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Tobacco use and the Risk of Non-communicable Diseases (NCDs) in Zimbabwe: A Comparative Study of the Smoking Characteristics of Urban (Bulawayo Province) and Rural settings (Mashonaland East Province)

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Abstract:

Aim: The study analysed tobacco smoking characteristics in a rural and an urban setting of Zimbabwean males.

Background: There is limited information on the smoking characteristics of the Zimbabwean population, and yet smoking exposes individuals to non-communicable diseases (NCDs).

Objectives: To compare smoking practices and their relationship with demographic variables, analyze cessation characteristics, assess exposure to second-hand smoke, and evaluate the risk of metabolic factors for non-communicable diseases.

Methodology: The study focused on the provinces of Bulawayo (urban) and Mashonaland East (rural). Four hundred participants were randomly selected from the two provinces. A regression analysis was performed to check for relationships between variables (demographic characteristics and smoking, smoking, and metabolic risk factors for NCDs).

Results: The rural group was 52% less likely to have current tobacco smokers compared to the urban group, i.e., 16.6%, 95% C.I. (21.1 – 22.6) and 29.0%, 95% C.I. (23.5 – 36) respectively. The rural group was 58% less likely to have respondents who started smoking at the ages between 14 and 17 years. The respondents with tertiary education were 80% less likely to smoke tobacco compared to those with lower educational qualifications. Those resident in households with income between $400 and $600 were two times more likely to report smoking than those earning less than $400. Tobacco smokers were more than two times more likely to have elevated blood glucose than non-smokers.

Conclusion: Urbanisation has led to higher smoking levels. Smoking is positively associated with elevated blood glucose. There is a need for education campaigns on the harmful effects of smoking.

Keywords: Tobacco, Cession, Income, Education, Blood glucose, Blood pressure.

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1. INTRODUCTION

Developed countries, such as America, have higher smoking rates in rural areas than in urban areas [1]. The same pattern has also been witnessed in some developing countries such as India and China [2, 3]. However, a study conducted in Peru concluded that smoking rates are higher in urban areas than in rural areas [4]. Relationships between tobacco and demographic variables such as education, have also shown both positive and negative relationships [5-8]. Studies have also shown that tobacco smokers are at a higher risk of developing type 2 diabetes [9, 10]. A meta-analysis of the literature has revealed that tobacco smoking is also linked to increased blood pressure [11]. Evidence shows that tobacco smoking is a lifestyle risk factor for NCDs. The current tobacco prevalence rate in Zimbabwe is 18% [9]. The smoking rate for men is 17.5%, while for women is 1.3% [12]. Tobacco smoking in Zimbabwe has contributed to 11.5% of all deaths in men and 4.3% of all deaths in women [12]. The pattern shows that tobacco smoking affects more men in comparison to women, which is the reason this study only focuses on men. The Zimbabwe Demographic and Health survey reports that tobacco smoking rates are higher in rural areas (17.9%) than in urban areas (15.8%) [13]. This pattern is in contrast to studies in other low-income countries where smoking rates are higher in urban areas [4, 14]. The reported tobacco smoking rates for Mashonaland East province (which is largely rural) were comparable to that of Bulawayo province (urban setting) [13]. This study will contribute to the debates on the factors affecting smoking rates between rural and urban settings. The Zimbabwe Statistical Agency (ZimStat) report indicates that Bulawayo, an urban area, has the lowest prevalence rates of hypertension and diabetes combined. In contrast, Mashonaland East which is largely rural, has the highest rates [15]. This finding may be considered unexpected as studies have indicated that urbanisation is one of the underlying drivers associated with NCDs in developing countries [16]. This pattern is different from other studies in developing countries in Sub-Saharan Africa, namely Sierra Leone, Rwanda, Malawi, Ghana, and South Africa [17, 18]. There is a need to investigate this discrepancy in order to implement appropriate measures to reduce tobacco smoking and the associated risk of non-communicable diseases (NCDs) in both settings.To date, no studies have been conducted in Zimbabwe to determine the levels of smoking and their association with demographic characteristics. Existing studies on non-communicable diseases in Zimbabwe rely on data from other regions, which are then extrapolated to the Zimbabwean context [19]. Therefore, there is a pressing need for studies that provide actual statistics specific to Zimbabwe. The objectives of this study were to compare smoking rates between rural and urban settings, assess the relationship between tobacco smoking and demographic factors, and examine the association between tobacco smoking and the risk of high blood pressure and elevated glucose levels.

