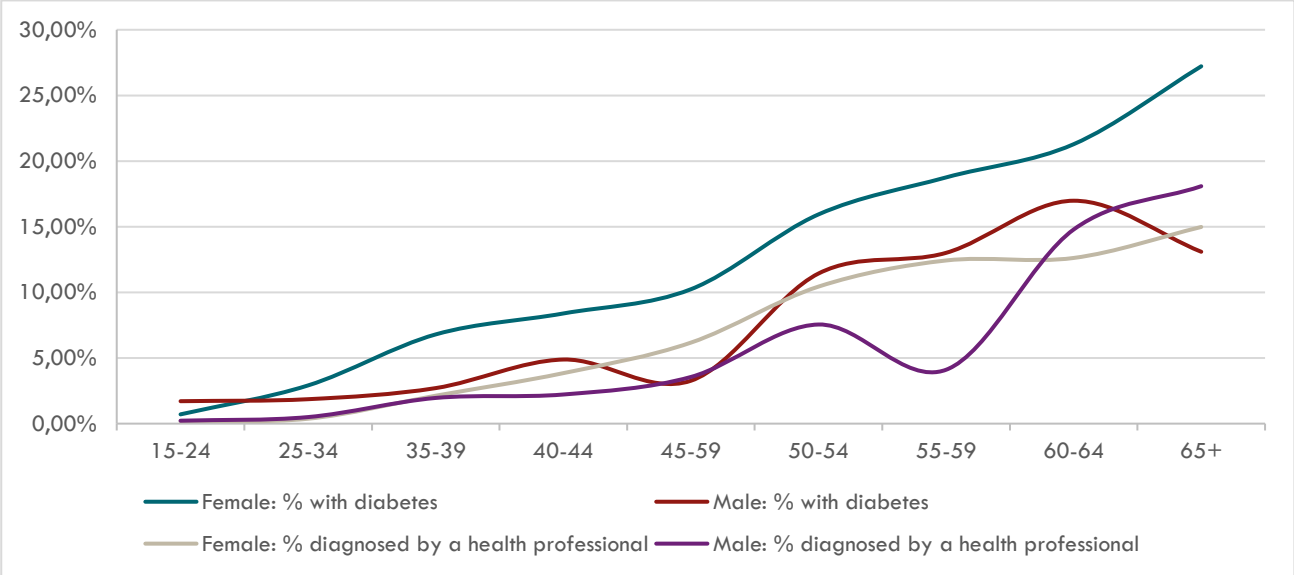


Figure 4 compares the estimated prevalence of diabetes by age and sex using an objective measure (HbA1c estimates) compared to the proportion of people who were aware that they had diabetes[c]. The results show an increase in the proportion of individuals with diabetes, based on both subjective and objective measures, with an increase in age. However, it is apparent that many individuals with diabetes are unaware of it. In total, 5% of men and 8.7% of women had blood glucose levels of 6.5% or higher, meaning that they had diabetes. However, only 3.5% of men and 5.1% of women actually knew that they had diabetes already. Put differently, 31% of men and 42% of women with diabetes were unaware that they had it.

The HbA1c tests also showed that 41.8% of women and 38% of men over the age of 15 years have insulin resistance. Therefore, according to the SADHS, 50.5% of women and 43% of men either have diabetes or are at very high risk of developing it.

[b] The prevalence estimates presented using household survey data have not been age standardized.
[c] These respondents reported that they had been told by a nurse or health professional that they had diabetes.

Figure 4: Diagnosed vs undiagnosed diabetes by sex and age, SADHS 2016[57]



Using SADHS data, we estimated some of the associations between risk factors and diabetes using logistic regressions[d]. We estimated two regressions. The first estimated the relationship between risk factors such as body mass index (BMI), sex, age, socioeconomic statuse (SES), and race and diabetes. The second estimated the relationship between these risk factors and insulin resistance.

The results show that people who are overweight (odds ratio [OR]: 1.87) or obese (OR: 4.07) are significantly more likely to have diabetes compared to those with a normal BMI. The odds of having diabetes were also higher in older age groups[f]. Indian/Asian people were found to be more than twice as likely as black people to have diabetes, whereas white people are about half as likely as black people to have diabetes. SES was not found to be significantly associated with the likelihood of having diabetes.

