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Cigarette prices in eight sub-Saharan African countries in 2018: a cross-sectional analysis

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ABSTRACT

Objective While the trend in smoking prevalence is decreasing worldwide, the number of male tobacco smokers is growing in Africa. This study compares the cigarette market in eight sub-Saharan African countries. This includes examining cigarette prices, pricing differentials, pack sizes and affordability at national and subnational levels.

Design and setting A cross-sectional data analysis using data from the Data on Alcohol and Tobacco in Africa (DATA) Project. The DATA Project was centrally coordinated by project supervisors following a standardised protocol. University students were recruited to conduct data collection and a total of 22 347 retail cigarette price data points collected between June and August 2018 were analysed (including Botswana, Ethiopia, Lesotho, Namibia, Nigeria, South Africa, Zambia and Zimbabwe). Prices were converted to US$ and standardised to the price of a 20-cigarette pack.

Results This research found large price differentials within provinces/states, with the gap between medium and minimum prices per 20-cigarette pack exceeding 50% of the medium price in 18 out of 24 provinces/states. Single cigarettes were widely available, especially in Lesotho and Ethiopia. Results of multivariable regression suggest prices (per 20-cigarette pack) were lower for cigarettes sold in packs than single sticks (–US$0.27, 95% CI: –US$0.39 to –US$0.23) and lower in less populated areas (–US$0.28 in rural compared with urban settings, 95% CI: –US$0.41 to –US$0.15). Availability of cheaper single cigarettes (lower per unit price than packed cigarettes) were identified for Lesotho and South Africa.

Conclusions These findings identify a varied picture in cigarette pricing in studied countries and suggest measures to tackle pricing differentials and availability of single sticks are warranted. These measures should counteract the potential health consequences of the increasing penetration of tobacco industry in these sub-Saharan African countries.

Strengths and limitations of this study

- ► This study adds important new data on the cigarette price differentials, pack sizes and affordability in eight sub-Saharan African countries (Botswana, Ethiopia, Lesotho, Namibia, Nigeria, South Africa, Zambia and Zimbabwe).
- ► The large volume of retail cigarette prices collected from various types of sales outlets and multiple provinces/states visited enabled analyses to be conducted at national and subnational levels.
- ► Random sampling was not performed which may limit representativeness of the sample.
- ► Categorisation of conurbation size for some cities had to rely on older versions of population size estimates due to a lack of up-to-date data.

INTRODUCTION

Tobacco use is a major cause of preventable death and is currently responsible for more than 8 million deaths per year globally, including approximately 1.2 million deaths through exposure to secondhand smoke.[1] Over time, the global prevalence of tobacco smoking has declined from 25.7% in 2000 to 19.8% in 2015.[2] The number of tobacco smokers has similarly declined, however, this trend has not been consistently observed across all WHO regions.[2] The total number of tobacco smokers has increased in the African, South East Asian and Eastern Mediterranean regions, with increases driven by a growing number of male smokers.[2]

Africa has the lowest tobacco smoking prevalence among all WHO regions (ranged 10.8%–27.3%),[2] but is also the region with the greatest potential for growth of the tobacco market.[3] The large pool of children and young adults and rising disposable income make Africa an appealing prospect for transnational tobacco companies (TTCs).[3] These TTCs are known to take advantage of jurisdictions with relatively weak tobacco regulation and aggressively promote their products on the African continent.[4 5] Research showed the overall sales of cigarettes within Africa increased from 165.6 to 238.5 billion sticks between 1990 and 2012.[5] Africa has transformed from a net importer to a net exporter of cigarettes, with 62 production facilities in 30 countries reported as of 2017.[3 5] Despite

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44 out of 47 countries in the WHO African region have ratified the WHO Framework Convention on Tobacco Control (FCTC),[6] not all countries are protected by comprehensive and national tobacco control laws.[7] For example, an average of almost 60% of youths in the African region are exposed to mass media cigarette advertisements; 6.5% of youths are current cigarette smokers and more than two thirds of them were not refused when purchasing cigarettes in a store.[8] Lack of human and financial resources to implement and enforce tobacco control actions are obstacles commonly identified, but TTC's aggressive marketing and interference with policy making are also hindering efforts to improve tobacco control.[7] Strengthening and implementation of effective tobacco control interventions in African countries is therefore urgently required.

