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IMPLEMENTATION OF THE FCTC TOBACCO TAX PROVISION:

LIMITED PROGRESS

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ABSTRACT

OBJECTIVE: Evaluate implementation of the tobacco taxe provision (Article 6) in the World Health Organization Framework Convention on Tobacco Control (FCTC) using the WHO MPOWER as the standard for implementation.

METHODS: Based on MPOWER, we compared adoption of at least 50% and 75% (high) of retail price tobacco tax rates for the most sold brands in countries that did versus did not ratify the FCTC, accounting for years since ratification. We also compared cigarette affordability in 2014 to 1999.

RESULTS: FCTC ratification was not associated with implementing high tobacco taxes. More fragile countries in terms of security, political, economic, and social development were less likely to have at least 50% and 75% tobacco tax rates in 2014 compared with 1999. The higher the cigarette prices in 1999 the less likely the countries were to have at least 75% tobacco tax rates in 2014. However, cigarettes were less affordable in 2014 than in 1999 in countries that had ratified FCTC earlier.

CONCLUSIONS: Despite widespread FCTC ratification, implementing higher tobacco taxes remains incomplete. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for implementation of a tax escalator that gradually increases taxes to match rising level of incomes. Fragile countries are less likely to have high tobacco taxes and less affordable cigarettes. The tobacco control community should intensify efforts to help especially more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government.

WHAT THIS PAPER ADDS

- Tobacco taxes can effectively reduce tobacco use, but raising tobacco taxes remained the least implemented demand reduction measure and was the measure that had seen the least improvement over last ten years.
- FCTC ratification was not associated with implementing high tobacco taxes.
- Compared with 1999 cigarettes were not less affordable in 2014. However, this was the case in countries that had ratified FCTC earlier.
- Guidelines for FCTC Article 6 implementation should assigning definite targets for tobacco taxes and for implementation of a tax escalator that gradually increased taxes to match raising level of incomes.

INTRODUCTION

Raising tobacco taxes is an effective strategy to reduce tobacco use [1]. On average a 10% price increase will reduce tobacco use by 4% in high income countries and by 5% among low- and middle-income countries.[2] Article 6 of the World Health Organization (WHO) Framework Convention on Tobacco Control[3] (FCTC) commits parties to implement "tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption".[3] Article 6 implementation guidelines[4] include detailed recommendations for additional guiding principles, tobacco taxation levels, taxation systems and their administration. They recommend tax policies which take into account tobacco products' price elasticity (the rate by which tobacco consumption decreases as result of price increases) and income elasticity (the sensitivity of tobacco consumption to income changes) to make tobacco products less affordable over time, but does not set any specific target for prices or taxes.

Tobacco taxes are politically difficult to implement because tobacco companies fight them[5] by commissioning research claiming economic benefits of tobacco, creating alliances,[6] including with progressive organizations,[7] lobbying ministries of finance with poor knowledge of public health and FCTC requirements,[8] and arguing tax increases drive illicit trade.[5] They also learned how to cope with tax increases and sometimes actually benefit from them by overshifting taxes on premium brands to increase profits while downshifting taxes on ultra-low-price brands to cushion the effects of tax increases on total consumption.[9-12] Even a series of extranormal tax increases, such as in Australia[13], may not increase tax rate if the industry keeps overshifting tax increases to prices. In this sense, tax rates can be a relatively poor indicator of the price of cigarettes.

WHO established the MPOWER measures in 2008 to scale up key FCTC demand reduction measures including tobacco taxes. A key finding of the 2015 MPOWER report was that taxes were the least implemented MPOWER measure with only 10% of the world's population (living in 33 countries) covered by taxes of at least 75% of retail price[5]. This paper assesses the effect of FCTC ratification on implementing tobacco taxes by analyzing changes in tax rate using the WHO MPOWER standard and cigarette affordability. In addition, we assess the role of state capacity and previous tax and price levels[14 15] on taxes in 2014.

METHODS

Data

We obtained data on the tobacco tax rate, including specific excise, ad valorem excise, import duties, value added tax, other taxes from the World Health Organization Report on the Global Tobacco Epidemic 2015 public dataset for 2007, 2010, 2012 and 2014.[16] This dataset includes information collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was used in the calculation of tax rate.

We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64 countries that reported the share of cigarette taxes (including VAT) as a percentage of the retail price of a pack of cigarettes[17] supplemented by the tobacco industry's International Tobacco Documentation Centre's[18] 1998 *International Fiscal Guide to Tobacco* that mapped international taxation, price and tariff policies.[19]

Tobacco tax rate is the portion of the price represented by all taxes including VAT for the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables derived from WHO MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest MPOWER standard[5], and (2) taxes that totaled at least 50% of retail price, the second highest standard.[5] FCTC Article 6 does not set any targets on tobacco prices. The expectation in FCTC and WHO MPOWER program the government is that if the manufacturers increase wholesale prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes so that the tax share would go above 75% or 50%.

To analyze the income level of the countries we used World Bank 2016 gross national income (GNI) categories:[20] low-income countries were defined as those with a GNI per capita of $1,045 or less in 2014; middle-income economies, $1,046 to $12,735; high income, $12,736 or more. Lower-middle-income and upper-middle-income economies were separated at a GNI per capita of $4,125. Since our sample included only eight low-income countries, we combined low income and lower middle-income categories in the statistical analysis. We used information on cigarette prices expressed in nominal US dollars in 1998/1999.

We analyzed the effect of FCTC on affordability of cigarettes by using the fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold cigarette brand. This method is a more comprehensive and representative measure of income across countries in different income levels than, for example surveys of wages.[21]We used price data described above and World Bank data for GDP per capita for 1999 and 2014.[20] We used the growth of GDP per capita from 1999 to 2014[20] ([2014 GDP – 1999 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as additional independent variable on the assumption that

cigarettes would be more affordable in 2014 among those countries where the rise in income level is the fastest. We assume that changes in GDP over the 16-year period reflect changes in disposable income.

Other Variables

To study the willingness and ability of states to implement public policies we used Marshall and Cole's[22] state fragility index. This index scores all countries with population above 500,000 in four performance dimensions: security, political, economic, and social. The index gives higher scores for more fragile countries. (Sudan scored 23 while the 15 most stable countries scored 0.) We averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less likely to have high tobacco taxes in 2014.

We study the effect of previous tax and price levels on tax rate in 2014 with two variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999. We test whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999 are more likely to have high tax rates in 2014.

Statistical Analysis

Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as the outcome variable. We studied the effect of FCTC by calculating the number of years since FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already

had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded from the analysis.

Our analysis has 80% statistical power (with α=.05) to detect an OR by a factor of 1.25 (or 0.80) associated with FCTC ratification.

We also used logistic regression to analyze the effect of the FCTC on cigarette affordability by assigning a value of 1 for those countries where cigarettes were less affordable in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between state capacity and FCTC ratification to see if more fragile countries were slower in ratifying FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with extensive tobacco control measures.

We used R functions glm and minEffect.VSMc.logistic from powerMediation for the analysis.

RESULTS

Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014. In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and one country (Austria) had the same tax rate.

In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income countries had a tax that was above 75% of the retail price (Table 1). By 2014, 44% of high-income countries had taxes above 75% of retail value. The progress was slow among higher- and

lower-middle-income countries with just one additional country complying in each income category and no low-income country.

In 1998/1999 37 (82%) of high-income countries had taxes that comprised above 50% of retail price, while only 11 (46%) of higher-middle-income countries, 9 (35%) of lower-middle - income countries, and two (23%) low-income country had that tax rate. By 2014 39 (87%) of high-income countries had taxes above 50% of retail price, as did 16 (67%) of upper-middle - income countries, 13 (50%) of lower-middle-income countries, and 1 (13%) low-income country (Zimbabwe).

Table 1. FCTC Article 6 compliant tobacco tax in 1998/1999 and 2014 by income group

	Tobacco tax > 75% (high)			Tobacco tax > 50%		
	Compliant countries	Non-compliant countries	Fraction of compliant countries	Compliant countries	Non-compliant countries	Fraction of compliant countries
High-income						
1998/1999	8	37	18%	37	8	82%
2014	20	25	44%	39	7	87%
Upper-middle-income						
1998/1999	2	22	8%	11	13	46%
2014	3	21	13%	16	8	67%
Lower-middle-income						
1998/1999	1	25	4%	9	17	35%
2014	1	25	4%	13	13	50%
Low-income						
1998/1999	0	8	0%	2	6	23%

2014	0	8	0%	1	7	13%

The logistic regression showed that time since FCTC ratification was not associated with implementing high tobacco taxes (Table 2). More fragile countries were less likely to have 75% and 50% tobacco tax rates in 2014. Countries with higher cigarette prices in 1998/1999 were more likely to have 75% tax rates in 2014. Countries with higher tax rates in 1998/1999 were more likely than countries with lower tax rates in 1998/1999 to have 75% tobacco tax rates in 2014. To test overall effects, we calculated a linear regression model for all countries in our sample with tax rates in 2014 as the dependent variable and FCTC ratification, tax rate in 1999, price in 1999 and state capacity as independent variables ($R^2 = 0.48$). FCTC ratification and price were not statistically significant ($P>0.7$ and $P>0.3$ respectively). The coefficients for tax rate in 1999 were 0.40 ($p<0.001$) and for state capacity -1.58 ($p<0.001$). The variance inflation factors in the first model ranged from 1.08 to 1.68 and in the second model from 1.04 to 1.12, well below the threshold for multicollinearity concern.

As sensitivity analysis, we also ran OLS regression with tax rate in 2014 as dependent variable for the whole sample. We used the same independent variables as in logit analysis. Tax rate in 1999 was positively associated with tax rate in 2014 (coeff. 0.41, p=0.0003) and lack of state capacity was negatively associated with tax in 2014 (coeff. -1,52, p=0.00001). The results were essentially the same as the main logit analysis

Table 2. Odds of passing high standard tobacco taxes by 2014 (among non-compliant countries in 1998/1999)

	Tobacco tax ≥ 75% of retail price (high)	Tobacco tax ≥ 50% of retail price

Variable	Odds ratio	95% Cl	Odds ratio	95% Cl
Years since FCTC ratification	1.04	(0.81-1.43)	0.94	(0.76-1.15)
Tax rate in 1998/1999	1.07*	(1.00-1.14)	1.01	(0.94-1.08)
Price in 1998/1999	0.31*	(0.10-0.73)	0.78	(0.22-2.78)
State capacity	0.67**	(0.49-0.83)	0.86*	(0.74-0.99)
Number of countries (observations)	88		62	
* $P \leq 0.05$, ** $P \leq 0.01$, Numbers in parentheses are 95% confidence intervals.				

There were large differences in affordability of cigarettes across countries in both 1999 and 2014 (Figure 2). In 2014 less than one percent of per capita GDP was required to buy 100 packs of the most sold cigarette brands in Luxembourg, while in Tanzania the corresponding figure was 24.6% (28.9% in 1999). Cigarettes become less affordable between 1999 and 2014 in 51 countries and more affordable in 40 countries. Cigarettes had become less affordable in 73% of high-income countries (27/37), 61% of upper-middle-income countries (14/23) and 31% of lower-middle- and low-income countries (10/32). Ratifying the FCTC earlier was associated with cigarettes becoming less affordable in 2014 (Table 3). Cigarettes became more affordable in countries with high rates of per capita GDP growth between 1999 and 2014. Lack of state capacity was associated with lower odds for having less affordable cigarettes. The variance inflation factors ranged from 1.04 to 1.10, indicating no multicollinearity problems.

As sensitivity analysis, we also ran OLS regression with cigarette affordability in 2014 as dependent variable for the whole sample. We used the same independent variables as in logit analysis. The direction of association was again similar as in logit analysis. Ratifying the FCTC earlier was positively associated with cigarettes becoming less affordable in 2014 (coeff.0.04, p=0.03), while GDP growth (coeff.-0.10, p=0.001) and lack of state capacity (coeff.-0.02, p=0.001) were negatively associated with having less affordable cigarettes.

Table 3. Odds of cigarettes being less affordable by 2014

Variable	Odds ratio	95% Cl
Years since FCTC ratification	1.23*	(1.02-1.50)
GDP per capita growth from 1999 to 2014	0.48**	(0.28-0.75)
State capacity	0.90*	(0.82-0.99)
Number of countries (observations)	91	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

DISCUSSION

Our results confirm earlier findings showing slow progress of implementing high tobacco taxes among low- and middle-income countries.[5 23] Likewise, our results support concerns[5] that FCTC Article 6 has not, in general, led countries to implement high tobacco taxes. Lack of success can be partly attributed to state fragility. More fragile countries in terms of security, political, economic, and social development may not have administrative and technical capacity to implement high tobacco taxes.[24-27] We did not detect an interaction between state capacity and time since FCTC ratification, which indicates that weak state capacity as such may not prevent

countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic functions of government.[28 29]

Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries that had higher taxes for tobacco before the FCTC continued to do so also after ratifying it. The results indicate a path-dependency in tobacco taxation policies.[30-32] The passing of tobacco tax policies is a contingent event that sets into motion institutional patterns that have deterministic properties.[33] The result emphasizes the importance of intensifying efforts to implement high tobacco taxes especially in countries with originally low tax rates.

Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75% tobacco tax rates in 2014 (Table 2). This association may reflect a ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes are already relatively expensive. This could also result from tobacco industry lobbying.[5-8] FCTC Article 6 and its implementation guidelines expressly emphasize health goals in determining tobacco taxation but governments may try to maintain popular support through avoiding large tobacco tax increases. It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low before the tax increase.

Consistent with earlier studies on cigarette affordability, despite tax increases cigarettes were more affordable in 2014 than in 1999.[21 34 35]World Health Organization, 2015 #960} Our paper includes data that were collected well after 2010, so we are able base our analysis on a longer time horizon than these earlier analyses and thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant effect

of FCTC ratification on having high cigarette taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we include tobacco tax rates in 1999 into the model, FCTC ratification remains statistically significant.