BMI and sex did not have a statistically significant relationship with having insulin resistance; however, SES did. Insulin resistance was most prevalent in the poorest quintile. In comparison, the richest quintile had a statistically significant lower risk of having insulin resistance (OR: 0.72). Coloured people (OR: 0.72) were also found to be significantly less likely to have insulin resistance than black people, but this was not found for white and Indian/Asian people compared to black people.

Although these results and figures are based on objective measures of blood sugar levels, they may be biased as only 65% of SADHS respondents agreed to have their blood sugar tested; therefore, the true prevalence cannot be estimated with certainty. This may also affect the estimates of associations, as respondents' refusal may be associated with their actual or perceived health status. However, these findings do confirm some of the previously discussed associations such as the association between diabetes and obesity and older age. The relationship between SES and insulin resistance is likely due to urbanisation and the development of impoverish urban areas with obesogenic environments.

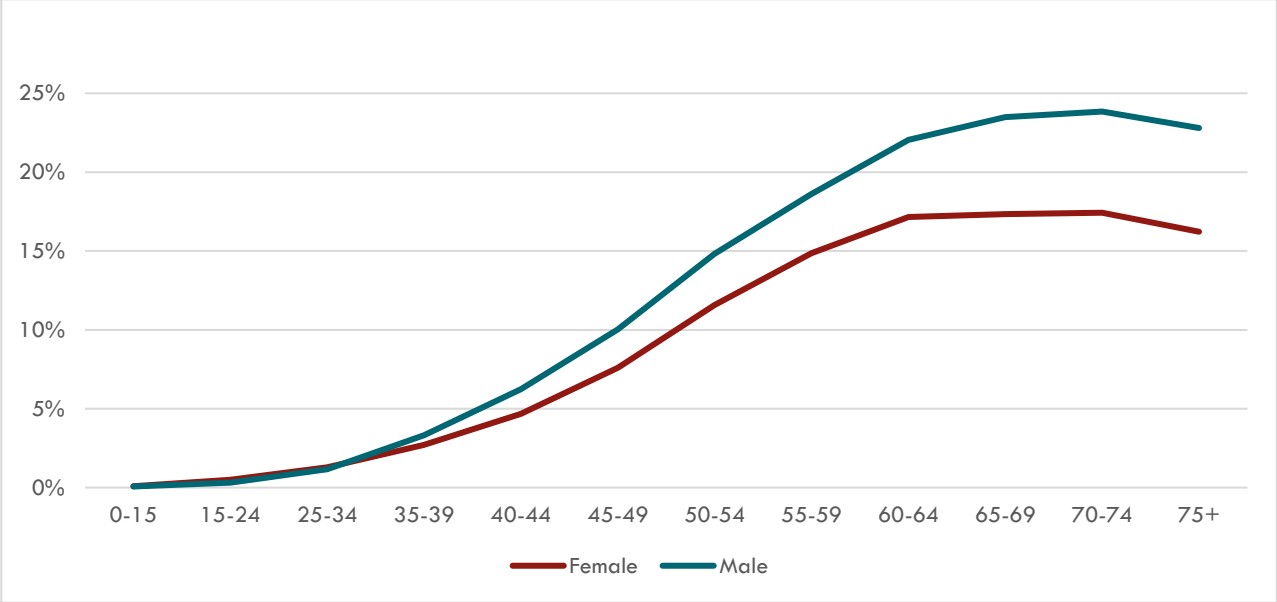
[d] Standard errors were adjusted in these regressions to account for similarities between households.
[e] Socioeconomic status is estimated using a wealth index which is a composite measure of the houses aggregate living standard based on household asset ownership. This wealth index divides household into wealth quintiles poorest, poorer, middle, richer, and richest.
[f] Those aged 25 to 49 (OR: 3.11) and those aged 50 and older (OR: 12.6) had higher odds of having diabetes compared to those aged 15 to 24. All ORs are statistically significant at the 1% level.

4.2 Medical scheme population

The prevalence of diabetes among the 8.9 million[58] South Africans with medical aid is estimated using aggregated claims data from the Council of Medical Schemes (CMS) for 2018. The number of people who have at least one diabetes-related claim to estimate the prevalence of diabetes in the private sector population. We find that the age standardised prevalence of diabetes is higher among men (4.6%) than it is among women (3.7%).

