

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

IMPLEMENTATION OF THE FCTC TOBACCO TAX PROVISION: LIMITED PROGRESS

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-021340
Article Type:	Research
Date Submitted by the Author:	22-Dec-2017
Complete List of Authors:	Hiilamo, Heikki; University of Helsinki, Department of Social Research, social and public policy; VID Spezialized University, Oslo, Norway , •Faculty of Theology, Diaconia and Leadership Studies Glantz, S; University of California, San Francisco, Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
Keywords:	tobacco industry, tobacco taxation, FCTC

SCHOLARONE™
Manuscripts

Peer Review Only

1
2
3 **IMPLEMENTATION OF THE FCTC TOBACCO TAX PROVISION:**
4
5 **LIMITED PROGRESS**
6
7
8
9

10 Heikki Hiilamo^{ab}, PhD

11
12 Stanton Glantz^c, PhD

13
14
15 ^a Social and public policy, Department of Social Research, 00014 University of Helsinki,
16 Finland, heikki.hiilamo@helsinki.fi

17 ^b VID Specialized University, •Faculty of Theology, Diaconia and Leadership Studies, Oslo,NO-
18 0319 Norway

19 ^cCenter for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy
20 Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
21 University of California San Francisco, San Francisco, CA 94143-1390, stanton.glantz@ucsf.edu
22
23
24
25

26 Corresponding Author:
27 Heikki Hiilamo, Professor
28 University of Helsinki
29 Department of Social Research
30 PL 16
31 00014 Helsingin yliopisto
32 Finland
33 Tel. +358403587203
34 Fax. +358294124835
35 heikki.hiilamo@helsinki.fi
36
37
38

39 Word count 3425
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ABSTRACT

OBJECTIVE: Evaluate implementation of the tobacco tax 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 assign 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 use¹. 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 Control³ (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 guidelines⁴ 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 them⁵ 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 Australia¹³, 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.

1
2
3 WHO established the MPOWER measures in 2008 to scale up key FCTC demand
4
5 reduction measures including tobacco taxes. A key finding of the 2015 MPOWER report was
6
7 that taxes were the least implemented MPOWER measure with only 10% of the world's
8
9 population (living in 33 countries) covered by taxes of at least 75% of retail price⁵. This paper
10
11 assesses the effect of FCTC ratification on implementing tobacco taxes by analyzing changes in
12
13 tax rate using the WHO MPOWER standard and cigarette affordability. In addition, we assess
14
15 the role of state capacity and previous tax and price levels^{14 15} on taxes in 2014.
16
17
18

19 METHODS

20 Data

21
22 We obtained data on the tobacco tax rate, including specific excise, ad valorem excise,
23
24 import duties, value added tax, other taxes from the World Health Organization Report on the
25
26 Global Tobacco Epidemic 2015 public dataset for 2007, 2010, 2012 and 2014.¹⁶ This dataset
27
28 includes information collected by WHO in-country experts as of 31 December 2014 on the prices
29
30 of the most-sold brand of cigarettes (both in local currency and in US dollars) and cigarette
31
32 taxes. (Because WHO did not report tax data for Syria in 2014 we used the data from 2012 for
33
34 2014.) In countries where different taxes applied to cigarettes based on length, quantity
35
36 produced, or type (e.g., filter vs. non-filter), the rate that applied to the most popular brand was
37
38 used in the calculation of tax rate.
39
40
41
42
43

44 We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64
45
46 countries that reported the share of cigarette taxes (including VAT) as a percentage of the retail
47
48 price of a pack of cigarettes¹⁷ supplemented by the tobacco industry's International Tobacco
49
50 Documentation Centre's¹⁸ 1998 *International Fiscal Guide to Tobacco* that mapped international
51
52 taxation, price and tariff policies.¹⁹
53
54
55
56
57
58
59
60

1
2
3 Tobacco tax rate is the portion of the price represented by all taxes including VAT for the
4 most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables
5 derived from WHO MPOWER standards in the *WHO Report on the Global Tobacco Epidemic*
6 *2015: Raising Taxes on Tobacco*: (1) taxes that totaled at least 75% of retail price, the highest
7 MPOWER standard⁵, and (2) taxes that totaled at least 50% of retail price, the second highest
8 standard.⁵ FCTC Article 6 does not set any targets on tobacco prices. The expectation in FCTC
9 and WHO MPOWER program the government is that if the manufacturers increase wholesale
10 prices so that the overall tax rate drops below 75% or 50%, the government would increase taxes
11 so that the tax share would go above 75% or 50%.
12
13
14
15
16
17
18
19
20
21
22
23

24 To analyze the income level of the countries we used World Bank 2016 gross national
25 income (GNI) categories:²⁰ low-income countries were defined as those with a GNI per capita of
26 \$1,045 or less in 2014; middle-income economies, \$1,046 to \$12,735; high income, \$12,736 or
27 more. Lower-middle-income and upper-middle-income economies were separated at a GNI per
28 capita of \$4,125. Since our sample included only eight low-income countries, we combined low
29 income and lower middle-income categories in the statistical analysis. We used information on
30 cigarette prices expressed in nominal US dollars in 1998/1999.
31
32
33
34
35
36
37
38
39