2. METHODOLOGY

Multi-stage probability-based sampling was employed to select 200 male respondents from Bulawayo Province (urban) and 200 male respondents from Mashonaland East Province (rural). The selection process began with the provinces, which were divided into districts, and then were further subdivided into wards. From these wards, households were randomly selected. The study utilized the enumeration areas (EAs) from the 2012 census, with wards being represented by these EAs. Each EA contains the locations of households, facilitating the sampling process. A total of 10 EAs were randomly selected, and 40 households were randomly chosen from each of these EAs.

Using the WHO STEP-wise approach, pictorial cards of tobacco were used to determine smokers, especially in the last 30 days. Daily smokers are defined as individuals who consumed at least one tobacco product (such as cigarettes, snuff, chewing tobacco, or pipe) every day or nearly every day for at least one month. The current rate of tobacco use was calculated as follows:

Number of current daily and less-than-daily tobacco users

Number of respondents (excluding Do not know respondents)

Current daily tobacco users: Number of current daily tobacco users

Number of respondents (excluding Do not know respondents)

Former Daily tobacco users: Number of daily users who no longer smoke

Number of respondents (excluding Do not know respondents)

The study employed a cross-sectional survey using the WHO step-wise questionnaire. A blood pressure monitor was used to measure blood pressure, and three readings (2 minutes apart) were taken for each participant. Normal blood pressure ranged from 120/80 to 139/89. Systolic and diastolic blood pressures were combined together, and those on treatment were put in the group with elevated blood pressure. For blood glucose, a glucose meter was used to take measurements, and each measurement was taken at least 2 hours after taking a meal. Blood glucose levels were determined from the measurements using a glucose meter. The meters were calibrated between strip batches and a code was used which had the correction factor. Measurements were done in the morning before participants had their breakfast. The advantage was that these readings were taken at night and are important for monitoring sugars related to diabetes control. Normal blood sugar level was between 4 mmol/l and 6.9 mmol/l. Respondents undergoing diabetes treatment were classified among those with elevated blood glucose.

3. DATA ANALYSIS

Using the WHO STEPwise approach, pictorial cards of tobacco were used to determine smokers, especially in the last 30 days. Exposure to secondhand smoke was analyzed

by assessing the presence of smokers at home and in confined workplaces. A Logistic regression analysis was performed to estimate the influence of the demographic factors on smoking outcome (age, level of education, marital status, income per month, knowledge level, place of residence).

4. RESULTS

4.1. Demographic Characteristics

Table **1** shows the demographic distribution of respondents according to age, education, income, and marital status. The rural group was 187% more likely to be aged between 18 and 24 years, 65% less likely to be aged between 35 and 44 years, and 65% less likely to be aged 55 years and above compared to the urban group. Rural respondents were 92% more likely to earn between $0 and $200.00 but 93% less likely to earn above $601.00.

4.2. Tobacco Smoking Characteristics

Table **2** shows the smoking characteristics of respondents from the two areas. The rural group was 52% less likely to have current tobacco smokers than the urban group. In terms of current daily smokers, the rural respondents were 68% less likely to participate than the urban respondents. The rural group was 60% less likely to have tobacco quitters than the urban group. The rural group was 65% less likely to report former daily smoking than the urban group. The rural group was 58% less likely to have respondents who started smoking at the ages of 14 and 17 years than the urban group. The rural group was 319% more likely to have respondents who started smoking between 18 and 21 years than the urban group. The respondents from rural areas were 80% less likely to have started smoking at the ages above 22 years than the urban respondents. The urban respondents started smoking tobacco at earlier ages than rural respondents. The rural group was 49% less likely to smoke manufactured cigarettes than the urban group.