There are many different ways that one could define an "effective" tax rate, including 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1). The WHO MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC had on tax policy, we used the WHO's own standard of success as defined in MPOWER. The WHO MPOWER measures for effective tax rates are arbitrary and different measures could be also used.

Our results emphasize the role of economic development in preventing cigarettes becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if taxes are kept constant.[5 21] This development is reflected in our result where rapid per capita GDP growth between 1999 and 2014 was associated with having more affordable cigarettes in 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate targets, for example 50% of retail price, is that they do not take into account the effect of rising incomes or the industry pricing behavior. Keeping other factors constant the demand for cigarettes generally increases with the average level of income, especially in developing countries.[21]

Lack of state capacity was associated with both lower odds for having high tobacco taxes and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile

countries, while taxes are high and cigarettes less affordable in more stable countries. The multinational tobacco companies are currently targeting emerging economies in Asia and Africa with young populations and relatively low smoking prevalence, especially among women.[36]

The tax provisions in the FCTC are not binding.[3] The unwillingness of states to commit to minimum tax levels during the negotiations is reflected in their lack of subsequent action.[37] FCTC Guidelines for Article 6 implementation recommend that Parties should take into account "both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence."[3] Our results demonstrate that the current policies for implementing tobacco taxes fail to meet this recommendation.

In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning definite targets not only for tobacco tax rates but also for measures to prevent tobacco products becoming more affordable.

The effect of cigarettes becoming more affordable with rapid income rises can be prevented by adopting adequate policy rules.[34 35 38] One example is a tax escalator which is adjusted to income growth or an equivalent variable that takes into account increases in consumer purchasing power.[5] Such a tax escalator is already in place in UK.[39]. With automatically increasing tobacco taxes by the increase in purchasing power the tobacco companies would increase prices, which would prevent tobacco products not becoming more affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard.

Limitations

Assessing the change in tax as a share of price over time can be complicated.[16] Determination of tax rates as a proportion of total cigarette retail price is dependent on changes in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax on cigarettes, the share of excise and total taxes in the retail price could remain the same or shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share of taxes in the final retail price might increase, even if there is no change in the tax levied on a pack of cigarettes.

To establish a baseline before FCTC we used tobacco tax and price data from two different sources, World Bank survey from 1999[17] and the International Tobacco Documentation Centre's[18] 1998 *International Fiscal Guide to Tobacco*. Both data sources include information on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping price information indicated the data was collected in substantially uniform manner. The correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more dramatically than cigarette prices. We deemed the World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all data sources including WHO data for 2014,[16] but were unable to confirm that definitions remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier research has shown the tobacco industry may simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on premium brands.[9] The higher the level of the excise

and other taxes the less room for tobacco industry price differentiation strategies. We were not able to analyze how countries' tax policies have accounted for country-specific price and income elasticities.

Our analysis focused only on cigarettes ignoring other categories of tobacco products, some of which (for example bidi) are more prevalent in more fragile countries. Since we had data only from two time points we were not able to assess trends in tax, price and affordability in prior periods.

Conclusions

In contrast to advertising restrictions,[30 32] health warning labels,[30] and smokefree environments,[31] FCTC ratification has not been systematically followed with higher tobacco taxation. Fragile countries are less likely to have high tobacco taxes. Rapid rise in incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for the implementation of a tax escalator that gradually increases taxes to match the rising level of incomes. The tobacco control community should intensify efforts to help more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government. The FCTC Conference of the Parties should assign definite targets not only for tobacco tax rates but also for measures to prevent tobacco products becoming more affordable.

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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP

HH developed the idea for this study and carried out the data collection. HH and SG carried out the data analysis and wrote and revised the manuscript.

DATA SHARING STATEMENT

Statistical code and dataset available upon request from corresponding author.

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FIGURE CAPTIONS

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

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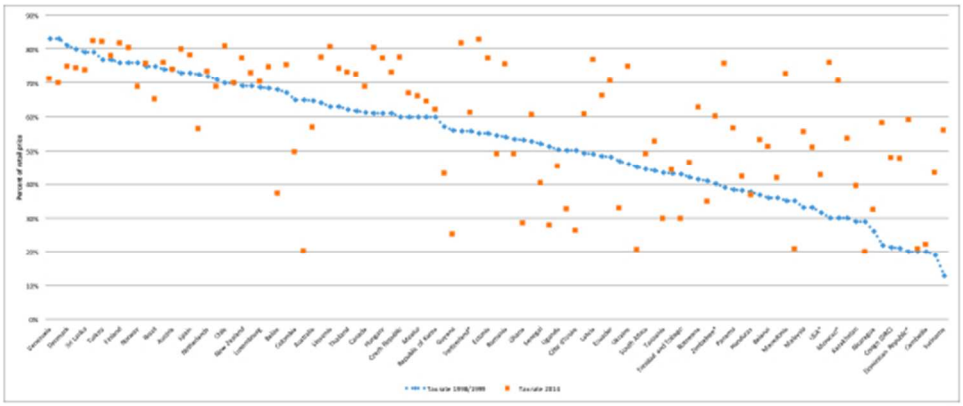

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

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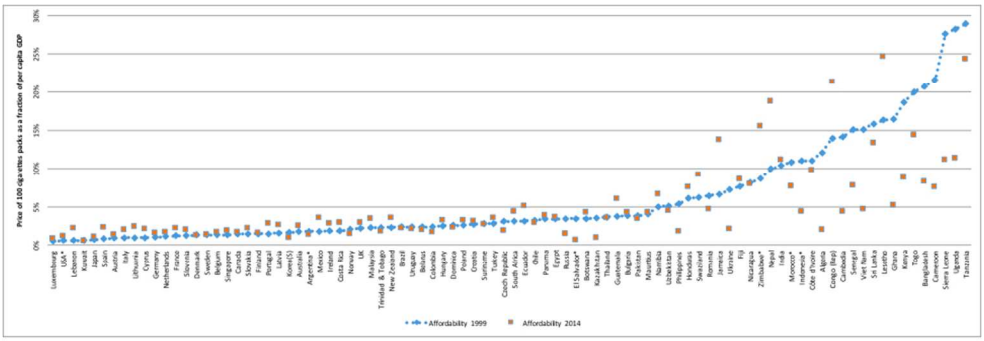

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

348x124mm (72 x 72 DPI)

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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ABSTRACT

OBJECTIVE: To quantify changes in tobacco tax rates and cigarette affordability afterafter countries ratified the WHO Framework Convention on Tobacco Control (FCTC) using with the World Health Organization MPOWER standards. .

METHODS: We used logistic regression to assess the association of FCTC ratification with adoption of at least 50% and 75% (high) of retail price tobacco tax rates for the most sold brands in countries, accounting for years since ratification and other covariates. We also compared cigarette affordability in 2014 to 1999.

RESULTS: By 2014, 44% of high-income countries had taxes above 75% of retail value compared to 18% in 1998/1999. In fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and a1 had the same tax rate. FCTC ratification was not associated with implementing high tobacco taxes. More fragile countries in terms of security, political, economic, and social development were less likely to have at least 50% and 75% tobacco tax rates in 2014 compared with 1999. The higher the cigarette prices in 1999 the less likely the countries were to have at least 75% tobacco tax rates in 2014. However, cigarettes were less affordable in 2014 than in 1999 in countries that had ratified FCTC earlier.

CONCLUSIONS: Despite widespread FCTC ratification, implementing higher tobacco taxes remains incomplete. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for implementation of a tax escalator that gradually increases taxes to match rising income levels. Fragile countries are less likely to have high tobacco taxes and less affordable cigarettes. The tobacco control community should intensify efforts to help fragile countries improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting basic functions of government.

WHAT THIS PAPER ADDS

- Tobacco taxes can effectively reduce tobacco use, but FCTC ratification was not associated with implementing high tobacco taxes.
- Compared with 1999 cigarettes were more affordable in 2014. However, in countries that had ratified FCTC earlier cigarettes were less affordable.
- Guidelines for FCTC Article 6 implementation should assign specific minimium targets for tobacco taxes and for implementation of a tax escalator that gradually increased taxes to match raising income levels.

INTRODUCTION

Raising tobacco taxes is an effective strategy to reduce tobacco use [1-3]. On average a 10% price increase will reduce tobacco use by 4% in high income countries and by 5% among low- and middle-income countries.[4] Article 6 of the World Health Organization (WHO) Framework Convention on Tobacco Control[5] (FCTC) commits parties to implement "tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption."[5] Article 6 implementation guidelines[6] recommend tax policies which take into account tobacco products' price elasticity (the rate by which tobacco consumption decreases as result of price increases) and income elasticity (the sensitivity of tobacco consumption to income changes) to make tobacco products less affordable over time, but does not set specific targets for taxes or prices.

Tobacco industry tactics to block tax increases have a major influence on tax rates and industry responses to tax increases have a major effect cigarette prices. Tobacco taxes are politically difficult to raise because tobacco companies fight tax increases[2] by commissioning research claiming economic benefits of tobacco, creating alliances,[7] including with progressive organizations,[8] lobbying ministries of finance with poor knowledge of public health and FCTC requirements,[9] and arguing tax increases drive illicit trade[2] and hurt disadvantaged groups.[8 10 11] They also learned how to cope with tax increases and sometimes actually benefit from them by overshifting taxes on premium brands to increase profits while downshifting taxes on ultra-low-price brands to cushion the effects of tax increases on total consumption.[12-15] Even a series of substantial tax increases, such as in Australia[16], may not increase tax rate if the industry keeps overshifting tax increases to prices. In this sense, tax rates can be a relatively poor indicator of cigarette prices.

WHO established the MPOWER measures in 2008 to scale up key FCTC demand reduction measures including tobacco taxes. MPOWER emphasizes that "increasing the price of tobacco through higher taxes is the single most effective way to encourage tobacco users to quit and prevent children from starting to smoke." [2] A key finding of the 2015 MPOWER report was that taxes were the least implemented MPOWER measure with only 10% of the world's population (living in 33 countries) covered by taxes of at least 75% of retail price[2]. This paper assesses the association of FCTC ratification with implementing tobacco taxes by analyzing changes in tax rate using the WHO MPOWER standard and cigarette affordability. In addition, we assess the role of state capacity and previous tax and price levels[17 18] on taxes in 2014.

METHODS

Data

Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties, value added tax, and other taxes were obtained from the World Health Organization Report on the Global Tobacco Epidemic 2015 public dataset for 2014.[19] This dataset includes information collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on the taxation of cigarettes (and when possible, most commonly used tobacco products) was collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was used to calculate the tax rate.

We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64 countries that reported the share of cigarette taxes (including value added tax, VAT) as a

percentage of the retail price of a pack of cigarettes[20] supplemented by the tobacco industry's International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco* that mapped international taxation, price and tariff policies.[22]

Tobacco tax rate is the portion of the price represented by all taxes (including VAT for the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables derived from WHO MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest MPOWER standard[2], and (2) taxes that totaled at least 50% of retail price, the second highest standard.[2] FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and WHO MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes so that the tax share would go above 75% or 50%.

To analyze the income level of the countries we used World Bank (WB) 2016 gross national income (GNI) categories:[23] low-income countries were defined as those with a GNI per capita of $1,045 or less in 2014; middle-income economies, $1,046 to $12,735; high income, $12,736 or more. Lower-middle-income and upper-middle-income economies were separated at a GNI per capita of $4,125. Since our sample included only eight low-income countries, after cross tabulation analysis we combined low income and lower middle-income categories in the regression analysis. We used information on cigarette prices expressed in nominal US dollars in 1998/1999.

We analyzed the association of FCTC with affordability of cigarettes by using the fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold cigarette brand. This method is a more comprehensive and representative measure

of income across countries in different income levels than, for example surveys of wages.[24]We used price data described above and World Bank data for GDP per capita for 1999 and 2014.[23] In addition, we used the growth of GDP per capita from 1999 to 2014[23] ([2014 GDP – 1999 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the assumption that cigarettes would be more affordable in 2014 among those countries where the rise in income level was the fastest. We assume that changes in GDP over the 16-year period reflect changes in disposable income.

Other Variables

To study the willingness and ability of states to implement public policies we used Marshall and Cole's[25] state fragility index. This index scores all countries with population above 500,000 in four performance dimensions: security, political, economic, and social. Previous literature has shown that state fragility matters for implementing effective cigarette health warnings.[17 18] The index gives higher scores for more fragile countries (Sudan scored 23 while the 15 most stable countries scored 0) but does not place countries into different categories. We averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries in the which score higher than others using Marshall and Cole's state fragility index.

We study the role of previous tax and price levels on tax rate in 2014 with two variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999. We test whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999 are more likely to have high tax rates in 2014.

Statistical Analysis

Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as the outcome variable. We studied the effect of FCTC by calculating the number of years since FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded from the analysis.

Our analysis has 80% statistical power (with α=.05) to detect an OR by a factor of 1.25 (or 0.80) associated with FCTC ratification.

We also used logistic regression to analyze the effect of the FCTC on cigarette affordability by assigning a value of 1 for those countries where cigarettes were less affordable in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between state capacity and FCTC ratification to see if more fragile countries were slower in ratifying FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with extensive tobacco control measures.

We used R functions glm and minEffect.VSMc.logistic from powerMediation for the analysis.

Patient and Public Involvement

Patients or public were not involved in the study.

RESULTS

Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014. In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it (30 FCTC ratifying countries), and one country (Austria) had the same tax rate.

In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income countries had a tax above 75% of the retail price (Table 1). By 2014, 44% of high-income countries had taxes above 75% of retail value. The progress was slow among higher- and lower-middle-income countries with just one additional country complying in each income category and no low-income country.

