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Diabetes mellitus mortality by major occupation category in South Africa, 2009—2016

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Summary

In South Africa, diabetes mellitus (DM) is an escalating non-communicable disease (NCD) and a leading cause of death. Certain occupational groups have an increased risk of diabetes. This study aimed to identify occupations associated with increased risk of DM mortality. We conducted a cross-sectional study using Statistics South Africa (StatsSA) mortality data. Participants aged 16—70 years, whose underlying cause of death was DM and whose occupations were provided, were included in the study. We used multivariable logistic regression to assess the association between DM mortality and occupation. Deaths from diabetes accounted for 184 080 (4.44%) of 4 147 326 total deaths for the period 2009—2016. In the unadjusted analysis, mortality odds ratios (MORs) increased significantly between 2009 and 2016. The adjusted MORs indicated that all major occupation groups had a higher risk of DM-associated mortality compared to the reference major occupation (skilled agricultural and fishery workers). We conclude that workers in all occupations are at comparatively high risk of diabetes mellitus mortality in South Africa. Specific risk factors include diet, sedentary work and lifestyle, and the causes of stress and reduced mental health. Diabetes mellitus morbidity likely affects productivity leading to adverse impacts on individuals, businesses and other entities, and the economy in general. Interventions and preventative measures (policies and awareness) are therefore indicated in all workplaces irrespective of the occupational group.
We recommend that workplaces provide:

- Access to, and education on, healthy food options that reduce the risk of DM;
- Support programmes and awareness campaigns regarding stress management and mental health;
- Awareness programmes and specific policies to prevent workplace violence and harassment;
- Policies and practices to alleviate long hours of sedentary work by encouraging periodic physical activity within a safe working environment.

Introduction

Diabetes mellitus (DM) is a major cause of morbidity and mortality globally.[1,2] Diabetes mellitus is characterised by a chronic hyperglycemia-induced triad of symptoms (polydipsia, polyuria and polyphagia) caused by elevated blood glucose levels and metabolic dysregulation.[2] Untreated DM leads to multiorgan and systemic injury to the heart, kidneys, nerves and blood vessels, which impairs quality of life and increases the rate of deaths caused by DM complications.[1,2] For example, people with DM have a twofold increased risk for cardiovascular mortality.[2] Diabetes mellitus also increases the risk of chronic kidney disease (affecting 30% to 40% of individuals with diabetes), which is a major predictor of long-term mortality.[2]

In 2017, 451 million adults worldwide were estimated to have DM.[2,3] The International Diabetes Federation (IDF) projected that by 2045, a total of 693 million DM cases will be recorded worldwide.[4,5] In South Africa, DM is among the rapidly escalating leading causes of death.[6,7] In 2009, more than 2 million people aged 30 years and older were diagnosed with DM.[4,6] This is attributable to several factors such as South Africa's increased urbanisation and unhealthy lifestyle behaviors including poor nutritional intake and a lack of exercise.[2] Additionally, the economic transition, an increase in the ageing population, the nutrition transition due to urbanisation and the increased obesity rate, have also contributed to the high prevalence of DM.[6] There seems to be a possibility that workplace factors, such as stress attributable to physically strenuous work and erratic working hours, can potentially impede optimal self-management, thereby contributing to an elevated risk of adverse health effects.[8]

This study aimed to identify those occupations associated with an increased risk of DM mortality in South Africa.