4.3. Distribution of Blood Pressure and Blood Glucose

According to Table **3** the rural respondents were 70% more likely to have normal diastolic blood pressure than those in urban areas. The rural group was 137% more likely to have elevated systolic blood pressure than the urban group. After combining systolic and diastolic blood pressure, the rural group was 52% more likely to have respondents with elevated blood pressure. The respondents from the rural group were 593% more likely to not be on treatment than those in urban areas. There were significant differences in the mean diastolic blood pressure (p. 0.000 < 0.05, with a higher mean in urban areas. However, the mean systolic blood pressure was higher among the rural group (134.50) than the urban group (130.15) (p. < 0.035). The rural group was 170% more likely to have respondents with normal blood glucose levels than the urban group. The respondents in rural areas were 56% less likely to have elevated blood glucose than the urban respondents. The mean blood glucose for the urban group was 6.14, while for the rural group was 5.5. A t-test yielded a p-value of 0.000, indicating a significant mean difference. Individuals with elevated blood pressure and blood glucose were referred to the nearest health center for monitoring.

Table 1. Demographic characteristics.

-	Total n=200	Urban n % (95% CI)	Total n=200	Rural n% (95% CI)	Odds ratio (95%CI)	p-value
Age	-	-	-	-	-	-
18-24	41	20.9 (15.8 – 26)	85	42.4 (35.4 – 49.5)	2.866 (1.840 – 4.465)	0.000
25-34	50	23.5 (18.4 – 29.6)	58	29.3 (23.7 – 35.9)	1.225 (0.787 – 1.907)	0.368
35-44	78	39.8 (33.7 – 47.4)	37	18.7 (13.1 – 24.1)	0.355 (0.225 – 0.560)	0.000
45-54	12	6.1 (3.1 – 9.7)	12	6.1 (3.0 – 9.6)	1.00 (0.438 – 2.283)	1.000
55+	19	9.7 (5.6 – 13.8)	7	3.5 (1.0 – 6.6)	0.346 (0.142 – 0.841)	0.015
Education	-	-	-	-	-	-
Primary	13	6.5 (3.5 – 10.0)	16	8.0 (5.5 – 12.5)	1.252 (0.531 – 2.696)	0.563
Secondary	129	64.5 (57.0 – 71.5)	147	73.5 (67.0 – 80.5)	1.527 (0.996 – 2.340)	0.052
Tertiary	58	29.0 (22.5 – 35.5)	37	18.5 (13.0 – 24.0)	0.556 (0.347 – 0.889)	0.014
Household Income	-	-	-	-	-	-
0-200.00	95	47.5 (40.5 – 53.5)	127	63.5 (57.0 – 70.0)	1.923 (1.289 – 2.868)	0.001
201.00-400.00	47	23.5 (18.0- 29.5)	41	20.0 (14.5 – 26.0)	0.839 (0.523 – 1.348)	0.469
401.00-600.00	33	16.5 (11.5 – 22.0)	30	15.0 (10.0 – 19.5)	0.893 (0.521 – 1.530)	0.681
601.00+	25	12.5 (8.0 – 17.5)	2	1.0 (0.0 – 2.5)	0.071 (0.017 – 0.303)	0.000
Marital Status	-	-	-	-	-	-
Single	74	37.0 (31.0 – 44.0)	107	53.5 (46.0 – 60.5)	1.959 (1.314 – 2.921)	0.001
Married/ Cohabiting	94	47.0(40.0 – 53.5)	86	43.0 (35.0 – 49.5)	0.85 (0.573 – 1.262)	0.421
Separated/ Divorced Widowed	32	16.0 (11.5 – 21.5)	7	3.5 (1.0 – 6.5)	0.190 (0.082 – 0.443)	0.000

Table 2. Smoking characteristics.