40 We analyzed the effect of FCTC on affordability of cigarettes by using the fraction of per
41 capita gross domestic product (GDP) that would be needed to buy 100 packs of the most sold
42 cigarette brand. This method is a more comprehensive and representative measure of income
43 across countries in different income levels than, for example surveys of wages.²¹ We used price
44 data described above and World Bank data for GDP per capita for 1999 and 2014.²⁰ We used the
45 growth of GDP per capita from 1999 to 2014²⁰ ($[(2014 \text{ GDP} - 1999 \text{ GDP}) / 1999 \text{ GDP}]$, GDP
46 expressed in 2014 US dollars) as additional independent variable on the assumption that
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 cigarettes would be more affordable in 2014 among those countries where the rise in income
4 level is the fastest. We assume that changes in GDP over the 16-year period reflect changes in
5 disposable income.
6
7
8

9 10 **Other Variables**

11
12 To study the willingness and ability of states to implement public policies we used
13 Marshall and Cole's²² state fragility index. This index scores all countries with population above
14 500,000 in four performance dimensions: security, political, economic, and social. The index
15 gives higher scores for more fragile countries. (Sudan scored 23 while the 15 most stable
16 countries scored 0.) We averaged scores for 2007, 2010 and in 2013 to test whether more fragile
17 countries were less likely to have high tobacco taxes in 2014.
18
19
20
21
22
23
24
25

26 We study the effect of previous tax and price levels on tax rate in 2014 with two
27 variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in
28 1998/1999. We test whether countries with higher cigarette taxes and higher price cigarettes in
29 1998/1999 are more likely to have high tax rates in 2014.
30
31
32
33
34

35 **Statistical Analysis**

36
37 Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as
38 the outcome variable. We studied the effect of FCTC by calculating the number of years since
39 FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the
40 FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of
41 the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United
42 States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican
43 Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded
4
5 from the analysis.
6

7
8 Our analysis has 80% statistical power (with $\alpha=.05$) to detect an OR by a factor of 1.25
9
10 (or 0.80) associated with FCTC ratification.
11

12 We also used logistic regression to analyze the effect of the FCTC on cigarette
13
14 affordability by assigning a value of 1 for those countries where cigarettes were less affordable
15
16 in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between
17
18 state capacity and FCTC ratification to see if more fragile countries were slower in ratifying
19
20 FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with
21
22 extensive tobacco control measures.
23
24

25
26 We used R functions `glm` and `minEffect.VSMc.logistic` from `powerMediation` for the
27
28 analysis.
29

30 31 RESULTS

32
33 Tobacco tax rates have not uniformly increased from 1998/1999 to 2014 as shown in
34
35 Figure 1 where the countries are ranked by their tax rate in 1998/1999. The average tax rate
36
37 increased from 53% of the price of the most sold cigarette brands in 1998/1999 to 58% in 2014.
38
39 In those fifteen years 69 countries increased the tobacco tax rate, 33 decreased it, and one
40
41 country (Austria) had the same tax rate.
42
43

44
45 In 1998/1999 only 8 (18%) of high-income, 2 (8%; Brazil and Costa Rica) upper-
46
47 middle-income, one lower-middle-income country (4%, Sri Lanka), and none of the low-income
48
49 countries had a tax that was above 75% of the retail price (Table 1). By 2014, 44% of high-
50
51 income countries had taxes above 75% of retail value. The progress was slow among higher- and
52
53
54
55
56
57

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).

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 \geq 75% of retail price (high)	Tobacco tax \geq 50% of retail price

Variable	Odds ratio	95% CI	Odds ratio	95% CI
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% CI
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 concerns⁵ 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

1
2
3 countries from ratifying FCTC. Promoting the FCTC should include strengthening of the basic
4 functions of government.^{28 29}
5
6

7
8 Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax
9 rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries
10 that had higher taxes for tobacco before the FCTC continued to do so also after ratifying it. The
11 results indicate a path-dependency in tobacco taxation policies.³⁰⁻³² The passing of tobacco tax
12 policies is a contingent event that sets into motion institutional patterns that have deterministic
13 properties.³³ The result emphasizes the importance of intensifying efforts to implement high
14 tobacco taxes especially in countries with originally low tax rates.
15
16
17
18
19
20
21
22

23
24 Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75%
25 tobacco tax rates in 2014 (Table 2). This association may reflect a ceiling effect where
26 governments are reluctant to increase tobacco taxes if the cigarettes are already relatively
27 expensive. This could also result from tobacco industry lobbying.⁵⁻⁸ FCTC Article 6 and its
28 implementation guidelines expressly emphasize health goals in determining tobacco taxation but
29 governments may try to maintain popular support through avoiding large tobacco tax increases.
30 It is also possible that that it is easier for a country to reach the 75% tax rate if the price was low
31 before the tax increase.
32
33
34
35
36
37
38
39
40
41

42
43 Consistent with earlier studies on cigarette affordability, despite tax increases cigarettes
44 were more affordable in 2014 than in 1999.^{21 34 35} World Health Organization, 2015 #960} Our
45 paper includes data that were collected well after 2010, so we are able base our analysis on a
46 longer time horizon than these earlier analyses and thereby confirm well-established trend in
47 cigarette affordability. Countries that ratified FCTC earlier on average had less affordable
48 cigarettes in 2014. The results seem to contradict the earlier finding of the non-significant effect
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 of FCTC ratification on having high cigarette taxes. It may well be that the FCTC prompted
4 countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also
5 possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we
6 include tobacco tax rates in 1999 into the model, FCTC ratification remains statistically
7 significant.
8
9

