

Non-communicable disease comorbidities in KwaZulu-Natal Province, South Africa

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Background. The prevalence of chronic non-communicable disease (NCD) comorbidity in low- to middle-income countries is increasing, yet evidence on the pattern, prevalence, awareness and treatment of NCD comorbidity is inadequate.

Objectives. To investigate the prevalence, awareness, treatment and control of comorbid hypertension and diabetes, and the underlying risk factors in Mpumza, KwaZulu-Natal Province, South Africa (SA).

Methods. Data were gathered by the SA Human Sciences Research Council from 587 participants in KwaZulu-Natal in 2015. Percentages were used to describe all the variables. Cross-tabulations and χ^2 tests were used to describe variations in the prevalences of hypertension, diabetes and comorbidities according to sociodemographic and socioeconomic variables and lifestyle risk factors.

Results. Approximately a third of the participants had hypertension (32%) and 9% had diabetes. The prevalence of comorbid hypertension and diabetes was 6%, and this was significantly higher among women, the aged, the obese, and the formerly married compared with their counterparts. Comorbidity awareness was high (86%). Although most of the participants with comorbidities were being treated with lifestyle changes, insulin and antihypertensive medication (74%), control of comorbidities was low (13%).

Conclusion. The study reported a higher burden of comorbid hypertension and diabetes among vulnerable populations in Mpumza, SA, particularly women, the obese, and those with a low level of education. In addition, control of comorbidities was low. Developing appropriate interventions to improve control of comorbidities can reduce the risk of macrovascular and microvascular diseases in this population.

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Globally, the past few decades have witnessed a major rise in non-communicable diseases (NCDs) due to the growing ageing population, increasingly unhealthy lifestyles, and rapid unplanned urbanisation.^[1,2] At the same time, chronic multimorbidity (also referred to as NCD comorbidities), defined in the context of this article as the co-occurrence of two or more NCDs,^[3] is also increasing to an unprecedented extent.^[4,5] The prevalence of multimorbidity in low- to middle-income countries (LMICs) is increasing rapidly.^[6,7] People living with NCD multimorbidity have a high healthcare utilisation rate^[8-10] and high rates of hospitalisation.^[11,12] A study in the USA reported that as many as 65% of hospital medical experiences were associated with NCD multimorbidity.^[13] Furthermore, an intersection of NCDs and the Sustainable Development Goals (SDGs) has recently been recognised in policy efforts towards and discourses on the achievement of the SDGs.^[1] This is attributed to the fact that the growing burden of NCDs is likely to retard socioeconomic development and growth and overall attainment of the SDGs. Tackling the high burden of NCDs in the course of achieving the SDGs will therefore require transformative change across the health system to tackle the growing burden of NCD multimorbidity. Such transformative change must include initiatives

to gather adequate and reliable NCD data, monitor and treat NCDs, and enhance policy coherence by addressing the challenges presented by high levels of comorbidities.

Despite the growing body of research on the multimorbidity burden from NCDs, international literature on multimorbidity is still insufficient, and existing data on multimorbidity reflect situations in high-income countries.^[14] A key limitation of existing information on multimorbidity is that evidence on the pattern, prevalence, awareness and treatment of people with NCD multimorbidity is inadequate. In the context of South Africa (SA), although studies have advanced understanding of the rising burden of NCDs,^[15,16] there is a paucity of information on the prevalence, awareness and treatment of multimorbidity. Knowledge of the underlying risk factors for the growing burden of NCD-related multimorbidity in this setting is also sparse. A recent study in SA reported a 4% prevalence of multimorbidity among adult populations, with the majority (70%) of those who were affected being women,^[17] highlighting the potential gender dimension of this problem. Owing to the limited information on NCD multimorbidity in SA, there is little well-established contextual evidence to inform current policy decisions to prevent and control its rising burden.

Objectives

In light of the above, the objective of this study was to investigate the prevalence, awareness and control of patterns of comorbid hypertension and diabetes and the underlying risk factors in KwaZulu-Natal (KZN) Province, SA. Various studies have reported evidence of the burden of hypertension and diabetes in KZN.^[18-20] Although diabetes and hypertension are the most common NCDs (40 - 60%),^[21,22] the extent of their coexistence in KZN is unknown. While findings from the present study will help bridge the knowledge gap on NCD multimorbidity in SA, and by extension in many LMICs, they may also be relevant to inform the development of health policies to ameliorate the current multimorbidity burden and strengthen the health system to provide better care for patients with such multimorbidity.

