BMJ Open Spatial distribution and correlates of smoking in Zambia

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To cite: Nyirenda HT, Mulenga D, Silitongo M, *et al.* Spatial distribution and correlates of smoking in Zambia. *BMJ Open* 2019;**9**:e030044. doi:10.1136/ bmjopen-2019-030044

Prepublication history for this paper is available online. To view these files please visit the journal online (http://dx.doi. org/10.1136/bmjopen-2019-030044).

Received 25 February 2019 Revised 23 July 2019 Accepted 25 July 2019

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ABSTRACT

Objective The objective of the paper was to investigate the spatial distribution and correlates of tobacco smoking in various regions of Zambia.

Methods This paper adopts a cross-sectional study design. The study used data from the 2013/2014 Zambia Demographic Health Survey which is a nationwide health survey conducted in all the 10 provinces. A random sample of men and women from 15 920 households was successfully selected and interviewed. All women aged 15–49 and men aged 15–59 who were either permanent residents of the households or visitors present in the households on the night before the survey were eligible to be interviewed.

Results The results show that 8.2% and 11% of Zambians in urban and rural areas smoke, respectively. In urban areas, the risk of being a cigarette smoker was 2.31 (Cl: 1.69 to 3.16) and 2.03 (Cl: 1.36 to 3.02) times higher for the divorced and separated. However, the risk of being a cigarette smoker was lower for those with some formal education. In rural areas, the risk of being a cigarette smoker was lower for the married (relative risk ratios (RRR): 0.69, Cl: 0.55 to 0.86) and those with a formal education. Nevertheless, in rural areas, the risk of being a pipe and other smoker was higher for those who were self-employed (RRR: 8.46, Cl: 2.95 to 24.20) and with an occupation (RRR: 2.37, Cl: 1.39 to 4.02) but was lower among women.

Conclusion Tobacco smoking varies between and within regions as well as provinces. Therefore, interventions to curb **s**moking should target specific demographic, socioeconomic and cultural factors and how they are spatially distributed.

INTRODUCTION

Smoking and other forms of tobacco use can cause a wide variety of diseases and can lead to death as it is one of the common causes of preventable morbidity and mortality globally.^{1 2} Smoking is a risk factor for cardiovascular diseases, lung cancer and other forms of cancer, and it contributes to the severity of pneumonia, emphysema and chronic bronchitis symptoms. The prevalence of smoking differs widely between populations in different localities which results in disparities at national, regional and global level.³

Studies in Zambia and elsewhere have had varied findings on rural and urban disparities

Strengths and limitations of this study

- The paper uses a large sample size and is nationally representative providing depths for generalisation and making inferences.
- This paper assesses the status of forms or types (cigarette, pipe and other forms) of smoking fundamental to regions of Zambia.
- The paper builds a body of knowledge on the variations in smoking hence enhancing decision-making on public health surveillance on smoking behaviour and the evaluation of policy and programme development at regional level.
- The study is limited to the available indicators hence could not associate the correlates of smoking to health outcomes such the effect of tobacco smoking on non-communicable diseases. The data could not provide other indicators/variables such as reasons for smoking as it is limited to available data.

on the influences of demographic characteristics on tobacco smoking.⁴ In Zambia, having a primary education decreased chances of female smoking and women living in rural areas had a threefold increased likelihood of smoking compared with those in urban areas.⁵ In Cameroon, Proctor *et al* reported no significant differences in smoking between children in rural and urban areas, but Finau et al reported significantly higher tobacco consumption in Tongan.⁶ ⁷ Notably, in a report on Sub-Saharan African Countries, the greatest difference in current smoking prevalence between urban and rural areas was observed in Zambia were 22.4% in rural Zambia, compared with 6.8% in urban areas were tobacco smokers. Further, with regard to urban/rural differences, urban dwellers were more likely to be cigarette smokers while subjects living in rural areas were more often consumers of other forms of tobacco that are more accessible in these settings.⁸

Various Demographic Health Surveys (DHS) have shown regional variations in tobacco use. High cigarette use was reported among men in several nations of east central Africa and Madagascar and lowest use in nations of west central Africa, and medium use in nations of southern Africa. However, Global estimates indicate that high rates of tobacco use and tobacco-related deaths are in America and lowest in Africa.⁹ The burden of tobacco-related deaths in Africa revealed an increase of about 70% highest in Eastern Africa and the lowest in Central Africa.¹⁰ Findings also show that among men, the prevalence of smoking was high in Sierra Leone, Lesotho and Madagascar and low (<10%) in Ethiopia, Benin, Ghana, Nigeria and Sao Tome & Principe while among women, the prevalence rates were low (<5%) in most countries except for Burundi and Sierra Leone.¹¹ In Ghana and Lesotho, tobacco use was lower among men in urban areas compared with rural areas.¹² Variations of tobacco use among men in Indonesia and among women in Nepal were also observed.¹³ Despite the existence of differences in tobacco use in Sub Sahara Africa, Madagascar has exceptionally higher prevalence rates almost five times higher in males than females.¹⁴ Another study indicates that tobacco use varies significantly globally for men and women as it exceeds 40% for men in all the countries examined in North Africa, West Asia, Europe, Central Asia, South and Southeast Asia.¹⁵ Age and socioeconomic status in Zambia were influential determinants of tobacco smoking. According to the 2007 Zambia Demographic Health Survey (ZDHS), the prevalence of smoking among females aged 15-49 years living in rural areas was three times higher compared with females living in urban areas. Lower education and lower socioeconomic status were also found to be a significant predictor of smoking prevalence.¹

It is vital to assess rural-urban differentials in tobacco smoking as Zambia is a land-locked country that has administratively been divided into 10 provinces of which two are predominantly urban and the remaining eight are predominantly rural. The country has a mixed economy consisting of a rural agricultural sector and a modern urban sector that, geographically, follows the rail line. Poverty continued to be more prevalent among rural than urban residents.¹ The paper was aimed at estimating correlates of tobacco smoking among rural and urban Zambians. Understanding the correlates of smoking in rural and urban areas can contribute to filling the gap on how to deal with non-communicable diseases (NCDs) which generally develop over a long period and, if addressed at an early stage, are often preventable.¹⁰

METHODS

Population characteristics and setting

Zambia covers a land area of 752612 km². This study was conducted in Zambia's 10 provinces. The provinces include Central, Copperbelt, Eastern, Lusaka, Southern, Luapula, Muchinga, Northern, North-Western and Western provinces.

Data source

This paper used data from the 2013/2014 ZDHS which is a nationally representative sample survey of women and men of reproductive age designed to provide up-to-date information on health status and behaviour. This study adopted a cross-sectional study design. The study was purely quantitative and was conducted through structured interviews. Three questionnaires were used and these include; the Household Questionnaire, the Woman's Questionnaire and the Man's Questionnaire. The three instruments were based on the questionnaires developed by the Demographic and Health Surveys Program and adapted to Zambia's specific data needs.

The 2013–2014 ZDHS used an updated list of enumeration areas (EAs) for the 2010 Population and Housing Census as the sampling frame for the survey. The frame comprised 25631 EAs and 2815897 households. An EA is a convenient geographical area with an average size of 130 households or 600 people. For each EA, information is available on its location, type of residence (rural or urban), number of households and total population. Each EA has a cartographical map with delimited boundaries and main landmarks of the area. A 2013–2014 ZDHS cluster is essentially representative of an EA.

The survey used a two-stage stratified cluster sample design, with EAs (or clusters) selected during the first stage and households selected during the second stage. In the first stage, 722 EAs (305 in urban areas and 417 in rural areas) were selected with probability proportional to the size. The 10 provinces were stratified into 20 sampling strata and a complete list of households served as the sampling frame in the selection of households for enumeration with an average of 25 households being selected in each EA. Therefore, a random sample of 18052 households across Zambia was selected from 722 clusters, of which only 16258 were occupied at the time of the fieldwork. Of the occupied households, 15920 were successfully interviewed, yielding a household response rate of 98%. 'All women aged 15-49 and men aged 15-59 who were either permanent residents of the households or visitors present in the households on the night before the survey were eligible to be interviewed', (2013/2014,ZDHS).

Measurement and definition

Dependent variable

Smoking in this paper refers to the act or habit of inhaling and exhaling the smoke of tobacco by men and women in rural and urban Zambia. Therefore, tobacco use status is a composite variable from the various questions on the mode of tobacco smoking and was classified into three categories namely non-smoker, cigarette smoker, and lastly pipe and other smokers. The variable was thus measured on a nominal scale.

Independent variables

The independent variables include respondent's age, province, region, years lived in place of residence, highest

educational level, religion, wealth index, marital status, gender, occupation, sex of the household head, frequency of listening to radio and television and relationship to the household head.

The wealth index is a composite measure of a household's cumulative living standard and was calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles, materials used for housing construction and types of water access and sanitation facilities. The wealth index was thus generated with a statistical procedure known as principal components analysis, the wealth index places individual households on a continuous scale of relative wealth. DHS classified households into five wealth quintiles which are lowest, second, middle, fourth and highest. This study classified the wealth index into three categories as follows: lowest and second as low, middle as middle, fourth and highest as high.

Data analysis

Data analysis was done using Stata V.13 and the data was survey weighted to factor in population estimates. Bivariate analysis or Chi-square (χ^2) analysis was conducted in an attempt to describe and establish the association between smoking and socioeconomic as well as demographic factors. A multivariate analysis involving multinomial logistic regression was conducted to ascertain the risk associated with smoking. Therefore, Relative Risk Ratios (RRR) associated with smoking were generated for the socioeconomic and demographic factors that were significant at bivariate analysis (χ^2). The study also conducted a spatial distribution analysis indicating the regional differences in tobacco smoking and Moran's I to ascertain autocorrelation



Figure 1 Spatial distribution of cigarette smoking by Province.

Patient and public involvement

This was a household survey which involved the participation of the general public. Participants are made aware of the study results through publication and statistical bulletins. There were no patients involved in the study.