10
11
12
13
14
15 There are many different ways that one could define an “effective” tax rate, including
16 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1).
17 The WHO MPOWER set a target of 75% of price. Because this is a paper on the effect that the
18 FCTC had on tax policy, we used the WHO’s own standard of success as defined in MPOWER.
19 The WHO MPOWER measures for effective tax rates are arbitrary and different measures could
20 be also used.
21
22
23
24
25
26
27

28
29 Our results emphasize the role of economic development in preventing cigarettes
30 becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if
31 taxes are kept constant.^{5 21} This development is reflected in our result where rapid per capita
32 GDP growth between 1999 and 2014 was associated with having more affordable cigarettes in
33 2014. Among those 14 countries where the per capita GDP increased more than 300% in 15
34 years, cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco
35 tax rate targets, for example 50% of retail price, is that they do not take into account the effect of
36 rising incomes or the industry pricing behavior. Keeping other factors constant the demand for
37 cigarettes generally increases with the average level of income, especially in developing
38 countries.²¹
39
40
41
42
43
44
45
46
47
48
49
50

51
52 Lack of state capacity was associated with both lower odds for having high tobacco taxes
53 and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile
54
55
56
57

1
2
3 countries, while taxes are high and cigarettes less affordable in more stable countries. The
4
5 multinational tobacco companies are currently targeting emerging economies in Asia and Africa
6
7 with young populations and relatively low smoking prevalence, especially among women.³⁶
8
9

10 The tax provisions in the FCTC are not binding.³ The unwillingness of states to commit
11
12 to minimum tax levels during the negotiations is reflected in their lack of subsequent action.³⁷
13
14 FCTC Guidelines for Article 6 implementation recommend that Parties should take into account
15
16 “both price elasticity and income elasticity of demand, as well as inflation and changes in
17
18 household income, to make tobacco products less affordable over time in order to reduce
19
20 consumption and prevalence.”³ Our results demonstrate that the current policies for
21
22 implementing tobacco taxes fail to meet this recommendation.
23
24
25

26 In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC
27
28 Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning
29
30 definite targets not only for tobacco tax rates but also for measures to prevent tobacco products
31
32 becoming more affordable.
33
34

35 The effect of cigarettes becoming more affordable with rapid income rises can be
36
37 prevented by adopting adequate policy rules.^{34 35 38} One example is a tax escalator which is
38
39 adjusted to income growth or an equivalent variable that takes into account increases in
40
41 consumer purchasing power.⁵ Such a tax escalator is already in place in UK.³⁹ With
42
43 automatically increasing tobacco taxes by the increase in purchasing power the tobacco
44
45 companies would increase prices, which would prevent tobacco products not becoming more
46
47 affordable. To allow this process to take place tobacco taxes rates could, at least temporarily, rise
48
49 even above the 75% standard.
50
51
52

53 **Limitations**

54
55
56
57

1
2
3 Assessing the change in tax as a share of price over time can be complicated.¹⁶
4

5 Determination of tax rates as a proportion of total cigarette retail price is dependent on changes
6
7 in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax
8
9 on cigarettes, the share of excise and total taxes in the retail price could remain the same or
10
11 shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share
12
13 of taxes in the final retail price might increase, even if there is no change in the tax levied on a
14
15 pack of cigarettes.
16
17

18
19 To establish a baseline before FCTC we used tobacco tax and price data from two
20
21 different sources, World Bank survey from 1999¹⁷ and the International Tobacco Documentation
22
23 Centre's¹⁸ 1998 *International Fiscal Guide to Tobacco*. Both data sources include information
24
25 on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping
26
27 price information indicated the data was collected in substantially uniform manner. The
28
29 correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement
30
31 error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more
32
33 dramatically than cigarette prices. We deemed the World Bank survey more reliable than the
34
35 *International Fiscal Guide to Tobacco* produced by the tobacco industry. We focused on the
36
37 price and tax for the most-sold cigarette brand on all data sources including WHO data for
38
39 2014,¹⁶ but were unable to confirm that definitions remained stable over time. The most-sold
40
41 cigarette may not fully describe the effect of tobacco taxation to tobacco consumption. We did
42
43 not analyze the tax structure. Our outcome variable, the share of all tobacco taxes of the most
44
45 sold brand, does not fully capture the role of taxes in reducing demand for tobacco. Earlier
46
47 research has shown the tobacco industry may simultaneously absorb the tax increases on its
48
49 cheapest brands while over-shifting taxes on premium brands.⁹ The higher the level of the excise
50
51
52
53
54
55
56
57
58
59
60

1
2
3 and other taxes the less room for tobacco industry price differentiation strategies. We were not
4
5 able to analyze how countries' tax policies have accounted for country-specific price and income
6
7 elasticities.
8
9

10 Our analysis focused only on cigarettes ignoring other categories of tobacco products,
11
12 some of which (for example bidi) are more prevalent in more fragile countries. Since we had
13
14 data only from two time points we were not able to assess trends in tax, price and affordability in
15
16 prior periods.
17
18