Among all tobacco control policies recommended by the WHO, taxation of tobacco products is the most effective and cost-effective measure.[9] A 10% increase in price is expected to reduce tobacco consumption by 5% in low-income and middle-income countries (LMICs).[10] Increases in tobacco taxation have also been associated with improved health outcomes, including decreased infant mortality.[11] TTCs employ a range of tactics to prevent new tobacco control legislation or attenuate its effects, such as to differentially price their products (eg, raising price of more expensive products by a larger amount) to ensure that cheap cigarettes remain in the market,[12 13] and to maintain the availability of single cigarette sticks.[14] The WHO FCTC recommends a ban on the sale of single cigarettes and several African countries have complied with this.[15] There is limited research on single cigarettes in Africa but a recent study in ten African countries found that single cigarettes were widely sold, suggesting insufficient law enforcement on banning the sale of single cigarettes.[14]

The WHO global report on the tobacco epidemic presents prices of most sold, premium and cheap cigarettes (per 20-cigarette pack) that enable pricing differentials to be assessed at country level. However, these data are often not up-to-date for African countries and do not cover the full range of prices; additional data on pack sizes and sub-national variations are not readily available.[9] To fill these gaps in the literature, we conducted a cross-sectional analysis of cigarette price data from eight sub-Saharan African countries in 2018 to explore elements of the cigarette market, such as pack sizes, pricing differentials and affordability at both national and sub-national levels.

METHODS

Retail cigarette prices

Cigarette price data were obtained from the publicly accessible Data on Alcohol and Tobacco in Africa (DATA) Project.[16] The DATA project was conducted by the University of Cape Town and consisted of seven rounds of data collection during 2016–2019.[16] It was centrally coordinated by the project supervisors following a standardised protocol. Although random sampling was not feasible, the DATA project aimed to collect retail prices of tobacco products sold in various types of outlets (including retail outlets, spaza shops, and street vendors) in a wide range of locations across countries in Africa.[16] Students in the University were recruited to conduct data collection. They were assigned to visit different locations in Africa, and were given detailed instructions on the recording of the price (in both local currency and US$), type and brand of tobacco products, the quantity they were sold in, and the type of outlet visited including its address and GPS coordinates.[16] Data collectors were specifically instructed to enquire the store owner whether there were any cheaper tobacco products available.[16] Data had to be submitted with a photo of the tobacco product and price recorded as well as the storefront of outlet visited, and these were used to verify the validity of price data entries.[16]

We analysed data from round six of the DATA project which were collected between June and August 2018, as it provides a relatively recent cross-sectional overview of the retail prices with the largest volume of data collected from multiple countries.[16] This includes data from 24 provinces/states (referred to as provinces from here onwards) and 43 towns/cities in eight African countries (Botswana, Ethiopia, Lesotho, Namibia, Nigeria, South Africa, Zambia and Zimbabwe).

A total of 22 347 cigarette price data entries were included for analyses after excluding prices of non-cigarette tobacco products (n=780); and prices recorded in quantities of 2, 3 and 6 cigarettes (n=14) as these could be erroneous since data collectors were originally instructed to collect prices of single cigarettes or packs of 10, 20, and 30 or more.[16] Examination of the distribution of cigarette price data for each province/country did not reveal any substantial outliers. For example, there were no sudden 'big jumps' between the lowest and second lowest cigarette prices of each country/province in the dataset. To facilitate comparison of cigarette prices across African countries, we used prices recorded in local currency and converted them to US$ based on the exchange rate at the midpoint of the data collection period (1 July 2018) (online supplemental table 1).[17] Moreover, we standardised cigarette price data by dividing the price entries by their corresponding quantity recorded and then multiplied by 20 to obtain equivalent price for a pack of 20 cigarettes.