Ethical consideration

The paper used secondary data hence posed no risk or harm to the respondents. The data did not contain any of the respondent's names nor traces of the respondents. This paper, therefore, holds respondents' information with the highest confidentiality.

RESULTS

Socioeconomic and demographic characteristics

The results reveal that 46.1% of Zambians live in urban areas while 53.9% live in rural areas. In the urban area, 22.6% of the study participants were aged between 15 and 19 years. Almost half (49.1%) were married, about 6 in 10 (59.2%) had a secondary school education, over half (52.7%) were females, over three quarters (78.4%) were protestants, 85.8% were in the high wealth quintile, 4 in 10 (40.6%) were not working, 45.4% listened to the radio almost every day and 6 in 10 (60.4%) watched television almost every day, 31% were the household heads and over three quarters (78.1%) of the households were male-headed households.

In the rural area, 22.1% of the study participants were aged between 15 and 19 years. Close to two-thirds (64%) were married, over half (58.2%) had a primary school education, slightly over half (52.5%) were females, about 8 in 10 (80.3%) were protestants, 61.1% were in the low wealth quintile, over one-third (36.5%) were employed in the agriculture sector, 36.5% never listened to the radio and almost three quarters (72.4%) never watched television, over one-third were (35.5%) were household heads and 8 in 10 (81.1%) of the households were male-headed households.

Prevalence of smoking

The results show that only 8.2% of Zambians in urban areas smoke. However, 8.1% were cigarette smokers and only 0.1% smoked pipe and other. With regard to gender, 16.7% of the males smoked cigarette compared with only 0.3% of females.

Results also showed that 11% of Zambians in rural areas smoke. One in 10 (10.7%) were cigarette smokers and only 0.3% smoked pipe and other. With regards to gender, 21.8% of the males smoked cigarette compared with only 0.6% of females

Spatial distribution of cigarette smoking

Figure 1 shows the spatial distribution of cigarette smoking in Zambia. The prevalence of cigarette smoking was highest in Eastern and Luapula provinces and lowest in Western and Muchinga provinces in Zambia. After running the Moran's I to assess for autocorrelation, the

Table 1 Percentage distribution and association between sn	ssociation between		nomic and demo	noking, socioeconomic and demographic factors in urban Zambia	ırban Zambia		
Urban							
Smoking status							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Age in 5-year groups							
15–19	98.2	(97.4 to 98.8)	1.8	(1.2 to 2.6)			3258
20–24	93.5	(92.3 to 94.5)	6.5	(5.4 to 7.7)			2748
25–29	90.4	(88.4 to 92.1)	9.6	(7.9 to 11.6)			2281
30-34	89.1	(87.3 to 90.6)	10.7	(9.2 to 12.5)	0.2	(0.1 to 0.7)	2066
35–39	90.7	(88.4 to 92.5)	6	(7.1 to 11.3)	0.3	(0.1 to 0.9)	1626
40-44	87.1	(84.2 to 89.6)	12.8	(10.4 to 15.8)	0.1	(0.0 to 0.3)	1157
45-49	88.1	(84.7 to 90.8)	11.9	(9.2 to 15.2)			777
50-54	77.5	(70.0 to 83.5)	22.5	(16.5 to 30.0)			286
55-59	81.5	(73.6 to 87.4)	18.5	(12.6 to 26.4)			191
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14388
Pearson: uncorrected chi-square (16)=405.5742	05.5742						
Design-based F(12.31, 3631.48)=16.2815 p<0.001	15 p<0.001						
Marital status							
Never in union	94	(93.0 to 94.8)	9	(5.2 to 7.0)			5888
Married	90.7	(89.7 to 91.5)	9.2	(8.3 to 10.2)	0.1	(0.1 to 0.3)	7064
Living with partner	91.2	(80.9 to 96.2)	8.8	(3.8 to 19.1)			87
Widowed	95.2	(90.6 to 97.6)	4.8	(2.4 to 9.4)			385
Divorced	87.4	(83.7 to 90.3)	12.5	(9.6 to 16.2)	0.1	(0.0 to 0.3)	668
No longer living Together/separated	84.4	(78.1 to 89.1)	15.5	(10.8 to 21.7)	0.1	(0.0 to 0.8)	296
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14388
Pearson: uncorrected chi-square (10)=100.3434	00.3434						
Design-based F(6.95, 2051.56)=7.1598 p<0.001	p<0.001						
Province							
Central	92.8	(90.3 to 94.7)	7.1	(5.2 to 9.6)	0.1	(0.0 to 0.9)	742
Copperbelt	90.2	(88.5 to 91.7)	9.7	(8.2 to 11.5)	0.1	(0.0 to 0.4)	4572
Eastern	93.2	(91.1 to 94.9)	6.7	(5.1 to 8.8)	0.1	(0.0 to 0.4)	524
Luapula	90.4	(88.0 to 92.4)	9.5	(7.5 to 11.9)	0.1	(0.0 to 0.6)	462
							Continued

Smoking status							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Lusaka	93	(91.9 to 93.9)	7	(6.0 to 8.1)			5545
Muchinga	92.5	(90.1 to 94.3)	7.2	(5.5 to 9.4)	0.3	(0.1 to 0.9)	350
Northern	89.3	(86.8 to 91.4)	10.7	(8.6 to 13.2)			473
North western	93.7	(92.0 to 95.0)	5.7	(4.4 to 7.5)	0.6	(0.3 to 1.3)	363
Southern	93.1	(91.3 to 94.5)	6.9	(5.5 to 8.7)			986
Western	90.7	(88.0 to 92.9)	8.9	(6.8 to 11.6)	0.4	(0.1 to 1.0)	371
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14 388
Pearson: uncorrected chi-square (18)=59.9506	18)=59.9506						
Design-based F(9.62, 2838.63)=2.7270 p=0.003	⁷ 270 p=0.003						
Education status							
No education	93.4	(89.6 to 95.9)	6.6	(4.1 to 10.4)			335
Primary	89.3	(88.0 to 90.5)	10.6	(9.4 to 11.8)	0.2	(0.1 to 0.4)	3853
Secondary	92.4	(91.6 to 93.1)	7.6	(6.8 to 8.4)	0.1	(0.0 to 0.2)	8510
Higher	94.8	(93.2 to 96.0)	5.2	(4.0 to 6.7)			1686
Total	91.9	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14384
Pearson: uncorrected chi-square(6)=60.3249)=60.3249						
Design-based F(5.20, 1534.67)=7.7282 p<0.001	7282 p<0.001						
Sex							
Male	83.1	(81.6 to 84.5)	16.7	(15.3 to 18.2)	0.2	(0.1 to 0.3)	6803
Female	99.7	(99.5 to 99.8)	0.3	(0.2 to 0.5)			7585
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14388
Pearson: uncorrected chi-square (2)=1340.6624	2)=1340.6624						
Design-based F(1.95, 574.01)=571.3623 p<0.001	.3623 p<0.001						
Religion							
Catholic	88.5	(86.7 to 90.1)	11.5	(9.8 to 13.3)	0.1	(0.0 to 0.1)	2830
Protestant	92.9	(92.2 to 93.6)	7	(6.4 to 7.7)	0.1	(0.0 to 0.2)	11249
Muslim	86.8	(76.2 to 93.1)	13.2	(6.9 to 23.8)			194
Other	20.9	(53.8 to 83.6)	29.1	(16.4 to 46.2)			82

Table 1 Continued							
Urban							
Smoking status							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14 356
Pearson: uncorrected chi-square (6)=119.4077	19.4077						
Design-based F(2.89, 851.69)=6.5833 p<0.001	o<0.001						
Wealth index							
Low	82	(78.5 to 85.0)	17.8	(14.8 to 21.3)	0.2	(0.1 to 0.6)	384
Middle	86.2	(84.1 to 88.0)	13.7	(11.9 to 15.8)	0.1	(0.0 to 0.3)	1667
High	92.9	(92.2 to 93.6)	7	(6.3 to 7.7)	0.1	(0.0 to 0.2)	12338
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14388
Pearson: uncorrected chi-square (4)=143.9332	43.9332						
Design-based F(2.90, 855.70)=41.9643 p<0.001	p<0.001						
Occupation							
Not working	98.1	(97.4 to 98.6)	1.9	(1.4 to 2.6)			5815
Professional/technical	95.9	(94.1 to 97.2)	4.1	(2.8 to 5.9)			881
Clerical	92.4	(90.9 to 93.6)	7.5	(6.3 to 8.9)	0.1	(0.0 to 0.4)	3560
Agricultural-self employed	81.7	(74.0 to 87.5)	18.2	(12.4 to 25.9)	0.1	(0.0 to 0.8)	165
Agricultural – employee	84.6	(81.5 to 87.2)	15.3	(12.7 to 18.4)	0.1	(0.0 to 0.4)	752
Services	86.4	(82.3 to 89.7)	13.6	(10.3 to 17.7)			655
Skilled manual	79.6	(76.6 to 82.3)	20.2	(17.5 to 23.2)	0.2	(0.1 to 0.4)	1354
Unskilled manual	77.5	(71.9 to 82.3)	22.3	(17.6 to 27.9)	0.2	(0.0 to 0.6)	540
Other	82	(76.8 to 86.3)	17.5	(13.2 to 22.8)	0.5	(0.1 to 2.7)	615
Total	91.9	(91.2 to 92.6)	8	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14336
Pearson: uncorrected chi-square (16)=956.0431	956.0431						
Design-based F(9.70, 2862.46)=36.6685 p<0.001	5 p<0.001						
Frequency of listening to radio							
Not at all	94.7	(93.3 to 95.8)	5.3	(4.2 to 6.7)			2944
Less than once a week	91.3	(89.1 to 93.1)	8.5	(6.8 to 10.7)	0.1	(0.1 to 0.4)	1682
At least once a week	90.3	(88.7 to 91.7)	9.7	(8.3 to 11.2)		(0.0 to 0.1)	3220
Almost every day	91.4	(90.3 to 92.5)	8.4	(7.4 to 9.6)	0.1	(0.1 to 0.3)	6529
							Continued