19 **Conclusions**

20
21 In contrast to advertising restrictions,^{30 32} health warning labels,³⁰ and smokefree
22
23 environments,³¹ FCTC ratification has not been systematically followed with higher tobacco
24
25 taxation. Fragile countries are less likely to have high tobacco taxes. Rapid rise in incomes
26
27 undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6 implementation
28
29 should assign definite targets for tobacco taxes and for the implementation of a tax escalator that
30
31 gradually increases taxes to match the rising level of incomes. The tobacco control community
32
33 should intensify efforts to help more fragile countries to improve performance in FCTC
34
35 implementation both through strengthening their administrative and technical capacity and
36
37 through supporting the basic functions of government. The FCTC Conference of the Parties
38
39 should assign definite targets not only for tobacco tax rates but also for measures to prevent
40
41 tobacco products becoming more affordable.
42
43
44
45

46 **FUNDING**

47
48
49 This work was supported by National Cancer Institute grant CA-087472. The funding
50
51 agency played no role in the conduct of the research or preparation of the manuscript.
52
53

54 **COMPETING INTERESTS**

1
2
3 There are no competing interests.
4

5 **CONTRIBUTORSHIP**
6

7 HH developed the idea for this study and carried out the data collection. HH and SG
8 carried out the data analysis and wrote and revised the manuscript.
9
10
11

12 **DATA SHARING STATEMENT**
13

14 Statistical code and dataset available upon request from corresponding author.
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

For peer review only

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.

1. World Health Organization. WHO technical manual on tobacco tax administration. Geneva, 2010.
2. International Agency for Research on Cancer. IARC handbooks of cancer prevention: tobacco control. Volume 14: effectiveness of tax and price policies for tobacco control Lyon, France: IARC; 2011 [
3. World Health Organization. Framework Convention on Tobacco Control. Geneva 2003.
4. FCTC/COP/6/7. Guidelines for implementation of Article 6 of the WHO FCTC 2014.
5. World Health Organization. WHO Report on the Global Tobacco Epidemic 2015: Raising taxes on tobacco. Geneva: World Health Organization, 2015.
6. Campbell RB, Balbach ED. Cigarette Excise Taxes in Context: Cautionary Lessons from the U.S. Experience. *Int J Health Serv* 2015;45(3):564-77. doi: 10.1177/0020731415584553
7. Campbell RB, Balbach ED. Building alliances in unlikely places: progressive allies and the Tobacco Institute's coalition strategy on cigarette excise taxes. *Am J Public Health* 2009;99(7):1188-96. doi: 10.2105/AJPH.2008.143131
8. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control* 2013;22(2):144-53. doi: 10.1136/tobaccocontrol-2011-050098
9. Gilmore AB, Tavakoly B, Taylor G, et al. Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. *Addiction* 2013;108(7):1317-26. doi: 10.1111/add.12159
10. Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11 Suppl 1:162-72.
11. Brock B, Choi K, Boyle RG, et al. Tobacco product prices before and after a statewide tobacco tax increase. *Tob Control* 2016;25(2):166-73. doi: 10.1136/tobaccocontrol-2014-052018
12. Alamar B, Mahmoud L, Glantz SA. Cigarette Smuggling in California: Fact and Fiction. Tobacco Control Policy Making: United States. San Francisco: Center for Tobacco Control Research and Education, UC San Francisco, 2003.
13. Hirono KT, Smith KE. Australia's \$40 per pack cigarette tax plans: the need to consider equity. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2016-053608
14. David PA. Clio and the Economics of QWERTY. *The American Economic Review* 1985;75(2):332-37.
15. Hiilamo H, Glantz SA. Implementation of effective cigarette health warning labels among low and middle income countries: state capacity, path-dependency and tobacco industry activity. *Soc Sci Med* 2015;124:241-5. doi: 10.1016/j.socscimed.2014.11.054
16. World Health Organization. WHO report on the global tobacco epidemic 2015, dataset. Geneva, 2015.

