

# Hypertension and associated risk factors among informal waste pickers in Johannesburg, South Africa

V Ntlebi<sup>1</sup>, F Made<sup>1,2</sup>, K Wilson<sup>1,2</sup>, T Kootbodien<sup>1</sup>, N Tlotleng<sup>1</sup>, N Naicker<sup>1,2,3</sup>

<sup>1</sup>National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa

<sup>2</sup>School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

<sup>3</sup>Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa

**Correspondence:** Mr Vusi Ntlebi, National Institute for Occupational Health, 25 Hospital Street, Constitution Hill, Johannesburg, 2001, South Africa e-mail: vusint@nioh.ac.za

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## ABSTRACT

**Background:** A growing number of individuals, commonly known as waste pickers, driven by poverty and unemployment, earn a living recovering recyclable material. A few studies have investigated the prevalence of hypertension in the South African general population but none has investigated hypertension in waste pickers. We aimed to estimate the proportion of hypertension and to identify associated risk factors among waste pickers in Johannesburg, South Africa.

**Methods:** In this cross-sectional study, convenience sampling was used to select waste pickers at two landfill sites in Johannesburg, in 2018. Health-screening assessments included measurements of weight, height and blood pressure. An electronic questionnaire was used to collect socio-demographic, health status and behavioural information. Descriptive statistics for continuous covariates, such as age, were summarised as means and standard deviations, while categorical variables were summarised as numbers and percentages. The two-sample test for proportions was conducted to assess the differences in proportions of hypertension. Logistic regression was used to test associations between hypertension and risk factors.

**Results:** Three hundred and sixty-one landfill waste pickers participated in the study. Of these, 265 (73.4%) were male and 96 (26.6%) were female. The proportion of women (42.7%; n = 41) with hypertension was higher than that of men (24.2%; n = 64). The adjusted analyses showed that age and injuries were statistically significantly associated with hypertension. For every one-year increase in age, the odds of developing hypertension increased by 5% (AOR = 1.05; 95% CI: 1.03–1.09). The AOR for hypertension in waste pickers with injuries was double that of waste pickers without injuries (AOR = 2.43; 1.20–4.97).

**Conclusion:** The proportion of landfill waste pickers with hypertension was higher among women than men. Age and injuries were associated with hypertension. The findings suggest the need for a combination of primary healthcare and occupational health services for these workers.

## INTRODUCTION

Urbanisation has resulted in increasing poverty due to few job opportunities, especially for migrants with low education levels.<sup>1,2</sup> Worldwide, rapid urbanisation produces huge amounts of recyclable waste material in towns and cities, and an estimated 15 million people are involved in informal waste recycling.<sup>3,4</sup> In developing countries, uncontrolled urbanisation has led to people resorting to informal economic activities,<sup>5</sup> such as waste picking. In South Africa, it is estimated that there are 60 000 to 90 000 waste pickers but, with rising unemployment and urbanisation, the actual number may be as high as 215 000.<sup>6</sup> Due to the informal nature of their work, waste pickers are not covered by the Occupational Health and Safety Act and therefore cannot access unemployment benefits established by law.<sup>7</sup> Due to their poor working conditions and low income, waste pickers find themselves socially and economically vulnerable.<sup>4</sup>

Waste picking poses potential health and safety risks related to hazards, such as heavy workloads and exposures to toxic chemicals, harmful microbial substances or dust particles.<sup>8</sup> Research on informal recycling has shown an association between working at a landfill site and increased poor health and injuries.<sup>8-10</sup> Waste pickers work long hours and often put health considerations, such as visiting local healthcare facilities for health check-ups, at the bottom of their lists of priorities.<sup>11</sup>

Poor socio-economic status may be associated with non-communicable diseases (NCDs), such as hypertension and other cardiovascular diseases.<sup>12</sup> A 2011 World Health Organization (WHO) report projected that NCDs will be the leading cause of death, globally, possibly exceeding deaths due to communicable diseases, by 2030.<sup>13</sup> Hypertension is a major global public health problem and a major risk factor for cardiovascular diseases, such as chronic heart disease and stroke.<sup>14</sup> Bradshaw et al. reported that the most prevalent NCDs leading to many premature adult deaths in South Africa are hypertension, stroke and ischaemic heart disease.<sup>15</sup> According to the WHO, in 2016 Africa had the highest prevalence of hypertension: 46% for both sexes combined.<sup>16</sup> Lloyd-Sherlock and colleagues, using the WHO Global Ageing and Adult Health (WHO-SAGE) data collected from 2007 to 2010, found that the prevalence of hypertension in South Africa in people older than 50 years, was above 77% and was among the highest in all sub-Saharan countries.<sup>17</sup>

Several factors, including age, education, income, smoking, obesity, physical inactivity and excessive alcohol consumption have been shown to influence the risk of developing hypertension.<sup>18,19</sup> To our knowledge, no study has investigated hypertension among landfill waste pickers in South Africa. We aimed to estimate the proportion

and associated risk factors of hypertension among waste pickers in Johannesburg, South Africa.