Table 1 Continued							
Smoking status							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14375
Pearson: uncorrected chi-square (6)=51.3026	1.3026						
Design-based F(4.69, 1384.79)=5.4160 p<0.001) p<0.001						
Frequency of watching television							
Not at all	90.4	(88.8 to 91.7)	9.5	(8.2 to 11.1)	0.1	(0.0 to 0.2)	2805
Less than once a week	83.4	(80.5 to 86.0)	16.5	(13.9 to 19.4)	0.1	(0.0 to 0.4)	1118
At least once a week	88.8	(86.2 to 90.9)	11.2	(9.1 to 13.8)		(0.0 to 0.1)	1763
Almost every day	94	(93.2 to 94.8)	5.9	(5.1 to 6.8)	0.1	(0.0 to 0.2)	8689
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14375
Pearson: uncorrected chi-square (6)=198.0866	98.0866						
Design-based F(4.21, 1241.79)=22.6512 p<0.001	2 p<0.001						
Relationship to household head							
Head	84.6	(82.9 to 86.1)	15.2	(13.7 to 16.8)	0.2	(0.1 to 0.5)	4463
Spouse	99.1	(98.6 to 99.5)	0.8	(0.5 to 1.4)	0.1	(0.0 to 0.2)	3448
Son/daughter	99.6	(98.9 to 99.8)	0.4	(0.2 to 1.1)			1568
Daughter-in-law	87	(84.6 to 89.0)	13	(11.0 to 15.4)			1748
Granddaughter/son	97.9	(94.1 to 99.3)	2.1	(0.7 to 5.9)			252
Father/mother	90.5	(84.8 to 94.3)	9.2	(5.5 to 14.9)	0.3	(0.1 to 1.1)	228
Father/mother-in-law	69.3	(25.0 to 93.9)	30.7	(6.1 to 75.0)			7
Brother/sister	100						330
Co-spouses	82.6	(75.2 to 88.2)	17.2	(11.7 to 24.6)	0.1	(0.0 to 0.7)	328
Other relative	94.4	(91.4 to 96.4)	5.6	(3.6 to 8.6)			813
Adopted/foster child	93.5	(87.0 to 96.9)	6.5	(3.1 to 13.0)			176
Not related	88.5	(83.8 to 92.0)	11.4	(8.0 to 16.1)	0.1	(0.0 to 0.5)	371
Niece/nephew by blood	96.2	(92.8 to 98.1)	3.8	(1.9 to 7.2)			400
Niece/nephew by marriage	92.4	(87.8 to 95.3)	7.6	(4.7 to 12.2)			254
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14385
Pearson: uncorrected chi-square (26)=872.7312	872.7312						
							Continued

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Table 1 Continued							
Urban							
Smoking status							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other Pipe and other Population smokers smokers estimates	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Design-based F(16.59, 4893.34)=20.5155 p<0.001	5 p<0.001						
Sex of household head							
Male	91.3	(90.5 to 92.1)	8.6	(7.8 to 9.4)	0.1	(0.0 to 0.2)	11233
Female	93.8	(92.4 to 95.0)	6.2	(5.0 to 7.6)			3155
Total	91.8	(91.1 to 92.5)	8.1	(7.4 to 8.8)	0.1	(0.0 to 0.2)	14 388
Pearson: uncorrected chi-square (2)=21.3809	3809						
Design-based F(1.37, 402.84)=7.7563 p=0.002	=0.002						

results show that there was clustering of dissimilar values in tobacco use among province. However the results were not statistically significant (p=0.152).

$\chi^2\!\!:$ association between smoking and socioeconomic and demographic factors

The χ^2 results indicate that among residents in urban areas, a statistically significant association existed between smoking status and the following factors: age (p<0.001), marital status (p<0.001), province (p=0.003), education status (p<0.001), sex (p<0.001), religion (p<0.001), wealth index (p<0.001), occupation (p<0.001), frequency of listening to the radio (p<0.001) and watching television (p<0.001), respondents relationship to the household head (p<0.001) and sex of the household head (p=0.002) (table 1).

A statistically significant association was found between smoking status and the following factors among rural residents; age (p<0.001), marital status (p<0.001), province (p<0.001), education status (p<0.001), sex (p<0.001), religion (p<0.001), wealth index (p<0.001), occupation (p<0.001), frequency of listening to the radio (p<0.001) and watching television (p<0.001), respondents relationship to the household head (p<0.001) and sex of the household head (p<0.001) (table 2).

Spearman Rank Correlation

A Spearman rank correlation was performed between age and wealth index, the findings indicate a statistically significant weak negative correlation (r=-0.0668, p<0.001) between age and wealth index.

Multinomial Logistic regression: Correlates of smoking in rural and urban Zambia (RRR).

The results are split into two tables, table 3 presenting results of multinomial logistic regression for cigarette smokers while table 4 presenting results of the multinomial logistic regression for pipe and other smokers. After conducting a multinomial logistic regression and controlling for predictor variables, results in table 3 show that the relative risk of being a cigarette smoker versus a non-smoker increases with each additional age group in both urban and rural areas. For residents in urban areas, the risk of being a cigarette smoker was 3.44 (CI: 1.48 to 7.96), 1.55 (CI: 1.25 to 1.93) and 2.08 (CI: 1.24 to 3.49) times higher for sons/daughters, son/daughter-in-law and niece/nephew by marriage to the household head relative to the head of the household, respectively, while in rural areas the risk was 0.66 (CI: 0.51 to 0.85) and 0.49 (CI: 0.26 to 0.89) lower for son/daughter-in-law and others related to the household head, respectively.

Similarly in urban areas, the risk of being a cigarette smoker versus a non-smoker was 2.31 (CI: 1.69 to 3.16) and 2.03 (CI: 1.36 to 3.02) times higher for the divorced and separated relative to the never married respectively were as in rural areas the risk was lower for the married (RRR: 0.69, CI: 0.55 to 0.86) and those living with a partner (RRR: 0.45, CI: 0.23 to 0.90) relative to the never married. Further, the risk of being a cigarette smoker

Table 2 Percentage distributi	Percentage distribution and association between si	tween smoking, soc	ioeconomic and o	moking, socioeconomic and demographic factors in rural Zambia	ı rural Zambia		
Rural							
Smoking							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Age in 5-year groups							
15–19	98.7	(98.2 to 99.0)	1.3	(1.0 to 1.8)			3705
20-24	94.5	(93.4 to 95.4)	5.4	(4.5 to 6.5)	0.1	(0.0 to 0.3)	2591
25–29	88.9	(87.6 to 90.1)	10.7	(9.5 to 12.1)	0.4	(0.2 to 0.7)	2477
30–34	87.6	(85.9 to 89.0)	11.9	(10.5 to 13.5)	0.5	(0.3 to 1.0)	2337
35–39	86.8	(84.9 to 88.5)	12.7	(11.1 to 14.6)	0.5	(0.2 to 0.9)	2047
40-44	83.1	(81.1 to 84.9)	16.3	(14.5 to 18.3)	0.6	(0.3 to 1.2)	1691
45-49	77.5	(74.8 to 79.9)	21.8	(19.4 to 24.4)	0.7	(0.4 to 1.3)	1210
50-54	65	(59.5 to 70.1)	33.8	(28.6 to 39.3)	1.3	(0.5 to 3.4)	415
55–59	62.7	(56.7 to 68.3)	37.1	(31.5 to 43.1)	0.2	(0.0 to 1.4)	319
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (16)=1130.6582	are (16)=1130.6582						
Design-based F(13.80, 5601.60)=67.4280 p<0.001	0)=67.4280 p<0.001						
Marital status							
Never in union	95.4	(94.7 to 96.1)	4.5	(3.8 to 5.2)	0.1	(0.0 to 0.2)	4683
Married	86.2	(85.4 to 86.9)	13.4	(12.7 to 14.1)	0.4	(0.3 to 0.6)	10744
Living with partner	87	(77.8 to 92.8)	11.5	(5.8 to 21.6)	1.4	(0.4 to 5.2)	66
Widowed	92.6	(88.5 to 95.4)	6.6	(4.0 to 10.7)	0.8	(0.2 to 3.1)	280
Divorced	87	(84.3 to 89.3)	12.5	(10.2 to 15.3)	0.5	(0.2 to 1.3)	733
No longer living together/ separated	90.1	(86.0 to 93.1)	9.9	(6.9 to 14.0)			254
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (10)=290.4825	are (10)=290.4825						
Design-based F(9.16, 3720.36)=27.5671 p<0.001)=27.5671 p<0.001						
Province							
Central	91.6	(89.6 to 93.2)	8.3	(6.7 to 10.3)	0.1	(0.0 to 0.4)	1985
Copperbelt	87.4	(84.7 to 89.7)	12.4	(10.1 to 15.1)	0.2	(0.0 to 0.9)	876
Eastern	88.8	(87.6 to 89.9)	11	(10.0 to 12.2)	0.2	(0.0 to 0.6)	3266
Luapula	85	(83.3 to 86.6)	14.9	(13.3 to 16.7)	0.1	(0.0 to 0.3)	1610