Methods

Source of data

The data for this study were gathered in KZN. The project was conducted in rural and periurban communities in the province between January and June 2015, by the SA Human Sciences Research Council (HSRC).^[23] The objective of the project was to understand the complexity, severity and prevalence of NCDs in a community with high HIV incidence and prevalence (Mpumza, home to ~50 000 people). The project was a follow-up of a previous HIV home-based counselling and testing (HBCT) study conducted in November 2011 and June 2012. The HIV data were not made available. The NCD data were anonymised before they were made available online. Informed consent was provided by each participant during the data collection.

In 2011/2012, a sample of 545 Mpumza households were randomly selected. Adults aged ≥ 18 years were invited to participate in the study. All the participants who were enrolled during the HBCT study in 2011/2012 and were present in 2015 were invited to participate in the follow-up study. Respondents for this study were all the 587 participants whose data were made available by the HSRC.

Measurements

Hypertension prevalence, awareness, treatment and control

Consenting study participants had their blood pressure measured in accordance with the American Heart Association recommendations using Omron HBP-1300-E devices (Omron Global, Japan). Three blood pressure readings were taken at 10-minute resting intervals. The last two measurements were used in the study. Hypertension was defined as an average systolic blood pressure (SBP) ≥ 140 mmHg and/or an average diastolic blood pressure (DBP) ≥ 90 mmHg,^[24] or self-report of having been diagnosed with hypertension by a medical professional.^[24,25] Among participants who were classified as hypertensive, hypertension awareness was defined as self-report of previous diagnosis by a health professional. Hypertension treatment was investigated among participants who self-reported that they were living with hypertension. Hypertension treatment was defined as use of an antihypertensive in the past 2 weeks and categorised as 1 (treatment of hypertension) or 0 (no treatment of hypertension). Hypertension control was checked among participants who were on treatment. Hypertension control was defined as an average SBP < 140 mmHg and/or an average DBP < 90 mmHg.

Diabetes prevalence, awareness, treatment and control

The careET-202 EasyTouch GC device (Roche Diabetes Care South Africa (Pty) Ltd.) and test strips were used to measure random plasma glucose. A push-button lancet safety needle was used to draw blood from the finger. Participants were classified as having diabetes if their

plasma blood glucose level was ≥ 11 mmol/L or they self-reported prior diagnosis of diabetes by a medical professional.^[26] Among those who had diabetes, diabetes awareness was defined as self-report of previous diagnosis by a health professional. The American Diabetes Association and the European Association for the Study of Diabetes have recommended that a combination of pharmacological treatment and lifestyle changes is essential for the management of type 2 diabetes.^[26] Diabetes treatment was defined as taking insulin or other blood sugar-lowering medication in the past 2 weeks and following a special diet, exercise regimen or weight control programme. If a respondent said yes to both the pharmacological and lifestyle diabetes treatment questions, they were classified as 1 (treatment of diabetes); those who responded no were classified as 0 (no treatment of diabetes). Participants living with diabetes with a blood glucose level < 7.8 mmol/L were considered to be controlled as determined by the International Diabetes Federation guideline.^[27]

Comorbidities prevalence, awareness, treatment and control

The outcome variable for the present study was comorbid hypertension and diabetes. We were interested in the prevalence, awareness, treatment and control of these comorbid conditions. We defined comorbidities as the coexistence of hypertension and diabetes.^[28] Patients were categorised as 0 (no condition); 1 (single condition, for individuals with either hypertension or diabetes) or 2 (comorbidities, for participants with both hypertension and diabetes). Among participants living with comorbidities, awareness was defined as self-reported diagnosis of both hypertension and diabetes. Comorbidities awareness was categorised as 0 (no awareness, if the participant was unaware of living with both hypertension and diabetes) and 1 (aware, if the participant was aware of living with both diabetes and hypertension). Using diabetes and hypertension treatment, treatment of comorbidities was measured. The sample size was very small at this stage, so a variable was created based on the various forms of treatment the participants reported. These were 0 (none), 1 (lifestyle changes, insulin and antihypertensive), 2 (antihypertensive), 3 (insulin and antihypertensive), 4 (antihypertensive and lifestyle changes), and 5 (lifestyle changes and insulin). Control of comorbidities was defined as 0 (none controlled), 1 (comorbidities controlled, for participants who had both hypertension and diabetes controlled), 2 (diabetes controlled) and 3 (hypertension controlled).