## METHODS

We conducted a cross-sectional study in two of the largest landfill sites in Johannesburg. The first site is located west of Johannesburg, with approximately 600 active waste pickers. The second site, with approximately 3 000 waste pickers, is located south-west of Johannesburg. Waste pickers aged 18 years and older who were present on the day of the study were recruited; participation was voluntary.

The sample size was calculated as 348 to have a confidence level of 95%. The numbers were proportionately distributed between the two landfill sites: 81% (n = 284) and 19% (n = 68) for sites 1 and 2, respectively. Convenience sampling was used to select study participants. To account for non-responses, additional participants were recruited. Trained nurses performed health-screening assessments that included measurements of height, weight, temperature, cholesterol, haemoglobin and blood pressure.

The study was explained to waste pickers by trained field workers and the interviews were conducted in whichever one of the 11 South African languages that the participants understood. Trained field-workers interviewed the participants after obtaining consent, using a structured and validated electronic questionnaire. Information was collected on socio-demographic, work-related, health and behavioural factors (Table 1). Questions on health status and access to health services, such as the use of antihypertensive treatment at the time of the study, chronic medical conditions, and clinic visits in the past 12 months, were included.

Ethics clearance was obtained from the Human Research Ethics Committee (Medical), University of the Witwatersrand (clearance certificate number: M171120). Permission to conduct the study at the landfill sites was obtained from the landfill management.

## Data analysis

Data were captured using RedCap and then imported into Excel. Data cleaning and analyses were conducted using Stata SE version 15.1 (StataCorp. 2017. College Station, TX: StataCorp LLC). Descriptive statistics for continuous covariates, such as age, were summarised as means and standard deviations, while categorical variables were summarised as numbers and percentages. Hypertension was defined as systolic blood pressure  $\geq$  140 mmHg and/or diastolic blood pressure  $\geq$  90 mmHg.

A logistic regression model was fitted to assess the association between hypertension and other risk factors. Unadjusted analysis was conducted to assess the association by individual variables.

Adjusted logistic regression analysis was fitted using all variables with a forward variable addition model building method. The maximum likelihood ratio test was used to select variables that were significant at the 5% level for inclusion into the final multivariable model. Interaction terms for age and body mass index (BMI), and age and diabetes, were also investigated. Clustering in the two landfill sites was accounted for by robust estimation of standard errors. Results were presented as odds ratios with 95% confidence intervals. The final model was tested using Pearson's chi-square goodness of fit test.

## RESULTS

### Socio-demographic characteristics, health status, behavioural factors and hypertension

A total of 361 landfill waste pickers participated in the study; 265 (73.0%) were male and 96 (27.0%) were female (Table 2). The mean age of the participants was  $34.0 \pm 10.3$ . The average monthly income was R1 792. Most had a secondary education (n = 285, 79.2%), 72.0% (n = 252) were smokers, and 41.7% (n = 116) consumed alcohol. Seventy-nine (21.9%) of the participants were overweight/obese. About half (55.0%) of the participants had normal body weights; 2.2% reported to have been diagnosed with diabetes.

The overall proportion of hypertension among waste pickers was 29.1% (n = 105). A higher proportion of women (n = 41, 42.7%) than men (n = 64, 24.2%) had hypertension (p = 0.046). Out of the eight waste pickers who reported having diabetes, 75.0% (n = 6) had hypertension. The proportion with hypertension was higher in smokers than non-smokers (Table 2). Sixty-eight percent of the waste pickers reported accidents, of which 89.7% were related to sharp objects.

Unadjusted odds ratios (ORs) and adjusted odds ratios (AORs) for hypertension in relation to socio-demographic and health factors are presented in Table 3. In the unadjusted analyses, sex (OR 2.34, 95% CI 1.43–3.83), age (OR 1.06, 95% CI 1.04–1.09), smoking (OR 0.50, 95% CI 0.31–0.83), BMI group (OR 2.13, 95% CI 1.07–4.26), and diabetes (OR 7.17, 95% CI 1.53–38.87) were statistically significantly associated with hypertension.