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Continued

Monting Annotene	Rural								
Non-smokes Cigaretic Cigaretic Cigaretic Pipe and other Pipe and other	Smoking								
$\sqrt{6}$ 65% cl $\sqrt{10}$	8	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates	
a 90.4 (88.4 b 92.0) 9.4 (7.8 to 11.4) 0.2 (0.10.08) mat 87.6 (83.5 u 83.9) 12.7 (0.7 to 15.1) 0.4 (0.0 to 0.0) western 80.5 (85.9 to 89.0) 12.3 (108 to 13.9) 0.1 (0.0 to 0.0) western 80.5 (81.1 to 94.2) 6.5 (9.81 to 94.3) 0.2 (0.14 to 28) m 84.7 (82.2 to 86.9) 14.1 (12.0 to 16.5) 12.2 (0.14 to 28) m 84.7 (82.2 to 86.9) 14.1 (12.0 to 16.5) 12.2 (0.14 to 28) m 84.7 (82.2 to 86.9) 14.7 (10.1 to 11.3) 0.3 (0.3 to 0.5) m 84.7 (82.1 to 89.6) 10.7 (11.1 to 12.6) 0.3 (0.3 to 0.5) m 87.7 (87.1 to 88.7) (87.1 to 88.7) (11.1 to 12.6) 0.3 (0.3 to 0.5) m 87.7 (87.1 to 88.6) 10.7 (11.1 to 12.6) 0.3 (0.3 to 0.5) m 88.7 to 88.6) <th></th> <th>%</th> <th>95% CI</th> <th>%</th> <th>95% CI</th> <th>%</th> <th>95% CI</th> <th></th>		%	95% CI	%	95% CI	%	95% CI		
nga 66.9 (64.6 \text{ 0.86.9}) (12 (10.7 \text{ 0.15}) (04 (02.0 0.0) mm 87.6 (65.9 \text{ 0.80.0}) 12.3 (10.8 \text{ 0.13}) 0.1 (00.0 0.0) Western 90.5 (86.6 \text{ 0.82.2}) 7.5 (59.10 \text{ 0.83}) 0.1 (10.4 \text{ 0.22}) Western 82.9 (81.4 \text{ 0.83.0}) (11.4 \text{ 0.22}) (03.0 \text{ 0.63}) mm 81.7 (22.10 \text{ 0.83}) (10.1 \text{ 1.13}) 0.3 (0.3 \text{ 0.63}) mucorrected Ch-square (19.2.292.2696) (37.0 \text{ 0.83.0}) (10.1 \text{ 1.13}) 0.3 (0.3 \text{ 0.63}) mucorrected Ch-square (19.2.292.2696) (37.0 \text{ 0.83.0}) (37.0 \text{ 0.83.0}) (37.0 \text{ 0.83.0}) (37.0 \text{ 0.83.0}) mucorrected Ch-square (19.2.292.2696) (37.0 \text{ 0.83.0}) (37.1 \text{ 0.83.0}) (31.0 \text{ 0.83.0}) (32.0 \text{ 0.83.0}) visit 87.7 (37.0 \text{ 0.83.0}) (31.1 \text{ 0.12.6}) (32.0 \text{ 0.83.0}) (33.0 \text{ 0.83.0}) visit 87.7 (37.0 \text{ 0.83.0}) (37.0 \text{ 0.83.0}) (3	Lusaka	90.4	(88.4 to 92.0)	9.4	(7.8 to 11.4)	0.2	(0.1 to 0.8)	765	
m 87.6 85.5 be 80.0 12.3 (10.8 to 13.3) 0.1 (0.0 to 0.6) Western 90.5 (88.6 to 92.2) 7.5 (5.5 to 9.4) 2 (14.1 to 2.5) Western 8.3 (8.1 to 8.4) (1.1 to 12.5) 0.2 (0.0 to 0.0) m 8.47 (8.2 to 86.9) 14.1 (12.1 to 11.5) 0.2 (0.1 to 0.2) muccorrected chi-square (19-239.2666 11.9 (10.1 to 11.5) 0.3 (0.1 to 0.2) hased F(1.3.65.4 36)-9583 p-0.001 8.7 (8.7 to 88.6) 11.9 (11.1 to 12.6) 0.3 (0.3 to 0.5) hased F(1.3.65.4 36)-9583 p-0.001 8.7 (7.8 to 9.6) 0.4 0.3 to 0.5) (1.1 to 12.6) 0.3 (0.3 to 0.5) hased F(1.3.67.8) 10.7 (1.1 to 12.6) 0.4 0.3 (0.3 to 0.5) runcorrected chi-square (5)-48.092 68.4 to 88.6) 10.7 (7.8 to 9.5) 0.4 0.3 to 0.5) runcorrected chi-square (5)-48.092 9.4 (7.1 to 12.5) 0.4 0.3 to 0.5) runcorrected chi-square (5)-48.092	Muchinga	86.9	(84.6 to 88.9)	12.7	(10.7 to 15.1)	0.4	(0.2 to 0.8)	1280	
Western 90.5 (88.6 to 9.2.2) 7.5 (54.0 8.4) 2 (1.4 to 2.8) m 84.7 (82.2 to 86.9) 141 (12.0 to 16.5) 1.2 (0.1 to 0.9) m 84.7 (82.2 to 86.9) 141 (12.0 to 16.5) 1.2 (0.1 to 2.2) m 84.7 (82.2 to 86.9) 10.7 (10.1 to 11.3) 0.3 (0.3 to 0.5) mucmeretad chi-square (19-232 2666 1.3 (1.4 to 12.8) (1.4 to 12.8) (0.3 to 0.5) mucmeretad chi-square (19-232 2666 1.0 (1.1 to 12.5) 0.3 (0.3 to 0.5) total status 88.7 (8.7 to 80.8) 11.9 (1.1 to 12.6) 0.3 (0.2 to 0.5) total status 88.7 (8.7 to 80.8) 10.7 (10.1 to 11.3) 0.3 (0.2 to 0.5) dary 90.9 (90.0 to 91.9) 10.7 (10.1 to 11.3) 0.3 (0.2 to 0.5) dary 90.9 (80.1 to 91.6) 10.7 (10.1 to 11.3) 0.3 (0.2 to 0.5) dary 90.9 (80.1 to 91.6)	Northern	87.6	(85.9 to 89.0)	12.3	(10.8 to 13.9)	0.1	(0.0 to 0.6)	1774	
em 22.9 (9.116.94.3) 6.9 (5616.85) 0.2 (0.010.09) m 84.7 (32.216.65.9) 14.1 (12.016.15) 1.2 (0.170.22) muncometed chi-square (18)=239.2686 10.7 (10.110.11.3) 0.3 (0.310.05) muncometed chi-square (18)=239.2686 11.9 (10.110.11.3) 0.3 (0.310.05) muncometed chi-square (18)=239.2686 11.9 (11.110.12.6) 0.3 (0.240.07) tional status (87.010.88.6) 11.9 (11.110.12.6) 0.3 (0.310.06) vietue 89.3 (83.410.896.7) 5.1 (33.10.73) 0.3 (0.310.06) vietue 89 (84.10.80.7) 1.7 (10.110.11.3) 0.3 (0.310.06) runcometed chi-square (6)=48.04032 1.7 (11.110.12.3) 0.3 (0.310.05) runcometed chi-square (6)=48.04032 1.7 (10.110.11.3) 0.3 (0.310.05) runcometed chi-square (6)=48.0493 1.7 (10.110.11.3) 0.3 (0.310.05) runcometed chi-square (6)=48.0493 </td <td>North-Western</td> <td>90.5</td> <td>(88.6 to 92.2)</td> <td>7.5</td> <td>(5.9 to 9.4)</td> <td>2</td> <td>(1.4 to 2.8)</td> <td>958</td>	North-Western	90.5	(88.6 to 92.2)	7.5	(5.9 to 9.4)	2	(1.4 to 2.8)	958	
m 84.7 $(8.2 \ Lo \ B6.9)$ 14.1 $(12.0 \ Lo \ B5.)$ 12.2 $(0.7 \ Lo \ C2)$ n: uncorrected chi-square (13)–233.2686 $(38.1 \ Lo \ B3.6)$ $(31.0 \ Lo \ C3)$ $(33.0 \ C3)$ n: uncorrected chi-square (13)–233.2686 $(37.0 \ Lo \ B3.6)$ $(11.0 \ L1.2)$ $(3.1 \ Lo \ C3)$ $(3.1 \ C3, C3)$ n: uncorrected chi-square (13)–3058 p-c001 $(37.0 \ L0 \ B3.6)$ $(11.0 \ L1.2)$ $(24.0 \ C3, C3)$ n: uncorrected chi-square (5)-48.092) $(37.0 \ B3.6)$ $(37.0 \ B3.6)$ $(37.0 \ B3.6)$ n: uncorrected chi-square (5)-48.092) $(37.0 \ B3.6)$ $(37.0 \ C3.6)$ $(37.0 \ C3.6)$ n: uncorrected chi-square (5)-48.0492) $(37.0 \ B3.6)$ $(37.0 \ C3.6)$ $(37.0 \ C3.6)$ n: uncorrected chi-square (5)-48.0492) $(37.0 \ C3.6)$ $(37.0 \ C3.6)$ $(37.0 \ C3.6)$ n: uncorrected chi-square (5)-48.04) $(10.7 \ C3.6)$ $(10.1 \ C1.61.3)$ $(10.7 \ C3.6)$ n: uncorrected chi-square (5)-48.04) $(10.7 \ C3.6)$ $(10.7 \ C3.6)$ $(10.7 \ C3.6)$ n: uncorrected chi-square (5	Southern	92.9	(91.1 to 94.3)	6.9	(5.6 to 8.5)	0.2	(0.0 to 0.9)	2932	
89 (8.41 & 6.8.4) 10.7 (10.1 to 11.3) 0.3 (0.3 to 0.5) n: urocrrected chi-square (19)=239.2696	Western	84.7	(82.2 to 86.9)	14.1	(12.0 to 16.5)	1.2	(0.7 to 2.2)	1346	
on: uncorrected chi-square (18)–239.2686 h-based F(13.85, 5824.85)–9.3688 p<0.001	Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793	
-based F(13.65, 5624.85)=9.0583 p<-0.001	Pearson: uncorrected ch	i-square (18)=239.2696							
Itional status titional status inclusion 88.7 (87.0 to 90.3) 10.9 (9.4 to 12.7) 0.4 (0.2 to 0.5) inclusion 87.8 (87.0 to 88.6) 11.9 (11.1 to 12.6) 0.3 (0.2 to 0.5) inclusion 90.9 (90.0 to 91.8) 8.7 (7.8 to 96.6) 0.4 (0.2 to 0.5) inclusion 94.9 (92.2 to 96.7) 5.1 (3.3 to 7.8) (0.3 to 0.5) on: uncorrected chi-square (6)-48.0402 tith in the state (6)-48.0402 tin the state (6)-48.0402 <th colsp<="" td=""><td>Design-based F(13.85, 5</td><td>624.85)=9.9583 p<0.001</td><td></td><td></td><td></td><td></td><td></td><td></td></th>	<td>Design-based F(13.85, 5</td> <td>624.85)=9.9583 p<0.001</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Design-based F(13.85, 5	624.85)=9.9583 p<0.001						
weation88.7 $(87.0 \ b0.03)$ (10) $(0.4 \ b0.12.7)$ $(0.4 \ b0.05)$ γ 87.8 $(87.0 \ b0.86)$ 11.9 $(11.1 \ b1.26)$ 0.3 $(0.2 \ b0.05)$ $dary$ 90.9 $(90.0 \ b91.8)$ 8.7 $(7.8 \ b9.6)$ 0.4 $(0.2 \ b0.05)$ $dary$ 90.9 $(90.0 \ b91.8)$ 8.7 $(7.8 \ b9.6)$ 0.4 $(0.2 \ b0.05)$ r 94.9 $(92.2 \ b0.67)$ 5.1 $(3.3 \ c7.8)$ 0.3 $(0.2 \ b0.6)$ r 94.9 $(92.2 \ b0.67)$ 5.1 $(3.3 \ c7.8)$ 0.3 $(0.2 \ b0.6)$ r 94.9 $(92.2 \ b0.67)$ 5.1 $(3.3 \ c7.8)$ 0.3 $(0.3 \ b0.6)$ r 94.9 $(92.1 \ b0.67)$ 10.7 $(10.1 \ b11.3)$ 0.3 $(0.3 \ b0.6)$ r 77.4 $(7.6 \ c7.8)$ 21.8 $(2.07 \ b2.3.1)$ 0.7 $(0.5 \ b1.0)$ r 77.4 $(7.6 \ c7.8)$ 21.8 $(0.4 \ b0.6)$ 0.7 $(0.5 \ b1.0)$ r 77.4 $(7.6 \ c7.8)$ 21.8 $(0.7 \ b0.2)$ 0.7 $(0.5 \ b1.0)$ r 99.4 $(99.1 \ b99.6)$ 0.6 $(0.4 \ b0.2)$ 0.7 $(0.5 \ b1.0)$ r 77.4 $(7.6 \ c7.8)$ 0.6 $(0.7 \ b0.6)$ 0.7 $(0.7 \ b0.6)$ r 77.4 $(7.8) \ c8.4) \ c8.6)$ 10.7 $(10.1 \ b1.13)$ 0.7 $(10.1 \ b1.6)$ r 10.7 $(10.7 \ c7.8)$ 0.6 $(0.4 \ c0.6)$ 0.6 $(0.4 \ c0.6)$ <	Educational status								
γ 67.3 $(87.0 \ 0.86)$ 11.9 $(11.1 \ 0.12.6)$ 0.3 $(0.2 \ 0.0.5)$ $dary$ 90.9 $90.0 \ 0.91.8$) 8.7 $(7.81 \ 0.96)$ 0.4 $(0.3 \ 0.0.6)$ r 94.9 $(22.2 \ 0.96.7)$ 5.1 $(3.31 \ 0.7.8)$ 0.4 $(0.31 \ 0.0.6)$ r 89.9 $(88.4 \ 0.89.6)$ 10.7 $(10.11 \ 0.11.3)$ 0.3 $(0.31 \ 0.0.6)$ r 89 $(88.4 \ 0.89.6)$ 10.7 $(10.11 \ 0.11.3)$ 0.3 $(0.31 \ 0.0.6)$ r r $(7.81 \ 0.86.6)$ 21.8 $(20.7 \ 0.23.1)$ 0.7 $(0.51 \ 0.10.6)$ r 77.4 $(76.2 \ 0.78.6)$ 21.8 $(0.41 \ 0.0.8)$ 0.7 $(0.51 \ 0.10.6)$ r 99.4 $(99.11 \ 0.90.6)$ 0.6 $(0.41 \ 0.0.8)$ 0.7 $(0.51 \ 0.10.6)$ r 77.4 $(7.81 \ 0.8.6)$ 10.7 $(10.11 \ 0.11.3)$ 0.7 $(0.51 \ 0.10.6)$ r $89.4 \ 0.99.6$ 10.7 $(11.7 \ 0.41.6)$ 0.3 $(0.31 \ 0.0.6)$ r r r 10.7 $(11.7 \ 0.41.6)$ 0.8 $(11.0.0.6)$ r 88.7 88.7 $88.2 \ 0.90.4$ $98.2 \ 0.90.4$ $98.2 \ 0.00.6$ 0.4 $(0.14 \ 0.0.5)$ r r r 10.7 $11.7 \ 0.41.65.7$ $11.7 \ 0.41.65.7$ $11.7 \ 0.41.65.7$ r r $11.7 \ 0.41.65.7$ $11.7 \ 0.41.65.7$ $11.7 \ 0.41.65.7$ $11.7 \ 0.41.65.7$ r $11.7 \ 0.85.7$ $11.7 \ 0.85.7$ $11.7 \ 0$	No education	88.7	(87.0 to 90.3)	10.9	(9.4 to 12.7)	0.4	(0.2 to 0.7)	1599	
	Primary	87.8	(87.0 to 88.6)	11.9	(11.1 to 12.6)	0.3	(0.2 to 0.5)	9770	
	Secondary	6.06	(90.0 to 91.8)	8.7	(7.8 to 9.6)	0.4	(0.3 to 0.6)	5077	
89(83.4 to 89.6)10.7(10.1 to 11.3)0.3(0.3 to 0.5)n: uncorrected chi-square (b)=48.0492 -1 -1 -1 -1 -1 -1 n-based F(5.4.1 2198.19)=7.1355 p<0.001	Higher	94.9	(92.2 to 96.7)	5.1	(3.3 to 7.8)			330	
n: uroorrected chi-square (6)=48.0492 -based F(5.41, 2198.19)=7.1355 p<0.001	Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16776	
-based F(5.41, 2198.19)=7.1355 p<0.001(0.5 to 1.0)(0.5 to 1.0) 77.4 77.4 76.2 to 78.6) 21.8 20.7 to 23.1 0.7 $(0.5 to 1.0)$ e99.4(99.1 to 99.6) 0.6 $(0.4 to 0.8)$ 0.3 $(0.3 to 0.5)$ n: uncorrected chi-square (2)=2024.584310.7 $(10.1 to 11.3)$ 0.3 $(0.3 to 0.5)$ on: uncorrected chi-square (2)=2024.584310.7 $(10.1 to 11.3)$ 0.3 $(0.3 to 0.5)$ on: uncorrected chi-square (2)=2024.584310.7 $(10.1 to 11.3)$ 0.3 $(0.3 to 0.5)$ onnn $(1.59, 645.90)=866.1712$ $(1.7 to 1.4, 5)$ 0.3 $(0.3 to 0.5)$ onn13 $(11.7 to 1.4.5)$ 0.3 $(0.1 to 0.5)$ n72.2 $(9.3 to 98.4)$ 9.8 $(9.3 to 10.5)$ 0.4 $(0.3 to 0.5)$ n71.4 $(63.3 to 78.3)$ 28.6 $(10.4 to 45.2)$ 4.2 $(0.6 to 25.7)$	Pearson: uncorrected ch	ii-square (6)=48.0492							
77.4 $(76.2 \text{ to} 78.6)$ 21.8 $(20.7 \text{ to} 23.1)$ 0.7 $(0.5 \text{ to} 1.0)$ e 99.4 $(99.1 \text{ to} 99.6)$ 0.6 $(0.4 \text{ to} 0.8)$ $(0.3 \text{ to} 0.5)$ 89 $(88.4 \text{ to} 89.6)$ 10.7 $(10.1 \text{ to} 11.3)$ 0.3 $(0.3 \text{ to} 0.5)$ 71.4 $(99.1 \text{ to} 99.6)$ 10.7 $(10.1 \text{ to} 11.3)$ 0.3 $(0.3 \text{ to} 0.5)$ $91.1 \text{ corrected chi-square (2)=2024.58431.07(10.7 \text{ to} 11.3)0.3(0.3 \text{ to} 0.5)71.486.7(88.4 \text{ to} 89.6)10.7(10.1 \text{ to} 11.3)0.3(0.3 \text{ to} 0.5)1010.510.711.711.711.60.3(0.1 \text{ to} 0.5)1086.7(85.2 \text{ to} 80.4)9.8(9.3 \text{ to} 10.5)0.4(0.3 \text{ to} 0.5)1072.2(49.8 \text{ to} 87.1)23.6(10.4 \text{ to} 45.2)4.2(0.6 \text{ to} 25.7)1071.4(63.3 \text{ to} 78.3)28.6(21.7 \text{ to} 36.7)(0.6 \text{ to} 25.7)$	Design-based F(5.41, 21	98.19)=7.1355 p<0.001							
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Sex								
e 99.4 $99.1 to 99.6$) 0.6 $(0.4 to 0.8)$ 89 $88.4 to 89.6$) 10.7 $(10.1 to 11.3)$ 0.3 $(0.3 to 0.5)$ $71 to 00000000000000000000000000000000000$	Male	77.4	(76.2 to 78.6)	21.8	(20.7 to 23.1)	0.7	(0.5 to 1.0)	7969	
89 $88.4 \text{ to } 89.6$ 10.7 $(10.1 \text{ to } 11.3)$ 0.3 $(0.3 \text{ to } 0.5)$ n: nrorrected chi-square (2)=2024.5843n-based F(1.59, 645.90)=866.1712 p<0.01	Female	99.4	(99.1 to 99.6)	0.6	(0.4 to 0.8)			8823	
DescriptionDescriptionDescriptionDescription1-based F(1.59, 645.90)=866.1712 p<0.001	Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793	
n-based F(1.59, 645.90)=866.1712 p<0.001(11.100)(11.7 to 14.5)(11.0 to 14.5)(11.0 to 15.5)on 86.7 86.7 $85.2 to 88.1$ 13 $(11.7 to 14.5)$ 0.3 $0.1 to 0.5$ lic 89.8 $89.2 to 90.4$ 9.8 $9.3 to 10.5$ 0.4 $0.3 to 0.5$ n 72.2 $(49.8 to 87.1)$ 23.6 $(10.4 to 45.2)$ 4.2 $(0.6 to 25.7)$ 71.4 $(63.3 to 78.3)$ 28.6 $(21.7 to 36.7)$	Pearson: uncorrected ch	ii-square (2)=2024.5843							
on 86.7 (85.2 to 88.1) 13 (11.7 to 14.5) 0.3 (0.1 to 0.5) itant 89.8 (89.2 to 90.4) 9.8 (9.3 to 10.5) 0.4 (0.3 to 0.5) n 72.2 (49.8 to 87.1) 23.6 (10.4 to 45.2) 4.2 (0.6 to 25.7) n 71.4 (63.3 to 78.3) 28.6 (21.7 to 36.7) 1.5 1.5	Design-based F(1.59, 64	5.90)=866.1712 p<0.001							
lic 86.7 (85.2 to 88.1) 13 (11.7 to 14.5) 0.3 (0.1 to 0.5) stant 89.8 (89.2 to 90.4) 9.8 (9.3 to 10.5) 0.4 (0.3 to 0.5) n 72.2 (49.8 to 87.1) 23.6 (10.4 to 45.2) 4.2 (0.6 to 25.7) 71.4 (63.3 to 78.3) 28.6 (21.7 to 36.7) 1.4 (0.6 to 25.7)	Religion								
itant 89.8 (89.2 to 90.4) 9.8 (9.3 to 10.5) 0.4 (0.3 to 0.5) n 72.2 (49.8 to 87.1) 23.6 (10.4 to 45.2) 4.2 (0.6 to 25.7) 71.4 (63.3 to 78.3) 28.6 (21.7 to 36.7) (0.6 to 25.7)	Catholic	86.7	(85.2 to 88.1)	13	(11.7 to 14.5)	0.3	(0.1 to 0.5)	3103	
n 72.2 (49.8 to 87.1) 23.6 (10.4 to 45.2) 4.2 (0.6 to 25.7) 71.4 (63.3 to 78.3) 28.6 (21.7 to 36.7)	Protestant	89.8	(89.2 to 90.4)	9.8	(9.3 to 10.5)	0.4	(0.3 to 0.5)	13438	
71.4 (63.3 to 78.3) 28.6 (21.7 to 36.7)	Muslim	72.2	(49.8 to 87.1)	23.6	(10.4 to 45.2)	4.2	(0.6 to 25.7)	30	
	Other	71.4	(63.3 to 78.3)	28.6	(21.7 to 36.7)			166	

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Rural								
Smoking								
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates	
	%	95% CI	%	95% CI	%	95% CI		
Total	89	(88.4 to 89.6)	10.6	(10.1 to 11.2)	0.4	(0.3 to 0.5)	16736	
Pearson: uncorrected chi-square (6)=100.7914	re (6)=100.7914							
Design-based F(5.62, 2281.12)=13.6607 p<0.001	=13.6607 p<0.001							
Wealth index								
Low	86.3	(85.5 to 87.0)	13.2	(12.5 to 14.0)	0.5	(0.4 to 0.7)	10253	
Middle	93	(92.0 to 93.8)	6.9	(6.1 to 7.8)	0.1	(0.1 to 0.3)	4197	
High	93.7	(92.4 to 94.7)	6.3	(5.2 to 7.5)	0.1	(0.0 to 0.3)	2342	
Total	68	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793	
Pearson: uncorrected chi-square (4)=196.4984	re (4)=196.4984							
Design-based F(3.88, 1573.92)=48.2620 p<0.001	=48.2620 p<0.001							
Occupation								
Not working	97.5	(96.9 to 98.1)	2.4	(1.9 to 3.1)	0.1	(0.0 to 0.2)	4855	
Professional/technical	89.1	(82.9 to 93.3)	10.9	(6.7 to 17.1)			289	
Clerical	93.4	(91.7 to 94.7)	6.5	(5.1 to 8.1)	0.2	(0.1 to 0.6)	1444	
Agricultural-self employed	83.6	(81.6 to 85.5)	15.5	(13.6 to 17.5)	0.9	(0.6 to 1.3)	2942	
Agricultural—employee	85.3	(84.2 to 86.4)	14.4	(13.3 to 15.5)	0.3	(0.1 to 0.5)	6112	
Services	80.2	(72.1 to 86.4)	18.3	(12.4 to 26.2)	1.5	(0.3 to 7.1)	129	
Skilled manual	7.77	(73.3 to 81.5)	21.9	(18.1 to 26.3)	0.4	(0.1 to 1.3)	582	
Unskilled manual	80.1	(72.2 to 86.2)	18.6	(12.7 to 26.4)	1.3	(0.3 to 5.4)	144	
Other	85.5	(79.9 to 89.7)	12.7	(8.7 to 18.1)	1.9	(0.8 to 4.5)	240	
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16737	
Pearson: uncorrected chi-square (16)=688.4888	re (16)=688.4888							
Design-based F(11.23, 4559.07)=32.9800 p<0.001	7)=32.9800 p<0.001							
Frequency of listening to radio	.0							
Not at all	91.6	(90.7 to 92.4)	8.2	(7.4 to 9.1)	0.2	(0.1 to 0.4)	6119	
Less than once a week	84.8	(83.0 to 86.4)	14.7	(13.1 to 16.4)	0.5	(0.3 to 0.9)	2100	
At least once a week	87.7	(86.3 to 89.1)	11.9	(10.6 to 13.3)	0.4	(0.2 to 0.7)	3143	
Almost every day	88.4	(87.4 to 89.3)	11.2	(10.3 to 12.1)	0.4	(0.3 to 0.7)	5415	
							Continued	

Table 2 Continued							
Rural							
Smoking							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16778
Pearson: uncorrected chi-square (6)=87.1177	are (6)=87.1177						
Design-based F(5.56, 2255.47)=13.0440 p<0.001)=13.0440 p<0.001						
Frequency of watching television	ision						
Not at all	89.2	(88.5 to 89.9)	10.4	(9.7 to 11.1)	0.4	(0.3 to 0.5)	12140
Less than once a week	82.4	(80.2 to 84.4)	17.3	(15.3 to 19.5)	0.3	(0.1 to 0.7)	1764
At least once a week	90.2	(88.2 to 91.9)	9.4	(7.8 to 11.4)	0.4	(0.1 to 1.0)	1320
Almost every day	93.1	(91.6 to 94.4)	6.7	(5.5 to 8.2)	0.1	(0.0 to 0.4)	1553
Total	89	(88.4 to 89.5)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16778
Pearson: uncorrected chi-square (6)=110.4672	are (6)=110.4672						
Design-based F(5.55, 2251.39)=16.6299 p<0.001)=16.6299 p<0.001						
Relationship to household head	ead						
Head	75.4	(74.0 to 76.7)	23.8	(22.5 to 25.1)	0.8	(0.6 to 1.1)	5953
Spouse	98.3	(97.8 to 98.7)	1.6	(1.3 to 2.2)	0.1	(0.0 to 0.2)	5115
Son/daughter	99.5	(98.8 to 99.8)	0.5	(0.2 to 1.2)			1695
Daughter-in-law	93.5	(92.1 to 94.6)	6.4	(5.2 to 7.7)	0.1	(0.1 to 0.4)	2027
Granddaughter/son	94.9	(91.3 to 97.0)	5.1	(3.0 to 8.7)	0		304
Father/mother	89.2	(84.3 to 92.7)	10.3	(6.8 to 15.1)	0.6	(0.1 to 2.3)	262
Father/mother-in-law			100				CJ
Brother/sister	100						107
Co-spouse	80.1	(72.3 to 86.2)	19.9	(13.8 to 27.7)			174
Other relative	96.8	(94.8 to 98.0)	2.6	(1.5 to 4.5)	0.6	(0.2 to 1.9)	400
Adopted/foster child	98.7	(94.6 to 99.7)	1.3	(0.3 to 5.4)			151
Not related	83.2	(77.1 to 87.9)	16.2	(11.6 to 22.3)	0.6	(0.1 to 4.1)	251
Niece/nephew by blood	96	(91.7 to 98.1)	3.8	(1.7 to 8.0)	0.3	(0.0 to 1.8)	220
Niece/nephew by marriage	88.6	(81.1 to 93.3)	11.4	(6.7 to 18.9)			131
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (26)=1885.3640	are (26)=1885.3640						
							Continued

lable 2 Continued							
Rural							
Smoking							
	Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
	%	95% CI	%	95% CI	%	95% CI	
Design-based F(20.98, 8518.16)=56.9133 p<0.001	6)=56.9133 p<0.001						
Sex of household head							
Male	87.9	(87.2 to 88.6)	11.7	(11.1 to 12.4)	0.4	(0.3 to 0.5)	13733
Female	93.8	(92.7 to 94.7)	9	(5.1 to 7.1)	0.2	(0.1 to 0.4)	3059
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (2)=86.5974	are (2)=86.5974						
Design-based F(1.92, 781.31)=41.2201 p<0.001	=41.2201 p<0.001						

versus a non-smoker for urban residents was higher for those working or with an occupation relative to those who were not doing anything. On the contrary, the risk of being a cigarette smoker versus a non-smoker in both urban and rural was lower for the following: those with an education relative to those with no form of education; Protestants relative to Catholics and lastly those in the middle wealth quintile as well as high wealth quintile relative to those in the low wealth quintile.

On the other hand, table 4 shows that the risk of being a pipe and other smoker versus a non-smoker increases with each additional age in rural areas. In urban areas, the risk of being a pipe and other smoker was higher for fathers/mothers to the household head (RRR: 14.29, CI: 1.66 to 122.79) relative to the head of the household. Similarly, in rural areas, the risk of being a pipe and other smoker was higher for those who were self-employed (RRR: 8.46, CI: 2.95 to 24.20) or with an occupation (RRR: 2.37, CI: 1.39 to 4.02) relative to those who were not doing anything and was higher for Muslims (RRR: 18.55, CI: 1.81 to 189.77) relatives to Catholics.