In 1998/1999 37 (82%) of high-income countries had taxes that comprised above 50% of retail price, while only 11 (46%) of higher-middle-income countries, 9 (35%) of lower-middle-income countries, and two (23%) low-income country had that tax rate. By 2014 39 (87%) of high-income countries had taxes above 50% of retail price, as did 16 (67%) of upper-middle - income countries, 13 (50%) of lower-middle-income countries, and 1 (13%) low-income country (Zimbabwe).

Table 1. Countries with 75% and 50% tobacco tax rates in 1998/1999 and 2014 by income group

	Tobacco tax > 75% (high)			Tobacco tax > 50%		
	Yes	No	Fraction of countries	Yes	No	Fraction of countries
High-income						

1998/1999	8	37	18%	37	8	82%
2014	20	25	44%	39	7	87%
Upper-middle-income						
1998/1999	2	22	8%	11	13	46%
2014	3	21	13%	16	8	67%
Lower-middle-income						
1998/1999	1	25	4%	9	17	35%
2014	1	25	4%	13	13	50%
Low-income						
1998/1999	0	8	0%	2	6	23%
2014	0	8	0%	1	7	13%

45 countries changed WB status during the observation period. The following countries changed from low-income countries to lower-middle income countries: Bangladesh, Cambodia, Cameroon, Côte d'Ivoire, Ghana, Honduras, India, Kenya, Lesotho, Nicaragua, Nigeria, Pakistan and Vietnam. The following countries changed from lower-middle income countries to upper-middle income countries: Algeria, Belarus, Belize, Bulgaria, Columbia, Costa Rica, Dominican Republic, Ecuador, Fiji, Guyana, Jamaica, Kazakhstan, Macedonia, Namibia, Panama, Romania, Russia, Suriname and Thailand. The following countries changed from upper-middle-income countries to high income countries: Barbados, Chile, Czech Republic, Estonia, Hungary, Malta, Poland, Republic of Korea, Slovakia, Trinidad and Tobago and Uruguay. Latvia and Lithuania changed from lower-income countries to high-income countries. No country changed to a lower income group.

The logistic regression showed that time since FCTC ratification was not associated with implementing high tobacco taxes (Table 2). More fragile countries were less likely to have 75% and 50% tobacco tax rates in 2014. Countries with higher cigarette prices in 1998/1999 were more likely to have 75% tax rates in 2014. Countries with higher tax rates in 1998/1999 were more likely than countries with lower tax rates in 1998/1999 to have 75% tobacco tax rates in

2014. To test overall effects we calculated a linear regression model for all countries in our sample with tax rates in 2014 as the dependent variable and FCTC ratification, tax rate in 1999, price in 1999 and state capacity as independent variables ($R^2 = 0.48$). FCTC ratification and price were not statistically significant (P>0.7 and P>0.3 respectively). The coefficients for tax rate in 1999 were 0.40 (p<0.001) and for state capacity -1.58 (p<0.001). The variance inflation factors in the first model ranged from 1.08 to 1.68 and in the second model from 1.04 to 1.12, well below the threshold for multicollinearity concern.

As a sensitivity analysis, we also ran OLS regression with actual tax rate in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. Tax rate in 1999 was positively associated with tax rate in 2014 (coeff. 0.41, p=0.0003) and lack of state capacity was negatively associated with tax in 2014 (coeff. -1,52, p=0.00001). The results were essentially the same as the logistic regression analysis.

Table 2. Odds of passing high standard tobacco taxes by 2014 (among non-compliant countries in 1998/1999)

	Tobacco tax ≥ 75% of retail price (high)		Tobacco tax ≥ 50% of retail price	
Variable	Odds ratio	95% Cl	Odds ratio	95% Cl
Years since FCTC ratification	1.04	(0.81-1.43)	0.94	(0.76-1.15)
Tax rate in 1998/1999	1.07*	(1.00-1.14)	1.01	(0.94-1.08)
Price in 1998/1999	0.31*	(0.10-0.73)	0.78	(0.22-2.78)
State capacity	0.67**	(0.49-0.83)	0.86*	(0.74-0.99)

Number of countries (observations)	88		62	
* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.				

There were large differences in affordability of cigarettes across countries in both 1999 and 2014 (Figure 2). At the lower end of the range, in 2014 less than one percent of per capita GDP was required to buy 100 packs of the most sold cigarette brands in Luxembourg, while at the upper end in Tanzania the corresponding figure was 24.6% (28.9% in 1999). Cigarettes become less affordable between 1999 and 2014 in 51 countries and more affordable in 40 countries. Cigarettes had become less affordable in 73% of high-income countries (27/37), 61% of upper-middle-income countries (14/23) and 31% of lower-middle- and low-income countries (10/32). Ratifying the FCTC earlier was associated with cigarettes becoming less affordable in 2014 implying perhaps that countries with affordable cigarette prices in 1999 were quicker to ratify the FCTC and implement its tax provision (Table 3). Cigarettes became more affordable in countries with high rates of per capita GDP growth between 1999 and 2014. Lack of state capacity was associated with lower odds for having less affordable cigarettes. The variance inflation factors ranged from 1.04 to 1.10, indicating no multicollinearity problems.

As a sensitivity analysis, we also ran OLS regression with cigarette affordability in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. The direction of association was again similar as in logit analysis. Ratifying the FCTC earlier was positively associated with cigarettes becoming less affordable in 2014 (coeff.0.04, p=0.03), while GDP growth (coeff.-0.10, p=0.001) and lack of state capacity (coeff.-0.02, p=0.001) were negatively associated with having less affordable cigarettes.

Table 3. Odds of cigarettes being less affordable by 2014		
Variable	Odds ratio	95% Cl
Years since FCTC ratification	1.23*	(1.02-1.50)
GDP per capita growth from 1999 to 2014	0.48**	(0.28-0.75)
State capacity	0.90*	(0.82-0.99)
Number of countries (observations)	91	
* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.		

DISCUSSION

Our results confirm earlier findings showing slow progress in meeting the 75% or 50% tobacco tax rate targets among low- and middle-income countries.[2 26] Likewise, our results support concerns[2] that FCTC Article 6 has not, in general, led countries to implement high tobacco taxes. Lack of success can be partly attributed to state fragility. More fragile countries in terms of security, political, economic, and social development may not have administrative and technical capacity to implement high tobacco taxes.[27-30] We did not detect an interaction between state capacity and time since FCTC ratification, which indicates that weak state capacity as such may not prevent countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic functions of government.[31 32]

Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The results indicate a path-dependency in tobacco taxation policies.[33-35] The passing of tobacco tax

policies is a contingent event that sets into motion institutional patterns that have deterministic properties.[36] The result emphasizes the importance of intensifying efforts to implement high tobacco taxes especially in countries with originally low tax rates.

Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75% tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have reached the target with regular inflationary adjustments. This association may also reflect a possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes are already relatively expensive. This could also result from tobacco industry lobbying.[2 7-9] FCTC Article 6 and its implementation guidelines expressly emphasize health goals in determining tobacco taxation but governments may try to maintain popular support through adopting small tobacco tax increases instead of large increases. It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low before the tax increase.

Consistent with earlier studies on cigarette affordability, cigarettes were more affordable in 2014 than in 1999 despite tax increases.[24 37 38] World Health Organization, 2015 #960} Our paper includes data collected well after 2010, so we were able base our analysis on a longer time horizon than earlier analyses and thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant association of FCTC ratification with having high cigarette taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC ratification remains statistically significant.

There are many different ways that one could define an "effective" tax rate, including 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1). The WHO MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC had on tax policy, we used the WHO's own standard of success as defined in MPOWER. The WHO MPOWER measures for effective tax rates are arbitrary and different measures could be also used.

Our results emphasize the role of economic development in preventing cigarettes from becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if taxes are kept constant.[2 24] This development is reflected in our result where rapid per capita GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate targets, for example 50% of retail price, is that they do not take into account the effect of rising incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes generally increases with the average level of income, especially in developing countries.[24]

Lack of state capacity was associated with both lower odds for having high tobacco taxes and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile countries, while taxes are high and cigarettes less affordable in more stable countries. As of 2018, the multinational tobacco companies were targeting countries in Asia and Africa with young populations and relatively low smoking prevalence, especially among women.[39]

The tax provisions in the FCTC do not include specific tax targets.[5] The unwillingness of states to commit to minimum tax levels during FCTC negotiations is reflected in their lack of subsequent action.[40] FCTC Guidelines for Article 6 implementation recommend that Parties

should take into account "both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence."[5] Our results demonstrate that current policies for implementing tobacco taxes fail to meet this recommendation.

In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning definite targets not only for tobacco tax rates but also for measures that prevent tobacco products from becoming more affordable.

The effect of cigarettes becoming more affordable with rapid income rises can be prevented by adopting adequate policies.[37 38 41] One example is a tax escalator which is adjusted to income growth or an equivalent variable that accounts for increases in consumer purchasing power.[2] Such a tax escalator is already in place in the UK.[42] With automatically increasing tobacco taxes by the increase in purchasing power the tobacco companies would increase prices, which would prevent tobacco products not becoming more affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard. Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so would make it more difficult for tobacco companies to downshift tax increases.

Limitations

Assessing the change in tax as a share of price over time can be complicated.[19] Determination of tax rates as a proportion of total cigarette retail price is dependent on changes in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax on cigarettes, the share of excise and total taxes in the retail price could remain the same or shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share

of taxes in the final retail price might increase, even if there is no change in the tax levied on a pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not enough, given that the FCTC did not specify 50/75% tax rates as a requirement.

To establish a baseline before FCTC we used tobacco tax and price data from two different sources, World Bank survey from 1999[20] and the International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco*. Both data sources include information on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping price information indicates the data was collected in a substantially uniform manner. The correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more dramatically than cigarette prices. Given the more reliable international standing we deemed the World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all data sources including WHO data for 2014,[19] but were unable to confirm that definitions remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier research has shown the tobacco industry may simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on premium brands.[12] The higher the level of the excise and other taxes the less room for tobacco industry price differentiation strategies. We were not able to analyze how countries' tax policies have accounted for country-specific price and income elasticities.

In this study we were not able to assess the causal effects. Besides the variables used in this study other factors such as economic cycles, political leadership and tobacco control activity outside of FCTC may have affected the outcome variables.

Our analysis focused only on cigarettes ignoring other categories of tobacco products, some of which (for example bidi) are more prevalent in more fragile countries such as Bangladesh and India[43]. Since we had data only from two time points we were not able to assess trends in tax, price and affordability in prior periods.

Conclusions

In contrast to advertising restrictions,[33 35] health warning labels,[33] and smokefree environments,[34] FCTC ratification has not been systematically followed regarding higher tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke free environments, health warnings and advertising bans that fall into domain of health government, while Article 6 concerns financial policy, which falls under finance ministries. There need to be further efforts to increase financial ministries' knowledge of and responsibility to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for the implementation of a tax escalator that gradually increases taxes to match the rising income levels. The tobacco control community should intensify efforts to help more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government. The FCTC

Conference of the Parties should assign definite targets not only for tobacco tax rates but also for measures to prevent tobacco products from becoming more affordable.

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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP

HH developed the idea for this study and carried out the data collection. HH and SG carried out the data analysis and wrote and revised the manuscript.

DATA SHARING STATEMENT

No data is shared since we are using data which is already made public.

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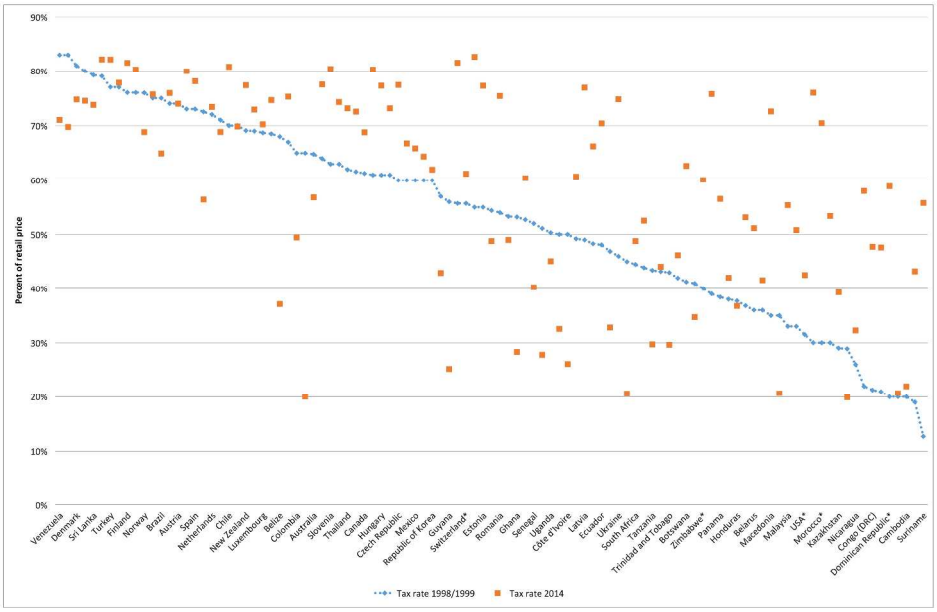
FIGURE CAPTIONS

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

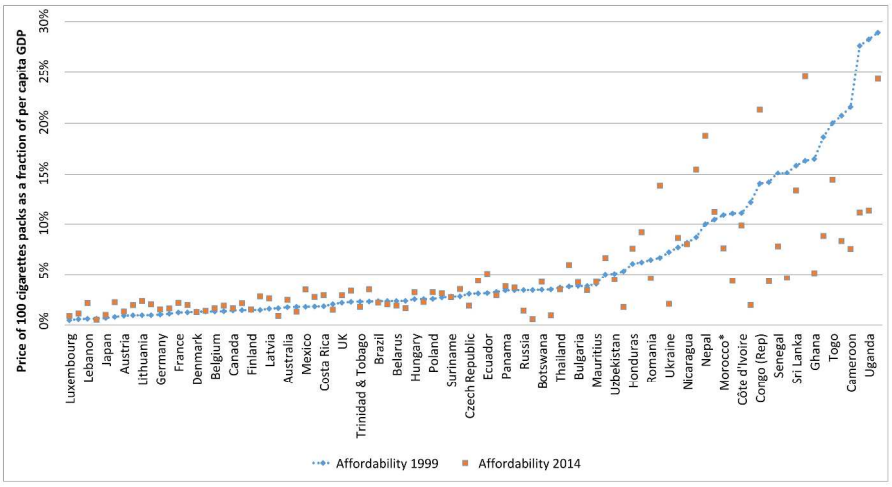


* Country has not ratified FCTC.