Materials and Methods

Data sources and management

The South African Standard Classification of Occupations (SASCO) categorises occupations hierarchically into four groups namely: major group, sub-major group, minor group and unit group.[10] There are nine major groups, which are the broadest level of job classification.[9] For this analysis major occupation group data in the StatsSA mortality dataset was used. Data collected from the working-age population, 16—76 years and older, for the periods 2009—2016 were included in this analysis. The age (>65 years) was included as it is possible to develop DM after retirement. All persons whose cause of death was DM, with a death date before 2009 and after 2016 were excluded. Furthermore, all DM deaths recorded for persons whose usual occupation status is unknown or unspecified were excluded. The use of codes for ill-defined and unknown causes of death has also been reported.[10]

Statistical analysis

Descriptive statistics to describe the socio-demographic characteristics of DM mortality were computed and presented as frequencies and proportions. To estimate the prevalence of DM mortality by major occupation group in South Africa for the study period 2009 to 2016, the following equation was used:

$$\text{Prevalence} = \frac{\text{Number of people in all occupation groups who died from DM}}{\text{Total number of people in all occupation groups who died, 2009—2016}} \times 100$$

Frequencies and proportions were plotted on a graph. Finally, a multiple logistic regression analysis was computed for major occupation groups for the years 2009—2016 and 2011—2015, respectively. The skilled agricultural and fishery workers group was used as the reference in the model as this group had the lowest proportion of diabetes deaths among the major occupational groups. In the final model, a priori confounders namely; age, sex, ethnic group, year of death, province of death, educational attainment and smoking status, were included. The results are presented as mortality odds ratios (MORs) at 95% confidence.

Results

Diabetes mellitus mortality

From 2009 to 2016, a total of 4 147 326 deaths were recorded in South Africa. Diabetes mellitus deaths increased from 2009 to 2016 by approximately 21%. Kwa-Zulu-Natal Province had the highest DM deaths (48 413), followed by Gauteng Province with 31 470 DM deaths. The highest proportional DM mortalities were recorded among those aged 56 to 65 and 66 to 70 years (8.39% and 9.8% respectively) (Table 1). The Indian or Asian population group (14.4%) accounted for the highest proportion of DM deaths.

Table 1. Diabetes mellitus deaths among persons aged 16 to 70 years by sociodemographic characteristics, South Africa, 2009—2016, (N = 4 147 326) unadjusted mortality odds ratios (MORs).

Table 1. Congenital Rubella Syndrome Cases Reported at Sentinel Surveillance Site, South Africa, 2010-2017

Characteristic	Total Deaths	Number of Diabetes Deaths	Proportion of diabetes deaths (%)	Unadjusted MOR* (95% CI)	p-value
Total for the entire dataset	4 147 326	184 080	4.44%		
Year of death					
2009	598 291	20 782	3.47%	Reference	
2010	566 712	21 717	3.83%	1.11 (1.09—1.13)	<0.001
2011	531 840	21 307	4.01%	1.16 (1.14—1.18)	<0.001
2012	509 994	21 961	4.31%	1.25 (1.23—1.27)	<0.001
2013	492 261	23 192	4.71%	1.37 (1.35—1.40)	<0.001
2014	492 048	24 092	4.90%	1.43 (1.40—1.46)	<0.001
2015	487 607	25 774	5.29%	1.55 (1.52—1.58)	<0.001
2016	468 573	25 255	5.39%	1.58 (1.55—1.61)	<0.001
Age categories					
16 to 25 years	226 956	1 318	0.58%	Reference	
26 to 35 years	541 105	3 067	0.00%	0.98 (0.91—1.04)	0.460
36 to 45 years	570 476	8 756	0.00%	2.67 (2.52—2.83)	<0.001
46 to 55 years	547 184	25 970	4.75%	8.53 (8.07—9.02)	<0.001
56 to 65 years	559 888	46 972	8.39%	15.68 (14.84—16.56)	<0.001
66 to 70 years	262 655	25 736	9.80%	18.60 (17.59—19.66)	<0.001
Sex					
Male	2 155 084	72 161	3.35%	Reference	
Female	1 972 187	111 790	5.67%	1.71 (1.69—1.73)	<0.001
Ethnic Group					
White	319 115	13 667	4.28	Reference	
Unspecified	717 559	23 338	3.25	0.72 (0.70—0.74)	<0.001
Black African	2 800 866	120 237	4.29	0.90 (0.88—0.93)	<0.001
Indian or Asian	66 141	9 554	14.44	3.63 (3.49—3.77)	<0.001
Coloured	243 645	17 284	7.09	1.51 (1.46—1.56)	<0.001
Nationality					
Foreign national	196 904	7 357	3.74	Reference	
South African national	3 947 700	176 679	4.48	2.85 (2.12—3.84)	<0.001
Education attained					
None	313 021	17 890	5.72%	Reference	
Primary education	576 444	31 029	5.38%	0.90 (0.88—0.92)	<0.001
Secondary education	807 391	31 889	3.95%	0.67(0.65—0.68)	<0.001
Tertiary education	108 376	4 952	4.57%	0.83 (0.80—0.87)	<0.001
Unspecified	2 342 094	98 320	4.20%	0.91 (0.88—0.93)	<0.001