17. Yurekli A, de Beye J. Design and administer tobacco taxes. World Bank economics of tobacco toolkit ; no. 4. design and administration. Washington D.C.: World Bank, 1999.
18. McDaniel PA, Intinarelli G, Malone RE. Tobacco industry issues management organizations: creating a global corporate network to undermine public health. *Global Health* 2008;4:2. doi: 1744-8603-4-2 [pii]
10.1186/1744-8603-4-2 [published Online First: 2008/01/19]
19. International Tobacco Documentation Centre. International fiscal guide to tobacco. World taxation, price, tariff and regulatory information. Philip Morris, 1998:2074330579-1410.
20. World Bank. Country and Lending Groups., 2016.
21. Blecher E, van Walbeek C. An Analysis of Cigarette Affordability. Paris: International Union Against Tuberculosis and Lung Disease, 2008.
22. Marshall MG, Cole BR. Global Report 2014. Conflict, Governance and State Fragility. : Center for Systemic Peace 2014 [Available from: <http://www.systemicpeace.org/SFI/matrix2010c.pdf> accessed 31 Jan 2014.
23. World Health Organization. 2014 global progress report on implementation of the WHO Framework Convention on Tobacco Control, 2014.
24. Crosbie E, Sebie EM, Glantz SA. Tobacco industry success in Costa Rica: the importance of FCTC article 5.3. *Salud Publica Mex* 2012;54(1):28-38. doi: S0036-36342012000100005 [pii] [published Online First: 2012/01/31]
25. Crosbie E, Sosa P, Glantz SA. Costa Rica's implementation of the Framework Convention on Tobacco Control: Overcoming decades of industry dominance. *Salud Publica Mex* 2016;58(1):62-70.
26. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2017-053690
27. Crosbie E, Sosa P, Glantz SA. The importance of continued engagement during the implementation phase of tobacco control policies in a middle-income country: the case of Costa Rica. *Tob Control* 2017;26(1):60-68. doi: 10.1136/tobaccocontrol-2015-052701
28. Bump JB, Reich MR. Political economy analysis for tobacco control in low- and middle-income countries. *Health Policy Plan* 2013;28(2):123-33. doi: czs049 [pii]
10.1093/heapol/czs049 [published Online First: 2012/05/16]
29. Leischow SJ, Ayo-Yusuf O, Backinger CL. Converging research needs across framework convention on tobacco control articles: making research relevant to global tobacco control practice and policy. *Nicotine Tob Res* 2012;15(4):761-6. doi: nts199 [pii]
10.1093/ntr/nts199 [published Online First: 2012/09/20]
30. Sanders-Jackson AN, Song AV, Hiilamo H, et al. Effect of the Framework Convention on Tobacco Control and voluntary industry health warning labels on passage of mandated cigarette warning labels from 1965 to 2012: transition probability and event history analyses. *Am J Public Health* 2013;103(11):2041-7. doi: 10.2105/AJPH.2013.301324 [published Online First: 2013/09/14]
31. Uang R, Hiilamo H, Glantz SA. Accelerated Adoption of Smoke-Free Laws After Ratification of the World Health Organization Framework Convention on Tobacco Control. *Am J Public Health* 2016;106(1):166-71. doi: 10.2105/AJPH.2015.302872
32. Hiilamo H, Glantz S. FCTC followed by accelerated implementation of tobacco advertising bans. *Tob Control* 2016 doi: 10.1136/tobaccocontrol-2016-053007
33. Mahoney J. Path Dependence in Historical Sociology. *Theory and Society* 2000;29:507-48.

- 1
2
3 34. Blecher E. Targeting the affordability of cigarettes: a new benchmark for taxation policy in low-
4 income and-middle-income countries. *Tob Control* 2010;19(4):325-30. doi:
5 10.1136/tc.2009.030155
6
7 35. Blecher E, Ross H, Leon ME. Cigarette affordability in Europe. *Tob Control* 2013;22(4):e6. doi:
8 10.1136/tobaccocontrol-2012-050575
9
10 36. Gilmore AB, Fooks G, Drope J, et al. Exposing and addressing tobacco industry conduct in low-income
11 and middle-income countries. *Lancet* 2015;385(9972):1029-43. doi: 10.1016/S0140-
12 6736(15)60312-9
13
14 37. Wipfli H. The Global War on Tobacco. Mapping the World's First Public Health Treaty. Baltimore:
15 Johns Hopkins University Press 2016.
16
17 38. Blecher E, Ross H, Stoklosa M. Lessons learned from cigarette tax harmonisation in the European
18 Union. *Tob Control* 2014;23(e1):e12-4. doi: 10.1136/tobaccocontrol-2012-050728
19
20 39. Campaign for Tobacco-Free Kids. Tobacco tax success story: United Kingdom. Washington, 2012.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

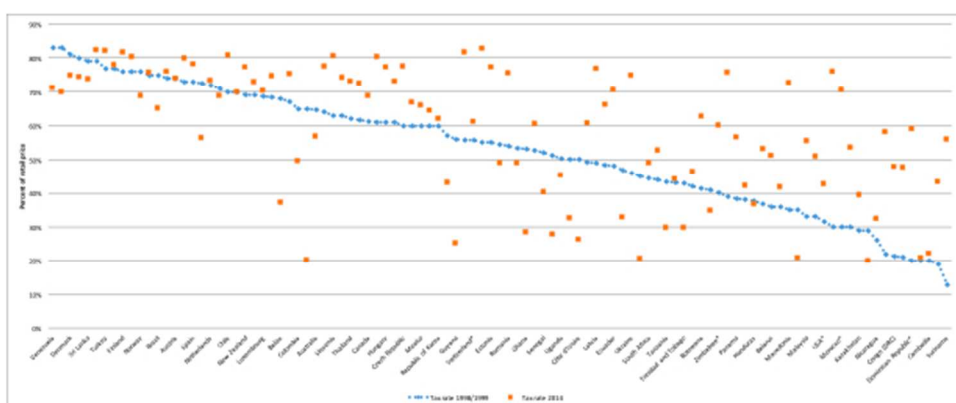


Figure 1. Tobacco tax rates in 1998/1999 and 2014 as percent of retail price.

226x99mm (72 x 72 DPI)

Peer review only

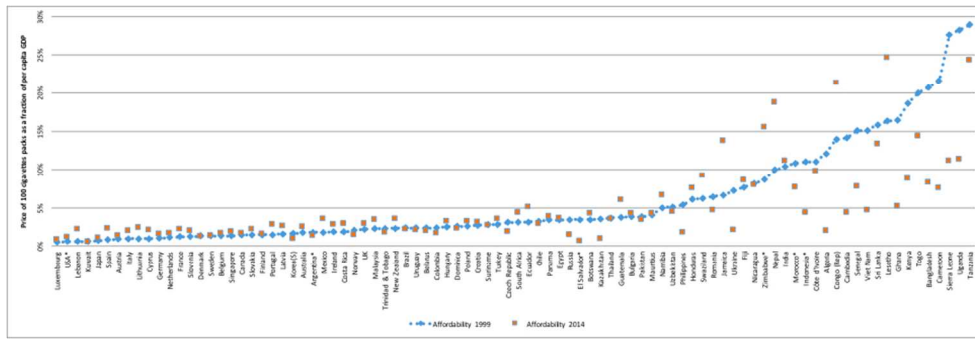


Figure 2. Shares of price of 100 cigarette packs of Gross Domestic Product per Capita in 1999 and 2014 as percent of retail price.