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Caption : Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

504x377mm (300 x 300 DPI)



* Country has not ratified FCTC.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

Caption : Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

504x313mm (300 x 300 DPI)

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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ABSTRACT

OBJECTIVE: To quantify changes in tobacco tax rates and cigarette affordability after countries ratified the WHO Framework Convention on Tobacco Control (FCTC) using with the World Health Organization MPOWER standards.

METHODS: We used logistic regression to assess the association of FCTC ratification with adoption of at least 50% and 75% (high) of retail price tobacco tax rates for the most sold brands in countries, accounting for years since ratification and other covariates. We also compared cigarette affordability in 2014 to 1999.

RESULTS: By 2014, 44% of high-income countries had taxes above 75% of retail value compared to 18% in 1998/1999. In fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and one had the same tax rate. FCTC ratification was not associated with implementing high tobacco taxes. More fragile countries in terms of security, political, economic, and social development were less likely to have at least 50% and 75% tobacco tax rates in 2014 compared with 1999. The higher the cigarette prices in 1999 the less likely the countries were to have at least 75% tobacco tax rates in 2014. However, cigarettes were less affordable in 2014 than in 1999 in countries that had ratified FCTC earlier.

CONCLUSIONS: Despite widespread FCTC ratification, implementing higher tobacco taxes remains incomplete. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for implementation of a tax escalator that gradually increases taxes to match rising income levels. Fragile countries are less likely to have high tobacco taxes and less affordable cigarettes. The tobacco control community should intensify efforts to help fragile countries improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting basic functions of government.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- We were able to assess changes in tobacco taxes and prices over 15 years in 103 countries.
- We used WHO's own standards for effective tax rates.
- The willingness and ability of states to implement effective tobacco taxes was measured through state fragility index.
- The limitation of the study is that we could not analyze how the tobacco companies respond to the tax increase.
- The baseline data came from two different data sources.

WHAT THIS PAPER ADDS

- Tobacco taxes can effectively reduce tobacco use, but FCTC ratification was not associated with implementing high tobacco taxes.
- Compared with 1999 cigarettes were more affordable in 2014. However, in countries that had ratified FCTC earlier cigarettes were less affordable.
- Guidelines for FCTC Article 6 implementation should assign specific minimium targets for tobacco taxes and for implementation of a tax escalator that gradually increased taxes to match raising income levels.

INTRODUCTION

Raising tobacco taxes is an effective strategy to reduce tobacco use [1-3]. On average a 10% price increase will reduce tobacco use by 4% in high income countries and by 5% among low- and middle-income countries.[4] Article 6 of the World Health Organization (WHO) Framework Convention on Tobacco Control[5] (FCTC) commits parties to implement "tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption."[5] Article 6 implementation guidelines[6] recommend tax policies which take into account tobacco products' price elasticity (the rate by which tobacco consumption decreases as result of price increases) and income elasticity (the sensitivity of tobacco consumption to income changes) to make tobacco products less affordable over time, but does not set specific targets for taxes or prices.

Tobacco industry tactics to block tax increases have a major influence on tax rates and industry responses to tax increases have a major effect on cigarette prices. Tobacco taxes are politically difficult to raise because tobacco companies fight tax increases[2] by commissioning research claiming economic benefits of tobacco, creating alliances,[7] including with progressive organizations,[8] lobbying ministries of finance with poor knowledge of public health and FCTC requirements,[9] and arguing tax increases drive illicit trade[2] and hurt disadvantaged groups.[8 10 11] They also learned how to cope with tax increases and sometimes actually benefit from them by overshifting taxes on premium brands to increase profits while downshifting taxes on ultra-low-price brands to cushion the effects of tax increases on total consumption.[12-15] Even a series of substantial tax increases, such as in Australia[16], may not increase the tax rate if the industry keeps overshifting tax increases to prices. In this sense, tax rates can be a relatively poor indicator of cigarette prices.

WHO established the MPOWER measures in 2008 to scale up key FCTC demand reduction measures including tobacco taxes. MPOWER emphasizes that "increasing the price of tobacco through higher taxes is the single most effective way to encourage tobacco users to quit and prevent children from starting to smoke." [2] A key finding of the 2015 MPOWER report was that taxes were the least implemented MPOWER measure with only 10% of the world's population (living in 33 countries) covered by taxes of at least 75% of retail price[2]. This paper assesses the association of FCTC ratification with implementing tobacco taxes by analyzing changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we assess the role of state capacity and previous tax and price levels[17 18] on taxes in 2014.

METHODS

Data

Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties, value added tax, and other taxes were obtained from the World Health Organization Report on the Global Tobacco Epidemic 2015 public dataset for 2014.[19] This dataset includes information collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on the taxation of cigarettes (and when possible, most commonly used tobacco products) was collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was used to calculate the tax rate.

We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64 countries that reported the share of cigarette taxes (including value added tax, VAT) as a

percentage of the retail price of a pack of cigarettes[20] supplemented by the tobacco industry's International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco* that mapped international taxation, price and tariff policies.[22]

Tobacco tax rate is the portion of the price represented by all taxes (including VAT for the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables derived from MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest MPOWER standard[2], and (2) taxes that totaled at least 50% of retail price, the second highest standard.[2] FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes so that the tax share would go above 75% or 50%.

To analyze the income level of the countries we used World Bank (WB) 2016 gross national income (GNI) categories:[23] low-income countries were defined as those with a GNI per capita of $1,045 or less in 2014; middle-income economies, $1,046 to $12,735; high income, $12,736 or more. Lower-middle-income and upper-middle-income economies were separated at a GNI per capita of $4,125. Since our sample included only eight low-income countries, after cross tabulation analysis we combined low income and lower middle-income categories in the regression analysis. We used information on cigarette prices expressed in nominal US dollars in 1998/1999.

We analyzed the association of FCTC with affordability of cigarettes by using the fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold cigarette brand. This method is a more comprehensive and representative measure

of income across countries in different income levels than, for example surveys of wages.[24]We used price data described above and World Bank data for GDP per capita for 1999 and 2014.[23] In addition, we used the growth of GDP per capita from 1999 to 2014[23] ([2014 GDP – 1999 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the assumption that cigarettes would be more affordable in 2014 among those countries where the rise in income level was the fastest. We assume that changes in GDP over the 16-year period reflect changes in disposable income.

Other Variables

To study the willingness and ability of states to implement public policies we used Marshall and Cole's[25] state fragility index. This index scores all countries with population above 500,000 in four performance dimensions: security, political, economic, and social. Previous literature has shown that state fragility matters for implementing effective cigarette health warnings.[17 18] The index gives higher scores for more fragile countries (Sudan scored 23 while the 15 most stable countries scored 0) but does not place countries into different categories. We averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries which score higher on Marshall and Cole's state fragility index.

We studied the role of previous tax and price levels on tax rate in 2014 with two variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999 were more likely to have high tax rates in 2014.

Statistical Analysis

Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as the outcome variable. We studied the effect of FCTC by calculating the number of years since FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded from the analysis.

Our analysis has 80% statistical power (with α=.05) to detect an OR by a factor of 1.25 (or 0.80) associated with FCTC ratification.

We also used logistic regression to analyze the effect of the FCTC on cigarette affordability by assigning a value of 1 for those countries where cigarettes were less affordable in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between state capacity and FCTC ratification to see if more fragile countries were slower in ratifying FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with extensive tobacco control measures.

We used R functions glm and minEffect.VSMc.logistic from powerMediation for the analysis.

Patient and Public Involvement

Patients or public were not involved in the study.

RESULTS

Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014. In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it (30 FCTC ratifying countries), and one country (Austria) had the same tax rate.

In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income countries had a tax above 75% of the retail price (Table 1). By 2014, 44% of high-income countries had taxes above 75% of retail value. The progress was slow among higher- and lower-middle-income countries with just one additional country complying in each income category and no low-income country.

In 1998/1999 37 (82%) of high-income countries had taxes that comprised above 50% of retail price, while only 11 (46%) of higher-middle-income countries, 9 (35%) of lower-middle-income countries, and two (23%) low-income country had that tax rate. By 2014 39 (87%) of high-income countries had taxes above 50% of retail price, as did 16 (67%) of upper-middle - income countries, 13 (50%) of lower-middle-income countries, and 1 (13%) low-income country (Zimbabwe).

Table 1. Countries with 75% and 50% tobacco tax rates in 1998/1999 and 2014 by income group

	Tobacco tax > 75% (high)			Tobacco tax > 50%		
	Yes	No	Fraction of countries	Yes	No	Fraction of countries
High-income						
1998/1999	8	37	18%	37	8	82%
2014	20	25	44%	39	7	87%
Upper-middle-income						

1998/1999	2	22	8%	11	13	46%
2014	3	21	13%	16	8	67%
Lower-middle-income						
1998/1999	1	25	4%	9	17	35%
2014	1	25	4%	13	13	50%
Low-income						
1998/1999	0	8	0%	2	6	23%
2014	0	8	0%	1	7	13%

45 countries changed WB status during the observation period. The following countries changed from low-income countries to lower-middle income countries: Bangladesh, Cambodia, Cameroon, Côte d'Ivoire, Ghana, Honduras, India, Kenya, Lesotho, Nicaragua, Nigeria, Pakistan and Vietnam. The following countries changed from lower-middle income countries to upper-middle income countries: Algeria, Belarus, Belize, Bulgaria, Columbia, Costa Rica, Dominican Republic, Ecuador, Fiji, Guyana, Jamaica, Kazakhstan, Macedonia, Namibia, Panama, Romania, Russia, Suriname and Thailand. The following countries changed from upper-middle-income countries to high income countries: Barbados, Chile, Czech Republic, Estonia, Hungary, Malta, Poland, Republic of Korea, Slovakia, Trinidad and Tobago and Uruguay. Latvia and Lithuania changed from lower-income countries to high-income countries. No country changed to a lower income group.

The logistic regression showed that time since FCTC ratification was not associated with implementing high tobacco taxes (Table 2). More fragile countries were less likely to have 75% and 50% tobacco tax rates in 2014. Countries with higher cigarette prices in 1998/1999 were more likely to have 75% tax rates in 2014. Countries with higher tax rates in 1998/1999 were more likely than countries with lower tax rates in 1998/1999 to have 75% tobacco tax rates in 2014. To test overall effects we calculated a linear regression model for all countries in our sample with tax rates in 2014 as the dependent variable and FCTC ratification, tax rate in 1999, price in 1999 and state capacity as independent variables ($R^2 = 0.48$). FCTC ratification and price were not statistically significant ($P>0.7$ and $P>0.3$ respectively). The coefficients for tax rate in 1999 were 0.40 ($p<0.001$) and for state capacity -1.58 ($p<0.001$). The variance inflation

factors in the first model ranged from 1.08 to 1.68 and in the second model from 1.04 to 1.12, well below the threshold for multicollinearity concern.

As a sensitivity analysis, we also ran OLS regression with actual tax rate in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. Tax rate in 1999 was positively associated with tax rate in 2014 (coeff. 0.41, p=0.0003) and lack of state capacity was negatively associated with tax in 2014 (coeff. -1,52, p=0.00001). The results were essentially the same as the logistic regression analysis.

Table 2. Odds of passing high standard tobacco taxes by 2014 (among non-compliant countries in 1998/1999)

	Tobacco tax ≥ 75% of retail price (high)		Tobacco tax ≥ 50% of retail price	
Variable	Odds ratio	95% Cl	Odds ratio	95% Cl
Years since FCTC ratification	1.04	(0.81-1.43)	0.94	(0.76-1.15)
Tax rate in 1998/1999	1.07*	(1.00-1.14)	1.01	(0.94-1.08)
Price in 1998/1999	0.31*	(0.10-0.73)	0.78	(0.22-2.78)
State capacity	0.67**	(0.49-0.83)	0.86*	(0.74-0.99)
Number of countries (observations)	88		62	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

There were large differences in affordability of cigarettes across countries in both 1999 and 2014 (Figure 2). At the lower end of the range, in 2014 less than one percent of per capita GDP was required to buy 100 packs of the most sold cigarette brands in Luxembourg, while at the upper end in Tanzania the corresponding figure was 24.6% (28.9% in 1999). Cigarettes become less affordable between 1999 and 2014 in 51 countries and more affordable in 40 countries. Cigarettes had become less affordable in 73% of high-income countries (27/37), 61% of upper-middle-income countries (14/23) and 31% of lower-middle- and low-income countries

(10/32). Ratifying the FCTC earlier was associated with cigarettes becoming less affordable in 2014 implying perhaps that countries with affordable cigarette prices in 1999 were quicker to ratify the FCTC and implement its tax provision (Table 3). Cigarettes became more affordable in countries with high rates of per capita GDP growth between 1999 and 2014. Lack of state capacity was associated with lower odds for having less affordable cigarettes. The variance inflation factors ranged from 1.04 to 1.10, indicating no multicollinearity problems.

As a sensitivity analysis, we also ran OLS regression with cigarette affordability in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. The direction of association was again similar as in logit analysis. Ratifying the FCTC earlier was positively associated with cigarettes becoming less affordable in 2014 (coeff.0.04, p=0.03), while GDP growth (coeff.-0.10, p=0.001) and lack of state capacity (coeff.-0.02, p=0.001) were negatively associated with having less affordable cigarettes.

Table 3. Odds of cigarettes being less affordable by 2014

Variable	Odds ratio	95% Cl
Years since FCTC ratification	1.23*	(1.02-1.50)
GDP per capita growth from 1999 to 2014	0.48**	(0.28-0.75)
State capacity	0.90*	(0.82-0.99)
Number of countries (observations)	91	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

DISCUSSION

Our results confirm earlier findings showing slow progress in meeting the 75% or 50% tobacco tax rate targets among low- and middle-income countries.[2 26] Likewise, our results support concerns[2] that FCTC Article 6 has not, in general, led countries to implement high tobacco taxes. Lack of success can be partly attributed to state fragility. More fragile countries in

terms of security, political, economic, and social development may not have administrative and technical capacity to implement high tobacco taxes.[27-30] We did not detect an interaction between state capacity and time since FCTC ratification, which indicates that weak state capacity as such may not prevent countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic functions of government.[31 32]

Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The results indicate a path-dependency in tobacco taxation policies.[33-35] The passing of tobacco tax policies is a contingent event that sets into motion institutional patterns that have deterministic properties.[36] The result emphasizes the importance of intensifying efforts to implement high tobacco taxes especially in countries with originally low tax rates.

Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75% tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have reached the target with regular inflationary adjustments. This association may also reflect a possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes are already relatively expensive. This could also result from tobacco industry lobbying.[2 7-9] FCTC Article 6 and its implementation guidelines expressly emphasize health goals in determining tobacco taxation but governments may try to maintain popular support through adopting small tobacco tax increases instead of large increases. It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low before the tax increase.

Consistent with earlier studies on cigarette affordability, cigarettes were more affordable in 2014 than in 1999 despite tax increases. [2 24 37 38] Our paper includes data collected well after

2010, so we were able base our analysis on a longer time horizon than earlier analyses and thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant association of FCTC ratification with having high cigarette taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC ratification remains statistically significant.

There are many different ways that one could define an "effective" tax rate, including 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1). The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC had on tax policy, we used the WHO's own standard of success as defined in MPOWER. The MPOWER measures for effective tax rates are arbitrary and different measures could be also used.

Our results emphasize the role of economic development in preventing cigarettes from becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if taxes are kept constant.[2 24] This development is reflected in our result where rapid per capita GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate targets, for example 50% of retail price, is that they do not take into account the effect of rising incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes generally increases with the average level of income, especially in developing countries.[24]

Lack of state capacity was associated with both lower odds for having high tobacco taxes and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile countries, while taxes are high and cigarettes less affordable in more stable countries. As of 2018, the multinational tobacco companies were targeting countries in Asia and Africa with young populations and relatively low smoking prevalence, especially among women.[39]

The tax provisions in the FCTC do not include specific tax targets.[5] The unwillingness of FCTC parties to commit to minimum tax levels during FCTC negotiations is reflected in the lack of subsequent action.[40] FCTC Guidelines for Article 6 implementation recommend that Parties should take into account "both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence."[5] Our results demonstrate that current policies for implementing tobacco taxes fail to meet this recommendation.

In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning definite targets not only for tobacco tax rates but also for measures that prevent tobacco products from becoming more affordable.

The effect of cigarettes becoming more affordable with rapid income rises can be prevented by adopting adequate policies.[37 38 41] One example is a tax escalator which is adjusted to income growth or an equivalent variable that accounts for increases in consumer purchasing power.[2] Such a tax escalator is already in place in the UK.[42] With automatically increasing tobacco taxes by the increase in purchasing power the tobacco companies would increase prices, which would prevent tobacco products not becoming more affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard.

Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so would make it more difficult for tobacco companies to downshift tax increases.

Limitations

Assessing the change in tax as a share of price over time can be complicated.[19] Determination of tax rates as a proportion of total cigarette retail price is dependent on changes in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax on cigarettes, the share of excise and total taxes in the retail price could remain the same or shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share of taxes in the final retail price might increase, even if there is no change in the tax levied on a pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not enough, given that the FCTC did not specify 50/75% tax rates as a requirement.

To establish a baseline before FCTC we used tobacco tax and price data from two different sources, World Bank survey from 1999[20] and the International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco*. Both data sources include information on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping price information indicates the data was collected in a substantially uniform manner. The correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more dramatically than cigarette prices. Given the more reliable international standing we deemed the World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all data sources including WHO data for 2014,[19] but were unable to confirm that definitions remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco

taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier research has shown the tobacco industry may simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on premium brands.[12] The higher the level of the excise and other taxes the less room for tobacco industry price differentiation strategies. We were not able to analyze how countries' tax policies have accounted for country-specific price and income elasticities.

In this study we were not able to assess the causal effects. Besides the variables used in this study other factors such as economic cycles, political leadership and tobacco control activity outside of FCTC may have affected the outcome variables.

Our analysis focused only on cigarettes ignoring other categories of tobacco products, some of which (for example bidi) are more prevalent in more fragile countries such as Bangladesh and India[43]. Since we had data only from two time points we were not able to assess trends in tax, price and affordability in prior periods.

Conclusions

In contrast to advertising restrictions,[33 35] health warning labels,[33] and smokefree environments,[34] FCTC ratification has not been systematically followed regarding higher tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke free environments, health warnings and advertising bans that fall into domain of health government, while Article 6 concerns financial policy, which falls under finance ministries. There need to be further efforts to increase financial ministries' knowledge of and responsibility to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in

incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for the implementation of a tax escalator that gradually increases taxes to match the rising income levels. The tobacco control community should collaborate with other parts of civil society to intensify efforts to help more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government. The FCTC Conference of the Parties should assign definite targets not only for tobacco tax rates but also for measures to prevent tobacco products from becoming more affordable.

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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP

HH developed the idea for this study and carried out the data collection. HH and SG carried out the data analysis and wrote and revised the manuscript.

DATA SHARING STATEMENT

No data is shared since we are using data which is already made public.

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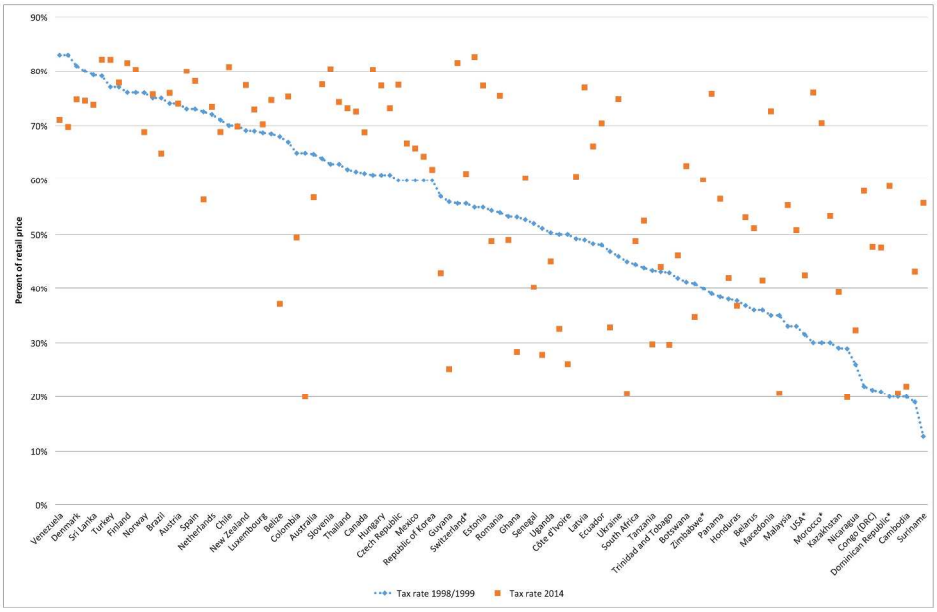
FIGURE CAPTIONS

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

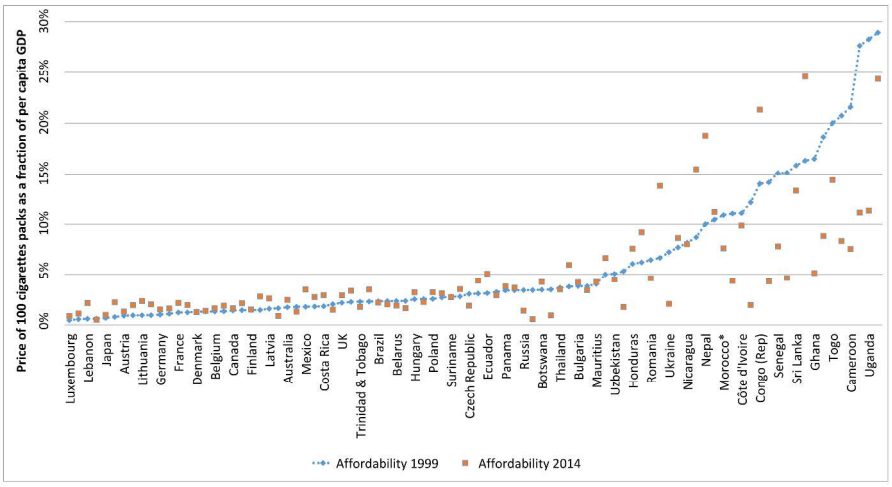


* Country has not ratified FCTC.

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Caption : Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

504x377mm (300 x 300 DPI)



* Country has not ratified FCTC.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

Caption : Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

504x313mm (300 x 300 DPI)

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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ABSTRACT

OBJECTIVE: To quantify changes in tobacco tax rates and cigarette affordability after countries ratified the WHO Framework Convention on Tobacco Control (FCTC) using with the World Health Organization MPOWER standards. .

METHODS: We used logistic regression to assess the association of FCTC ratification with adoption of at least 50% and 75% (high) of retail price tobacco tax rates for the most sold brands in countries, accounting for years since ratification and other covariates. We also compared cigarette affordability in 2014 to 1999.

RESULTS: By 2014, 44% of high-income countries had taxes above 75% of retail value compared to 18% in 1998/1999. In fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and one had the same tax rate. FCTC ratification was not associated with implementing high tobacco taxes. More fragile countries in terms of security, political, economic, and social development were less likely to have at least 50% and 75% tobacco tax rates in 2014 compared with 1999. The higher the cigarette prices in 1999 the less likely the countries were to have at least 75% tobacco tax rates in 2014. However, cigarettes were less affordable in 2014 than in 1999 in countries that had ratified FCTC earlier.

CONCLUSIONS: Despite widespread FCTC ratification, implementing higher tobacco taxes remains incomplete. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for implementation of a tax escalator that gradually increases taxes to match rising income levels. Fragile countries are less likely to have high tobacco taxes and less affordable cigarettes. The tobacco control community should intensify efforts to help fragile countries improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting basic functions of government.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- We were able to assess changes in tobacco taxes and prices over 15 years in 103 countries.
- We used WHO's own standards for effective tax rates.
- The willingness and ability of states to implement effective tobacco taxes was measured through state fragility index.
- The limitation of the study is that we could not analyze how the tobacco companies respond to the tax increase.
- The baseline data came from two different data sources.

INTRODUCTION

Raising tobacco taxes is an effective strategy to reduce tobacco use [1-3]. On average a 10% price increase will reduce tobacco use by 4% in high income countries and by 5% among low- and middle-income countries.[4] Article 6 of the World Health Organization (WHO) Framework Convention on Tobacco Control[5] (FCTC) commits parties to implement "tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption."[5] Article 6 implementation Guidelines[6] recommend tax policies which take into account tobacco products' price elasticity (the rate by which tobacco consumption decreases as result of price increases) and income elasticity (the sensitivity of tobacco consumption to income changes) to make tobacco products less affordable over time, but does not set specific targets for taxes or prices.

Tobacco industry tactics to block tax increases have a major influence on tax rates and industry responses to tax increases have a major effect on cigarette prices. Tobacco taxes are politically difficult to raise because tobacco companies fight tax increases[2] by commissioning research claiming economic benefits of tobacco, creating alliances,[7] including with progressive organizations,[8] lobbying ministries of finance with poor knowledge of public health and FCTC requirements,[9] and arguing tax increases drive illicit trade[2] and hurt disadvantaged groups.[8 10 11] They also learned how to cope with tax increases and sometimes actually benefit from them by overshifting taxes on premium brands to increase profits while downshifting taxes on ultra-low-price brands to cushion the effects of tax increases on total consumption.[12-15] Even a series of substantial tax increases, such as in Australia[16], may not increase the tax rate if the industry keeps overshifting tax increases to prices. In this sense, tax rates can be a relatively poor indicator of cigarette prices.

WHO established the MPOWER measures in 2008 to scale up key FCTC demand reduction measures including tobacco taxes. MPOWER emphasizes that "increasing the price of tobacco through higher taxes is the single most effective way to encourage tobacco users to quit and prevent children from starting to smoke." [2] A key finding of the 2015 MPOWER report was that taxes were the least implemented MPOWER measure with only 10% of the world's population (living in 33 countries) covered by taxes of at least 75% of retail price[2]. This paper assesses the association of FCTC ratification with implementing tobacco taxes by analyzing changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we assess the role of state capacity and previous tax and price levels[17 18] on taxes in 2014.

METHODS

Data

Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties, value added tax, and other taxes were obtained from the World Health Organization Report on the Global Tobacco Epidemic 2015 public dataset for 2014.[19] This dataset includes information collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on the taxation of cigarettes (and when possible, most commonly used tobacco products) was collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was used to calculate the tax rate.

We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64 countries that reported the share of cigarette taxes (including value added tax, VAT) as a

percentage of the retail price of a pack of cigarettes[20] supplemented by the tobacco industry's International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco* that mapped international taxation, price and tariff policies.[22]

Tobacco tax rate is the portion of the price represented by all taxes (including VAT for the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables derived from MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest MPOWER standard[2], and (2) taxes that totaled at least 50% of retail price, the second highest standard.[2] FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes so that the tax share would go above 75% or 50%.

To analyze the income level of the countries we used World Bank (WB) 2016 gross national income (GNI) categories:[23] low-income countries were defined as those with a GNI per capita of $1,045 or less in 2014; middle-income economies, $1,046 to $12,735; high income, $12,736 or more. Lower-middle-income and upper-middle-income economies were separated at a GNI per capita of $4,125. Since our sample included only eight low-income countries, after cross tabulation analysis we combined low income and lower middle-income categories in the regression analysis. We used information on cigarette prices expressed in nominal US dollars in 1998/1999.

We analyzed the association of FCTC with affordability of cigarettes by using the fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold cigarette brand. This method is a more comprehensive and representative measure

of income across countries in different income levels than, for example surveys of wages.[24]We used price data described above and World Bank data for GDP per capita for 1999 and 2014.[23] In addition, we used the growth of GDP per capita from 1999 to 2014[23] ([2014 GDP – 1999 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the assumption that cigarettes would be more affordable in 2014 among those countries where the rise in income level was the fastest. We assume that changes in GDP over the 16-year period reflect changes in disposable income.

Other Variables

To study the willingness and ability of states to implement public policies we used Marshall and Cole's[25] state fragility index. This index scores all countries with population above 500,000 in four performance dimensions: security, political, economic, and social. Previous literature has shown that state fragility matters for implementing effective cigarette health warnings.[17 18] The index gives higher scores for more fragile countries (Sudan scored 23 while the 15 most stable countries scored 0) but does not place countries into different categories. We averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries which score higher on Marshall and Cole's state fragility index.

We studied the role of previous tax and price levels on tax rate in 2014 with two variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999 were more likely to have high tax rates in 2014.

Statistical Analysis

Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as the outcome variable. We studied the effect of FCTC by calculating the number of years since FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded from the analysis.

Our analysis has 80% statistical power (with α=.05) to detect an OR by a factor of 1.25 (or 0.80) associated with FCTC ratification.

We also used logistic regression to analyze the effect of the FCTC on cigarette affordability by assigning a value of 1 for those countries where cigarettes were less affordable in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between state capacity and FCTC ratification to see if more fragile countries were slower in ratifying FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with extensive tobacco control measures.

We used R functions glm and minEffect.VSMc.logistic from powerMediation for the analysis.

Patient and Public Involvement

Patients or public were not involved in the study.

RESULTS

Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014. In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it (30 FCTC ratifying countries), and one country (Austria) had the same tax rate.

In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income countries had a tax above 75% of the retail price (Table 1). By 2014, 44% of high-income countries had taxes above 75% of retail value. The progress was slow among higher- and lower-middle-income countries with just one additional country complying in each income category and no low-income country.

In 1998/1999 37 (82%) of high-income countries had taxes that comprised above 50% of retail price, while only 11 (46%) of higher-middle-income countries, 9 (35%) of lower-middle-income countries, and two (23%) low-income country had that tax rate. By 2014 39 (87%) of high-income countries had taxes above 50% of retail price, as did 16 (67%) of upper-middle - income countries, 13 (50%) of lower-middle-income countries, and 1 (13%) low-income country (Zimbabwe).

Table 1. Countries with 75% and 50% tobacco tax rates in 1998/1999 and 2014 by income group

	Tobacco tax > 75% (high)			Tobacco tax > 50%		
	Yes	No	Fraction of countries	Yes	No	Fraction of countries
High-income						
1998/1999	8	37	18%	37	8	82%
2014	20	25	44%	39	7	87%
Upper-middle-income						

1998/1999	2	22	8%	11	13	46%
2014	3	21	13%	16	8	67%
Lower-middle-income						
1998/1999	1	25	4%	9	17	35%
2014	1	25	4%	13	13	50%
Low-income						
1998/1999	0	8	0%	2	6	23%
2014	0	8	0%	1	7	13%

45 countries changed WB status during the observation period. The following countries changed from low-income countries to lower-middle income countries: Bangladesh, Cambodia, Cameroon, Côte d'Ivoire, Ghana, Honduras, India, Kenya, Lesotho, Nicaragua, Nigeria, Pakistan and Vietnam. The following countries changed from lower-middle income countries to upper-middle income countries: Algeria, Belarus, Belize, Bulgaria, Columbia, Costa Rica, Dominican Republic, Ecuador, Fiji, Guyana, Jamaica, Kazakhstan, Macedonia, Namibia, Panama, Romania, Russia, Suriname and Thailand. The following countries changed from upper-middle-income countries to high income countries: Barbados, Chile, Czech Republic, Estonia, Hungary, Malta, Poland, Republic of Korea, Slovakia, Trinidad and Tobago and Uruguay. Latvia and Lithuania changed from lower-income countries to high-income countries. No country changed to a lower income group.

The logistic regression showed that time since FCTC ratification was not associated with implementing high tobacco taxes (Table 2). More fragile countries were less likely to have 75% and 50% tobacco tax rates in 2014. Countries with higher cigarette prices in 1998/1999 were more likely to have 75% tax rates in 2014. Countries with higher tax rates in 1998/1999 were more likely than countries with lower tax rates in 1998/1999 to have 75% tobacco tax rates in 2014. To test overall effects we calculated a linear regression model for all countries in our sample with tax rates in 2014 as the dependent variable and FCTC ratification, tax rate in 1999, price in 1999 and state capacity as independent variables ($R^2 = 0.48$). FCTC ratification and price were not statistically significant ($P>0.7$ and $P>0.3$ respectively). The coefficients for tax rate in 1999 were 0.40 ($p<0.001$) and for state capacity -1.58 ($p<0.001$). The variance inflation

factors in the first model ranged from 1.08 to 1.68 and in the second model from 1.04 to 1.12, well below the threshold for multicollinearity concern.

As a sensitivity analysis, we also ran OLS regression with actual tax rate in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. Tax rate in 1999 was positively associated with tax rate in 2014 (coeff. 0.41, p=0.0003) and lack of state capacity was negatively associated with tax in 2014 (coeff. -1,52, p=0.00001). The results were essentially the same as the logistic regression analysis.

Table 2. Odds of passing high standard tobacco taxes by 2014 (among non-compliant countries in 1998/1999)

	Tobacco tax ≥ 75% of retail price (high)		Tobacco tax ≥ 50% of retail price	
Variable	Odds ratio	95% Cl	Odds ratio	95% Cl
Years since FCTC ratification	1.04	(0.81-1.43)	0.94	(0.76-1.15)
Tax rate in 1998/1999	1.07*	(1.00-1.14)	1.01	(0.94-1.08)
Price in 1998/1999	0.31*	(0.10-0.73)	0.78	(0.22-2.78)
State capacity	0.67**	(0.49-0.83)	0.86*	(0.74-0.99)
Number of countries (observations)	88		62	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

There were large differences in affordability of cigarettes across countries in both 1999 and 2014 (Figure 2). At the lower end of the range, in 2014 less than one percent of per capita GDP was required to buy 100 packs of the most sold cigarette brands in Luxembourg, while at the upper end in Tanzania the corresponding figure was 24.6% (28.9% in 1999). Cigarettes become less affordable between 1999 and 2014 in 51 countries and more affordable in 40 countries. Cigarettes had become less affordable in 73% of high-income countries (27/37), 61% of upper-middle-income countries (14/23) and 31% of lower-middle- and low-income countries

(10/32). Ratifying the FCTC earlier was associated with cigarettes becoming less affordable in 2014 implying perhaps that countries with affordable cigarette prices in 1999 were quicker to ratify the FCTC and implement its tax provision (Table 3). Cigarettes became more affordable in countries with high rates of per capita GDP growth between 1999 and 2014. Lack of state capacity was associated with lower odds for having less affordable cigarettes. The variance inflation factors ranged from 1.04 to 1.10, indicating no multicollinearity problems.

As a sensitivity analysis, we also ran OLS regression with cigarette affordability in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. The direction of association was again similar as in logit analysis. Ratifying the FCTC earlier was positively associated with cigarettes becoming less affordable in 2014 (coeff.0.04, p=0.03), while GDP growth (coeff.-0.10, p=0.001) and lack of state capacity (coeff.-0.02, p=0.001) were negatively associated with having less affordable cigarettes.

Table 3. Odds of cigarettes being less affordable by 2014

Variable	Odds ratio	95% Cl
Years since FCTC ratification	1.23*	(1.02-1.50)
GDP per capita growth from 1999 to 2014	0.48**	(0.28-0.75)
State capacity	0.90*	(0.82-0.99)
Number of countries (observations)	91	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

DISCUSSION

Our results confirm earlier findings showing slow progress in meeting the 75% or 50% tobacco tax rate targets among low- and middle-income countries.[2 26] Likewise, our results support concerns[2] that FCTC Article 6 has not, in general, led countries to implement high tobacco taxes. Lack of success can be partly attributed to state fragility. More fragile countries in

terms of security, political, economic, and social development may not have administrative and technical capacity to implement high tobacco taxes.[27-30] We did not detect an interaction between state capacity and time since FCTC ratification, which indicates that weak state capacity as such may not prevent countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic functions of government.[31 32]

Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The results indicate a path-dependency in tobacco taxation policies.[33-35] The passing of tobacco tax policies is a contingent event that sets into motion institutional patterns that have deterministic properties.[36] The result emphasizes the importance of intensifying efforts to implement high tobacco taxes especially in countries with originally low tax rates.

Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75% tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have reached the target with regular inflationary adjustments. This association may also reflect a possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes are already relatively expensive. This could also result from tobacco industry lobbying.[2 7-9] FCTC Article 6 and its implementation Guidelines expressly emphasize health goals in determining tobacco taxation but governments may try to maintain popular support through adopting small tobacco tax increases instead of large increases. The health groups play an important role in creating awareness and building capacity for FCTC implementation.[37 38 30] It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low before the tax increase.

Consistent with earlier studies on cigarette affordability, cigarettes were more affordable in 2014 than in 1999 despite tax increases. [2 24 39 40] Our paper includes data collected well after 2010, so we were able base our analysis on a longer time horizon than earlier analyses and thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant association of FCTC ratification with having high cigarette taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC ratification remains statistically significant.

There are many different ways that one could define an "effective" tax rate, including 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1). The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC had on tax policy, we used the WHO's own standard of success as defined in MPOWER. The MPOWER measures for effective tax rates are arbitrary and different measures could be also used.

Our results emphasize the role of economic development in preventing cigarettes from becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if taxes are kept constant.[2 24] This development is reflected in our result where rapid per capita GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate targets, for example 50% of retail price, is that they do not take into account the effect of rising

incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes generally increases with the average level of income, especially in developing countries.[24]

Lack of state capacity was associated with both lower odds for having high tobacco taxes and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile countries, while taxes are high and cigarettes less affordable in more stable countries. As of 2018, the multinational tobacco companies were targeting countries in Asia and Africa with young populations and relatively low smoking prevalence, especially among women.[41]

The tax provisions in the FCTC do not include specific tax targets.[5] The unwillingness of FCTC parties to commit to minimum tax levels during FCTC negotiations is reflected in the lack of subsequent action.[42] FCTC Guidelines for Article 6 implementation recommend that Parties should take into account "both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence."[5] Our results demonstrate that current policies for implementing tobacco taxes fail to meet this recommendation.

In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning definite targets not only for tobacco tax rates but also for measures that prevent tobacco products from becoming more affordable.

The effect of cigarettes becoming more affordable with rapid income rises can be prevented by adopting adequate policies.[39 40 43] One example is a tax escalator which is adjusted to income growth or an equivalent variable that accounts for increases in consumer purchasing power.[2] Such a tax escalator is already in place in the UK.[44] With automatically increasing tobacco taxes by the increase in purchasing power the tobacco companies would increase prices,

which would prevent tobacco products not becoming more affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard. Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so would make it more difficult for tobacco companies to downshift tax increases.

Limitations

Assessing the change in tax as a share of price over time can be complicated.[19] Determination of tax rates as a proportion of total cigarette retail price is dependent on changes in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax on cigarettes, the share of excise and total taxes in the retail price could remain the same or shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share of taxes in the final retail price might increase, even if there is no change in the tax levied on a pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not enough, given that the FCTC did not specify 50/75% tax rates as a requirement.

The Article 6 Guidelines were adopted in 2014, nine years after the FCTC entered force and may have delayed Parties' attention to implementing tax increases. Other analyses of health warning labels[18 33] (Article 11), smokefree policies[34] (Article 8) and advertising bans[35] (Article 13), however, demonstrated an effect of FCTC ratification without considering the delay in adoption of the implementing guidelines for these articles.

To establish a baseline before FCTC we used tobacco tax and price data from two different sources, World Bank survey from 1999[20] and the International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco*. Both data sources include information on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping price information indicates the data was collected in a substantially uniform manner. The

correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more dramatically than cigarette prices. Given the more reliable international standing we deemed the World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all data sources including WHO data for 2014,[19] but were unable to confirm that definitions remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier research has shown the tobacco industry may simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on premium brands.[12] The higher the level of the excise and other taxes the less room for tobacco industry price differentiation strategies. We were not able to analyze how countries' tax policies have accounted for country-specific price and income elasticities.

In this study we were not able to assess the causal effects. Besides the variables used in this study other factors such as economic cycles, political leadership and tobacco control activity outside of FCTC may have affected the outcome variables.