Province of death					
Northern Cape	118 114	4 251	3.60%	Reference	
Western Cape	390 659	25 926	6.64%	1.85 (1.77—1.92)	<0.001
Eastern Cape	594 444	23 915	4.02%	1.06 (1.02—1.11)	0.005
Free State	311 344	11 222	3.60%	0.98 (0.94—1.03)	0.468
KwaZulu-Natal	846 984	43 413	5.13%	1.36 (1.31—1.42)	<0.001
North West	306 226	10 953	3.58%	0.98 (0.94—1.03)	0.405
Gauteng	846 349	31 470	3.72%	1.02 (0.98—1.06)	0.454
Mpumalanga	310 802	13 262	4.27%	1.12 (1.07—1.17)	<0.001
Limpopo	401 670	19 098	4.75%	1.36 (1.30—1.42)	<0.001
Smoking history					
No	1 332 198	83 697	3.75%	Reference	
Yes	597 384	17 174	2.87%	0.47 (0.46—0.48)	<0.001
Unspecified	2 217 744	83 209	6.28%	0.78 (0.77—0.79)	<0.001
Major Occupation Group					
Skilled agricultural & fishery workers	29 104	1 000	3.44%	Reference	
Unspecified, Armed forces, unemployed	3 618 384	157 779	4.36%	1.58 (1.45—1.71)	<0.001
Managers	18 285	973	5.32%	1.93 (1.72—2.17)	<0.001
Professionals	58 555	3 937	6.72%	2.51 (2.28—2.75)	<0.001
Technicians and associate professionals	19 847	1 050	5.29%	1.87 (1.67—2.09)	<0.001
Clerical support workers	24 689	1 271	5.15%	1.94 (1.74—2.16)	<0.001
Service and sales workers and armed forces	58 983	2 620	4.44%	1.39 (1.26—1.53)	<0.001
Craft and related trade workers	60 128	2 864	4.76%	1.48 (1.35—1.63)	<0.001
Plant, machine operators and assemblers	61 790	2 963	4.80%	1.62 (1.47—1.78)	<0.001
Elementary occupations	197 561	9 623	4.87%	1.42 (1.30—1.55)	<0.001

* MOR = Mortality odds ratio, CI = 95% confidence interval

Diabetes mellitus adjusted MORs by major occupations

Nine major occupations were associated with increased odds of DM mortality compared to skilled agricultural and fishery workers. The lowest increased odds were observed for the elementary occupations and unspecified occupations groups. Plant machine operators and assemblers had the highest odds of DM mortality. This was followed by professionals, technicians and associate professionals, and service-and-sales workers (Table 2).

Table 2. Adjusted diabetes mellitus mortality odds ratios (MORs) for major occupations in South Africa, 2009—2016.