-	n = 200	Urban % (95% CI)	n = 200	Rural % (95% CI)	OR 95%C.I.	p-value
Smoking Status						
Current Smokers	58	29.0 (23.5 – 36.0)	33	16.6 (12.1 – 22.6)	0.484 (0.299 – 0.784)	0.003
Current daily smokers	47	23.5 (17.5 – 29.5)	18	9.0 (5.0 – 14.0)	0.322 (0.179 – 0.377)	0.000
Former smokers	23	11.5 (7.0 – 16.0)	10	5.0 (2.0 – 8.5)	0.405 (0.188 – 0.875)	0.018
Former daily smokers	19	9.5 (5.0 – 14.0)	7	3.5 (1.0 – 6.5)	0.346 (0.142 – 0.841)	0.015
Age of smoking onset						
14 -17	36	62.1 (48.3 – 74.1)	17	51.5 (33.3 – 69.6)	0.423 (0.229 – 0.782)	0.006
18 - 21	3	5.2 (0.0 – 12.1)	12	36.4 (21.2 – 54.5)	4.191 (1.164 – 15.088)	0.028
22+	19	32.8 (20.7 – 44.8)	4	12.1 (3.0 – 24.2)	0.194 (0.065 – 0.582)	0.003
Types of Tobacco products consumed						
Manufactured cigarettes	53	26.5 (20.0 – 33.0)	31	15.5 (10.5 – 20.5)	0.509 (0.310 – 0.895)	0.007
Hand rolled cigarettes	4	2.0 (0.0 – 4.0)	2	1.0 (0.0 -2.5)	0.995 (0.090 – 2.733)	0.411
Snuff by mouth	12	6.0 (3.0 – 9.5)	18	9.0 (5.0 – 13.5)	1.549 (0.726 – 3.308)	0.215
Quitting	-	-	-	-	-	-
Tried to quit	38	19.0 (13.5 – 25.0)	17	8.5 (4.5 – 12.5)	0.396 (0.215 – 0.729)	0.002

Table 3. Blood pressure and blood glucose distribution.

-	Urban n =161	Urban % (95%CI)	Rural n = 184	Rural % (95%CI)	Odds Ratio (95%CI)	p-value
Diastolic Blood Pressure						
Normal	111	55.5 (48.0 – 62.5)	136	68.0 (61.0 – 74.5)	1.704 (1.134 – 2.561)	0.010
Elevated	50	25.0 (19.0 – 31.0)	48	24.0 (19.0 – 30.5)	0.947 (0.601 – 1.494)	0.816
Systolic Blood Pressure						
Normal	124	62.0 (55.0 – 69.0)	129	64.5 (57.5 – 70.5)	1.114 (0.741 – 1.672)	0.605
Elevated	27	13.5 (9.0 – 18.0)	54	27.0 (21.5 – 34.0)	2.370 (1.421 – 3.954)	0.001
On Treatment	8	5.3 (2.0 – 9.3)	1	0.8 (0.0 – 2.4)	6.930 (0.855 – 56.184)	0.034
Combined elevated systolic and diastolic + those on treatment	54	27.0 (21.0 – 33.0)	72	36.0 (29.5 – 42.5)	1.521 (0.994 – 2.327)	0.530
Blood Glucose						
Normal	87	43.5 (37.0 – 51.0)	135	67.5 (61.5 – 73.5)	2.698 (1.796 – 4.053)	0.000
Pre-diabetes	15	7.5 (4.0 – 11.5)	22	11.0 (7.0 – 15.5)	1.524 (0.766 – 3.032)	0.227
Diabetes	37	18.5 (13.0 – 23.5)	18	9.0 (5.5 – 12.5)	0.436 (0.239 – 0.795)	0.006

4.4. Relationship between Smoking and Blood Pressure and Blood Glucose

According to Table **4**., there was no significant relationship between tobacco smoking and elevated blood pressure, although the tobacco smoking group had more respondents with elevated blood pressure (p.0.232). Tobacco smokers were 248% more likely to have elevated blood glucose than their non-smoker counterparts.

There was no significant relationship between tobacco smoking and elevated blood pressure, although there were more tobacco smokers with elevated blood pressure (p.0.232).

Table 4. Relationship between tobacco and blood pressure, tobacco and blood glucose.

