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Prevalence and associations of hypertension detection, treatment and control in Cape Town

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Abstract

Aim Globally, the prevalence of hypertension is high and rising; however, hypertension care remains suboptimal, including in South Africa. Therefore, the aim of this study was to determine the prevalence and associations of hypertension detection, treatment and control in > 21-year-old urban black residents with hypertension in Cape Town, South Africa.

Methods In this randomly selected community-based cross-sectional study, data collection comprised administered questionnaires, clinical measurements and fasting biochemical analyses, including oral glucose tolerance tests. Hypertension was defined as blood pressure ≥ 140/90 mmHg or known hypertension on treatment. Separate logistic regression models evaluated the associations with hypertension detection, treatment and control. Each model included sociodemographic characteristics, problem drinking, daily tobacco smoking, family history of hypertension, obesity (body mass index ≥ 30 kg/m^2), and comorbidities of diabetes, high low-density lipoprotein cholesterol and chronic kidney disease (CKD).

Results Among 460 participants with hypertension, 65% were women and the mean age was 50.7 (SD ± 12.1) years. Prevalence of hypertension detection among participants with hypertension (62.4%), treatment among the detected (75.6%) and control among the treated (57.1%) were sub-optimal, with better rates in women (73.6%, 80.0%, 59.1%, respectively) than in men (41.6%, 61.2%, 48.8%) ($p < 0.05$ for detection and treatment). Hypertension detection among participants with hypertension was associated with age ≥ 45 years, female gender (OR: 3.56, 95%CI: 1.94–6.55), a family history of hypertension (OR: 1.81, 95% CI: 1.09–3.00), ≤ 7 years of education (OR: 1.76, 95%CI: 1.02–3.03), ≥ 50% of life spent in city (OR: 1.82, 95%CI: 1.07–3.10) and comorbid diabetes (OR: 3.51, 95%CI: 1.80–6.86) or CKD (OR: 6.27, 95%CI: 1.31–30.10). The poorest participants were half as likely as their counterparts to have their hypertension detected (OR: 0.51, 95%CI: 0.28–0.92). Treated hypertension in those detected was significantly associated with female gender (OR: 3.29, 95% CI: 1.42–7.67) and just missed being associated with comorbid diabetes (OR: 2.00, 95% CI: 0.99–4.03). Hypertension control among participants who were treated was significantly associated with female gender (OR: 2.36, 95%CI: 1.01–5.51) in the logistic regression analyses.

Conclusions Participants who were female and with comorbid diabetes were more likely to have better hypertension care overall, while the poorest and less urbanised participants were less likely to have their hypertension detected. Strategies are required to ensure equitable distribution of hypertension care. In-depth research is required to understand the contributors to suboptimal hypertension care, which likely differ by age, gender, socioeconomic status and level of care.

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Introduction

Worldwide, the prevalence of hypertension or high blood pressure (BP) is high and rising with the burden having approximately doubled between 1990 and 2019; almost 1.3 billion 30–79-year-old adults had hypertension in 2019 [1]. This is of concern because high systolic BP is the leading modifiable risk factor for cardiovascular disease (CVD) contributing to ischaemic heart disease and stroke, the top two causes of mortality globally [2]. Considering that the harm inflicted by high BP is modifiable, it is imperative to ensure that the condition is detected early, treated effectively and optimally controlled. Unfortunately, despite the availability of cost-effective and efficient treatment to optimally manage hypertension, care remains suboptimal, particularly in low- and middle-income countries (LMICs) [1]. Worldwide, in 2019, hypertension control among adults with the condition was unacceptably low at 18% and 23% in men and women, respectively, with a wide gap between high-income countries and LMICs. Unsurprisingly, high BP remains a major contributor to morbidity and premature mortality globally accounting for 8.5 million deaths annually [1].