Independent variables

Sociodemographic data used included age (15 - 25, 26 - 35, 36 - 45, 46 - 55 and ≥ 55 years) and sex (male, female). In addition, marital status was defined as never married, currently married and formerly married. Religious affiliation was defined as none, Christian and traditional. Socioeconomic data included level of education (none, primary, secondary, tertiary) and wealth quintiles (poorest, poor, middle, richer and richest). Principal component analysis was used to create the wealth index. The household assets used were electricity, motor vehicle, fridge, microwave, washing machine, landline, cell phone, radio, video machine, DSTV, computer, internet and television. The wealth index was equally divided into five groups to create wealth quintiles following the Demographic and Health Survey methodology.^[29] The quintiles were poorest, poor, middle, richer and richest.

The lifestyle risk factors included in the analysis were substance use (alcohol and smoking), fruit and vegetable intake, self-rated health, and body mass index. Participants who had never consumed alcohol were classified as non-drinkers, those who had consumed alcohol but not in the past 30 days were classified as occasional

drinkers, and participants who had consumed alcohol in the past 30 days were classified as regular drinkers. Participants were asked if they had ever smoked. Those who said yes were classified as smokers. Participants were asked to indicate the number of servings of fruits and vegetables they consumed daily. The responses were categorised into ≤ 1 servings daily, 2 - 3 servings daily, 4 - 5 servings daily and > 5 servings daily. Body mass index (BMI) was measured using weight (kg) and height (cm) information collected during the survey, and categorised as underweight ($< 18.5 \text{ kg/m}^2$), normal weight ($18.5 - 24.9 \text{ kg/m}^2$), overweight ($25 - 29.9 \text{ kg/m}^2$) and obese ($\geq 30 \text{ kg/m}^2$).^[30]

Statistical analyses

Percentages were used to describe all the variables. Cross-tabulations and χ^2 tests were used to describe the variations in prevalence of hypertension, diabetes and comorbidities according to the sociodemographic and socioeconomic variables, and lifestyle risk factors. Owing to the small numbers for some of the cells, we could not fit multivariate models for the prevalence, awareness, treatment and control of hypertension, diabetes and comorbidities. For the same reason, control of comorbidities was only examined by type of treatment.

Ethical considerations

The HSRC was granted ethical clearance for data collection by both the HSRC Ethics Committee (ref. no. 1/26/05/11) and the University of Washington Institutional Review Board (ref. no. 48733). Only individuals who consented were enrolled in the survey.

Results

Background characteristics

A total of 587 participants were enrolled. Approximately two-thirds were female (69%) (Table 1). Ages ranged from 19 to 94 years (mean (standard deviation) 43.2 (17.2) years). Approximately a third had attained secondary school and a third high school levels of education (32% and 33%, respectively). More than half of the participants had never married (67%), and the majority were Christians (76%). Approximately two-thirds of the participants were in the poorest, poor and middle wealth quintile categories.

Seventeen percent of the participants were smokers, and close to half were regular drinkers (45%). Fruit and vegetable intake was low, $< 4\%$ of the participants consuming 4 - 5 servings daily (2% and 3%, respectively). About 8% more men than women rated themselves as having very good health (38% v. 30%). With regard to BMI, more than two-fifths of the participants (46%) were obese. A higher proportion of women were obese compared with men (60% v. 16%).

Distribution of the prevalence, awareness, treatment and control of hypertension according to background characteristics

Table 2 shows the prevalence, awareness, treatment and control of hypertension according to background characteristics. Approximately a third of the sample had hypertension (32%). The prevalence of hypertension was twice as high among women than among men ($p=0.00$), and increased significantly with age and marital status. The prevalence of hypertension was also higher among those who rated their health as moderate (53%), bad (67%) and very bad (83%) than among those who rated it as good or very good. BMI was associated with hypertension in this sample. A higher proportion of subjects who were overweight and obese had hypertension (30% and 45%, respectively) compared with those who were of normal weight (12%).