Conversely, in urban areas, the risk of being a pipe and other smoker was lower for those with a primary education (RRR: 0.36, CI: 0.11 to 1.16) relative to those without any form of education; and for protestants (RRR: 0.39, CI: 0.14 to 1.11) relative to Catholics. Similarly, in rural areas, the risk of being a pipe and other smoker was lower for those in the middle wealth quintile (RRR: 0.31, CI: 0.14 to 0.67) and high wealth quintile (RRR: 0.16, CI: 0.04 to 0.73) relative to those in the low wealth quintile. However, in both urban and rural, the risk of being a pipe and other smoker was lower for women relative to men.

DISCUSSION

The findings of this study indicate that the prevalence of smoking in Zambia is a notable public health problem and it is consistent with the prevailing prevalence in Sub-Saharan Africa.⁹ The overall prevalence of smoking in this study is slightly higher in the overall urban Zambia compared with the prevalence obtained in Lusaka alone, the capital city of Zambia by Siziya *et al.*¹⁶ The findings are similar to findings by Pampel who found high cigarette use among urban residents.⁹ The prevalence of male cigarette smokers in this study was high compared with that of females both in the rural and urban areas. This is consistent with the findings of Siziya et al in Lusaka¹⁶ and of Zyaambo *et al* in Kitwe, the mining city of Zambia¹⁷ and of Mulenga et al in Kaoma and Kasama, rural towns in Zambia.¹⁸ To the best of our knowledge, the current study is the first of its kind to evaluate and compare smoking between rural and urban in the same study in Zambia, the other studies only focused on either rural or urban areas alone.

In many previous studies, the risk of cigarette smoking has been correlated to various demographic, socioeconomic and cultural factors by different researchers. Our study found that; age, gender, education, occupation,

		Urban	Rural
		RRR	
Base outcome	Non-smokers		
Type of smoking	Cigarette smokers		
Socioeconomic and demographic variables			
Age	15–19 (RC)	1	1
	20–24	4.33***	5.77***
		(3.08–6.09)	(4.08–8.15)
	25–29	9.27***	12.97***
		(6.51–13.22)	(9.00–18.68)
	30–34	9.16***	13.82***
		(6.3–13.2)	(9.47–20.16)
	35–39	7.71***	15.21***
		(5.28–11.25)	(10.38–22.28)
	40–44	9.95***	19.96***
		(6.75–14.67)	(13.63–29.25)
	45–49	10.96***	28.52***
		(7.28–16.51)	(19.31–42.13)
	50–54	8.96***	22.00***
		(5.78–13.91)	(14.56–33.25)
	55–59	10.93***	20.17***
		(6.76–17.67)	(13.15–30.93)
Relationship to the household head	Head (RC)	1	1
	Son/daughter	3.44***	
		(1.48–7.96)	
	Son/daughter-in-law	1.55***	0.66***
		(1.25–1.93)	(0.51–0.85)
	Niece/nephew by marriage	2.08***	
		(1.24–3.49)	
	Other relative	· · · ·	0.49**
			(0.26–0.89)
Marital status	Never in union (RC)		1
	Married		0.69***
			(0.55–0.86)
	Living with a partner		0.45**
	<u> </u>		(0.23–0.90)
	Divorced	2.31***	1.84***
		(1.69–3.16)	(1.30–2.61)
	No longer living together/separated	2.03***	(
		(1.36–3.02)	

Continued

HeatUrbanRerailBas outcomCigarets mokers-Type of snokingCigarets mokers-OccupationNot occupied (RC)1.37"Professional/hechnical/managel1.37"-Agricultural-self employed1.62"-Agricultural-employee1.62"-1.12_45)Agricultural-employee1.62"-1.62"1.62"Agricultural-employee1.62"-1.62"1.62"1.62"Agricultural-employee1.64"-1.62"1.62"1.62"1.63"1.64"<	Table 3 Continued			
Base outcome Non-smokers Type of smoking Cigarette smokers Occupation Not occupied (RC) 1 Professional/technical/managerial 137** (1,07-1,76) Agricultural-self employed 1.65** Agricultural-self employee 1.62*** (1,11-2,45) Agricultural-employee 1.62*** Services 2.16*** (1,36-2,28) Skilled manual 1.74*** (1,36-2,23) Unskilled manual 1.85*** (1,26-2,35) Other occupation 1.72*** (1,26-2,35) Other occupation 1.72*** (0,64-0.88) Frequency of watching TV Not at all (RC) 1 At least once a week 0.75*** (0.64-0.88) Frequency of listening to the radio Not at all (RC) 1 1 At least once a week 0.67*** 0.72*** (0,64-0.88) Secondary 0.67*** 0.63*** Frequency of listening to the radio No education (RC) 1 1 Primary 0.67*** 0.22*** 0.23				Rural
Type of smoking Cigarette smokers Occupation Not occupied (RC) 1 Professional/technical/managerial 1.37** (1.07-1.76) Agricultural—self employed 1.65** Agricultural—self employee 1.62*** 1.11-2.45) Agricultural—employee 1.62*** 1.11-2.45) Agricultural—self employee 1.62*** 1.16-2.98) Services 1.56-2.98) 1.56-2.98) Skilled manual 1.74*** 1.36-2.53) Other occupation 1.72*** 1.12-2.55) Other occupation 1.72*** 1.12-2.45) Frequency of watching TV Not at all (RC) 1 At least once a week 0.75*** 0.64-0.88) Frequency of listening to the radio Not at all (RC) 1 At least once a week 0.82*** 0.637-0.78) 0.63-0.82) Education status No education (RC) 1 1 Primary 0.67*** 0.29*** 0.29*** Gender Male (RC) 1 1 Remale 0.			RRR	
Occupation Not occupied (RC) 1 Professional/technical/managerial 1.37** (1.07-1.78) (1.07-1.78) Agricultural—self employed 1.65** (1.11-2.45) (1.11-2.45) Agricultural—employee 1.62*** (1.23-2.14) Services Services 2.16** (1.36-2.24) (1.36-2.24) Unskilled manual 1.4*** (1.35-2.53) Unskilled manual 1.36*-2:03) (1.36-2.24) Unskilled manual 1.4*** (1.36-2.23) Unskilled manual 1.36*-2:03) (1.36-2.35) Other occupation 1.2*** (1.26-2.35) (1.26-2.35) Frequency of watching TV Not at all (RC) 1 At least once a week 0.2*** (0.64-0.88) Frequency of listening to the radio Not at all (RC) 1 At least once a week 0.2*** (0.37-0.78) (0.37-0.92) Secondary 0.3*** (0.31-0.54) 0.41*** 0.29*** (0.3	Base outcome	Non-smokers		
Professional/technical/managerial1.37**(1.07-1.76)Agricultural—employed1.65**(1.11-2.45)Agricultural—employee1.62***Agricultural—employee1.62***(1.23-2.14)1.54***Services2.16***Agricultural—employee1.65*-2.98)Agricultural—employee1.56*-2.98)Agricultural—employee1.56*-2.98)Agricultural—employee1.56*-2.98)Agricultural—employee1.56*-2.98)Agricultural—employee1.56*-2.98)Agricultural—employee1.55*-2.53)Agricultural—employee1.26*-2.93)Agricultural—employee1.26*-2.93)Agricultural—employee0.57***Agricultural—employee0.57***Agricultural—employee0.57***Agricultural—employee0.62***Agricultural—employee0.62***Agricultural—employee0.62***Agricultural—employee0.62***Agricultural—employee0.61***Agricultural—employee0.61***Agricultural—employee0.61***Agricultural—employee0.61***Agricultural—employee0.61***Agricultural—employee0.61****Agricultural—employee0.61****Agricultural—employee0.61****Agricultural—employee0.61****Agricultural—employee0.61*****Agricultural—employee0.61*****Agricultural—employee0.61*******Agricultural—employee0.61***********Agri	Type of smoking	Cigarette smokers		
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Religion (denomination)Catholic (RC)11Protestant0.64***0.65***		Female	0.01***	0.01***
Protestant 0.64*** 0.65***			(0.01–0.02)	(0.01–0.02)
	Religion (denomination)	Catholic (RC)	1	1
(0.55–0.75) (0.57–0.75)		Protestant	0.64***	0.65***
			(0.55–0.75)	(0.57–0.75)
Wealth Index Low (RC) 1 1	Wealth Index	Low (RC)	1	1
Middle 0.60*** 0.49***		Middle	0.60***	0.49***
(0.46–0.77) (0.42–0.57)			(0.46–0.77)	(0.42–0.57)
High 0.35*** 0.50***		High	0.35***	0.50***
(0.27–0.45) (0.40–0.62)			(0.27–0.45)	(0.40-0.62)

CI in parentheses.

*** p<0.01, ** p<0.05.

†p<0.1.

RC, reference category; RRR, relative risk ratio; TV, television.

Table 4 Correlates of smoking in rural a	and urban Zambia—multing	Urban		
		RRR	Rurai	
Base outcome	Non-smokers			
Type of smoking		Pipe and other smo	Pipe and other smokers	
Socioeconomic and demographic variat	bles			
Age	15–19 (RC)		1	
	25–29		14.71***	
			(2.65–81.72)	
	30–34		16.75***	
			(2.85–98.60)	
	35–39		15.72***	
			(2.56–96.36)	
	40–44		17.87***	
			(2.86–111.64)	
	45–49		41.51***	
			(6.87–250.65)	
	50–54		20.08***	
			(2.99–134.92)	
Relationship to the household head	Head (RC)	1		
	Father/mother	14.29**		
		(1.66–122.79)		
Occupation	Not working (RC)		1	
	Other occupation		8.46***	
			(2.95–24.20)	
	Agricultural-self emplo	byed	2.37***	
			(1.39–4.02)	
Education status	No education (RC)	1		
	Primary	0.36†		
		(0.11–1.16)		
Gender	Male (RC)	1	1	
	Female	0.05***	0.01***	

Catholic (RC)

Protestant

Muslims

Low (RC)

Middle

High

(0.01 - 0.39)

1

0.39† (0.14-1.11)

CI in parentheses, ***p<0.01, **p<0.05. †p<0.1

Religion (denomination)

Wealth index

RC, reference category.; RRR, relative risk ratio.