Other measures

Country-level data on gross domestic product (GDP) per capita, population size and income classification in 2018 were obtained from the World Bank (online supplemental table 1).[18] Population size and income classification were not used in subsequent analyses but are supplied to provide context of this study. We categorised the 43 towns/cities where cigarette price data were collected into four groups of conurbation size based on a modified version of the classification criteria from the United Nations Statistics Division (rural (<10 000 people); town

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(10 000–99 999 people); city (100 000–499 999 people) and urban (>500 000 people)).[19] Data on population size of the towns/cities were extracted from official census or government projections except for two locations where data were not found (n=148).[20–27]

Statistical analysis

Based on the cigarette prices we standardised for a 20-cigarette pack/equivalent, we computed the median and IQR, pricing differential and affordability for each country and province. Cigarette price differential was defined by a ratio of the difference between the median price and the minimum price over the median price and expressed as a percentage. Higher levels of price differentials indicate a larger gap in cigarette prices within country/province, and this is unfavourable since it may counteract the effectiveness of increased tobacco taxation as it provides opportunities for smokers to trade down to cheaper options instead of reducing consumption.[12] Cigarette affordability of the country/province was measured using relative income price (RIP), which was derived as the percentage of the GDP per capita required to purchase 2000 cigarettes of the median price.[9 28] We used country-specific GDP per capita for the derivation of affordability as the subnational level of GDP per capita were not available for all provinces.

We used the non-parametric Mann-Whitney U tests to compare difference in cigarette prices between provinces, in countries where prices were collected in multiple provinces. We further applied the Mann-Whitney tests to compare cigarette prices between those sold in single sticks and those in packs for each country; and between areas of different conurbation size, among countries with prices collected from different settings. A two-level linear random intercept regression model was employed to account for clustering of cigarette prices at the province level, and to assess differences in prices by pack size (categorised into a binary indicator for single cigarette/otherwise) and conurbation size (urban/city/town/rural) while adjusting for country. A two-sided α at 5% level was considered statistically significant. All statistical analyses were conducted in Stata V.15.

Patient and public involvement

No patients or public members were involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

At the subnational level, number of cigarette price data points collected ranged from 88 in Southern Zambia to 4569 in Maseru (Lesotho) (table 1). Data were collected in multiple provinces in Botswana, Namibia, South Africa and Zimbabwe. Among the 24 provinces included, median price per 20-cigarette pack/equivalent was found lowest in Benue (Nigeria) with US$ 0.56 (IQR: 0.46–0.69) and highest in South East (Botswana) with US$4.18 (IQR: 3.78–4.61) (figure 1).

Cigarette price differentials, as defined by a percentage of the difference between the median price and the minimum price within a province with respect to the median price in the province, were generally high, with 18 out of 24 provinces observed with a price differential over 50% of the median price. Higher cigarette price differentials indicate a larger range in prices within a province. Maseru (Lesotho) was identified with one of the highest price differentials (79.9%) but was also the area cigarettes found least affordable (28.0% for median priced cigarettes). Similarly, high price differentials were observed in provinces of South Africa, ranging from 68.7% to 87.2%. However, their cigarettes were more affordable as suggested by a lower RIP ranging from 3.7% to 4.6%.

Single cigarettes comprised >99% of all cigarette price data collected from Ethiopia and Lesotho (online supplemental table 2). Packs of 20 cigarettes were the most frequently reported option in the other six African countries. However, presence of single cigarettes was also observed and ranged from 0.80% in Namibia to 38.2% in Zimbabwe out of all cigarette price data collected in the respective country. Single cigarettes were generally more expensive in African countries studied than packed cigarettes (table 2). Nevertheless, there existed a wide IQR of prices of single cigarettes in Lesotho and South Africa, suggesting that cheaper single cigarettes were also available. Cigarette prices also varied between urban and rural areas, except for Namibia where no statistically significant difference in prices were identified.

Results of our multilevel regression model show that while clustering at the province level was accounted for, prices per 20-cigarette pack/equivalent were on average US$ 0.27 (95% CI −0.30 to −0.23) lower for cigarettes sold in packs than in single sticks (table 3). Compared with cigarette prices collected in urban areas, those collected from less populated areas were found significantly lower for example, by US$0.28 in rural settings (95% CI −0.41 to −0.15).