Blood Pressure	Total N= 400	% Elevated Blood Pressure (95% CI)	Unadjusted OR (95% CI)	p-value
Non-smokers	309	18.4 (14.6 – 23.0)	1.000	-
Smokers	91	26.4 |(17.6 – 36.3)	1.584 (0.916 – 2.739)	0.100
Blood Glucose	**Total N= 400**	**% Elevated Blood Glucose (95% CI)**	**Unadjusted OR (95% CI)**	**p-value**
Non-smokers	309	23.4 (18.5 – 28.6)	1.000	-
Smokers	91	51.5 (39.4 – 62.1)	3.481 (1.978 – 6.125)	0.000

4.5. Tobacco Smoking and Demographic Factors in an Urban Setting

In the urban setting, the respondents aged 35 – 44 years and above 45 years were significantly more likely to report smoking than those below the age of 35 years. Those with tertiary education were 80% less likely to smoke tobacco than those with high school and lower educational qualifications. The respondents in households with income between $400 and $600 were 251% more likely to report smoking than those earning less than $400, as shown in Table **5**.

4.6. Tobacco Smoking and Demographic Factors in a Rural Setting

As shown in Table **6**, the only demographic factor which had a significant relationship in the rural setting was the level of education where those with tertiary education were 88% less likely to smoke tobacco than those with lower educational attainments.

4.7. Perceptions towards tobacco smokers

Table **7** shows that rural respondents were 81% less likely to agree that tobacco smokers are enjoying their leisure time compared to respondents in urban areas.

Table 5. Tobacco smoking and demographic factors in an urban setting.

-	Total N= 200	% Current Tobacco Smokers (Urban) (95% CI)	Unadjusted OR (95% CI)	p-value
Age	-	-	-	-
18 - 24	41	19.5 (9.8 – 31.7)	1.000	-
25 – 34	50	22.0 (10.0 – 35.9)	0.860 (0.309 – 2.388)	0.772
35 - 44	78	43.6 (32.1 – 53.8)	0.314 (0.128 – 0.766)	0.011
45+	31	16.1 (6.5 – 29.0)	1.261 (0.369 – 4.312)	0.712
Marital Status	-	-	-	-
Single	74	32.4 (21.6 – 43.2)	1.000	-
Married	94	26.6 (18.1 – 36.1)	0.815 (0.328 – 2.028)	0.660
Divorced/widowed/separated	32	28.1 (15.6 – 43.8)	1.080 (0.441 – 2.646)	0.866
Education	-	-	-	-
High school and below	142	36.6 (29.6 – 44.3)	1.000	-
Tertiary	58	10.3 (3.4 – 19.0)	0.200 (0.80 – 0.497)	0.001
Household Income ($)	-	-	-	-
0 - 200	95	47.5 (40.5 – 54.0)	1.000	-
201 - 400	47	23.5 (18.0 – 29.5)	0.654 (0.318 – 1.343)	0.247
401 - 600	33	16.5 (11.5 – 22.5)	3.512 (1.134 – 10.870)	0.029
601+	25	12.5 (8.0 – 17.5)	3.552 (0.987 – 12.779)	0.052

Table 6. Tobacco smoking and demographic factors in a rural setting.

-	Total N= 200	% Current Tobacco Smokers (Rural) (95% CI)	Unadjusted OR (95% CI)	p-value
Age	-	-	-	-
18-24	86	15.1 (8.1 – 23.3)	1.000	-
25-34	58	20.7 (10.3 – 32.8)	0.683 (0.287 – 1.625)	0.388
35-44	37	18.9 (8.1 – 32.4)	0.763 (0.277 – 2.100)	0.601
45+	19	5.3 (0.0 – 15.8)	3.205 (0.393 – 26.133)	0.277
Marital Status	-	-	-	-
Single	107	13.1 (7.5 – 20.5)	1.000	-
Married	86	20.9 (12.8 – 29.1)	1.107 (0.124 – 9.895)	0.927
Divorced/widowed/separated	7	14.3 (0.0 – 42.9)	0.630 (0.071 – 5.569)	0.677
Education	-	-	-	-
High school and below	163	19.6 (13.5 – 25.8)	1.000	-
Tertiary	37	2.7 (0.0 – 8.1)	0.114 (0.015 – 0.861)	0.035
Household Income ($)	-	-	-	-
0 - 200	127	63.5 (56.0 – 70.5)	1.000	-
201 - 400	41	20.5 (14.5 – 27.0)	0.802 (0.309 -2.083)	0.651
401 - 600	30	15.0 (10.5 – 19.5)	0.454 (0.176 – 1.175)	0.454
601+	2	1.0 (0.0 – 2.5)	2666	0.999

Table 7. Perceptions towards tobacco smokers.