Figure 5 below paints a more detailed picture of how the prevalence of diabetes changes with age. The prevalence of diabetes for both men and women increases with age and peaks in the age band of 70 to 74 years, with 24% of men and 17% of women having made at least one diabetes-related claim.

Figure 5: Proportion of beneficiaries with at least one diabetes-related claim, CMS 2018[58]



Both CMS and SADHS data show that the likelihood of having diabetes increases with age. The prevalence rates for diabetes are also lower in the medical scheme population than they are in the public sector population. However, it is possible that both these estimates are underestimated. The source of bias in the CMS prevalence estimates may also be the same as that in the SADHS data: only those tested for diabetes and diagnosed are likely to make a claim. There may also be a sizable share of the private sector population that is also living with undiagnosed diabetes.

As mentioned in section 0, the complications associated with undiagnosed and untreated diabetes are incredibly costly to both the private and public sector. Given that diabetes is preventable, and insulin resistance is reversible, it is therefore in the interest of medical schemes to incentivise regular screening for diabetes among their clients, especially high-risk individuals, such as those who are over the age of 50, overweight or obese.

5. Sweet secrets

South Africa currently has the highest prevalence of obesity in sub-Saharan Africa.[59] A large part of this has been linked to added sugar intake, which increases the risk of obesity, diabetes, and other metabolic conditions.[60] The World Health Organisation (WHO) recommends less than 12 teaspoons of granulated sugar per day.[61] However, this is not the reality for most South Africans who consume high-sugar food, such as sugary drinks, as a result of addiction, habit and/or the lower cost in comparison to healthier alternatives.[60,62]

South Africa has attempted to combat this through the introduction of the Health Promotion Levy (HPL), which is the 11% tax on sugary drinks. The aim of this levy is to decrease consumption of these drinks and the rate of obesity by 10% by 2025. This tax has caused manufacturers to decrease the amount of sugar added to many drinks or reduce their size. It has also raised approximately ZAR3 billion, which is added to the Nation Revenue Fund.[63] In general, these prevention-based interventions have been found to be cost-effective in LMICs.[64]

While this reflects a step in the right direction, it is not sufficient. The World Health Organization recommends a 20% or greater tax in order for this intervention to be effective.[61] A South African study found that with the recommended 20% tax, obesity rates would drop by 3,8% and 2.4% in men and women, respectively.[65] This would prevent 220,000 cases of adult obesity and avert 72 000 deaths, 550 000 stroke-related health-adjusted life years lost and more than ZAR5 billion in costs over 20 years.[65,66]

Although strategies such as the HPL have been put in place as part of the health-promotion agenda, they have not addressed the availability of healthy foods and the marketing of unhealthy, sugary foods in townships. These locales are targets of soft drink marketing through advertising.[67] Impoverished individuals consume cheap, high-calorie, overly processed foods that are promoted by big food companies.[68] Therefore, despite these progressive health policies, low-income neighbourhoods remain obesogenic environments.[68] This is described more vividly in Vignette 2.

Vignette 2: Changing foodscapes and access to quality food

In the Eastern Cape Karoo, the past fifty years have seen dramatic changes in residents' diets. Rather than being about individual tastes; these changes have been driven by social, political, economic, and environmental forces far beyond residents' dinner tables.

Big Food has arrived to the region – in the form of Spars, U-Saves, Shoprites and Pick 'n Pays. Local food economies have struggled to compete with larger ones, and many are eating food that is produced far outside of the Karoo.

The introduction of minimum wage, along with mounting economic constraints on farms, has meant that relationships between farm owners and farm labourers have shifted dramatically. In the past, labourers' 'wages' were often paid in-kind through a feudal-like system. Housing was subsidised and farm produce was 'rationed', with workers receiving regular packages of vegetables, meat, sugar, coffee and so on, as well as a small amount of monetary wages. Farms were far more self-sufficient, producing fruit, vegetables, dairy and grain beyond the livestock they sold. Today, the number of permanent farm workers have decreased dramatically, while the number of contract workers has grown. Workers are paid almost exclusively in cash and must purchase their food, often many kilometres away. Transport costs and high food prices have meant that cheaper, processed, non-perishable foods have gained more prominence in farm labourers' kitchens. Meanwhile, without access to cheap, consistent labour; many farms have moved away from producing food for self-sustenance.