348x124mm (72 x 72 DPI)

Peer review only

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-021340.R1
Article Type:	Research
Date Submitted by the Author:	06-Apr-2018
Complete List of Authors:	Hiilamo, Heikki; University of Helsinki, Department of Social Research, social and public policy; VID Specialized University, Oslo, Norway , •Faculty of Theology, Diaconia and Leadership Studies Glantz, S; University of California, San Francisco, Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Global health
Keywords:	tobacco industry, tobacco taxation, FCTC

SCHOLARONE™
Manuscripts

Only

1
2
3 **LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON**
4
5 **TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON**
6
7
8
9
10

11
12 Heikki Hiilamo^{ab}, PhD
13

14 Stanton Glantz^c, PhD
15

16
17 ^a VID Specialized University, Oslo, Norway

18 ^b Social and public policy, Department of Social Research, 00014 University of Helsinki,
19 Finland, heikki.hiilamo@helsinki.fi

20 ^cCenter for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy
21 Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
22 University of California San Francisco, San Francisco, CA 94143-1390, stanton.glantz@ucsf.edu
23
24
25
26

27 Corresponding Author:
28 Heikki Hiilamo, Professor
29 University of Helsinki
30 Department of Social Research
31 Snellmaninkatu 10
32 00014 Helsingin yliopisto
33 Finland
34 Tel. +358403587203
35 Fax. +358294124835
36 heikki.hiilamo@helsinki.fi
37
38
39

40 Word count 3425
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 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 minimum 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 use¹⁻³. 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 Control⁵ (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 guidelines⁶ 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 increases² 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 trade² 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 Australia¹⁶, 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.

1
2
3 WHO established the MPOWER measures in 2008 to scale up key FCTC demand
4
5 reduction measures including tobacco taxes. MPOWER emphasizes that “increasing the price of
6
7 tobacco through higher taxes is the single most effective way to encourage tobacco users to quit
8
9 and prevent children from starting to smoke.”² A key finding of the 2015 MPOWER report was
10
11 that taxes were the least implemented MPOWER measure with only 10% of the world’s
12
13 population (living in 33 countries) covered by taxes of at least 75% of retail price². This paper
14
15 assesses the association of FCTC ratification with implementing tobacco taxes by analyzing
16
17 changes in tax rate using the WHO MPOWER standard and cigarette affordability. In addition,
18
19 we assess the role of state capacity and previous tax and price levels^{17 18} on taxes in 2014.
20
21
22
23

24 **METHODS**

25 **Data**

26
27 Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties,
28
29 value added tax, and other taxes were obtained from the World Health Organization Report on
30
31 the Global Tobacco Epidemic 2015 public dataset for 2014.¹⁹ This dataset includes information
32
33 collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold
34
35 brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on
36
37 the taxation of cigarettes (and when possible, most commonly used tobacco products) was
38
39 collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we
40
41 used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based
42
43 on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most
44
45 popular brand was used to calculate the tax rate.
46
47
48
49
50

51 We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64
52
53 countries that reported the share of cigarette taxes (including value added tax, VAT) as a
54
55
56
57

percentage of the retail price of a pack of cigarettes²⁰ supplemented by the tobacco industry's International Tobacco Documentation Centre's²¹ 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 standard², 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

1
2
3 of income across countries in different income levels than, for example surveys of wages.²⁴We
4 used price data described above and World Bank data for GDP per capita for 1999 and 2014.²³ In
5
6 addition, we used the growth of GDP per capita from 1999 to 2014²³ ($[2014 \text{ GDP} - 1999$
7
8 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the
9
10 assumption that cigarettes would be more affordable in 2014 among those countries where the
11
12 rise in income level was the fastest. We assume that changes in GDP over the 16-year period
13
14 reflect changes in disposable income.
15
16
17

18 19 **Other Variables**

20
21 To study the willingness and ability of states to implement public policies we used
22
23 Marshall and Cole's²⁵ state fragility index. This index scores all countries with population above
24
25 500,000 in four performance dimensions: security, political, economic, and social. Previous
26
27 literature has shown that state fragility matters for implementing effective cigarette health
28
29 warnings.^{17 18} The index gives higher scores for more fragile countries (Sudan scored 23 while
30
31 the 15 most stable countries scored 0) but does not place countries into different categories. We
32
33 averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less
34
35 likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries
36
37 in the which score higher than others using Marshall and Cole's state fragility index.
38
39
40
41

42 We study the role of previous tax and price levels on tax rate in 2014 with two variables,
43
44 tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in 1998/1999.
45
46 We test whether countries with higher cigarette taxes and higher price cigarettes in 1998/1999
47
48 are more likely to have high tax rates in 2014.
49
50

51 **Statistical Analysis**

1
2
3 Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as
4 the outcome variable. We studied the effect of FCTC by calculating the number of years since
5 FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the
6 FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of
7 the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United
8 States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican
9 Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already
10 had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded
11 from the analysis.
12
13
14
15
16
17
18
19
20
21
22