-	Urban (95% C.I.)	Rural (95% C.I.)	OD (95% C.I.)	p-Value
Tobacco smokers relieve themselves of stress	44.6 (32.1 – 58.9)	42.9 (28.6 – 60.0)	0.520 (0.241 – 1.124)	0.096
Tobacco smokers enjoy their leisure time	80.4 (69.6 – 91.1)	40.0 (22.9 – 54.3)	0.186 (0.085 – 0.405)	0.000
It's fashionable to smoke tobacco	17.9 (8.9 – 26.8)	2.9 (0.0 – 8.6)	0.672 (0.256 – 1.762)	0.419
Tobacco smokers are cool	17.9 (8.9 – 26.8)	2.9 (0.0 – 8.6)	0.561 (0.222 – 1.416)	0.221

5. DISCUSSION

The current study has shown that rural respondents were 52% less likely to smoke than urban respondents. Rural smokers were 68% less likely to smoke daily. The tobacco smoking rates in urban areas (29%) are higher than the national average (18%), while the rates in rural areas (16.6%) are lower [13]. The rates are, however, lower than the findings in three provinces of Zimbabwe, with an average of 33.4% [20]. The differences may be due to differences in methodology i.e., the current study looked at age groups from 18 and above, while the ZDHS report included ages 15 to 17 years. The Ministry of Health study focused on individuals above 24 years, while the ZDHS examined those aged 15 to 49 years.This pattern confirms findings from other Sub-Saharan African countries where urban dwellers smoke more [17, 18]. The reasons given for higher smoking levels in urban areas are related to stress, fear of losing a job, commuting every day to work, and work pressure [17]. Smoking has been linked to stressful conditions, and the high costs of living in urban areas in Zimbabwe are creating stressful environments that can lead to high tobacco consumption levels [21-23]. In Zimbabwe, high-income earners live in towns, where the stressful urban lifestyle may contribute to higher smoking levels in urban areas compared to rural areas. Smoking has been seen as an activity to alleviate boredom [24]. The current study shows that respondents in urban areas exhibit negative attitudes that contribute to higher smoking rates, confirming findings in Pakistan where individuals with a positive attitude had lower smoking rates [25, 26]. The results have shown that urban respondents view smokers as people who are enjoying their leisure time. This might lead to higher smoking rates in urban areas. Another reason may be that urbanization has made tobacco products more readily available for consumption by urban residents. The cost of smoking products could also contribute to higher smoking levels in urban areas in the current study, as those with higher incomes are typically found in urban areas. The rural respondents were 49% less likely to smoke manufactured cigarettes than the urban respondents. This was due to the high costs involved as the results have shown that more people in rural areas had lower incomes than those in urban areas. These findings confirm patterns observed in South Africa and Finland [18, 27]. High-income individuals have the ability to purchase tobacco products, whereas low income generally prioritize basic commodities. However, the findings are different from the findings in the ZDHS (2015) report, where those with high income smoked less than those with low income [13]. The difference can be explained in terms of the differences in sample size where the sample for the current study was smaller, and the current study did not consider those below the age of 18 years. The observed pattern is also different from patterns in developed countries where those with low income consume more [26]. Some scholars have shown that people with high incomes smoke less than those with low incomes, as high-income earners tend to have a healthier lifestyle, a trend observed in countries at higher levels of economic transition [21, 28-30]. These same developed countries saw high-income earners consuming more during the early years of their transition. Zimbabwe, being in its early years of transition, affects high-income earners first. In urban settings, high-income earners smoke more than low-income earners, but the relationship is not significant in rural settings.

There is a negative association between smoking and education in both areas. This might be a result of the effects of education in changing people`s attitudes towards health management [6, 7]. These findings are similar to findings in the ZDHS (2015) report, which observed a decline in smoking with higher educational attainment [13]. This pattern confirms experiences in developed counties where those with higher education smoke less [28, 31]. Low education meant that people still had strong cultural ties, leading to higher tobacco consumption compared to the more educated population [29, 32].

The age group that smoked the most in urban areas was 35 years and above (67.2% to 22.8%), while in rural areas, it was 18 to 34 years (75.8% to 24.2%). These age groups are typically employed or seeking employment and often have family responsibilities that create stressful conditions associated with smoking [22, 23]. This pattern differs from that observed in 2005, when individuals aged above 65 years smoked more than other age groups [20]. The current statistics are similar to those in the WHO publication, where the difference between youth and adults was minimal, at 22.0% versus 22.9% [14]. These findings are similar to the statistics in the ZDHS report [13]. The differences may be attributed to variations in methodologies, particularly the composition of the samples. Individuals aged above 35 years smoke more because smoking is socially acceptable among adults, as observed in India [33]. However, this pattern differs from findings in countries like Ghana, where older generations smoke more than younger ones due to traditional beliefs [29]. In this research, individuals aged 30 to 44 were economically active and had means of earning. Therefore, they could purchase tobacco products, which signifies that income is an important factor for purchasing tobacco. In this study, it was found that urban respondents started smoking earlier than rural respondents. This pattern of

early onset of tobacco smoking in urban areas is similar to findings in the urban areas of Ghana, where 87% started smoking before the age of 30 [29].

Married individuals were 10% more likely to smoke, while those who were divorced, separated, or widowed exhibited a 30% higher likelihood of smoking compared to the single group. This finding supports the notion that stress may act as a contributing factor to smoking behavior, particularly among individuals who are divorced, separated, or widowed, as they may lack a partner with whom to share responsibilities and navigate stressful situations [32]. Other studies have indicated that married individuals tend to smoke less, likely due to the support provided by a spouse [34]. The current study further supports the notion that marriage serves as a protective factor against unhealthy behaviors. The single group exhibited lower smoking rates compared to other marital status groups. This could be attributed to the fact that the single group primarily consists of younger individuals, who may refrain from smoking due to societal norms, as observed in countries such as India and Ghana [2, 29].

Tobacco smokers were found to be at a higher risk of elevated blood glucose, corroborating findings from studies conducted in China and Switzerland [35, 36]. This is supported by the CDC report of 2014, which reported that smokers have a 30% to 40% higher risk of diabetes than non-smokers and the risk increases with the number of cigarettes smoked. This may be attributed to the fact that smoking induces inflammation in body cells and causes oxidative stress, both of which are associated with elevated blood glucose levels. [37].

The current study found no significant relationship between tobacco smoking and blood pressure, although a higher proportion of individuals in the smoking group exhibited elevated blood pressure.This confirms the findings in England, where no significant relationship could be identified [38]. However, these findings differ from studies conducted in Sub-Saharan Africa (Uganda, Tanzania, South Africa, Nigeria), where significant relationships were observed, with smokers having higher odds of elevated blood pressure [39]. Our findings also differ from those of studies conducted in China and a meta-analysis of 23 population-based studies (CARTA consortium, including England, the Netherlands, and Scotland, among others), where current smokers exhibited lower blood pressure compared to non-smokers and former smokers [40, 41].

CONCLUSION

The current study revealed that urban respondents smoke more than their rural counterparts, and that individuals with higher incomes tend to smoke more than those with lower incomes. Additionally, economically active age groups were found to smoke more than other age groups. Those with higher levels of education smoked less than those with lower education, and individuals who were divorced, separated, or widowed smoked more than those in other marital status categories. Smokers were also found to be at a higher risk of elevated blood glucose. It is recommended that education on the health effects of smoking be incorporated into school curricula, similar to the approach taken by the government of Zimbabwe with HIV/AIDS. Further research is also recommended, focusing on both women and men, and encompassing a broader range of provinces.

AUTHORS' CONTRIBUTION

The authors confirm their contribution to the paper as follows: study conception and design, Analysis, draft manuscript: N.M.; analysis and interpretation of results: K.V.; analysis and draft manuscript: W.N.N. ; analysis and draft manuscript: N.M. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

NCDs	=	Non-communicable Diseases
EAs	=	Enumeration Areas

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethical clearance certificate number FF505/16 was obtained from the biomedical research ethics committee (BREC) of the University of Kwazulu Natal (UKZN), South Africa. The permission was taken from the Ministry of Health and Child Care (MMHCC).

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all the participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author, [N.M], on special request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest financial or otherwise.

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