LMICs have not been spared with southern Africa among the regions with the highest prevalence of hypertension worldwide [1]. The adverse outcomes associated with the high hypertension burden are exacerbated in the region with hypertension control rates of < 10% in Sub-Saharan Africa [1]. In South Africa, high systolic BP was the 2nd leading risk factor contributing to 12.4% of mortality in the country [3]. High systolic BP contributed to stroke, ischaemic heart disease and hypertensive heart disease, which were among the 10 leading causes of mortality in South Africa [3]. Age-standardised death rates attributable to high systolic BP were the highest in black Africans compared with other population groups in the country at 373 and 311 per 100,000 in men and women, respectively [4].

To reduce the morbidity and mortality associated with high systolic BP, there needs to be effective screening and management of hypertension. However, hypertension care, while improving between 1998 and 2016 as demonstrated in the South African Demographic and Health Surveys (SADHS), remains suboptimal [5]. There is a need to explore and understand the factors contributing to hypertension care so that appropriate strategies and programmes may be developed to manage hypertension optimally and efficiently. Therefore, the aim of this study was to determine the prevalence and associations of hypertension detection, treatment and control in > 21-year-old urban black residents in Cape Town.

Methods

Study population, sampling procedure and data collection

Adult residents of the predominantly black townships of Langa, Guguletu, Crossroads, Nyanga and Khayalitsha in Cape Town were included in this cross-sectional study. Considering that the prevalence of hypertension was historically much higher than that for diabetes in this population, the sample size of 1260 was based on an estimated diabetes prevalence of 8% with a precision of 1.5% two-sided with 95% confidence. Nevertheless, the current analyses focused on participants identified with hypertension in this study.

In 2008/09 when the study was conducted, a 3-stage cluster sampling procedure was used to randomly select participants; the details of which have been previously described [6]. Residential blocks within the main strata were randomly selected using aerial maps of each township. Thereafter, quotas pre-specified by age and gender categories, determined using the most recent census, guided the selection of individuals from households. There was disproportionate sampling across age groups with older age groups over-sampled to ensure at least 50 men and women in each gender category. Adults who were unable to give consent, bedridden, pregnant or lactating, living in Cape Town for less than three months, on antiretroviral or tuberculosis treatment or had been treated for cancer in the previous year were excluded.

Data collection consisted of administered questionnaires, clinical assessments and biochemical analyses. Trained fieldworkers administered the structured questionnaires which included sociodemographic details, self-reported medical history, and the use of tobacco (WHO STEPwise surveillance questionnaire) [7] and alcohol (CAGE set of four questions) [8]. Assets that defined wealth were documented and included ownership of consumer items (durable goods), access to electricity, and the source of drinking water and toilet facilities.

Clinical assessments comprised anthropometric and BP measurements. Anthropometric measurements were collected using standardised techniques to calculate body mass index (BMI) [9]. These included weights measured to the nearest 0.1 kg using a calibrated scale with participants barefoot and in light clothing, and heights measured to the nearest 0.1 cm using a stadiometer. Three BP measurements were recorded with an Omron M6 Comfort BP monitor using an appropriately sized cuff. BP was measured at two-minute intervals after the participant had been seated for five minutes. The average of the second and third BP readings was used for analysis.

Blood samples to determine glucose and lipid levels were drawn after a 10-h overnight fast. This was followed by the administration of a standard oral glucose tolerance test with 75 g of anhydrous glucose dissolved in 250 ml of water. Blood samples were drawn again after 120 min [10]. These were kept on ice and transported to the laboratory within six hours to be centrifuged, aliquoted and stored at −80° until the assays were performed.

Serum creatinine levels were assessed in 2018/2019 from blood specimens which had been stored at −80 degrees Celsius. The latter, which was used to estimate glomerular filtration rate (eGFR), was measured by the Jaffe kinetic method.

Definitions

Low education level was defined as ≤ 7 years of schooling. Problematic alcohol use was considered present if ≥ 2 of the CAGE set of four questions were answered positively [8]. Smoking ≥ 1cigarette/day classified participants who smoked daily. A family history of hypertension was defined as self-reported hypertension in a first degree relative. Using BMI, calculated as weight in kilograms divided by height in metres squared (kg/m^2), obesity was defined as BMI ≥ 30 kg/m^2 [11]. Hypertension was diagnosed as BP ≥ 140/90 mmHg or the use of antihypertensive medication [12]. Hypertension detection was defined as being previously informed by a doctor or nurse of their high BP status. Hypertension treatment was described as the use of antihypertensive agents in participants with detected hypertension. Hypertension control was defined as BP < 140/90 mmHg in participants on antihypertensive agents.