The final multivariable model included sex, age, smoking status, BMI, diabetes and injuries (Table 3). The model had good fit as the difference between the observed and expected values was not statistically significant (p = 0.465). There were no significant interactions between age and diabetes (p = 0.698) or between age and BMI (p = 0.090). Age and injuries were significantly associated with hypertension. For every one-year increase in age, the adjusted odds of developing hypertension increased by 5%. Individuals who experienced injuries at work had more than

**Table 1. Summary of information collected**

Category	Information
Socio-demographic information	Age, sex, height, weight, number of children, language spoken, country of birth, province of birth, years lived in Johannesburg, place of residence, landfill site, residential suburb, education, monthly income, type of housing
Work conditions	Years spent in this job, place of work, type of material handled, exposure to risks, use of personal protective equipment, occupational accidents
Lifestyle/behaviour	Alcohol consumption, smoking status
Health conditions	Diabetes, hypertension, tuberculosis, asthma, HIV, cancer, respiratory diseases, allergies, waterborne diseases, mental disorders
Access to health services	Clinic visit in last 12 months, diagnosis, type of healthcare

double the likelihood of having hypertension than those who did not (AOR 2.4, CI 1.20–4.97). The AOR for hypertension in obese waste pickers was 1.82 times greater than that in waste pickers with normal weight (AOR 1.82, 95% CI 0.85–3.95) but the association was not statistically significant. Although the AOR for waste pickers with diabetes

was five times higher than for those without diabetes (AOR 5.21, 95% CI 0.98–27.70), the association was not statistically significant. The AORs for sex, education, housing type, smoking status, alcohol use, CMD, HIV and tuberculosis (TB) status were not statistically significant.

**Table 2. Characteristics of informal waste pickers by hypertension status (N = 361)**

Characteristic	Hypertension			
	No (n = 256)		Yes (n = 105)	
	Mean	SD	Mean	SD
Age (years)	32.0	9.1	38.8	11.4
Monthly income (ZAR)	1 874.1	2 179.1	1 594.9	1 343.9
	n	%	n	%
Sex				
Male	201	75.8	64	24.2
Female	55	57.3	41	42.7
Education				
None	8	53.3	7	46.7
Primary	39	66.1	20	33.9
Secondary	208	72.7	78	27.3
Housing type				
Formal house	76	72.4	29	27.6
Informal house	53	70.7	22	29.3
Backyard formal	45	68.2	21	31.8
Backyard informal	79	70.5	33	29.5
Smoking status				
Non-smoker	59	60.2	39	39.8
Smoker	189	75.0	63	25.0
Alcohol consumption				
No	119	73.5	43	26.5
Yes	84	72.4	32	27.6
BMI category				
Underweight	67	80.7	16	19.3
Normal weight	139	70.2	59	29.8
Overweight	28	71.8	11	28.2
Obese	21	52.5	19	47.5
Diabetes				
No	252	72.0	98	28.0
Yes	2	25.0	6	75.0
HIV status				
Negative	219	71.8	86	28.2
Positive	26	65.0	14	35.0
Tuberculosis				
No	245	70.8	101	29.2
Yes	8	72.7	3	27.3
CMD				
No risk	166	72.5	63	27.5
At risk	90	68.2	42	31.8
Injuries				
No	49	79.0	13	20.9
Yes	206	69.4	91	30.6

SD: standard deviation; CMD: common mental disorders

## DISCUSSION

Hypertension is a silent killer as symptoms are rarely visible in its early stages; thus, it is important to control as a chronic disease.<sup>14</sup> Almost 30% of the waste pickers in our study had hypertension. This is lower than the 45% prevalence in the general population of South Africa as reported by Davids et al. (2019).<sup>20</sup> The proportion of hypertension in our study is similar to that observed in Latin American (24.4%) and Brazilian (32.8%) waste pickers.<sup>11,21</sup> We also found that age and injuries were associated with hypertension.

A higher proportion of women than men had hypertension (43% and 24%, respectively). The 2013 WHO data showed that 27.4% of men and 26.1% of women in South Africa had hypertension.<sup>22</sup> Everett et al.<sup>23</sup> and Shirani et al.<sup>24</sup> reported that women who are younger than 50 years (premenopausal) have a lower hypertension prevalence than older women, and also showed that prevalence of hypertension was higher in women than in men.<sup>22</sup>

Although we found no statistically significant association between diabetes and hypertension, the association is reported in the literature. Bretzel et al. (2007)<sup>25</sup> reported an increased prevalence of hypertension among individuals with diabetes and showed that non-diabetic individuals with high blood pressure were 2.5 times more likely to develop diabetes within five years than those with normal blood pressure.<sup>25</sup> We found that obese waste pickers had twice the odds of reported hypertension than those of normal weight, although the association was not statistically significant. Obesity develops when there is an imbalance between energy intake and energy expenditure. Although genetic predisposition may lead to development of obesity, eating habits and physical activity patterns play a more prominent role in obesity (2016).<sup>26</sup> Contrary to our findings, Gao et al. (2016) found that obesity was significantly associated<sup>27</sup> with an increased prevalence of hypertension in both males and females. Similarly, Patel et al. (2016) reported that an abnormally high BMI was associated with an increased probability of diabetes and hypertension among men aged 40 to 69 years.<sup>28</sup>