Of respondents living with hypertension, $\sim 82\%$ were aware of their status. Religion was the only significant variable that predicted awareness of hypertension status ($p=0.022$); $\sim 86\%$ of participants who self-identified as Christian and traditionalist were aware of their hypertension status, compared with 63% of those with no religion.

Although $\sim 82\%$ of the sample were aware of their hypertension status, only 73% were on treatment. Hypertension treatment was significantly associated with age, level of education and smoking status. A higher proportion of participants aged 45 - 54 years (71%) were on treatment compared with those aged 15 - 24 (33%) ($p=0.001$). The proportion of participants on treatment was lower among those with higher education (50%) compared with those with no education (87%) ($p=0.017$). More participants who did not smoke (76%) were on treatment compared with those who smoked (53%) ($p=0.036$).

Hypertension control was generally low in this sample. Approximately a third of the participants who were on treatment had their blood pressure controlled (37%). Hypertension control was lower among those who were overweight and obese compared with those who were of normal weight ($p=0.041$). With regard to wealth quintiles, a little above half of those in the poor (54%) and richer group (53%) had their blood pressure controlled ($p=0.029$).

Distribution of the prevalence, awareness, treatment and control of diabetes according to background characteristics

The prevalence of diabetes in this sample was 9% (Table 3). Diabetes prevalence was significantly associated with sex, age, level of education, marital status, smoking status, self-rated health and BMI. Diabetes prevalence was higher among females compared with males, and increased with age. Approximately two out of five participants aged ≥ 55 years had diabetes (20%) compared with those aged 15 - 24 years (3%) ($p=0.000$). A third of participants who had formerly been married had diabetes (32%) compared with 5% of the never-married ($p=0.000$). The prevalence of diabetes was higher among those who reported that their health was bad (23%) compared with those who said it was very good (3%) ($p=0.000$). Approximately 14% of those who were obese were living with diabetes ($p=0.000$).

Approximately four out of five people living with diabetes were aware of their status (79%). The variables that significantly predicted diabetes awareness were age ($p=0.000$) and marital status ($p=0.000$). Individuals in the older age categories tended to be more aware of their status compared with those in the younger age groups. For example, the majority of participants aged 45 - 54 years (80%) and ≥ 55 years (91%) were aware of their status, while for those aged 25 - 34 years the figure was 50%.

All the men were on treatment, while $\sim 16\%$ of women were not on treatment. Although not significant, the proportion on treatment was higher among respondents aged ≥ 55 (93%) and 45 - 54 years (75%) compared with those aged 25 - 34 years (50%). Among participants living with diabetes, all of those with higher education (100%) were on treatment compared with only two-thirds (67%) of those with primary education ($p=0.003$). All participants who were formerly married were on treatment (100%) compared with two-thirds of those who had never married (62%) ($p=0.005$). Only one out of five participants had their glucose controlled (23%). Diabetes control was not significantly related to any of the predicting variables.

Distribution of the prevalence, awareness and treatment of comorbidities according to background characteristics

Table 4 illustrates the prevalence of comorbid hypertension and diabetes according to sociodemographic, socioeconomic and lifestyle

Table 1. Characteristics of respondents

Variable	Male (n=183), %	Female (n=404), %	Total (N=587), %
Age (years)			
15 - 24	16.9	9.4	11.7
25 - 34	28.4	27.0	27.4
35 - 44	18.0	21.0	20.1
45 - 54	14.2	12.4	12.9
≥55	22.4	30.2	27.8
Level of education			
No education	10.4	15.1	13.6
Primary	19.7	18.1	18.6
Secondary school	32.2	32.2	32.2
High school	34.4	32.9	33.4
Tertiary	3.3	1.7	2.2
Marital status			
Never married	68.3	66.3	67.0
Currently married	28.4	23.5	25.0
Formerly married	3.3	10.1	8.0
Religion			
None	37.2	11.6	19.6
Christian	58.5	84.2	76.2
Traditional	4.4	4.2	4.3
Wealth quintiles			
Poorest	23.5	19.5	20.8
Poor	22.9	22.8	22.8
Middle	17.5	26.7	23.8
Richer	18.0	13.4	14.8
Richest	18.0	17.6	17.7
Smoking status			
Smoker	40.4	6.0	17.0
Non-smoker	59.6	94.0	83.0
Alcohol use			
None	46.4	49.7	48.7
Occasional	14.7	2.7	6.5
Regular	38.8	47.5	44.8
Fruit intake (servings/day)			
≤1	65.6	55.2	58.4
2 - 3	32.2	42.1	39.0
4 - 5	1.6	2.2	2.0
>5	0.6	0.5	0.6
Vegetable intake (servings/day)			
≤1	34.3	31.9	32.7
2 - 3	62.3	64.6	63.9
4 - 5	3.4	3.5	3.4
Self-rated health			
Very good	37.7	30.2	32.5
Good	38.2	33.4	34.9
Moderate	19.1	29.7	26.4
Bad	4.9	5.2	5.1
Very bad	0	1.5	1.0
BMI			
Underweight	3.8	1.5	2.2
Normal weight	51.9	14.6	26.2
Overweight	28.4	23.8	25.2
Obese	15.8	60.1	46.3
Total	100	100	100