DISCUSSION

This study analysed cigarette price data collected in 24 provinces of 8 African countries during 2018. We found that price differentials were generally large, with a gap between medium and minimum prices per 20-cigarette pack/equivalent exceeding 50% of the medium price in three quarters of the provinces. Single cigarettes were prevalent, especially in Lesotho and Ethiopia, but were also common in South Africa, Zambia and Zimbabwe. Most importantly, our analysis suggests there may be cheaper single cigarettes in the markets of Lesotho and South Africa. This finding is particularly interesting as these countries had among the highest smoking prevalence of countries studied.[9] By contrast, prevalence of cigarette use is comparatively low in Nigeria and Ethiopia,[9]

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Table 1 Province-level cigarette prices per 20-cigarette pack/equivalent, price differentials and affordability across 8 African countries

Country	Province	n	Median price	Minimum price	Maximum price	IQR	Price differential (%)	Affordability (%)
Botswana	Chobe District*	65	3.84	2.05	4.56	3.51–4.18	46.6	4.6
	Kweneng	355	4.02†	1.53	7.55	3.75–4.32	61.9	4.9
	South East	1198	4.18†	1.35	8.65	3.78–4.61	67.7	5.1
	Total	*1618*	*4.14*	*1.35*	*8.65*	*3.75–4.52*	*67.4*	*5.0*
Ethiopia	Oromia	1199	1.09	0.73	4.35	0.91–1.45	33.0	14.1
	Total	*1199*	*1.09*	*0.73*	*4.35*	*0.91–1.45*	*33.0*	*14.1*
Lesotho	Maseru	4569	3.64	0.73	4.37	1.46–3.64	79.9	28.0
	Total	*4569*	*3.64*	*0.73*	*4.37*	*1.46–3.64*	*79.9*	*28.0*
Namibia	Khomas*	3148	2.77	1.34	5.83	2.25–3.22	51.6	4.7
	Omusati	169	2.84	1.75	3.78	2.26–3.28	38.4	4.8
	Oshana	435	2.77	1.75	3.64	2.18–3.13	36.8	4.7
	Otjozondjupa	391	2.91	1.74	4.42	2.37–3.31	40.2	4.9
	Total	*4143*	*2.77*	*1.34*	*5.83*	*2.26–3.24*	*51.6*	*4.7*
Nigeria	Benue	92	0.56	0.28	1.11	0.46–0.69	50.0	2.8
	Total	*92*	*0.56*	*0.28*	*1.11*	*0.46–0.69*	*50.0*	*2.8*
South Africa	Free state*	154	2.35	0.73	5.83	1.46–2.91	68.9	3.7
	Gauteng	2275	2.51	0.36	5.10	1.46–2.97	85.7	3.9
	Kwa-Zulu Natal	355	2.91†	0.73	5.83	2.19–3.26	74.9	4.6
	Limpopo	2310	2.66†	0.34	5.83	2.03–3.06	87.2	4.2
	North West	481	2.66†	0.73	5.10	1.93–3.00	72.6	4.2
	Northern Cape	423	2.66†	0.73	4.37	2.11–2.91	72.6	4.2
	Western Cape	90	2.33	0.73	5.10	1.17–2.91	68.7	3.7
	Total	*6088*	*2.66*	*0.34*	*5.83*	*1.86–3.02*	*87.2*	*4.2*
Zambia	Southern	88	1.00	0.45	2.99	0.65–1.54	55.0	6.5
	Total	*88*	*1.00*	*0.45*	*2.99*	*0.65–1.54*	*55.0*	*6.5*
Zimbabwe	Harare*	1478	2.00	0.75	3.00	1.15–2.00	62.5	9.3
	Manicaland	2311	1.50†	0.50	3.00	1.00–2.00	66.7	7.0
	Mashonaland Central	108	1.30†	0.75	2.00	1.00–2.00	42.3	6.1
	Masvingo	15	2.00	1.00	2.00	1.00–2.00	50.0	9.3
	Matabeleland North	318	1.80†	0.71	3.00	1.00–2.00	60.6	8.4
	Midlands	320	2.00	1.00	2.00	1.28–2.00	50.0	9.3
	Total	*4550*	*1.80*	*0.50*	*3.00*	*1.00–2.00*	*72.2*	*8.4*