The 1998 WHO criteria diagnosed diabetes as fasting plasma glucose ≥ 7.0 mmol/l and/or 2-h post glucose load ≥ 11.1 mmol/l [10], and included participants with known diabetes. Dyslipidaemia was defined as low-density lipoprotein cholesterol (LDL-C) > 3.0 mmol/l calculated using the Friedewald equation or taking anti-lipid medication [13, 14]. Chronic kidney disease (CKD) was determined using the CKD Epidemiology Collaboration creatinine (CKD-EPIcr) Eq. (2009) [15], and defined as eGFR of < 60 mL/min/1.73 m^2.

Statistical analyses

Data analyses were conducted using STATA 18. Categorical data for sociodemographic characteristics, lifestyle behaviours and comorbidities are presented as counts and percentages. Ages (continuous variable) are presented as mean values and standard deviations (SD). An asset index, based on the assets that defined wealth, was developed using a principal component analysis of the pooled data [16]. Categories of relative wealth were created using tertiles and the lowest tertile identified the poorest participants. Logistic regression analyses investigated the associations with hypertension detection, treatment, and control in separate models. The same independent variables were entered in all three models. Additional logistic regression analyses were conducted replacing diabetes with known/detected diabetes only in the models. Further, logistic regression analyses were conducted to determine the associations with undetected hypertension in the entire realised study sample (n = 1092); participants with detected hypertension were excluded from the latter analyses. Data are reported as odds ratios (ORs) and 95% confidence intervals (CI). A p-value < 0.05 characterised statistically significant findings.

The study was conducted in accordance with principles of the International Declaration of Helsinki, 2013. Ethics approval was obtained from the South African Medical Research Council's Human Research Ethics Committee (EC026-9/2016) and the University of Cape Town's Research and Ethics Committee (224/2006). All participants signed informed consent.

Results

In the overall study, the age-standardised hypertension prevalence was 38.9% (95% CI: 35.6–42.3) with similar rates in men (38.7%, 95% CI: 33.0–44.8) and women (39.0%, 95% CI: 35.2–43.0), and has been described in detail previously [17]. There were 460 participants with hypertension in this study, among whom 287 were detected, 217 were treated and 124 were controlled. Among the 460 participants with hypertension, mean age 50.7 (SD ± 12.1) years, 65% (n = 299) were women (51.1 SD ± 11.8 years) and 35% (n = 161) were men (49.9 ± 12.7 years). Hypertension detection among participants with hypertension was 62.4% with higher rates in women (73.6%) than in men (41.6%) (p < 0.001) (Table 1). Treatment among those detected with hypertension was 75.6% with higher rates in women (80.0%) compared with men (61.2%) (p = 0.002). Hypertension control among the treated was 57.1%; rates in women were 59.1% vs. 48.8% in men (p = 0.230).

Detected hypertension was lower in unemployed participants compared with their counterparts (51.5 vs. 73.0%), those in the poorest compared with the wealthier tertiles (49.2% vs. 67.7%), and shack dwellers compared to participants living in better housing (49.1% vs. 70.0%) (Table 1). Additionally, detected hypertension was lower in problem drinkers compared with their

Table 1 Prevalence and univariate associations of socio-demographic characteristics, lifestyle behaviours and selected comorbidities with hypertension detection, treatment and control