BMI = body mass index.

Table 2. Prevalence, awareness, treatment and control of hypertension according to background characteristics

Variable	Prevalence (N=587), %	Awareness (n=188), %	Treatment (n=154), %	Control (n=112), %
Sex				
Male	19.1*	71.4	80.0	30.0
Female	37.9	84.3	71.3	38.0
Age (years)				
15 - 24	4.3*	100	33.3	0
25 - 34	9.9	75.0	33.3	20.0
35 - 44	22.0	76.9	55.0	60.0
45 - 54	36.8	75.0	71.4	33.3
≥55	70.6	85.2	82.7	35.8
Level of education				
No education	56.2*	84.4	86.8	48.5
Primary	48.6	88.7	80.8	34.2
Secondary school	30.7	77.6	62.2	28.6
High school	14.8	75.9	54.5	33.3
Tertiary	23.1	66.7	50.0	0
Marital status				
Never married	21.4	80.9	63.2	40.5
Currently married	49.7	80.8	81.4	34.7
Formerly married	66.0	87.1	77.8	33.3
Religion				
None	23.5	63.0*	76.5	69.2
Christian	28.0	85.7	83.3	40.0
Traditional	34.5	85.1	71.8	31.9
Wealth index				
Poorest	37.7	84.8	71.8	35.7*
Poor	32.1	83.7	72.2	53.8
Middle	27.9	84.6	78.8	16.0
Richer	31.0	77.8	76.2	52.9
Richest	31.7	75.8	64.0	25.0
Smoking status				
Smoker	22.0	86.4	52.6	30.0
Non-smoker	34.1	79.2	75.6	37.2
Alcohol use				
None	32.9	84.0	77.2	38.3
Occasional	28.9	72.7	62.5	20.0
Regular	31.6	80.7	68.7	36.2
Fruit intake (servings/day)				
≤1	32.1	80.9	79.8	38.0
2 - 3	32.3	82.4	62.3	31.6
4 - 5	25.0	100	66.7	50.0
>5	33.3	100	100	100
Vegetable intake (servings/day)				
≤1	26.6	86.3	79.5	37.1
2 - 3	34.3	80.9	71.7	36.8
4 - 5	30.0	66.7	25	0
Self-rated health				
Very good	16.2	80.6	72	38.9
Good	24.4	74.0	64.7	20.8
Moderate	52.9	84.2	79.7	40.0
Bad	66.7	90.0	66.7	50.0
Very bad	83.3	100	60	33.3
BMI				
Underweight	15.4	100	100	100*
Normal weight	12.3	68.4	61.5	0.0
Overweight	30.4	84.4	63.2	40.0
Obese	44.9	82.8	77.2	37.7
Total	32.03	81.9	72.7	36.6

BMI = body mass index.
*Significant (p<0.05).