All prices were standardised and presented in US$ per 20-cigarette pack.
The rows labelled with 'Total' refers to country-level results.
*Indicates the province of reference for each country.
†Indicates p<0.05 from Mann-Whitney U test that compared cigarette prices collected in a province to that collected in the reference province of the same country.
Price differential was defined as a ratio of the difference between the median price and the minimum price over the median price and expressed as a percentage.
Cigarette affordability was measured by relative income price, calculated as the percentage of the GDP per capita required to purchase 2000 cigarettes of the median price.
GDP, gross domestic product.

which were countries with the lowest price differentials as shown in our analysis.

In most of the countries we assessed, the median prices were close to the prices for the most sold 20-cigarette packs that are reported by the WHO and confirm the large variation in cigarette prices between countries.[9] However, our analysis additionally provides a more in-depth exploration of the cigarette market in these countries. First, we found that in Botswana, South Africa and Zimbabwe, cigarettes were sold in prices lower than those reported by the WHO in the 'cheapest brand' category in 2018.[9] This finding suggests that official data may not fully reflect the entire range of prices and products available in African countries. Local surveys and analyses would be valuable to inform national and subnational policies. Second, WHO does not always have country-level data available. For example, cigarette prices for the 'premium brand' and 'cheapest brand' were missing for

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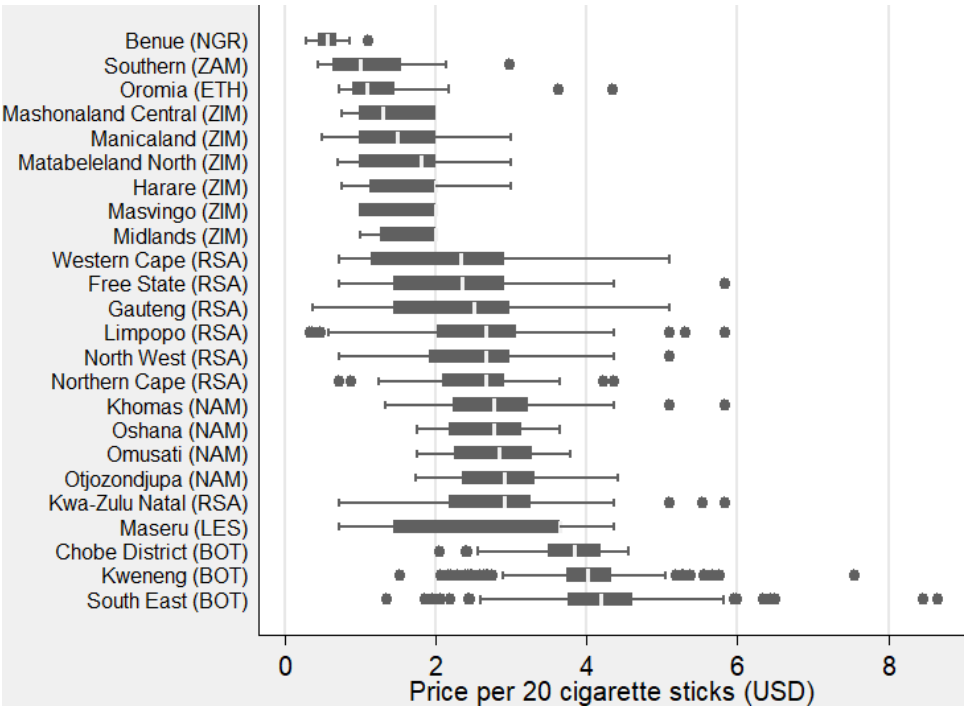