Our analysis focused only on cigarettes ignoring other categories of tobacco products, some of which (for example bidi) are more prevalent in more fragile countries such as Bangladesh and India[45]. Since we had data only from two time points we were not able to assess trends in tax, price and affordability in prior periods.

Conclusions

In contrast to advertising restrictions,[33 35] health warning labels,[33] and smokefree environments,[34] FCTC ratification has not been systematically followed regarding higher tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke free environments, health warnings and advertising bans that fall into domain of health government, while Article 6 concerns financial policy, which falls under finance ministries. There need to be further efforts to increase financial ministries' knowledge of and responsibility to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for the implementation of a tax escalator that gradually increases taxes to match the rising income levels. The tobacco control community should collaborate with other parts of civil society to intensify efforts to help more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government. The FCTC Conference of the Parties should assign definite targets not only for tobacco tax rates but also for measures to prevent tobacco products from becoming more affordable.

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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP

HH developed the idea for this study and carried out the data collection. HH and SG carried out the data analysis and wrote and revised the manuscript.

DATA SHARING STATEMENT

No data is shared since we are using data which is already made public.

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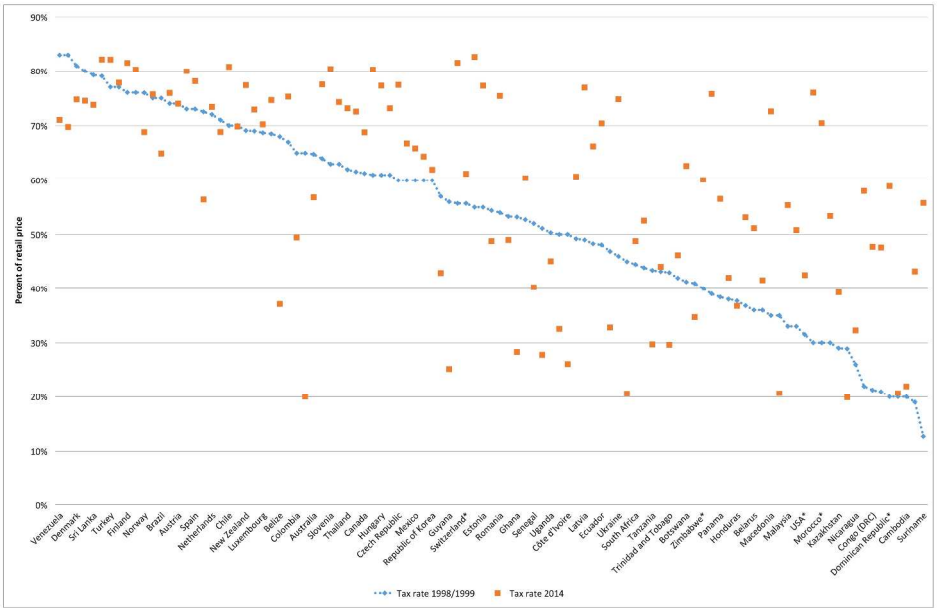
FIGURE CAPTIONS

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

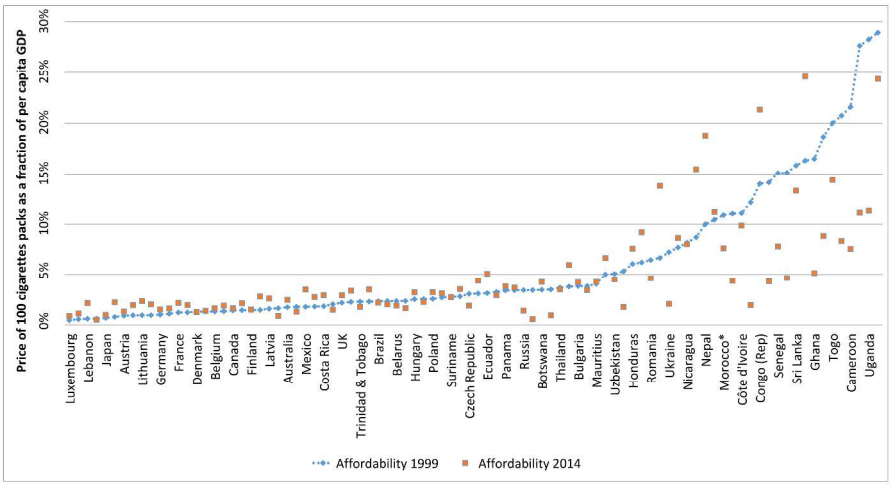


* Country has not ratified FCTC.

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Caption : Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

504x377mm (300 x 300 DPI)



* Country has not ratified FCTC.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

Caption : Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

504x313mm (300 x 300 DPI)

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON

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ABSTRACT

OBJECTIVE: To quantify changes in tobacco tax rates and cigarette affordability after countries ratified the WHO Framework Convention on Tobacco Control (FCTC) using with the World Health Organization MPOWER standards. .

METHODS: We used logistic regression to assess the association of FCTC ratification with adoption of at least 50% and 75% (high) of retail price tobacco tax rates for the most sold brands in countries, accounting for years since ratification and other covariates. We also compared cigarette affordability in 2014 to 1999.

RESULTS: By 2014, 44% of high-income countries had taxes above 75% of retail value compared to 18% in 1998/1999. In fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and one had the same tax rate. FCTC ratification was not associated with implementing high tobacco taxes. More fragile countries in terms of security, political, economic, and social development were less likely to have at least 50% and 75% tobacco tax rates in 2014 compared with 1999. The higher the cigarette prices in 1999 the less likely the countries were to have at least 75% tobacco tax rates in 2014. However, cigarettes were less affordable in 2014 than in 1999 in countries that had ratified FCTC earlier.

CONCLUSIONS: Despite widespread FCTC ratification, implementing higher tobacco taxes remains incomplete. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for implementation of a tax escalator that gradually increases taxes to match rising income levels. Fragile countries are less likely to have high tobacco taxes and less affordable cigarettes. The tobacco control community should intensify efforts to help fragile countries improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting basic functions of government.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- We were able to assess changes in tobacco taxes and prices over 15 years in 103 countries.
- We used WHO's own standards for effective tax rates.
- The willingness and ability of states to implement effective tobacco taxes was measured through state fragility index.
- The limitation of the study is that we could not analyze how the tobacco companies respond to the tax increase.
- The baseline data came from two different data sources.

INTRODUCTION

Raising tobacco taxes is an effective strategy to reduce tobacco use [1-3]. On average a 10% price increase will reduce tobacco use by 4% in high income countries and by 5% among low- and middle-income countries.[4] Article 6 of the World Health Organization (WHO) Framework Convention on Tobacco Control[5] (FCTC) commits parties to implement "tax policies and, where appropriate, price policies, on tobacco products so as to contribute to the health objectives aimed at reducing tobacco consumption."[5] Article 6 implementation Guidelines[6] recommend tax policies which take into account tobacco products' price elasticity (the rate by which tobacco consumption decreases as result of price increases) and income elasticity (the sensitivity of tobacco consumption to income changes) to make tobacco products less affordable over time, but does not set specific targets for taxes or prices.

Tobacco industry tactics to block tax increases have a major influence on tax rates and industry responses to tax increases have a major effect on cigarette prices. Tobacco taxes are politically difficult to raise because tobacco companies fight tax increases[2] by commissioning research claiming economic benefits of tobacco, creating alliances,[7] including with progressive organizations,[8] lobbying ministries of finance with poor knowledge of public health and FCTC requirements,[9] and arguing tax increases drive illicit trade[2] and hurt disadvantaged groups.[8 10 11] They also learned how to cope with tax increases and sometimes actually benefit from them by overshifting taxes on premium brands to increase profits while downshifting taxes on ultra-low-price brands to cushion the effects of tax increases on total consumption.[12-15] Even a series of substantial tax increases, such as in Australia[16], may not increase the tax rate if the industry keeps overshifting tax increases to prices. In this sense, tax rates can be a relatively poor indicator of cigarette prices.

WHO established the MPOWER measures in 2008 to scale up key FCTC demand reduction measures including tobacco taxes. MPOWER emphasizes that "increasing the price of tobacco through higher taxes is the single most effective way to encourage tobacco users to quit and prevent children from starting to smoke." [2] A key finding of the 2015 MPOWER report was that taxes were the least implemented MPOWER measure with only 10% of the world's population (living in 33 countries) covered by taxes of at least 75% of retail price[2]. This paper assesses the association of FCTC ratification with implementing tobacco taxes by analyzing changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we assess the role of state capacity and previous tax and price levels[17 18] on taxes in 2014.

METHODS

Data

Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties, value added tax, and other taxes were obtained from the World Health Organization Report on the Global Tobacco Epidemic 2015 public dataset for 2014.[19] This dataset includes information collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on the taxation of cigarettes (and when possible, most commonly used tobacco products) was collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was used to calculate the tax rate.

We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64 countries that reported the share of cigarette taxes (including value added tax, VAT) as a

percentage of the retail price of a pack of cigarettes[20] supplemented by the tobacco industry's International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco* that mapped international taxation, price and tariff policies.[22]

Tobacco tax rate is the portion of the price represented by all taxes (including VAT for the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables derived from MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest MPOWER standard[2], and (2) taxes that totaled at least 50% of retail price, the second highest standard.[2] FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes so that the tax share would go above 75% or 50%.

To analyze the income level of the countries we used World Bank (WB) 2016 gross national income (GNI) categories:[23] low-income countries were defined as those with a GNI per capita of $1,045 or less in 2014; middle-income economies, $1,046 to $12,735; high income, $12,736 or more. Lower-middle-income and upper-middle-income economies were separated at a GNI per capita of $4,125. Since our sample included only eight low-income countries, after cross tabulation analysis we combined low income and lower middle-income categories in the regression analysis. We used information on cigarette prices expressed in nominal US dollars in 1998/1999.

We analyzed the association of FCTC with affordability of cigarettes by using the fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold cigarette brand. This method is a more comprehensive and representative measure

of income across countries in different income levels than, for example surveys of wages.[24]We used price data described above and World Bank data for GDP per capita for 1999 and 2014.[23] In addition, we used the growth of GDP per capita from 1999 to 2014[23] ([2014 GDP – 1999 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the assumption that cigarettes would be more affordable in 2014 among those countries where the rise in income level was the fastest. We assume that changes in GDP over the 16-year period reflect changes in disposable income.

Other Variables

To study the willingness and ability of states to implement public policies we used Marshall and Cole's[25] state fragility index. This index scores all countries with population above 500,000 in four performance dimensions: security, political, economic, and social. Previous literature has shown that state fragility matters for implementing effective cigarette health warnings.[17 18] The index gives higher scores for more fragile countries (Sudan scored 23 while the 15 most stable countries scored 0) but does not place countries into different categories. We averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries which score higher on Marshall and Cole's state fragility index.

We studied the role of previous tax and price levels on tax rate in 2014 with two variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999 were more likely to have high tax rates in 2014.

Statistical Analysis

Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as the outcome variable. We studied the effect of FCTC by calculating the number of years since FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded from the analysis.

Our analysis has 80% statistical power (with α=.05) to detect an OR by a factor of 1.25 (or 0.80) associated with FCTC ratification.

We also used logistic regression to analyze the effect of the FCTC on cigarette affordability by assigning a value of 1 for those countries where cigarettes were less affordable in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between state capacity and FCTC ratification to see if more fragile countries were slower in ratifying FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with extensive tobacco control measures.

We used R functions glm and minEffect.VSMc.logistic from powerMediation for the analysis.

Patient and Public Involvement

Patients or public were not involved in the study.

RESULTS

Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014. In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it (30 FCTC ratifying countries), and one country (Austria) had the same tax rate.

In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income countries had a tax above 75% of the retail price (Table 1). By 2014, 44% of high-income countries had taxes above 75% of retail value. The progress was slow among higher- and lower-middle-income countries with just one additional country complying in each income category and no low-income country.

In 1998/1999 37 (82%) of high-income countries had taxes that comprised above 50% of retail price, while only 11 (46%) of higher-middle-income countries, 9 (35%) of lower-middle-income countries, and two (23%) low-income country had that tax rate. By 2014 39 (87%) of high-income countries had taxes above 50% of retail price, as did 16 (67%) of upper-middle - income countries, 13 (50%) of lower-middle-income countries, and 1 (13%) low-income country (Zimbabwe).

Table 1. Countries with 75% and 50% tobacco tax rates in 1998/1999 and 2014 by income group

	Tobacco tax > 75% (high)			Tobacco tax > 50%		
	Yes	No	Fraction of countries	Yes	No	Fraction of countries
High-income						
1998/1999	8	37	18%	37	8	82%
2014	20	25	44%	39	7	87%
Upper-middle-income						

1998/1999	2	22	8%	11	13	46%
2014	3	21	13%	16	8	67%
Lower-middle-income						
1998/1999	1	25	4%	9	17	35%
2014	1	25	4%	13	13	50%
Low-income						
1998/1999	0	8	0%	2	6	23%
2014	0	8	0%	1	7	13%

45 countries changed WB status during the observation period. The following countries changed from low-income countries to lower-middle income countries: Bangladesh, Cambodia, Cameroon, Côte d'Ivoire, Ghana, Honduras, India, Kenya, Lesotho, Nicaragua, Nigeria, Pakistan and Vietnam. The following countries changed from lower-middle income countries to upper-middle income countries: Algeria, Belarus, Belize, Bulgaria, Columbia, Costa Rica, Dominican Republic, Ecuador, Fiji, Guyana, Jamaica, Kazakhstan, Macedonia, Namibia, Panama, Romania, Russia, Suriname and Thailand. The following countries changed from upper-middle-income countries to high income countries: Barbados, Chile, Czech Republic, Estonia, Hungary, Malta, Poland, Republic of Korea, Slovakia, Trinidad and Tobago and Uruguay. Latvia and Lithuania changed from lower-income countries to high-income countries. No country changed to a lower income group.