Table 3. Distribution of diabetes prevalence, awareness, treatment and control according to background characteristics

Variable	Prevalence (N=587), %	Awareness (n=52), %	Treatment (n=41), %	Control (n=35), %
Sex				
Male	2.7*	60.0*	100	0
Female	11.6	80.8	84.2	25.0
Age (years)				
15 - 24	2.9*	0	0	0
25 - 34	2.5	50.0	50.0	0
35 - 44	6.8	62.5	60.0	33.3
45 - 54	6.6	80.0	75.0	33.3
≥55	20.2	90.9	93.3	78.6
Level of education				
No education	16.2*	100	100	30.7
Primary	12.8	85.7	66.7	25.0
Secondary school	5.8	81.8	77.8	14.3
High school	6.1	50.0	100	16.7
Tertiary	15.4	50.0	100	0
Marital status				
Never married	5.1*	65.0*	61.5	25.0
Currently married	11.6	82.3	92.9	23.1
Formerly married	31.9	93.3	100	21.4
Religion				
None	5.2	83.3	80.0	50.0
Christian	8.0	100	100	50.0
Traditional	9.8	77.3	85.3	17.2
Wealth index				
Poorest	9.0	81.8	100	22.2
Poor	11.2	86.7	69.2	22.2
Middle	8.6	83.3	80.0	25.0
Richer	4.6	75.0	100	33.3
Richest	9.6	60.0	100	16.7
Smoking status				
Smoker	2.0	100.0	50.0	0
Non-smoker	10.3	78.0	87.2	23.5
Alcohol use				
None	10.5	86.7	84.6	0
Occasional	2.6	0	0	22.7
Regular	8.0	71.4	86.7	23.1
Fruit intake (servings/day)				
≤1	9.3	75.0	79.2	21.0
2 - 3	7.9	83.3	93.3	28.6
4 - 5	8.3	100	100	0
>5	33.3	100	100	0
Vegetable intake (servings/day)				
≤1	9.4	88.9	81.2	23.1
2 - 3	8.8	71.9	86.9	25.0
4 - 5	10.0	100	100	0
Self-rated health				
Very good	3.1*	66.7	100	0
Good	6.3	61.5	87.5	14.3
Moderate	16.1	88.0	81.8	27.8
Bad	23.3	85.7	83.3	20.0
Very bad	16.7	100	100	100
BMI				
Underweight	0*	0	0	0
Normal weight	1.9	100	66.7	0
Overweight	6.8	80.0	87.5	14.3
Obese	14.3	76.9	86.7	26.9
Total	8.9	78.9	85.4	22.9

BMI = body mass index.
*Significant ($p < 0.05$).

Table 4. Distribution of comorbidities prevalence

Variable	None, %	Single condition, %	Comorbidities, %
Sex			
Male	79.8*	18.6	1.6
Female	58.7	33.2	8.2
Age (years)			
15 - 24	92.7*	7.2	0
25 - 34	87.6	12.4	0
35 - 44	73.7	23.7	2.5
45 - 54	60.5	35.5	3.9
≥55	27.6	54.0	18.4
Level of education			
No education	41.2	45.0	13.7
Primary	49.5	39.4	11.0
Secondary school	68.2	27.0	4.8
High school	80.6	17.9	1.5
Tertiary	69.2	23.1	7.7
Marital status			
Never married	75.8*	21.9	2.3
Currently married	48.3	42.2	9.5
Formerly married	29.8	42.6	27.7
Religion			
None	74.8	21.7	3.5
Christian	72.0	20.0	8.0
Traditional	62.4	30.9	6.7
Wealth index			
Poorest	61.5	30.3	8.2
Poor	64.2	28.4	7.5
Middle	67.9	27.9	4.3
Richer	67.0	26.4	4.6
Richest	64.2	29.8	5.8
Smoking status			
Smoker	77.0	22.0	1.0
Non-smoker	62.8	23.0	7.2
Alcohol use			
None	64.3	28.0	7.7
Occasional	71.0	26.3	2.6
Regular	65.4	29.7	4.9
Fruit intake (servings/day)			
≤1	64.1	30.3	5.5
2 - 3	66.4	27.1	6.6
4 - 5	75.0	16.7	8.3
>5	66.7	0	33.3
Vegetable intake (servings/day)			
≤1	68.7	26.6	4.7
2 - 3	63.2	30.1	6.7
4 - 5	70.0	30.0	10.0
Self-rated health			
Very good	82.2	16.2	1.6
Good	73.2	22.9	3.9
Moderate	42.6	45.8	11.6
Bad	33.3	43.3	23.3
Very bad	0	100	0
BMI			
Underweight	84.6	15.4	0
Normal weight	87.0	11.7	1.3
Overweight	68.2	26.3	5.4
Obese	50.4	40.1	9.5
Total	65.2	28.6	6.1

BMI = body mass index.
*Significant ($p < 0.05$).