Major occupations	Diabetes mellitus deaths	% (total deaths/ DM deaths)	Adjusted MOR *(95% CI)	p-value
Skilled agricultural & fishery workers.	29 104	3.44%	Reference	
Occupations unspecified, Armed forces and occupations not elsewhere classified and not economically active persons.	3 618 384	4.36%	1.22 (1.11—1.33)	<0.001
Managers	18 285	5.32%	1.41 (1.25—1.59)	<0.001
Professionals	58 555	6.72%	1.45 (1.31—1.60)	<0.001
Technicians and associate professionals.	19 847	5.29%	1.45 (1.29—1.63)	<0.001
Clerical support workers	24 689	5.15%	1.37 (1.23—1.54)	<0.001
Service-and-sales workers	58 983	4.44%	1.45 (1.32—1.60)	<0.001
Craft and related trade workers	60 128	4.76%	1.28 (1.16—1.41)	<0.001
Plant, machine operators and assemblers	61 790	4.80%	1.53 (1.39—1.69)	<0.001
Elementary occupations	197 561	4.87%	1.12 (1.02—1.22)	0.017

*Adjusted for age, sex, year of death, province of death, nationality, ethnicity and smoking status, MOR = Mortality odds ratio, CI = 95% confidence interval

Discussion

A significant increase in DM mortality was observed from 2009 to 2016. Although the results in this report are limited to the review period, there have been subsequent reports of increased prevalence from 4.5% in 2010 to 12.7% in 2019.[11]

Known risk factors for DM are gender, ethnicity and age. The MOR for females in this study was significantly higher in comparison to males. Similar findings have been reported in several other studies.[12,13,14,15] In 2016, DM was reported as the leading cause of death in women globally.[16] The Asian ethnic group had a significantly higher risk of mortality due to diabetes compared to other ethnic groups. Ethnicity and genetics are known risk factors for the development of DM and Asians have been reported to have increased risk in several other studies.[17,18,19]

The highest risk for diabetes mellitus mortality was observed among plant machine operators and assemblers, as well as occupations that tend to be more sedentary. This suggests that socioeconomic factors such as obesity, sedentary lifestyle, smoking, alcohol consumption, low income, unemployment, and occupation are risk factors for the development of diabetes mellitus and subsequent DM mortality.[20] Conversely, the lowest risk was observed for elementary and unspecified occupations, the armed forces and the unemployed. However, the prevalence of DM mortality was found to be high in all major occupations compared to the reference group, showing an overall increased risk of mortality from DM in South Africa.

There are certain limitations to this study. Data on sub-major and minor occupations would have added value to the report. This data is however not currently accessible from Stats SA. Completeness of death registration data and accurate coding of the underlying cause of death is important for mortality surveillance systems. The percentage of data that had occupation completed was 12.8% (528 942/4 147 326). One of the biggest limitations of this study was the use of ill-defined cause-of-death codes and unknown causes-of-death as well as the poor reporting of occupation information in the death certificate. Ill-defined cause of death codes and unknown causes of death constituted 71.5% (2 963 289/ 4 147 326) of the entire dataset. Another limitation in these data was the lack of information on overweight/obesity and physical activity levels, which could have possibly been predictive factors for acquiring DM, further leading to DM mortality. These challenges have previously been described.[22,23]

It is concluded that workers in all occupations are at comparatively high risk of DM mortality in South Africa. Specific risk factors include diet, sedentary work and lifestyle, and the causes of stress and reduced mental health. Diabetes mellitus morbidity likely affects productivity leading to adverse impacts on individuals, businesses and other entities, and the economy in general.

Recommendations

Interventions and preventative measures (policies and awareness) are indicated in all workplaces irrespective of the occupational group. It is therefore recommended that workplaces provide:

- Access to, and education on, healthy food options that reduce the risk of DM;
- Support programmes and awareness campaigns regarding stress management and mental health;
- Awareness programmes and specific policies to prevent workplace violence and harassment;
- Policies and practices to alleviate long hours of sedentary work by encouraging periodic physical activity within a safe working environment.[21]

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Conflicts of interest

The authors declare no conflicts of interest.

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