Regional urbanisation has seen an influx of people from farms into towns, where they have greater access to schools, shops, and essential services. The rise of game farms, and the consolidation of smaller farms into larger ones, has also resulted in many farms shedding labour. Families have been displaced into towns, where they have little or no access to land, and struggle to grow their own food. Instead, they are thrust into an exclusively cash-based economy in which food (along with everything else) is bought, and likely produced in a factory.

Finally, while drought has always been a feature of Karoo life, many residents suggest that recent droughts have been the worst they have seen in their lifetime. Access to water is restricted and expensive, which does not present ideal conditions for growing food. It also makes larger food production more expensive.

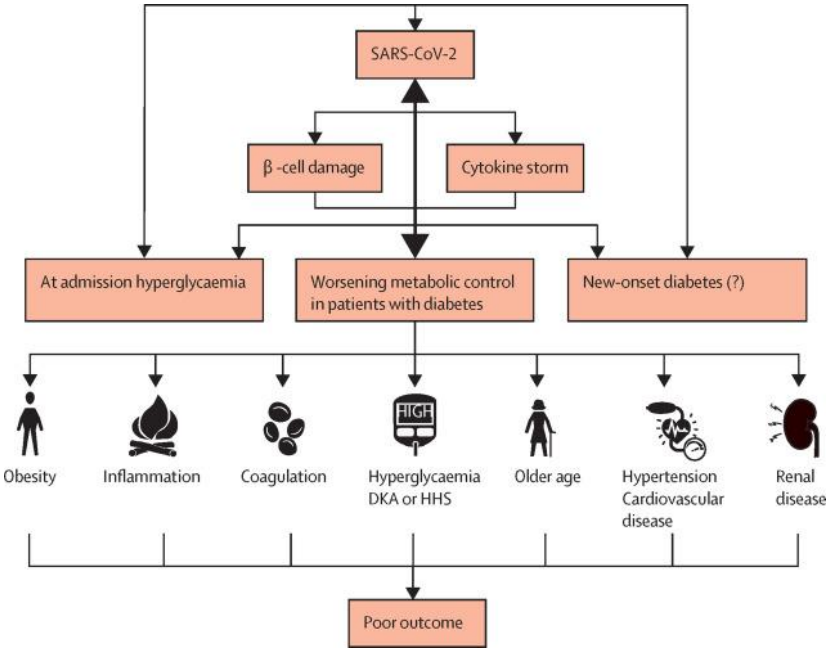
In our NCDs and Geography brief, we told the story of Tekkies, whose family was displaced to town in the early 1990's after the farm on which they lived was converted into a game lodge. Tekkies described dramatic changes to his diet, job insecurity, and limited land access. A few years after moving to town, Tekkies was diagnosed with diabetes and high blood pressure. While this correlation may be coincidental – related age as well as improved access to testing in screening; Tekkies only became symptomatic after moving to town following a number of dramatic changes to his life and livelihood.

6. Diabetes and Covid-19

There has been a strong focus on Covid-19 patients with underlying comorbidities, particularly diabetes. Although those with diabetes do not have an increased risk of contracting the virus, they have worse outcomes compared to the general population.[69] A study found that in Cape Town, approximately 40% of hospitalised diabetic Covid-19 patients die.[70] The risk is exacerbated in diabetic patients who are elderly males and have comorbidities such as hypertension, clotting disorders, cardiovascular disease and obesity.[69] These comorbidities often coexist in the form of metabolic syndrome. However, patients with well-controlled diabetes appear to have the same Covid-19 mortality risk as the general population, emphasizing the need for screening.[71]

The risk associated with developing diabetic complications is also increased in those with severe Covid-19 infections. Figure 6 illustrates the potential course of the Covid-19 infection. Once a susceptible individual is infected, the body releases chemicals required to fight the virus. This is known as a cytokine storm. However, these may also be harmful to the body. The β cells in the pancreas, which normally produce insulin, are damaged by these chemicals and the infection, and thus can no longer produce insulin. This creates a diabetes-type environment and hyperglycaemia. This environment worsens the condition in people with pre-existing diabetes by causing a lack of glycaemic control, potentially leading to hospitalization for an array of complications, and may even cause new onset diabetes in those who are at risk. This leads to the poor outcomes observed.[69]

Figure 6: Diabetic complications in patients with Covid-19[69]



7. A way forward

7.1 Where the cascade of care fails

In order to achieve optimal care in those with both diabetes and insulin resistance, adequate screening, diagnosis, treatment initiation, and chronic care are required. A potential missed step in this pathway may lead to inappropriate or inadequate care.