factors. The overall prevalence of comorbidities was 6%. A higher proportion of women (8%) had comorbidities compared with men (2%) ($p=0.000$). The prevalence of comorbidities increased with age. The age group >55 years had a significantly higher proportion of participants living with comorbidities (18%) than the younger age groups, and none of those aged 15 - 34 years had comorbid hypertension and diabetes. In addition, the prevalence of comorbidities among participants who had no education was ~14%, while those with tertiary education had a prevalence of ~8%. A significant association between marital status and comorbidities was also found. The prevalence of comorbidities was highest among those who had formerly been married (28%) and lowest among those who had never married (2%). Although the association was not significant, the prevalence of comorbidities was higher in poor households compared with richer households.

One of five participants who rated their health as bad had comorbidities (23%). As expected, a significant association was found between BMI and comorbidities. Participants who were obese recorded the highest prevalence of comorbidities (10%), compared with 1% of those of normal weight. Fruit and vegetable intake and alcohol use were not significantly associated with comorbidities.

Table 5 presents levels of awareness of comorbidities and the treatments the participants were using. The majority of the respondents (86%) were aware of their conditions. Most were on treatment, and many (74%) followed the recommended combination of lifestyle changes, insulin and antihypertensive medication. However, some of the participants did not follow the recommended treatment. Approximately 7% were only on pharmacological treatment with no lifestyle changes. Another 3% only treated their hypertension and diabetes, respectively.

Control of comorbidities is shown in Table 6. A high proportion of the participants had uncontrolled hypertension and diabetes

(71%). Approximately 17% of the participants who had controlled comorbidities were those who were using the lifestyle change, insulin and antihypertensive treatment regimen. All the participants who were not on treatment were uncontrolled.

Discussion

Hypertension prevalence, awareness, treatment and control

The study revealed that a third of the respondents in rural KZN were living with hypertension; 73% were on treatment, while more than a third of those treated were controlled. The prevalence was relatively low in this study compared with two studies on hypertension in SA and one comparative study in SA and Ghana. In a study of comorbidities in the Agincourt study site in SA, a prevalence of 63% was found.^[31] In Wave 2 of the World Health Organization-funded Global Study on Ageing and Adult Health (SAGE), a hypertension prevalence of 43% was reported.^[32] Furthermore, while we found a 37% control rate, more recent hypertension studies in SA report much lower levels of control (18 - 24%).^[31,32] The same pattern was observed for awareness and treatment. We found higher levels of awareness and treatment of hypertension compared with other studies. These differences could be explained by differences in the study population and perhaps the methodology. The SAGE data are primarily focused on the elderly population and therefore more likely to have higher estimates for conditions that are sensitive to ageing. Hypertension control is lower among the elderly for a variety of reasons, including limited income and having to depend on others for help. These reasons may challenge the drive for optimal hypertension treatment and subsequent control. However, our findings were consistent with regional-level hypertension studies where broad levels of prevalence were noted among different subpopulations.^[33-35] Crucially, over the past few years, hypertension and related complications have become a major part of the epidemiological profile both in SA and the broader African region.

Diabetes prevalence, awareness, treatment and control

The study showed that 9% of the respondents in rural KZN had type 2 diabetes, and this is slightly lower than the national estimate of 9.8%.^[36] Among individuals with diabetes, 79% were aware that they had it, and >85% of those who were aware of their condition were receiving treatment for it. Slightly more than one-fifth of those receiving treatment achieved adequate glycaemic control through treatment; this proportion is slightly higher than that observed in a study conducted in rural KZN (15.7%) describing the nature of care, glycaemic control and diabetes complications among patients with diabetes receiving treatment from a public hospital.^[37]

The results clearly show that glycaemic control is a challenge in this population. Evidence from the KZN Department of Health showed

Table 5. Awareness and treatment of comorbidities

Awareness and treatment	n (%)
Awareness	
Aware	31 (86.1)
Unaware	5 (13.9)
Total	36 (100)
Treatment	
No treatment	3 (9.7)
Lifestyle changes, insulin, antihypertensive	23 (74.2)
Antihypertensive	1 (3.2)
Insulin and antihypertensive	2 (6.5)
Antihypertensive and lifestyle changes	1 (3.2)
Lifestyle changes and insulin	1 (3.2)
Total	31 (100)