The logistic regression showed that time since FCTC ratification was not associated with implementing high tobacco taxes (Table 2). More fragile countries were less likely to have 75% and 50% tobacco tax rates in 2014. Countries with higher cigarette prices in 1998/1999 were more likely to have 75% tax rates in 2014. Countries with higher tax rates in 1998/1999 were more likely than countries with lower tax rates in 1998/1999 to have 75% tobacco tax rates in 2014. To test overall effects we calculated a linear regression model for all countries in our sample with tax rates in 2014 as the dependent variable and FCTC ratification, tax rate in 1999, price in 1999 and state capacity as independent variables ($R^2 = 0.48$). FCTC ratification and price were not statistically significant ($P>0.7$ and $P>0.3$ respectively). The coefficients for tax rate in 1999 were 0.40 ($p<0.001$) and for state capacity -1.58 ($p<0.001$). The variance inflation

factors in the first model ranged from 1.08 to 1.68 and in the second model from 1.04 to 1.12, well below the threshold for multicollinearity concern.

As a sensitivity analysis, we also ran OLS regression with actual tax rate in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. Tax rate in 1999 was positively associated with tax rate in 2014 (coeff. 0.41, p=0.0003) and lack of state capacity was negatively associated with tax in 2014 (coeff. -1,52, p=0.00001). The results were essentially the same as the logistic regression analysis.

Table 2. Odds of passing high standard tobacco taxes by 2014 (among non-compliant countries in 1998/1999)

	Tobacco tax ≥ 75% of retail price (high)		Tobacco tax ≥ 50% of retail price	
Variable	Odds ratio	95% Cl	Odds ratio	95% Cl
Years since FCTC ratification	1.04	(0.81-1.43)	0.94	(0.76-1.15)
Tax rate in 1998/1999	1.07*	(1.00-1.14)	1.01	(0.94-1.08)
Price in 1998/1999	0.31*	(0.10-0.73)	0.78	(0.22-2.78)
State capacity	0.67**	(0.49-0.83)	0.86*	(0.74-0.99)
Number of countries (observations)	88		62	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

There were large differences in affordability of cigarettes across countries in both 1999 and 2014 (Figure 2). At the lower end of the range, in 2014 less than one percent of per capita GDP was required to buy 100 packs of the most sold cigarette brands in Luxembourg, while at the upper end in Tanzania the corresponding figure was 24.6% (28.9% in 1999). Cigarettes become less affordable between 1999 and 2014 in 51 countries and more affordable in 40 countries. Cigarettes had become less affordable in 73% of high-income countries (27/37), 61% of upper-middle-income countries (14/23) and 31% of lower-middle- and low-income countries

(10/32). Ratifying the FCTC earlier was associated with cigarettes becoming less affordable in 2014 implying perhaps that countries with affordable cigarette prices in 1999 were quicker to ratify the FCTC and implement its tax provision (Table 3). Cigarettes became more affordable in countries with high rates of per capita GDP growth between 1999 and 2014. Lack of state capacity was associated with lower odds for having less affordable cigarettes. The variance inflation factors ranged from 1.04 to 1.10, indicating no multicollinearity problems.

As a sensitivity analysis, we also ran OLS regression with cigarette affordability in 2014 as the dependent variable for the whole sample. We used the same independent variables as in logit analysis. The direction of association was again similar as in logit analysis. Ratifying the FCTC earlier was positively associated with cigarettes becoming less affordable in 2014 (coeff.0.04, p=0.03), while GDP growth (coeff.-0.10, p=0.001) and lack of state capacity (coeff.-0.02, p=0.001) were negatively associated with having less affordable cigarettes.

Table 3. Odds of cigarettes being less affordable by 2014

Variable	Odds ratio	95% Cl
Years since FCTC ratification	1.23*	(1.02-1.50)
GDP per capita growth from 1999 to 2014	0.48**	(0.28-0.75)
State capacity	0.90*	(0.82-0.99)
Number of countries (observations)	91	

* P ≤ 0.05, ** P ≤ 0.01, Numbers in parentheses are 95% confidence intervals.

DISCUSSION

Our results confirm earlier findings showing slow progress in meeting the 75% or 50% tobacco tax rate targets among low- and middle-income countries.[2 26] Likewise, our results support concerns[2] that FCTC Article 6 has not, in general, led countries to implement high tobacco taxes. Lack of success can be partly attributed to state fragility. More fragile countries in

terms of security, political, economic, and social development may not have administrative and technical capacity to implement high tobacco taxes.[27-30] We did not detect an interaction between state capacity and time since FCTC ratification, which indicates that weak state capacity as such may not prevent countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic functions of government.[31 32]

Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The results indicate a path-dependency in tobacco taxation policies.[33-35] The passing of tobacco tax policies is a contingent event that sets into motion institutional patterns that have deterministic properties.[36] The result emphasizes the importance of intensifying efforts to implement high tobacco taxes especially in countries with originally low tax rates.

Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75% tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have reached the target with regular inflationary adjustments. This association may also reflect a possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes are already relatively expensive. This could also result from tobacco industry lobbying.[2 7-9] FCTC Article 6 and its implementation Guidelines expressly emphasize health goals in determining tobacco taxation. The health groups play an important role in creating awareness and building capacity for FCTC implementation.[37 38 30] It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low before the tax increase.

Consistent with earlier studies on cigarette affordability, cigarettes were more affordable in 2014 than in 1999 despite tax increases. [2 24 39 40] Our paper includes data collected well after

2010, so we were able base our analysis on a longer time horizon than earlier analyses and thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant association of FCTC ratification with having high cigarette taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC ratification remains statistically significant.

There are many different ways that one could define an "effective" tax rate, including 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1). The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC had on tax policy, we used the WHO's own standard of success as defined in MPOWER. The MPOWER measures for effective tax rates are arbitrary and different measures could be also used.

Our results emphasize the role of economic development in preventing cigarettes from becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if taxes are kept constant.[2 24] This development is reflected in our result where rapid per capita GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate targets, for example 50% of retail price, is that they do not take into account the effect of rising incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes generally increases with the average level of income, especially in developing countries.[24]

Lack of state capacity was associated with both lower odds for having high tobacco taxes and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile countries, while taxes are high and cigarettes less affordable in more stable countries. As of 2018, the multinational tobacco companies were targeting countries in Asia and Africa with young populations and relatively low smoking prevalence, especially among women.[41]

The tax provisions in the FCTC do not include specific tax targets.[5] The unwillingness of FCTC parties to commit to minimum tax levels during FCTC negotiations is reflected in the lack of subsequent action.[42] FCTC Guidelines for Article 6 implementation recommend that Parties should take into account "both price elasticity and income elasticity of demand, as well as inflation and changes in household income, to make tobacco products less affordable over time in order to reduce consumption and prevalence."[5] Our results demonstrate that current policies for implementing tobacco taxes fail to meet this recommendation.

In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning definite targets not only for tobacco tax rates but also for measures that prevent tobacco products from becoming more affordable.

The effect of cigarettes becoming more affordable with rapid income rises can be prevented by adopting adequate policies.[39 40 43] One example is a tax escalator which is adjusted to income growth or an equivalent variable that accounts for increases in consumer purchasing power.[2] Such a tax escalator is already in place in the UK.[44] With automatically increasing tobacco taxes by the increase in purchasing power the tobacco companies would increase prices, which would prevent tobacco products not becoming more affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard.

Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so would make it more difficult for tobacco companies to downshift tax increases.

Limitations

Assessing the change in tax as a share of price over time can be complicated.[19] Determination of tax rates as a proportion of total cigarette retail price is dependent on changes in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax on cigarettes, the share of excise and total taxes in the retail price could remain the same or shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share of taxes in the final retail price might increase, even if there is no change in the tax levied on a pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not enough, given that the FCTC did not specify 50/75% tax rates as a requirement.

The Article 6 Guidelines were adopted in 2014, nine years after the FCTC entered force and may have delayed Parties' attention to implementing tax increases. Other analyses of health warning labels[18 33] (Article 11), smokefree policies[34] (Article 8) and advertising bans[35] (Article 13), however, demonstrated an effect of FCTC ratification without considering the delay in adoption of the implementing guidelines for these articles.

To establish a baseline before FCTC we used tobacco tax and price data from two different sources, World Bank survey from 1999[20] and the International Tobacco Documentation Centre's[21] 1998 *International Fiscal Guide to Tobacco*. Both data sources include information on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping price information indicates the data was collected in a substantially uniform manner. The correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more

dramatically than cigarette prices. Given the more reliable international standing we deemed the World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all data sources including WHO data for 2014,[19] but were unable to confirm that definitions remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier research has shown the tobacco industry may simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on premium brands.[12] The higher the level of the excise and other taxes the less room for tobacco industry price differentiation strategies. We were not able to analyze how countries' tax policies have accounted for country-specific price and income elasticities.

In this study we were not able to assess the causal effects. Besides the variables used in this study other factors such as economic cycles, political leadership and tobacco control activity outside of FCTC may have affected the outcome variables.

Our analysis focused only on cigarettes ignoring other categories of tobacco products, some of which (for example bidi) are more prevalent in more fragile countries such as Bangladesh and India[45]. Since we had data only from two time points we were not able to assess trends in tax, price and affordability in prior periods.

Conclusions

In contrast to advertising restrictions,[33 35] health warning labels,[33] and smokefree environments,[34] FCTC ratification has not been systematically followed regarding higher tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets

were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke free environments, health warnings and advertising bans that fall into domain of health government, while Article 6 concerns financial policy, which falls under finance ministries. There need to be further efforts to increase financial ministries' knowledge of and responsibility to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation should assign definite targets for tobacco taxes and for the implementation of a tax escalator that gradually increases taxes to match the rising income levels. The tobacco control community should collaborate with other parts of civil society to intensify efforts to help more fragile countries to improve performance in FCTC implementation both through strengthening their administrative and technical capacity and through supporting the basic functions of government. The FCTC Conference of the Parties should assign definite targets not only for tobacco tax rates but also for measures to prevent tobacco products from becoming more affordable.

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COMPETING INTERESTS

There are no competing interests.

CONTRIBUTORSHIP

HH developed the idea for this study and carried out the data collection. HH and SG carried out the data analysis and wrote and revised the manuscript.

DATA SHARING STATEMENT

No data is shared since we are using data which is already made public.

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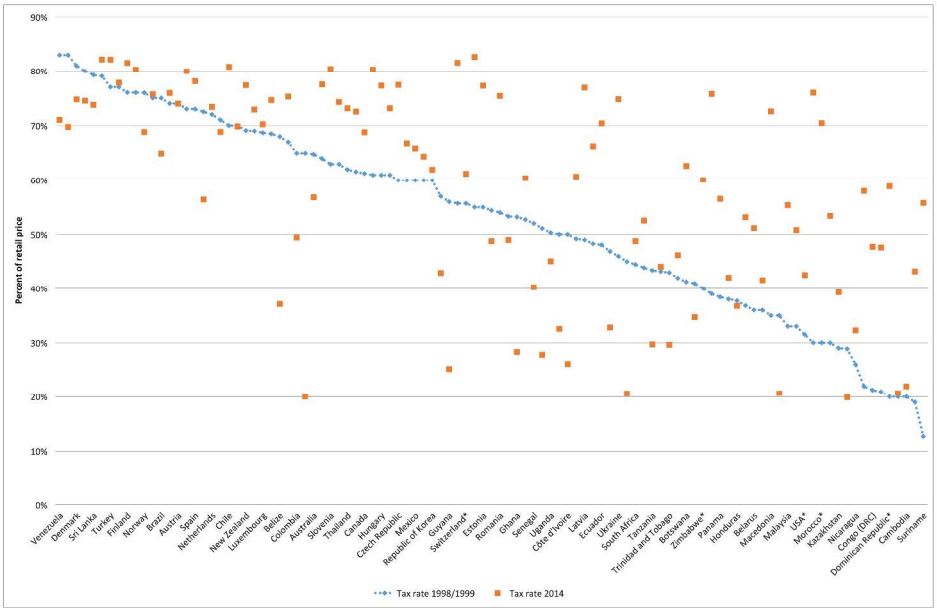
FIGURE CAPTIONS

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

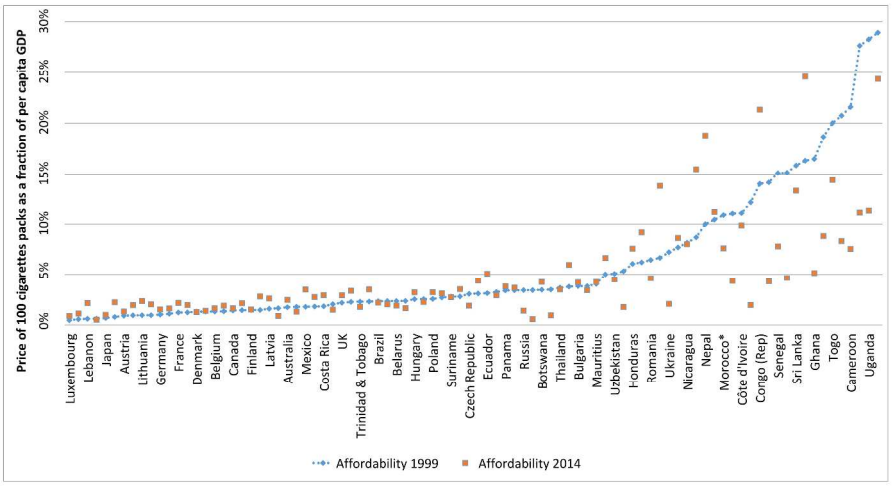


* Country has not ratified FCTC.

Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

Caption : Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

504x377mm (300 x 300 DPI)



* Country has not ratified FCTC.

Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

Caption : Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

504x313mm (300 x 300 DPI)