(0.01 - 0.07)

18.55** (1.81-189.77)

0.31*** (0.14-0.67)

0.16** (0.04-0.73)

1

marital status, religion, wealth index, relationship to head of household, frequency of watching television and listening to the radio are significantly associated with the risk of being a cigarette smoker. This study documents a significant association between age and the risk of cigarette smoking both in the rural and urban areas of Zambia. The observation by our study is that the risk of being a cigarette smoker in both rural and urban area increases with the increase in age. The findings concur with findings by Sreeramareddy et al who found that older ages were strongly associated with smoking.¹¹ Similar findings were found by Mamudu in Madagascar indicating that age, education, wealth, employment, marriage, religion and place of residence as factors significantly associated with the choice of tobacco use among males, while age, wealth and employment were significantly associated with that of females.¹⁴ This stands in contrast with the finding by Townsend and colleagues who relate age to ability to afford the cost of cigarette as opposed to simply increase in age.¹⁹

Gender showed significant association with the risk of cigarette smoking in our study, females presented a reduced risk of cigarette smoking compared with males and this is in accord with what is obtaining in sub-Saharan Africa where the estimated prevalence of tobacco consumption is 14% in males and 2% in females in 2010.¹⁶ Similarly, another study conducted in the rural parts of Zambia, Kaoma and Kasama by Mulenga et al indicate a high prevalence of smoking at 39.6% among males and 10.8% among female and 40.4% among males and 7.2% among females respectively.²⁰ Pampel also found that women had much lower prevalence than men but similar social patterns of use.⁹ Similarly, a study by Sreeramareddy et al found that there were fewer females who smoked in most countries.¹¹ However, a study by Kwamena in Ghana and Lesotho showed that Smoking prevalence was smaller in men with higher level of education compared with men with no education.¹² According to Hsia and Kaufmann, low tobacco use in men is generally found in countries in sub-Saharan Africa and Latin America/Caribbean while women are less likely than men to use tobacco.¹⁵

In our study religion was significantly associated with cigarette smoking. Non-Catholics were at low risk of cigarette smoking compared with catholic participants. This is supported by the religion-based public health interventions: relevance for tobacco control by Jabbour and Fouad.²¹ Religious affiliation was also noted by Kwamena, who found that tobacco use was higher in men who are traditionalist/spiritualists or who had no religion compared with Christians.¹²

Compared with those in the low wealth index, those in the middle and high wealth index were at a reduced risk of cigarette smoking. This findings are in contrast with the findings of Townsend and colleagues.¹⁹ On the other hand, individuals with an occupation in our study were at an increased risk of being cigarette smokers compared with those not having a job. This aspect agrees with Townsend who states that those with an income are less responsive to the health information and promotion regarding tobacco smoking. According to Kwamena, tobacco use was lower among professional workers compared with men in the agricultural sector in both Ghana and Lesotho.¹²

Individuals in this study from the rural areas were at an increased risk of cigarette smoking compared with those from the urban areas. This finding is comparable with the findings in Tunisia by Fakhfakf *et al*²² who also observed a higher prevalence of smoking in the rural area compared with the urban areas. It is also important to note that the prevalence of cigarette smoking in 2014^{19} is consistent with the prevalence obtained in previous ZDHS cigarette smoking statistics.

Our findings show that those with primary and secondary education were at a lower risk of cigarette smoking compared with those with no form of education, similarly, individuals who watched television or listened to the radio at least once a week were at a reduced risk of cigarette smoking compared with those who never watched television or listened to radio at all. The study findings also correlate with findings by Pampel who found that the less educated and lower status workers had high cigarette use.⁹ This observation is vital for programming and interventions as documented by Chapman²³ stating that there is evidence that health information, promotion, advertising and smoking restrictions can be effective interventions of cigarette smoking on television and radio.

Relatives to the head of household in urban areas were at a higher risk of smoking cigarette compared with the head of household. This finding agrees with the results in Chongwe, Zambia and Nigeria where the adolescents whose parents were smokers were more likely to start smoking²²⁴ compared with individuals whose parents were not smokers. However, in rural areas, our results indicate that relatives to the head of household were at low risk of smoking compared with the head of household and this can be attributed to local customs, implying some form of respect for the head of household. The married/ living with a partner were at a lower risk of smoking cigarette compared with those who have never been in union before. On the contrary, the divorced/separated were at a higher risk of smoking cigarette compared with those who have never been in union both in rural and urban area. This is more likely to be attributed to ways of reducing stress and feeling loneliness. The study was limited to the available indicators in the DHS dataset hence could not associate the correlates of smoking to health outcomes as tobacco use is a risk factor to many NCDs.

CONCLUSION

Factors influencing tobacco smoking vary between and within regions as well as provinces. The geographic disparities play a role in tobacco consumption between rural and urban areas. Therefore, interventions to curb **s**moking should target specific demographic, socioeconomic and cultural factors.

Acknowledgements We wish to thank the Zambia Central Statistics Office (CSO) for granting us permission to use the data. More specifically, we thank the Dissemination Office for the quick response to the request.

Contributors All authors were responsible for facets of the study. However, HTN was responsible for the formulation, methods, data analysis, results and discussion of the study. DM and TN contributed to the design, formulation and study discussion. HBCN and MS contributed to all facets of this research including writing, proof reading and discussion. The paper was read and reviewed by all authors read.

Funding The study was not funded as it used National Demographic Health Survey data.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Permission to use the data was sought from Central Statistics Office, Zambia and approval to use the data was granted.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. Data are available upon reasonable request.

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REFERENCES

- Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. *Zambia demographic and health survey 2013-14*. Calverton, Maryland, USA: CSO and Macro International Inc.
- Siziya S, Rudatsikira E, Muula AS, et al. Predictors of cigarette smoking among adolescents in rural Zambia: results from a cross sectional study from Chongwe [corrected] district. *Rural Remote Health* 2007;7:728.
- Brathwaite R, Addo J, Smeeth L, et al. A systematic review of tobacco smoking prevalence and description of tobacco control strategies in sub-Saharan African countries; 2007 to 2014. PLoS One 2015;10:e0132401.
- Siziya S. Higher prevalence rates of smoking in rural than urban areas among school-going adolescents in Lusaka Province, Zambia. *Med J Zambia* 2009;36.
- 5. Olowski P, Michelo C. Differential burden and determinants of tobacco smoking: population-based observations from the Zambia

demographic and health survey (2002 and 2007). *J Healthc Commun* 2015;01:2472–1654.

- Proctor MH, Moore LL, Singer MR, et al. Risk profiles for noncommunicable diseases in rural and urban schoolchildren in the Republic of Cameroon. *Ethn Dis* 1996:235–43.
- Finau SA, Stanhope JM, Prior IA. Kava, alcohol and tobacco consumption among Tongans with urbanization. Soc Sci Med 1982;16:35–41.
- Araújo C, Azevedo A, Damasceno A, et al. Evolving tobacco consumption in sub-Saharan Africa. Plos One 2015:153–6.
- Pampel F. Tobacco use in sub-Sahara Africa: estimates from the demographic health surveys. Soc Sci Med 2008;66:1772–83.
- Magitta Ng'weina Francis. Epidemiology of tobacco use and dependence in sub-Saharan Africa: a systematic review. Mbeya, Tanzania: Department of Biochemistry and Department of Clinical Pharmacology, Mbeya College of Health and Allied Sciences, University of Dar es Salaam, Journal of Pulmonology and Clinical Research (2018), 2018.
- Sreeramareddy CT, Pradhan PM, Sin S. Prevalence, distribution, and social determinants of tobacco use in 30 sub-Saharan African countries. *BMC Med* 2014;12.
- Dickson KS, Ahinkorah BO. Understanding tobacco use and socioeconomic inequalities among men in Ghana, and Lesotho. *Arch Public Health* 2017;75.
- Sinha DN, Suliankatchi RA, Amarchand R, et al. Prevalence and sociodemographic determinants of any tobacco use and dual use in six countries of the who south-east Asia region: findings from the demographic and health surveys. *NICTOB* 2016;18:750–6.
- Mamudu HM, John RM, Veeranki SP, et al. The odd man out in sub-Saharan Africa: understanding the tobacco use prevalence in Madagascar. BMC Public Health 2013;13:856.
- Hsia J, Kaufmann R. Tobacco use by men and women in 49 countries with demographic and health surveys. DHS comparative reports No. 31. Calverton, Maryland, USA: ICF International, 2013.
- Siziya S, Babaniyi O, Songolo P, et al. Prevalence and correlates for tobacco smoking among persons aged 25 years or older in Lusaka urban district, Zambia. J public health Epidemiol 2011;3:43–8.
- Zyaambo C, Babaniyi O, Songolo P, et al. Prevalence and predictors of cigarette smoking in a mining town in Kitwe, Zambia: a 2011 population-based survey. *Health* 2013;5:1021–5.
- Mulenga D, Siziya S, Rudatsikira E, *et al*. District specific correlates for hypertension in Kaoma and Kasama rural districts of Zambia. *Rural Remote Health* 2013;13:2345.
- Townsend J, Roderick P, Cooper J. Cigarette smoking by socioeconomic group, sex, and age: effects of price, income, and health publicity. *BMJ* 1994;309:923–7.
- 20. Blecher E, Ross H. *Tobacco use in Africa*. Tobacco Control through Prevention, American Cancer Society, 2013.
- 21. Jabbour S, Fouad FM. Religion-based tobacco control interventions: how should who proceed? *Bull Worl Health Organ* 2004;82.
- 22. Fakhfakh R, Hsairi M, Maalej M, *et al.* Tobacco use in Tunisia: behaviour and awareness. *Bull Worl Health Organ* 2002;80:350–6.
- 23. Chapman S. The role of doctors in promoting smoking cessation. *BMJ* 1993;307:518–9.
- Salawu FK, Danburum A, Desalu OO, et al. Cigarette smoking habits among adolescents in northwest Nigeria. Afri J of Resp Med 2009;8.