Table 6. Control of comorbidities according to type of treatment

Treatment	Control, %			
	None controlled	Comorbidities controlled	Diabetes controlled	Hypertension controlled
No treatment	100	-	-	-
Lifestyle changes, insulin, antihypertensive	69.6	17.4	-	13.0
Antihypertensive	-	-	-	100
Insulin and antihypertensive	100	-	-	-
Antihypertensive and lifestyle changes	100	-	-	-
Lifestyle changes and insulin	-	-	100	-
Total	70.9	12.9	3.2	12.9

that the number of clinic visits by diabetic patients in the province has increased significantly over time.^[38] Coupled with this, the large majority of people diagnosed with diabetes are seeking medical care, and the number of treatment defaulters reduced significantly between 2006 and 2016.^[38] What is unclear is why, despite these impressive success stories, glycaemic control remains a problem in the study area. Research revealed that adequate glycaemic control can reduce the risk of cardiovascular diseases in patients with diabetes.^[39] Nevertheless, the relatively low glycaemic control in this population suggests the need for urgent interventions to minimise diabetes complications such as microvascular (neuropathy, nephropathy and retinopathy) and macrovascular (stroke and peripheral vascular disease) disorders.^[40] Such interventions may be achieved by strengthening the local clinics in the province in terms of resources, staffing and clinician education.^[41]

Furthermore, the findings showed that sociodemographic characteristics such as sex, age, marital status and level of education play important roles in diabetes prevalence and awareness, just as has been found in previous studies.^[42,43] It will be important to leverage existing interventions on these sociodemographic characteristics in developing a policy action plan to reduce the burden of diabetes in KZN.

Comorbidities of diabetes and hypertension

To the best of our knowledge, this is the first community-based study in SA to present information about comorbid hypertension and diabetes prevalence, awareness, treatment and control in a rural population. The study showed that the prevalence of comorbid hypertension and diabetes was 6%, and the figure was significantly higher among women, individuals aged ≥ 55 years, and those who were formerly married. The co-occurrence of diabetes and hypertension observed in this study is higher than that reported in similar populations in Nepal (1.8%)^[44] and India (4.1%).^[45] Although this prevalence seems low, it deserves critical attention, as research has shown that comorbid diabetes and hypertension increase the risk of developing macrovascular and microvascular diseases.^[46-48]

The findings showed that the majority of respondents with comorbid hypertension and diabetes were aware of their conditions and were treating them using lifestyle changes, insulin and antihypertensive medications. However, only about one-tenth achieved hypertension and glycaemic control. The issue of comorbid control is clearly a problem in this population, despite a high level of treatment. Plausible explanations for the low level of comorbid hypertension and diabetes control in this population are that the medications used by the respondents were ineffective, or that there are non-adherence issues. There are three research implications for this. First, in future studies it will be important to explore factors accounting for poor hypertension and glycaemic control in KZN despite treatment. Second, future studies need to explore the level of medication adherence among those living with comorbidities of hypertension and diabetes. Third, it will be of great benefit to study the potency of antihypertensive and diabetes medications used in this population.

Study limitations

This study is not without limitations. The data were collected in 2015, and the findings may not reflect current hypertension, diabetes and comorbidities experiences in KZN. However, although this dataset was gathered in 2015, it is the first time such an analysis has been conducted using this dataset. More importantly, this study can be used as a baseline to evaluate the effectiveness of recent interventions

by the government to address obesity and NCDs in SA. Furthermore, the sample size for this study was too small to do rigorous analysis. As a result, multivariate analysis could not be carried out to examine the determinants of awareness, treatment and control of hypertension and diabetes comorbidities in this population. Nevertheless, the findings provide an important description and representation of the burden of hypertension and diabetes comorbidities in KZN.

Conclusions

This study examined the prevalence, awareness, treatment and control of comorbid hypertension and diabetes and the underlying risk factors in Mpumza, KZN, SA. The prevalence of comorbidities was 6%. Although this prevalence seems low, it was higher among vulnerable populations, particularly women, the obese, the poor and those with a low level of education. Furthermore, control of comorbidities was also low despite a high proportion of participants being on treatment. It is important to pay critical attention to this problem, as poor control has the potential to increase the risk of macrovascular and microvascular diseases and reduce gains towards achieving health and wellbeing, as specified by the SDGs.

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