23
24 Our analysis has 80% statistical power (with $\alpha=.05$) to detect an OR by a factor of 1.25
25 (or 0.80) associated with FCTC ratification.
26
27

28 We also used logistic regression to analyze the effect of the FCTC on cigarette
29 affordability by assigning a value of 1 for those countries where cigarettes were less affordable
30 in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between
31 state capacity and FCTC ratification to see if more fragile countries were slower in ratifying
32 FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with
33 extensive tobacco control measures.
34
35
36
37
38
39
40
41

42 We used R functions `glm` and `minEffect.VSMc.logistic` from `powerMediation` for the
43 analysis.
44
45

46 **Patient and Public Involvement**

47 Patients or public were not involved in the study.
48
49

50 **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%
<p>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.</p>						

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 \geq 75% of retail price (high)		Tobacco tax \geq 50% of retail price	
Variable	Odds ratio	95% CI	Odds ratio	95% CI
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). 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 became 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% CI
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	

* $P \leq 0.05$, ** $P \leq 0.01$, 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 concerns² 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

1
2
3 policies is a contingent event that sets into motion institutional patterns that have deterministic
4 properties.³⁶ The result emphasizes the importance of intensifying efforts to implement high
5 tobacco taxes especially in countries with originally low tax rates.
6
7
8
9

10 Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75%
11 tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have
12 reached the target with regular inflationary adjustments. This association may also reflect a
13 possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes
14 are already relatively expensive. This could also result from tobacco industry lobbying.^{2 7-9}
15 FCTC Article 6 and its implementation guidelines expressly emphasize health goals in
16 determining tobacco taxation but governments may try to maintain popular support through
17 adopting small tobacco tax increases instead of large increases. It is also possible that that it is
18 easier for a country to reach the 75% tax rate if the price was low before the tax increase.
19
20
21
22
23
24
25
26
27
28
29

30 Consistent with earlier studies on cigarette affordability, cigarettes were more affordable
31 in 2014 than in 1999 despite tax increases.^{24 37 38} World Health Organization, 2015 #960} Our
32 paper includes data collected well after 2010, so we were able base our analysis on a longer time
33 horizon than earlier analyses and thereby confirm well-established trend in cigarette
34 affordability. Countries that ratified FCTC earlier on average had less affordable cigarettes in
35 2014. The results seem to contradict the earlier finding of the non-significant association of
36 FCTC ratification with having high cigarette taxes. It may well be that the FCTC prompted
37 countries to increase tobacco taxes but not enough to obtain 50% or 75% tax rates. It is also
38 possible that countries with already high tax rates were more likely to ratify FCTC earlier. If we
39 include 199 tobacco tax rates in the model, FCTC ratification remains statistically significant.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 There are many different ways that one could define an “effective” tax rate, including
4
5 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1).
6
7 The WHO MPOWER set a target of 75% of price. Because this is a paper on the effect that the
8
9 FCTC had on tax policy, we used the WHO’s own standard of success as defined in MPOWER.
10
11 The WHO MPOWER measures for effective tax rates are arbitrary and different measures could
12
13 be also used.
14
15

16
17 Our results emphasize the role of economic development in preventing cigarettes from
18
19 becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if
20
21 taxes are kept constant.²⁴ This development is reflected in our result where rapid per capita
22
23 GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014.
24
25 Among those 14 countries where the per capita GDP increased more than 300% in 15 years,
26
27 cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate
28
29 targets, for example 50% of retail price, is that they do not take into account the effect of rising
30
31 incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes
32
33 generally increases with the average level of income, especially in developing countries.²⁴
34
35
36

37
38 Lack of state capacity was associated with both lower odds of having high tobacco taxes
39
40 and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile
41
42 countries, while taxes are high and cigarettes less affordable in more stable countries. As of
43
44 2018, the multinational tobacco companies were targeting countries in Asia and Africa with
45
46 young populations and relatively low smoking prevalence, especially among women.³⁹
47
48

49
50 The tax provisions in the FCTC do not include specific tax targets.⁵ The unwillingness of
51
52 states to commit to minimum tax levels during FCTC negotiations is reflected in their lack of
53
54 subsequent action.⁴⁰ FCTC Guidelines for Article 6 implementation recommend that Parties
55
56
57

1
2
3 should take into account “both price elasticity and income elasticity of demand, as well as
4
5 inflation and changes in household income, to make tobacco products less affordable over time
6
7 in order to reduce consumption and prevalence.”⁵ Our results demonstrate that current policies
8
9 for implementing tobacco taxes fail to meet this recommendation.
10
11

12 In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC
13
14 Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning
15
16 definite targets not only for tobacco tax rates but also for measures that prevent tobacco products
17
18 from becoming more affordable.
19
20

21 The effect of cigarettes becoming more affordable with rapid income rises can be
22
23 prevented by adopting adequate policies.^{37 38 41} One example is a tax escalator which is adjusted
24
25 to income growth or an equivalent variable that accounts for increases in consumer purchasing
26
27 power.² Such a tax escalator is already in place in the UK.⁴² With automatically increasing
28
29 tobacco taxes by the increase in purchasing power the tobacco companies would increase prices,
30
31 which would prevent tobacco products not becoming more affordable. To allow this process to
32
33 take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard.
34
35 Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so
36
37 would make it more difficult for tobacco companies to downshift tax increases.
38
39
40
41