	Detection among hypertension participants				Treatment among detected participants				Control among treated participants			
	Number	%	Odds ratio	95% CI	Number	%	Odds ratio	95% CI	Number	%	Odds ratio	95% CI
	287/460	62.4			217/287	75.6			124/217	57.1		
Age (years): < 35	16	29.1	1.00		12	75.0	1.00		7	58.3	1.00	
35–44	37	42.1	1.77	0.86–3.63	22	59.5	0.49	0.13–1.81	12	54.6	0.86	0.21–3.56
45–54	99	66.9	4.92	2.51–9.67	78	78.8	1.24	0.36–4.24	47	60.3	1.08	0.32–3.72
55–64	78	75.0	7.31	3.52–15.20	58	74.4	0.97	0.28–3.34	32	55.2	0.88	0.25–3.10
≥ 65	57	87.7	17.37	6.77–44.52	47	82.5	1.57	0.42–5.87	26	55.3	0.88	0.24–3.19
Gender: Male	67	41.6	1.00		41	61.2	1.00		20	48.8	1.00	
Female	220	73.6	3.91	2.61–5.86	176	80.0	2.54	1.40–4.59	104	59.1	1.52	0.77–3.00
Education (years): > 7	127	55.5	1.00		93	73.2	1.00		55	59.1	1.00	
≤ 7	160	69.3	1.81	1.24–2.65	124	77.5	1.26	0.73–2.16	69	55.7	0.87	0.50–1.49
% of life spent in city: < 50	83	56.1	1.00		65	78.3	1.00		34	52.3	1.00	
≥ 50	196	64.9	1.45	0.97–2.16	148	75.5	0.85	0.46–1.58	89	60.1	1.38	0.76–2.48
Work: Other	170	73.0	1.00		129	75.9	1.00		74	57.4	1.00	
Unemployed	117	51.5	0.39	0.27–0.58	88	75.2	0.96	0.56–1.67	50	56.8	0.98	0.57–1.69
House: Other	205	70.0	1.00		157	76.6	1.00		90	57.3	1.00	
Informal shack	82	49.1	0.41	0.28–0.61	60	73.2	0.83	0.46–1.50	34	56.7	0.97	0.53–1.77
Lowest/poorest wealth tertile: No	222	67.7	1.00		166	74.8	1.00		97	58.4	1.00	
Yes	65	49.2	0.46	0.31–0.70	51	78.5	1.23	0.63–2.39	27	52.9	0.80	0.43–1.50
Problematic alcohol use: No	238	69.6	1.00		183	76.9	1.00		105	57.4	1.00	
Yes	49	41.5	0.31	0.20–0.48	34	69.4	0.68	0.35–1.34	19	55.9	0.94	0.45–1.96
Smoking ≥ 1 cigarette/day: No	254	67.7	1.00		197	77.6	1.00		114	57.9	1.00	
Yes	33	38.8	0.30	0.19–0.49	20	60.1	0.45	0.21–0.95	10	50.0	0.73	0.29–1.83
Family history of hypertension: No	141	56.0	1.00		101	71.6	1.00		61	60.4	1.00	
Yes	138	69.7	1.81	1.22–2.68	112	81.2	1.71	0.97–2.99	62	55.4	0.81	0.47–1.40
Body mass index ≥ 30 kg/m^2: No	97	46.2	1.00		70	72.2	1.00		44	62.9	1.00	
Yes	190	76.0	3.69	2.48–5.49	147	77.4	1.32	0.75–2.31	80	54.4	0.71	0.39–1.26
Diabetes: No	189	54.6	1.00		134	70.9	1.00		77	57.5	1.00	
Yes	98	86.0	3.69	2.48–5.49	83	84.7	2.27	1.21–4.28	47	56.6	0.97	0.56–1.68
Dyslipidaemia: No	102	52.9	1.00		71	69.6	1.00		41	57.8	1.00	
Yes	185	69.3	5.09	2.88–8.99	146	78.9	1.63	0.94–2.83	83	56.9	0.96	0.54–1.71
Chronic kidney disease: No	259	60.2	1.00		193	74.5	1.00		112	58.0	1.00	
Yes	28	93.3	9.24	2.17–39.31	24	85.7	2.05	0.69–6.13	12	50	0.72	0.31–1.69

Work: other: employed, pensioners, homemakers, students and those receiving disability grants, House: other: council/core house, hostel and built formal unit (private); Problematic alcohol use: CAGE ≥ 2, Family history of hypertension: first degree relative; Diabetes: fasting plasma glucose ≥ 7.0 mmol/l and/or 2-h post glucose load ≥ 11.1 mmol/l, and participants with known/detected diabetes, Dyslipidaemia: low-density lipoprotein cholesterol ≥ 3 mmol/l or on treatment, Chronic kidney disease: estimated glomerular filtration rate < 60 mL/min/1.73m^2

Table 2 Multivariable logistic regression models for the associations with hypertension detection, treatment and control

	Detection among hypertension participants ($n = 287$)			Treatment among detected participants ($n = 217$)			Control among treated participants ($n = 124$)		
	Odds ratio	95% CI	*p*-value	Odds ratio	95% CI	*p*-value	Odds ratio	95% CI	*p*-value
Age in years: < 35	1.00								
35–44	1.68	0.73–3.88	0.222	0.41	0.10–1.66	0.213	0.77	0.17–3.46	0.736
45–54	3.61	1.62–8.06	**0.002**	1.15	0.31–4.30	0.834	1.13	0.30–4.20	0.859
55–64	5.22	2.13–12.78	**< 0.001**	1.03	0.26–4.04	0.967	0.85	0.22–3.31	0.814
≥ 65	9.22	2.72–31.23	**< 0.001**	2.80	0.56–13.93	0.208	1.03	0.24–4.43	0.974
Gender: female	3.56	1.94–6.55	**< 0.001**	3.29	1.42–7.67	**0.006**	2.36	1.01–5.51	**0.048**
Education: ≤ 7 years	1.76	1.02–3.03	**0.042**	1.42	0.73–2.77	0.301	0.91	0.48–1.70	0.757
≥ 50% of life spent in city	1.82	1.07–3.10	**0.027**	0.97	0.47–1.99	0.923	1.52	0.78–2.97	0.216
Work: unemployed	0.77	0.46–1.28	0.309	1.32	0.68–2.59	0.414	0.93	0.47–1.84	0.839
House: informal shack	0.99	0.58–1.70	0.965	0.85	0.41–1.76	0.659	1.00	0.49–2.02	0.993
Wealth tertile: lowest/poorest	0.51	0.28–0.92	**0.026**	1.03	0.44–1.76	0.948	0.78	0.36–1.69	0.525
Problematic alcohol use	0.67	0.38–1.20	0.183	1.09	0.47–2.54	0.833	0.98	0.42–2.27	0.959
Smoking ≥ 1 cigarette/day	0.96	0.50–1.87	0.913	0.52	0.21–1.30	0.164	0.58	0.20–1.66	0.308
Family history of hypertension	1.81	1.09–3.00	**0.022**	1.82	0.97–3.43	0.164	0.72	0.39–1.31	0.277
Body mass index ≥ 30 kg/m^2	1.56	0.89–2.73	0.120	0.56	0.25–1.23	0.149	0.53	0.26–1.07	0.076
Diabetes	3.51	1.80–6.86	**< 0.001**	2.00	0.99–4.03	0.054	0.95	0.52–1.72	0.862
Dyslipidaemia	1.05	0.64–1.72	0.854	1.26	0.66–2.41	0.481	0.80	0.42–1.52	0.493
Chronic kidney disease	6.27	1.31–30.10	**0.022**	1.66	0.51–5.40	0.403	0.68	0.28–1.65	0.398

Problematic alcohol use: CAGE ≥ 2; Family history of hypertension: first degree relative; Diabetes: fasting plasma glucose ≥ 7.0 mmol/l and/or 2-h post glucose load ≥ 11.1 mmol/l, and participants with known/detected diabetes, Dyslipidaemia: low-density lipoprotein cholesterol ≥ 3 mmol/l or on treatment, Chronic kidney disease: estimated glomerular filtration rate < 60 mL/min/1.73m^2

counterparts (41.5% vs. 69.6%) and in daily smokers vs. their counterparts (38.8% vs. 67.7%). Detected hypertension was higher in participants who were ≥ 45 years old, had ≤ 7 years vs. > 7 years of education (69.3% vs. 55.5%), a family history of hypertension vs. none (69.7% vs. 56%), and BMI ≥ 30 kg/m^2 vs. < 30 kg/m^2 (76.0% vs. 46.2%). Hypertension detection was higher in participants with comorbidities i.e., in those with compared to without diabetes (86.0% vs. 54.6%), dyslipidaemia (69.3% vs. 52.9%) and CKD (93.3% vs. 60.2%).

Hypertension treatment among the detected was significantly higher in females and participants with comorbid diabetes, while it was lower in those who smoked daily. Hypertension control among the treated was not significantly different by any sociodemographic characteristic, lifestyle behaviour or the presence of comorbidities (Table 1).

In the multivariable logistic regression analyses, as shown in Table 2, detected hypertension among participants with hypertension was significantly associated with age ≥ 45 years, female gender (OR: 3.56, 95% CI: 1.94–6.55), a family history of hypertension (OR: 1.81, 95% CI: 1.09–3.00), ≤ 7 years of education (OR: 1.76, 95% CI: 1.02–3.03), ≥ 50% of life spent in city (OR: 1.82, 95% CI: 1.07–3.10) and comorbid diabetes (OR: 3.51, 95% CI: 1.80–6.86) or CKD (OR: 6.27, 95% CI: 1.31–30.10). Notably, the poorest participants i.e., in lowest tertile, were half as likely as their counterparts to have their hypertension detected (OR: 0.51, 95% CI: 0.28–0.92). The association of known/detected diabetes with detected hypertension increased markedly when it replaced all diabetes in the latter model (OR: 11.32, 95% CI: 3.67–34.90). There was no change in the direction or significance of the other variables in the model except for ≤ 7 years of education, which was no longer significant ($p = 0.069$).

Treated hypertension in those detected was significantly associated with female gender (OR: 3.29, 95% CI: 1.42–7.67) and just missed being associated with comorbid diabetes (OR: 2.00, 95% CI: 0.99–4.03). When known/detected diabetes replaced diabetes in the latter model, the association with treated hypertension remained similar (OR: 2.16, 95% CI: 0.95–4.93). There was no change in the direction or significance of the other variables in the model.

Hypertension control among participants who were treated was only significantly associated with female gender (OR: 2.36, 95% CI: 1.01–5.51) in the logistic regression analyses. When known/detected diabetes replaced diabetes in the latter model, the association with hypertension control remained non-significant.

Supplementary Table 1 demonstrates the associations of undetected hypertension compared with no hypertension. Participants aged 35–64 years were 2–five-fold more likely to have undetected hypertension vs. no hypertension. Men compared with women twice as likely to have undetected hypertension (OR: 2.20, 95%CI: 1.40–3.45).When known/detected diabetes replaced all diabetes in the latter model, the association with undetected hypertension remained non-significant.

Discussion

The influences of optimal hypertension management are complex and involve determinants at the healthcare service, healthcare provider, patient and community levels [18–20]. This study explored selected patient-related factors that may be associated with hypertension care and illustrated the sub-optimal levels of hypertension detection, treatment and control in urban black South Africans. Increasing age, female gender, a family history of hypertension, greater urbanisation, lower education level and the presence of comorbid diabetes or CKD were related to better detection of hypertension. Notably, the poorest participants were half as likely as their less poor counterparts to have their hypertension detected. Female gender was associated with hypertension treatment among the detected and was linked with hypertension control among those treated.

Despite the higher prevalence of detected hypertension in this study (62%) compared with a national South African study in 2016 (women: 29%, men: 19%) [5] and a systematic review of SSA countries overall (27%) [21], this was suboptimal. It was lower than the target of 90% recommended for the detection of raised BP by the National Strategic Plan (NSP) for the prevention and control of NCDs [22], and the 80% target proposed by the World Hypertension League for Africa [23].