We found that waste pickers who experienced injuries while at work were likely to have hypertension. Most of the waste pickers (68.7%) reported accidents, most of which were related to sharp objects. These injuries can cause anxiety, which is associated with elevated blood pressure.<sup>29,30</sup> Anxiety may be due to the fact that injured waste pickers are unable to work for some time and therefore cannot provide for their families. This was reported by Chokhandre et al. (2017) who investigated the economic burden of injuries and morbidities in terms of work days lost and persistence of injuries/illness among waste pickers.<sup>2</sup> They found that the mean number of workdays lost due to injuries/illness was significantly higher among waste pickers (18 days) than a comparison group (11 days) with similar characteristics (living in and around the same community as the waste pickers).<sup>2</sup>

## Strengths and limitations

The study was conducted while waste pickers were at work, providing us with an opportunity to observe their work practices.

The results of this study are not generalisable to all waste pickers in South Africa since the study was restricted to two landfill sites in Johannesburg. In addition, participants were selected using convenience sampling. Due to the cross-sectional nature of the study design, we could not draw any conclusions about the cause of hypertension in this population. There could also have been recall bias as some participants might recall or forget events depending on their nature or severity.

## CONCLUSION

This is the first study conducted in South Africa on hypertension in waste pickers. The proportion of landfill waste pickers with hypertension was high, but less than that reported in the general South African population. Hypertension was associated with increasing age and injuries experienced by waste pickers. The introduction of health awareness programmes could assist with the prevention, early detection and comprehensive management of hypertension in this group of workers.

**Table 3. Factors associated with hypertension in waste pickers**

Variable	OR	95% CI	P value	AOR	95% CI	P value
<b>Sex</b>						
Male	1.00 (ref.)			1.00 (ref.)		
Female	2.34	1.43–3.83	0.001	1.24	0.60–2.57	0.555
<b>Age (years)</b>						
	1.06	1.04–1.09	< 0.001	1.05	1.03–1.09	< 0.001
<b>Education</b>						
None	1.00 (ref.)					
Primary	0.59	0.18–1.85	0.362			
Secondary	0.42	0.15–1.22	0.113			
<b>Income (ZAR)</b>						
	0.99	0.99–1.00	0.414			
<b>Housing Type</b>						
Formal house	1.00 (ref.)					
Informal dwelling	1.09	0.56–2.09	0.801			
Backyard formal	1.22	0.60–2.39	0.557			
Backyard informal	1.09	0.61–1.97	0.764			
<b>Smoking status</b>						
No	1.00 (ref.)			1.00 (ref.)		
Yes	0.50	0.31–0.83	0.007	0.81	0.41–1.62	0.559
<b>Alcohol consumption</b>						
No	1.00 (ref.)					
Yes	1.05	0.62–1.80	0.847			
<b>BMI category</b>						
Normal	1.00 (ref.)			1.00 (ref.)		
Underweight	0.56	0.30–1.05	0.071	0.52	0.25–1.09	0.083
Overweight	0.93	0.43–1.98	0.842	0.74	0.33–1.68	0.476
Obese	2.13	1.07–4.26	0.032	1.82	0.85–3.95	0.124
<b>Diabetes</b>						
No	1.00 (ref.)			1.00 (ref.)		
Yes	7.17	1.53–38.87	0.013	5.21	0.98–27.70	0.053
<b>HIV status</b>						
Negative	1.00 (ref.)					
Positive	1.37	0.68–2.75	0.374			
<b>Tuberculosis</b>						
No	1.00 (ref.)					
Yes	0.91	0.24–3.49	0.890			
<b>CMD</b>						
No risk	1.00 (ref.)					
At risk	1.23	0.77–1.96	0.386			
<b>Injuries</b>						
No	1.00 (ref.)			1.00 (ref.)		
Yes	1.67	0.86–3.22	0.130	2.43	1.20–4.97	0.014

OR: odds ratio; AOR: adjusted odds ratio; CI: confidence interval

## LESSONS LEARNED

1. Leadership by government is key for the recognition of the role played by waste pickers as they struggle to survive while, at the same time, keeping the environment clean.
2. The labour associations formed by waste pickers are key to accessing the waste picker community.
3. Waste picking activities at landfill sites prolong the lifespan of the sites, saving municipalities much money in the process.
4. Health and safety awareness campaigns are vital for the reduction of injuries experienced by waste pickers.
5. The provision of ablution facilities at landfill sites is needed to promote the dignity of waste pickers, especially women.

## DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

## AUTHOR CONTRIBUTIONS

Conception and design of the study: VN, FM, TK, NT, NN, KW

Data acquisition: VN, NN

Data analysis: VN, FM

Interpretation of the data: VN, FM, NN,

Drafting of the paper: VN

Critical revision of the paper: VN, FM, TK, NT, KW, NN

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