42 **Limitations**

43
44 Assessing the change in tax as a share of price over time can be complicated.¹⁹
45
46 Determination of tax rates as a proportion of total cigarette retail price is dependent on changes
47
48 in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax
49
50 on cigarettes, the share of excise and total taxes in the retail price could remain the same or
51
52 shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share
53
54
55
56
57
58
59
60

1
2
3 of taxes in the final retail price might increase, even if there is no change in the tax levied on a
4 pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not
5
6 enough, given that the FCTC did not specify 50/75% tax rates as a requirement.
7
8
9

10 To establish a baseline before FCTC we used tobacco tax and price data from two
11 different sources, World Bank survey from 1999²⁰ and the International Tobacco Documentation
12 Centre's²¹ 1998 *International Fiscal Guide to Tobacco*. Both data sources include information
13
14 on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping
15 price information indicates the data was collected in a substantially uniform manner. The
16 correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement
17 error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more
18 dramatically than cigarette prices. Given the more reliable international standing we deemed the
19 World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by
20 the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all
21 data sources including WHO data for 2014,¹⁹ but were unable to confirm that definitions
22 remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco
23 taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the
24 share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in
25 reducing demand for tobacco. Earlier research has shown the tobacco industry may
26 simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on
27 premium brands.¹² The higher the level of the excise and other taxes the less room for tobacco
28 industry price differentiation strategies. We were not able to analyze how countries' tax policies
29 have accounted for country-specific price and income elasticities.
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 In this study we were not able to assess the causal effects. Besides the variables used in
4 this study other factors such as economic cycles, political leadership and tobacco control activity
5 outside of FCTC may have affected the outcome variables.
6
7
8

9
10 Our analysis focused only on cigarettes ignoring other categories of tobacco products,
11 some of which (for example bidi) are more prevalent in more fragile countries such as
12 Bangladesh and India⁴³. Since we had data only from two time points we were not able to assess
13 trends in tax, price and affordability in prior periods.
14
15
16
17

18 **Conclusions**

19
20 In contrast to advertising restrictions,^{33 35} health warning labels,³³ and smokefree
21 environments,³⁴ FCTC ratification has not been systematically followed regarding higher
22 tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets
23 were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke
24 free environments, health warnings and advertising bans that fall into domain of health
25 government, while Article 6 concerns financial policy, which falls under finance ministries.
26 There need to be further efforts to increase financial ministries' knowledge of and responsibility
27 to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in
28 incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6
29 implementation should assign definite targets for tobacco taxes and for the implementation of a
30 tax escalator that gradually increases taxes to match the rising income levels. The tobacco
31 control community should intensify efforts to help more fragile countries to improve
32 performance in FCTC implementation both through strengthening their administrative and
33 technical capacity and through supporting the basic functions of government. The FCTC
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Conference of the Parties should assign definite targets not only for tobacco tax rates but also for
4
5 measures to prevent tobacco products from becoming more affordable.
6

7 8 **FUNDING** 9

10 This work was supported by National Cancer Institute grant CA-087472. The funding
11
12 agency played no role in the conduct of the research or preparation of the manuscript.
13

14 15 **COMPETING INTERESTS** 16

17 There are no competing interests.
18

19 20 **CONTRIBUTORSHIP** 21

22 HH developed the idea for this study and carried out the data collection. HH and SG
23
24 carried out the data analysis and wrote and revised the manuscript.
25

26 27 **DATA SHARING STATEMENT** 28

29 No data is shared since we are using data which is already made public.
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

1. World Health Organization. WHO technical manual on tobacco tax administration. Geneva, 2010.
2. World Health Organization. WHO Report on the Global Tobacco Epidemic 2015: Raising taxes on tobacco. Geneva: World Health Organization, 2015.
3. Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000;321(7257):358-61.
4. International Agency for Research on Cancer. IARC handbooks of cancer prevention: tobacco control. Volume 14: effectiveness of tax and price policies for tobacco control Lyon, France: IARC; 2011 [
5. World Health Organization. Framework Convention on Tobacco Control. Geneva 2003.
6. FCTC/COP/6/7. Guidelines for implementation of Article 6 of the WHO FCTC 2014.
7. Campbell RB, Balbach ED. Cigarette Excise Taxes in Context: Cautionary Lessons from the U.S. Experience. *Int J Health Serv* 2015;45(3):564-77. doi: 10.1177/0020731415584553
8. Campbell RB, Balbach ED. Building alliances in unlikely places: progressive allies and the Tobacco Institute's coalition strategy on cigarette excise taxes. *Am J Public Health* 2009;99(7):1188-96. doi: 10.2105/AJPH.2008.143131
9. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control* 2013;22(2):144-53. doi: 10.1136/tobaccocontrol-2011-050098
10. Campbell R, Balbach ED. Mobilising public opinion for the tobacco industry: the Consumer Tax Alliance and excise taxes. *Tob Control* 2008;17(5):351-6. doi: 10.1136/tc.2008.025338

- 1
2
3 11. Koch SF. Quasi-experimental evidence on tobacco tax regressivity. *Soc Sci Med*
4
5 2018;196:19-28. doi: 10.1016/j.socscimed.2017.11.004
6
- 7
8 12. Gilmore AB, