

BMJ Open Spatial distribution and correlates of smoking in Zambia

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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 (CI: 1.69 to 3.16) and 2.03 (CI: 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, CI: 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, CI: 2.95 to 24.20) and with an occupation (RRR: 2.37, CI: 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 smoking 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 25 631 EAs and 2 815 897 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 18 052 households across Zambia was selected from 722 clusters, of which only 16 258 were occupied at the time of the fieldwork. Of the occupied households, 15 920 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

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

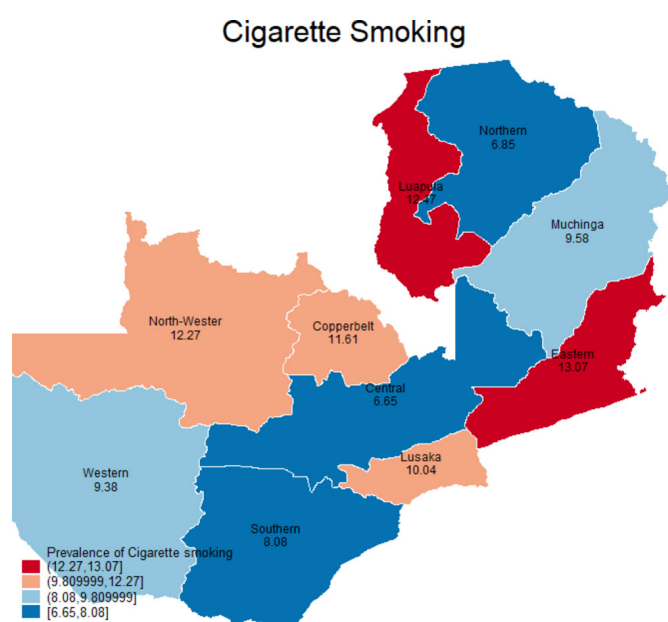


Figure 1 Spatial distribution of cigarette smoking by Province.

Table 1 Percentage distribution and association between smoking, socioeconomic and demographic factors in urban 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	%		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)	9		(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													
Design-based F(12.31, 3631.48)=16.2815 p<0.001													
Marital status													
Never in union	94		(93.0 to 94.8)	6		(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													
Design-based F(6.95, 2051.56)=7.1598 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

Table 1 Continued

Urban									
Smoking status									
	Non-smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers		Population estimates
	%	95% CI	%	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									
Design-based F(9.62, 2838.63)=2.7270 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)			14 384
Pearson: uncorrected chi-square(6)=60.3249									
Design-based F(5.20, 1534.67)=7.7282 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)			14 388
Pearson: uncorrected chi-square (2)=1340.6624									
Design-based F(1.95, 574.01)=571.3623 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)			11 249
Muslim	86.8	(76.2 to 93.1)	13.2	(6.9 to 23.8)					194
Other	70.9	(53.8 to 83.6)	29.1	(16.4 to 46.2)					82

Continued

Table 1 Continued							
Urban							
Smoking status							
	Non-smokers		Cigarette 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							
Design-based F(2.89, 851.69)=6.5833 p<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)	12 338
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 (4)=143.9332							
Design-based F(2.90, 855.70)=41.9643 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)	14 336
Pearson: uncorrected chi-square (16)=956.0431							
Design-based F(9.70, 2862.46)=36.6685 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

Urban

Smoking status

	Non-smokers		Cigarette 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)	14 375
Pearson: uncorrected chi-square (6)=51.3026							
Design-based F(4.69, 1384.79)=5.4160 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)	14 375
Pearson: uncorrected chi-square (6)=198.0866							
Design-based F(4.21, 1241.79)=22.6512 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)	14 385
Pearson: uncorrected chi-square (26)=872.7312							

Continued

Table 1 Continued

Urban											
Smoking status											
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers	
		Non-smokers		Cigarette smokers		Cigarette smokers					

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

χ^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 distribution and association between smoking, socioeconomic and demographic factors in rural Zambia

Rural									
Smoking									
	Non-smokers		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Population estimates
	%	95% CI	%	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									
Design-based F(13.80, 5601.60)=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)			99
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									
Design-based F(9.16, 3720.36)=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

Continued

Table 2 Continued

Rural									
Smoking									
	Non-smokers		Cigarette smokers		Pipe and other smokers		Pipe and other smokers		Population estimates
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Lusaka	90.4	(88.4 to 92.0)	9.4	(7.8 to 11.4)	0.2	(0.1 to 0.8)	0.2	(0.1 to 0.8)	765
Muchinga	86.9	(84.6 to 88.9)	12.7	(10.7 to 15.1)	0.4	(0.2 to 0.8)	0.4	(0.2 to 0.8)	1280
Northern	87.6	(85.9 to 89.0)	12.3	(10.8 to 13.9)	0.1	(0.0 to 0.6)	0.1	(0.0 to 0.6)	1774
North-Western	90.5	(88.6 to 92.2)	7.5	(5.9 to 9.4)	2	(1.4 to 2.8)	2	(1.4 to 2.8)	958
Southern	92.9	(91.1 to 94.3)	6.9	(5.6 to 8.5)	0.2	(0.0 to 0.9)	0.2	(0.0 to 0.9)	2932
Western	84.7	(82.2 to 86.9)	14.1	(12.0 to 16.5)	1.2	(0.7 to 2.2)	1.2	(0.7 to 2.2)	1346
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (18)=239.2696									
Design-based F(13.85, 5624.85)=9.9583 p<0.001									
Educational status									
No education	88.7	(87.0 to 90.3)	10.9	(9.4 to 12.7)	0.4	(0.2 to 0.7)	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)	0.3	(0.2 to 0.5)	9770
Secondary	90.9	(90.0 to 91.8)	8.7	(7.8 to 9.6)	0.4	(0.3 to 0.6)	0.4	(0.3 to 0.6)	5077
Higher	94.9	(92.2 to 96.7)	5.1	(3.3 to 7.8)					330
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	0.3	(0.3 to 0.5)	16776
Pearson: uncorrected chi-square (6)=48.0492									
Design-based F(5.41, 2198.19)=7.1355 p<0.001									
Sex									
Male	77.4	(76.2 to 78.6)	21.8	(20.7 to 23.1)	0.7	(0.5 to 1.0)	0.7	(0.5 to 1.0)	7969
Female	99.4	(99.1 to 99.6)	0.6	(0.4 to 0.8)					8823
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)	0.3	(0.3 to 0.5)	16793
Pearson: uncorrected chi-square (2)=2024.5843									
Design-based F(1.59, 645.90)=866.1712 p<0.001									
Religion									
Catholic	86.7	(85.2 to 88.1)	13	(11.7 to 14.5)	0.3	(0.1 to 0.5)	0.3	(0.1 to 0.5)	3103
Protestant	89.8	(89.2 to 90.4)	9.8	(9.3 to 10.5)	0.4	(0.3 to 0.5)	0.4	(0.3 to 0.5)	13438
Muslim	72.2	(49.8 to 87.1)	23.6	(10.4 to 45.2)	4.2	(0.6 to 25.7)	4.2	(0.6 to 25.7)	30
Other	71.4	(63.3 to 78.3)	28.6	(21.7 to 36.7)					166

Continued

Table 2 Continued

Rural							
Smoking							
	Non-smokers		Cigarette 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							
Design-based F(5.62, 2281.12)=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	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 (4)=196.4984							
Design-based F(3.88, 1573.92)=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	77.7	(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							
Design-based F(11.23, 4559.07)=32.9800 p<0.001							
Frequency of listening to radio							
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		Cigarette smokers		Cigarette smokers		Pipe and other smokers		Population estimates
	%	95% CI	%	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									
Design-based F(5.56, 2255.47)=13.0440 p<0.001									
Frequency of watching television									
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									
Design-based F(5.55, 2251.39)=16.6299 p<0.001									
Relationship to household head									
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						2
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									

Continued

Table 2 Continued

Rural						
Smoking						
Non-smokers	Non-smokers	Cigarette smokers	Cigarette smokers	Pipe and other smokers	Pipe and other smokers	Population estimates
Design-based F(20.98, 8518.16)=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)
Female	93.8	(92.7 to 94.7)	6	(5.1 to 7.1)	0.2	(0.1 to 0.4)
Total	89	(88.4 to 89.6)	10.7	(10.1 to 11.3)	0.3	(0.3 to 0.5)
Pearson: uncorrected chi-square (2)=86.5974						
Design-based F(1.92, 781.31)=41.2201 p<0.001						

Table 3 Correlates of cigarette smoking in rural and urban Zambia—multinomial logistic regression (RRR)

		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*** (3.08–6.09)	5.77*** (4.08–8.15)
	25–29	9.27*** (6.51–13.22)	12.97*** (9.00–18.68)
	30–34	9.16*** (6.3–13.2)	13.82*** (9.47–20.16)
	35–39	7.71*** (5.28–11.25)	15.21*** (10.38–22.28)
	40–44	9.95*** (6.75–14.67)	19.96*** (13.63–29.25)
	45–49	10.96*** (7.28–16.51)	28.52*** (19.31–42.13)
	50–54	8.96*** (5.78–13.91)	22.00*** (14.56–33.25)
	55–59	10.93*** (6.76–17.67)	20.17*** (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*** (1.25–1.93)	0.66*** (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** (0.23–0.90)
	Divorced	2.31*** (1.69–3.16)	1.84*** (1.30–2.61)
	No longer living together/separated	2.03*** (1.36–3.02)	

Continued

Table 3 Continued

		Urban	Rural
		RRR	
Base outcome	Non-smokers		
Type of smoking	Cigarette smokers		
Occupation	Not occupied (RC)	1	
	Professional/technical/managerial	1.37** (1.07–1.76)	
	Agricultural—self employed	1.65** (1.11–2.45)	
	Agricultural—employee	1.62*** (1.23–2.14)	
	Services	2.16*** (1.56–2.98)	
	Skilled manual	1.74*** (1.36–2.24)	
	Unskilled manual	1.85*** (1.35–2.53)	
	Other occupation	1.72*** (1.26–2.35)	
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*** (0.72–0.92)	
Education status	No education (RC)	1	1
	Primary	0.67*** (0.57–0.78)	0.72*** (0.63–0.82)
	Secondary	0.41*** (0.31–0.54)	0.29*** (0.18–0.48)
Gender	Male (RC)	1	1
	Female	0.01*** (0.01–0.02)	0.01*** (0.01–0.02)
Religion (denomination)	Catholic (RC)	1	1
	Protestant	0.64*** (0.55–0.75)	0.65*** (0.57–0.75)
Wealth Index	Low (RC)	1	1
	Middle	0.60*** (0.46–0.77)	0.49*** (0.42–0.57)
	High	0.35*** (0.27–0.45)	0.50*** (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 and urban Zambia—multinomial logistic regression (RRR)

		Urban	Rural
		RRR	
Base outcome	Non-smokers		
Type of smoking		Pipe and other smokers	
Socioeconomic and demographic variables			
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 employed	2.37*** (1.39–4.02)	
Education status	No education (RC)	1	
	Primary	0.36† (0.11–1.16)	
Gender	Male (RC)	1	
	Female	0.05*** (0.01–0.39)	
Religion (denomination)	Catholic (RC)	1	
	Protestant	0.39† (0.14–1.11)	
	Muslims	18.55** (1.81–189.77)	
Wealth index	Low (RC)	1	
	Middle	0.31*** (0.14–0.67)	
	High	0.16** (0.04–0.73)	

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

†p<0.1

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

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 Fakhfakh *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 2014¹⁹ 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 smoking should target specific demographic, socioeconomic and cultural factors.

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