Screening is an effective form of disease prevention. However, both patient- and system-related barriers exist. Patient-related factors include the lack of knowledge about diabetes and the initial lack of symptoms.[73] In more rural areas, barriers to healthcare, such a lack of health facilities and transport costs, make access to screening onerous.[74] The attitudes and knowledge of healthcare workers also play a substantial role in whether the need for screening is identified and whether it is ultimately performed.[75]

Once a diagnosis is made, initiation of care is required. While metformin, the first-line drug of choice, is often initiated in those diagnosed with diabetes, the initiation of insulin is often unsuccessful. Initiating insulin requires patients to inject themselves, which they are often afraid to do.[76,77] They may also feal a sense of failure in initiating insulin when oral medication is no longer sufficient.[77] A lack of knowledge and understanding, difficulties with temperature-controlled supply chains, as well as limited access to water and sanitation to safely inject, make insulin treatment a challenge to maintain.[76]

Systemic barriers also exist. Practitioners often lack the adequate time needed to explain to patients in detail how to administer medication.[76] Furthermore, there is often a lack of continuity of care between patients and providers, making understanding and monitoring challenging.[76] With a lack of continued care, patient- and system-related issues are left unaddressed, leading to a lack of adherence and poor diabetes control.[76] Ultimately, this cycle leads to complications and consequences that come at a cost to both the patient and healthcare system.

7.2 What the health system communicates to patients

These barriers to disease prevention also provide guidance as to what can address in order to improve care, particularly among high-risk individuals. A diabetic patient advocate interviewed for this brief expressed that, the efforts currently in place to address diabetes have been performed inconsistently and in silos. Pharmaceutical companies are expected to provide disease prevention material, as part of the state-sector tenders they are awarded, which primarily take the form of printed educational material. However, this material is often not contextually relevant and does not account for cultural differences. Content is often pitched at a level of education that is far higher than that of the target population and is only provided in English. Research into developing appropriate dietary guidelines for diabetics is often highly complex and fraught with differing scientific and ideological views on nutrition and, as a result, often does not get very far.

There has recently been a shift in providing behaviour change coaching to those living with diabetes, provided by organisations such as Guidepost.[78] However, this is currently not scalable. Sweetlife is developing practical and appropriate guides addressing topics such as food, adherence, physical activity, weight loss and motivation. Further, pilot studies are underway evaluating the use of Whatsapp for the distribution of health promotion material.

Although efforts are being made to address the high prevalence of diabetes in South Africa, there are still gaps and room for intervention. Current initiatives are primarily facility based. This creates a gap in care for those who are most vulnerable, lack access to care, and remain undiagnosed. Furthermore, the prevention and care currently provided seeks to improve patient knowledge with little emphasis on behaviour change. This has created a shift in responsibility and implies that patients have the ability to change their circumstances based

on the provided information. However, this is often not the case as those who are vulnerable remain trapped by their circumstances, unable to address the "choiceless" lifestyle factors they are faced with.

8. Conclusion

Type 2 diabetes and insulin resistance are highly prevalent amongst South Africans and are associated with significant morbidity and mortality. The elderly and women, undiagnosed patients, and individuals with insulin resistance, obesity or metabolic syndrome are at increased risk. Furthermore, the Covid-19 pandemic has created an additional risk factor for uncontrolled diabetics who face worse outcomes.

Environmental and lifestyle factors have been targeted by disease prevention strategies; however, diabetes is often "communicable" in nature. Genetic predisposition to diabetes is widespread, and many South Africans live in poor, underserviced areas with little access to healthier food alternatives or safe public outdoor spaces where they can be physically active. "Big food" has spread into townships and rural areas bringing with it highly processed, cheap, sugary foods, with obesity, metabolic syndrome, and diabetes following.

A two-pronged approach is needed to address these contextual factors. Firstly, the existing health policy interventions need to address advertising, particularly to children, and food labelling. Secondly, the communication gap between patients and the health system must be bridged, to promote screening and prevent complications. This should be addressed at each point in the patient's journey with a particular focus on high-risk groups.

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