Figure 1 Boxplot of province-level prices per 20-cigarette sticks in 8 African countries in 2018. BOT, Botswana; ETH, Ethiopia; LES, Lesotho; NAM, Namibia; NGR, Nigeria; RSA, South Africa; ZAM, Zambia; ZIM, Zimbabwe.

three out of the eight African countries included in this study, and therefore, country-level cigarette price differentials cannot be computed using WHO data. Third, the large volume of data collected at each locality enabled comparison of cigarette prices and price differentials to be conducted at the sub-national level. This is further corroborated by the differences in prices between provinces and rural/urban locations within the same country. Cigarettes sold in urban areas were on average more expensive than those available in rural areas. It is unclear if this can be explained by differences in income, retail costs or availability of illicit tobacco, but it has previously been observed in other middle-income countries.[29]

Comparison of prices between countries may not always paint an accurate picture, especially when there are stark differences in GDP per capita.[28] For instance, a pack of cigarettes in Botswana cost almost four times as much as in Ethiopia; however, Botswana is a much richer country, which means that the average inhabitant in Botswana needs to spend a much smaller proportion of their income to purchase the same quantity of cigarettes. This conclusion may not necessarily be applicable to individual smokers

Table 2 Country-level cigarette prices per 20-cigarette pack/equivalent as sold in different urban/rural environments and quantities across 8 African countries

	Conurbation size, median (IQR)				Pack size, median (IQR)	
Country	**Urban**	**City***	**Town**	**Rural**	**Single***	**Pack**
Botswana	–	4.18 (3.78–4.61)	4.02 (3.75–4.32)†	3.84 (3.51–4.18)†	4.81 (4.81–4.81)	4.13 (3.75–4.40)†
Ethiopia	1.09 (0.91–1.45)	–	–	–	1.09 (0.91–1.45)	–
Lesotho	–	3.64 (1.46–3.64)	–	–	3.64 (1.46–3.64)	2.84 (2.62–2.84)
Namibia	–	2.77 (2.25–3.22)	2.84 (2.33–3.27)	2.84 (2.26–3.28)	4.37 (3.64–4.37)	2.77 (2.26–3.22)†
Nigeria	–	0.56 (0.46–0.69)	–	–	0.56 (0.56–0.83)	0.56 (0.44–0.67)†
South Africa	2.66 (2.00–3.06)†	2.40 (1.46–2.91)	2.66 (1.89–2.99)†	2.66 (1.46–3.64)†	2.91 (1.46–4.37)	2.65 (2.03–2.91)†
Zambia	–	1.00 (0.65–1.54)	–	–	1.00 (1.00–1.00)	0.99 (0.50–1.59)†
Zimbabwe	2.00 (1.05–2.00)†	1.50 (1.00–2.00)	1.80 (1.00–2.00)†	–	2.00 (1.00–2.00)	1.50 (1.00–2.00)†

All prices were standardised and presented in US$ per 20-cigarette pack. Conurbation size was derived according to the population size and included four groups: urban (>500 000); city (100 000–499 999); town (10 000–99 999) and rural (<10 000). Data from Ga-Marishane and Ga-Phaahla of South Africa (n=148) were excluded from this analysis as no published data on population size were available for these two locations.
*Indicates the reference category.
†Indicates p<0.05 from Mann-Whitney U test that compared cigarette prices collected in urban/town/rural areas against that collected in city areas of the same country; or compared the prices of packaged cigarettes against prices of single cigarettes recorded for the same country.

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Table 3 Results of the multilevel linear regression model for the determinants of prices per 20 cigarettes