In contrast, the prevalence of treated hypertension among the detected, at 76%, was lower than the treatment rates among men (85%) and women (82%) detected with hypertension in the 2016 SADHS [5]. Inadequate hypertension treatment among the detected has been reiterated in other South African studies where there were poor linkages to care [24, 25]. In a rural area, only about a quarter (27%) of those with newly diagnosed raised BP sought care in the subsequent two years [24], and in a community screening programme, only 29% of individuals referred for raised BP presented for a clinic assessment [25]. The target recommended by the World Hypertension League for Africa is for 80% of diagnosed hypertension to be treated [23]. The NSP does not have a similar target but aims for 60% of individuals with raised BP to be treated [22]. Hypertension treatment among participants with hypertension, at 47% in this study, was lower than the NSP target. The suboptimal level of treated hypertension by either criterion underscores the need to ensure that individuals detected with hypertension receive treatment. Further research is necessary to identify and address the barriers to healthcare access and implement novel solutions. The latter may include expanding clinic service hours, decentralising of primary healthcare services with mobile clinics taken into communities, etc. [18, 24].

The latter suggestions may also improve hypertension detection amongst the poorest participants who were half as likely to have their hypertension detected compared with their less poor counterparts. The poor may experience greater difficulties in accessing healthcare despite hypertension screening and treatment being provided free of charge at the primary healthcare level in South Africa. These barriers to care experienced by the poor may include transport costs which are likely to be a considerable hurdle to accessing care for individuals with little income or savings [26, 27]. Further, the poor are more likely to be adversely affected by time lost from income-generating tasks when attending healthcare facilities; the latter are generally overburdened and have long waiting times leading to a major part of the day being spent at the clinic [26, 28]. The smaller sample sizes of participants with treated and controlled hypertension may have contributed to the absence of associations of wealth tertiles with these hypertension care measures.

Similarly, the association of urbanisation with detected hypertension underscores the vulnerability of less urbanised participants who may be migrants from rural areas. This study was conducted in an urban setting and less urbanised participants who were less familiar with the city may have greater difficulty in accessing healthcare [29]. Decentralisation of healthcare services together with easy access to community healthcare workers for BP screening, and the use of mobile Health (mHealth) for remote consultations, etc., may allow the less urbanised and the poorest individuals better access to healthcare [18, 19].

In contrast, the association of greater hypertension detection with comorbid diabetes or CKD is likely related to these individuals being in closer contact with healthcare services than their counterparts because of their ill-health. They are, therefore, more likely to have frequent BP screenings and to be detected and treated when diagnosed with hypertension. This is reinforced by the markedly stronger association of known/detected diabetes only vs. all diabetes with detected hypertension. It is further a reflection of the care provided to patients with known/detected diabetes who are more likely to have their BPs regularly checked.

Similarly, better hypertension care in women was unsurprising and generally accords with findings from middle-income and other African countries [30–34]. It is likely associated with greater healthcare seeking behaviour with women regularly attending maternal and child health programmes leading to more frequent opportunities for BP testing, etc. [33, 35–37]. Men generally utilise healthcare services less frequently leading to decreased opportunities for BP screening and having their hypertension diagnosed [32]. Traditional gender roles with men perceived to be healthy may lead to their underutilisation of healthcare services [36]. They may also be more likely to be breadwinners and more time constrained to attend healthcare facilities during office hours [36]. This explanation is in keeping with the greater likelihood of undetected hypertension in men compared with women revealed in this study. These findings also accord with other South African studies where women were more likely to have their hypertension detected and treated [24, 38].

The greater likelihood of undetected hypertension in 35–64-year-old participants underlines the need for targeted hypertension screening programmes to be directed at this age group. They were 2–fivefold more likely to have undetected hypertension, which suggests that screening strategies aimed at 35–64-year-olds are likely to effectively and optimally identify individuals with hypertension. Similarly, men were twice as likely as women to have undetected hypertension and should be targeted for regular BP monitoring. Interestingly, other sociodemographic characteristics, risky lifestyle behaviours, a family history of hypertension nor the presence of comorbidities were related to undetected hypertension. This suggests that using these variables to identify individuals with undetected hypertension may not prove useful.

The approximately two-fold greater likelihood of being detected with hypertension in the presence of a family history of hypertension may be linked to greater knowledge of the disease or encouragement from family members to seek care compared to those without a family history [27]. Awareness of the consequences of hypertension likely influences behaviour and motivates regular BP testing [36, 39]. However, knowledge about hypertension among patients with hypertension in South Africa is generally inadequate [39, 40] with patients reporting that they did not receive adequate information or counselling from their healthcare provider [40]. This illustrates a need for greater patient education to encourage health-seeking behaviours for hypertension care; this may be enhanced with the use of technology (mHealth) such as text messaging, etc. [19].

The association of lower education levels with greater hypertension detection was surprising because individuals with less education may be less equipped to heed health prevention and promotion messages encouraging hypertension screening; greater education level is generally expected to enhance access to information, increase knowledge and influence behaviour [26, 36]. Nevertheless, a similar link of lower education levels with greater hypertension detection was reported in South African studies conducted in another province [41] and nationally [38]. Individuals with lower education levels may be more accessible to community healthcare workers during home visits [41]; those at home may also be more likely to be women and older individuals.

Only 57% of treated hypertension participants in this study achieved good BP control; this rate was much lower than the 80% recommended by the World Hypertension League [23], but fulfilled the NSP target of 50% of individuals receiving treatment to be controlled [22]. Nevertheless, the NSP target for hypertension control is low and the higher level of 80% controlled hypertension among the treated should be the goal. The low NSP target may have been guided by the poor rates of hypertension control among the treated in the SADHS which were 30% in women and 26% in men [5]. Higher rates of hypertension control in this study compared with the SADHS, a nationally representative study, may reflect better healthcare provided in urban versus rural settings and in Cape Town compared with other centres in the country. Despite the availability of cost-effective, efficient, combination therapy and convenient once daily treatment regimens, optimal hypertension control remains a challenge. Common factors contributing to poor hypertension control include unavailability of medicines at clinics, healthcare provider inertia to optimise treatment, and non-adherence to clinic visits or medication regimens by patients, among other multiple barriers to optimal BP control [36].

Strengths and limitations.

The strengths of this study include the objective clinical and biochemical measurements of comorbidities of diabetes, CKD, dyslipidaemia and obesity in a community-based population. Limitations include the cross-sectional study design which precludes inferences on causality, the low sample realisation in men which is common in local epidemiological studies, and BP readings measured on a single occasion only. The small sample of participants with treated and controlled hypertension may have contributed to the lack, apart from female gender, of significant associations in these models. Additionally, the absence of data on other influences of hypertension care such as medication adherence, hypertension knowledge, distances travelled to clinics, cultural influences and beliefs, etc.

prevented a more nuanced examination of the determinants of hypertension detection, treatment and control.

Conclusions

This study highlights the gaps in detection among those with hypertension, treatment in the detected and control in those treated compared with the proposed World Hypertension League targets of 80%, 80% and 80% for Africa [23]. Furthermore, this study demonstrated lower hypertension detection amongst the most vulnerable i.e., the poorest participants and the less urbanised who were probably migrant from rural areas of the country. Women were more likely to have better hypertension management probably because of their more frequent contact with healthcare services. Research is required to identify additional barriers and potential solutions to the uptake of optimal hypertension care, which may differ by age, gender, socioeconomic status and level of care.

Supplementary Information

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Supplementary Material 1

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Authors' contributions

Manuscript concept and design: NP, APK. Acquisition, analysis, or interpretation of data: NP, NL, JG, CL, APK . Drafting of the manuscript: NP. All authors have read and approved the manuscript.

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Data availability

The authors would like to acknowledge the study participants, and the SAMRC fieldwork team and statisticians. We thank the City of Cape Town for the provision of the aerial maps.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the South African Medical Research Council's Human Research Ethics Committee (EC026-9/2016) and the University of Cape Town's Research and Ethics Committee (224/2006). All participants signed informed consent.

Consent for publication

Not applicable.

Competing interests

Naomi Levitt has received honoraria from Novartis for serving on the steering committee for the Navigator Trial and travel support from Novo Nordisk, Eli Lilly Laboratories and Sanofi Aventis. All other authors report no potential conflicts of interest, including specific financial interests, relevant to the subject of this manuscript.

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