	Unadjusted			Adjusted		
		95% CI			95% CI	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
Pack size						
Single	Ref			Ref		
Pack	−0.28*	−0.31	−0.25	−0.27*	−0.30	−0.23
Conurbation size						
Urban	Ref			Ref		
City	−0.37*	−0.48	−0.26	−0.28*	−0.38	−0.18
Town	−0.26*	−0.36	−0.17	−0.23*	−0.31	−0.14
Rural	−0.17*	−0.31	−0.03	−0.28*	−0.41	−0.15
Country						
South Africa	Ref			Ref		
Botswana	1.51*	1.63	1.40	1.63*	1.40	1.86
Ethiopia	−1.22*	−1.60	−1.95	−1.60*	−1.95	−1.26
Lesotho	0.28*	0.17	−0.17	0.17*	−0.17	0.51
Namibia	0.29*	0.42	0.22	0.42*	0.22	0.63
Nigeria	−1.93*	−1.80	−2.18	−1.80*	−2.18	−1.42
Zambia	−1.28*	−1.19	−1.58	−1.19*	−1.58	−0.81
Zimbabwe	−0.89*	−0.96	−1.15	−0.96*	−1.15	−0.77

Cigarette prices were standardised to US$ per 20-cigarette pack. Conurbation size was derived according to the population size and included four groups: urban (>500 000); city (100 000–499 999); town (10 000–99 999) and rural (<10 000). Ref indicates the reference category.
*Indicates p<0.05. Data from Ga-Marishane and Ga-Phaahla of South Africa (n=148) were excluded from this analysis as no published data on population size were available for these two locations.

whose income varies widely within the same country, but it can provide some context regarding the perceived cost of tobacco in a country. In addition, our RIP estimates highlight large differences in affordability, even between neighbouring countries. Our comparison of prices at the subnational level show that not only cigarette price differentials were generally high, but they also varied between provinces of the same country. Interestingly, this pattern seems to exist regardless of income status of the country. For example, Namibia is a richer country and its subnational cigarette price differentials ranging from 36.8% to 51.6%; whereas Zimbabwe is a low-income country with subnational cigarette price differentials ranged from 42.3% to 66.7%. Thus, this highlights the importance of narrowing gaps in cigarette prices while instituting sufficiently high tobacco taxation to ensure the effectiveness of taxation policy is fully realised.

A key cause of variability in prices and affordability may be the different levels of tobacco taxation. Taxation rates in the countries included in this analysis ranged from 18.8% of the retail price of the most sold brand in Ethiopia to 54.6% in South Africa, all substantially lower than the 75% threshold that is recommended by WHO.[9] Not surprisingly, Ethiopia, Nigeria, Zambia and Zimbabwe which had lower tax rates also had the lower median prices per pack. However, consideration of taxation structure is also important in determining the variation of prices within each market, and Ethiopia, Nigeria and Zambia all have a larger ad valorem than specific excise component. Zimbabwe does not use an ad valorem excise, but its specific excise tax rate (22.9%) is much lower than the specific excise instituted by the other four African countries (Botswana, Lesotho, Namibia and South Africa) with a higher overall tax rate. Specific excise taxes are the most effective in minimising differences between cheap and expensive cigarettes, while ad valorem taxes result in greater variation,[30 31] as they are proportional to the retail price and allow more space for price manipulation by the TTCs, particularly among cheaper brands.[13] TTCs can largely determine the retail price of cigarettes, especially when taxation is low. This may partly explain why South Africa and Nigeria have the most affordable prices among the countries we examined. They are both producers of cigarettes[3] and evidence from other LMIC settings suggest that domestic cigarettes are cheaper than imported ones.[29 32] All these factors highlight the need for strengthened taxation policies with adequately high level of tobacco taxation which incorporates specific excise as the main source of taxation, and also country-specific monitoring and ongoing surveillance of tobacco control data.[9]

Although comparisons of price and affordability between countries are often based on 'standardised' 20-cigarette packs, our analysis showed that in the countries we examined single cigarettes are still being sold. In Ethiopia and Lesotho especially, the large volume of data recorded as single cigarettes highlight their wide availability. An earlier study found that single cigarettes

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were sold in all ten African countries surveyed, but there was minimal overlap with the set of countries we examined.[14] We found that cigarettes sold as individual sticks were on average more expensive than those sold in packs when comparing the aggregate price of 20 individual sticks to a pack of 20, which is consistent with findings from other LMIC countries.[33] However, our data also showed that in Lesotho and South Africa there may be cheaper single cigarettes available, which likely contributed to the higher cigarette price differentials observed than the other six African countries compared. All eight sub-Saharan African countries studied have ratified the WHO FCTC, with Ethiopia and Zimbabwe being the latest partners that joined in 2014/2015.[6] The WHO advises banning single cigarette sales, but currently only Ethiopia, Namibia and Nigeria have regulations in place to prohibit sales of single cigarettes.[15] Our findings show a very low proportion of data from single cigarettes in Namibia (0.8%) which may be reflective of the regulation. However, 11.9% of the data collected in Nigeria and essentially all data collected in Ethiopia were from single cigarettes, which may be suggestive of insufficient enforcement of the law in these two countries. Single cigarettes are much more accessible for people with limited income, such as youth, and hence may undermine tobacco control measures.[34] Our findings highlight the urgent need for proper and strengthened regulatory actions to prohibit the sales of single cigarettes in these sub-Saharan African countries.

This study compares prices, affordability, pack sizes and their subnational variation in multiple African countries using granular data. A key limitation of our analysis is that data collection was conducted in selected locations rather than randomly sampled. For example, we only had data from a single city in Ethiopia, Lesotho, Nigeria and Zambia, which would limit the representativeness of the samples. However, more than 1000 observations from various types of sales outlets were collected in six of the eight countries. Considering the scarcity of such data in Africa, this constitutes a uniquely large sample size and increases confidence in the findings. Data were collected in mid-2018, therefore should reflect recent developments in the tobacco market in a number of African countries from different income groups. However, some of the other variables used in our analysis were not necessarily equally up to date. Some of the population size estimates were slightly older and hence our categorisation of conurbation size may not be entirely accurate as of 2018, although we used broad categories, which should make misclassification less likely. Finally, students collecting data were instructed to report prices for single cigarettes, 10-cigarette packs and 20-cigarette packs or more.[16] Therefore, we did not consider other pack sizes (such as those sold in 2, 3 or 6 cigarettes, n=14) and may not have captured the full range of cigarettes sold in each country.

CONCLUSION

Our findings showed a large variation in cigarette price differential of eight sub-Saharan African countries studied. There was also a wide availability of single cigarettes in countries where their sale is prohibited. Strengthened implementation of tobacco control measures are urgently needed in these sub-Saharan African countries to counteract the increasing penetration of tobacco industry and its potential health consequences.

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Supplementary Table 1: Characteristics of the analytic sample

Country	n	World Bank Income Classification	GDP per capita (in USD)	Population size in 2017 (in millions)	Period of cigarette price data collection
Botswana	1,618	Upper Middle	8,259	2.292	3rd Jul - 5th Aug, 2018
Ethiopia	1,199	Low	772	104.957	14th Jul - 23rd Jul, 2018
Lesotho	4,569	Lower Middle	1,299	2.233	14th Jun - 3rd Jul, 2018
Namibia	4,143	Upper Middle	5,932	2.534	25th Jun - 22nd Jul, 2018
Nigeria	92	Lower Middle	2,028	190.886	27th Jun - 27th Jul, 2018
South Africa	6,088	Upper Middle	6,374	56.717	17th Jun - 30th Jul, 2018
Zambia	88	Lower Middle	1,540	17.094	18th Jul, 2018
Zimbabwe	4,550	Low	2,147	16.530	12th Jun - 28th Jul, 2018

Supplementary Table 2. Quantity of cigarettes available in 8 African countries.

Country	Single (%)	10 pack (%)	20 pack (%)	Other* (%)
Botswana	8.0	9.2	77.9	4.8
Ethiopia	100	0	0	0
Lesotho	99.6	0.02	0.28	0.02
Namibia	0.80	0	94.5	4.6
Nigeria	11.9	0	80.4	7.6
South Africa	25.3	5.9	64.7	4.0
Zambia	28.4	0	65.9	5.6
Zimbabwe	38.2	1.8	57.1	2.7

Note: The quantities are shown as a percentage. The quantities categories are single cigarette, pack of 10, pack of 20 and other. Other* includes quantities of 30, 160, 200 or 300 cigarettes. Individual proportions may not add to total due to rounding.*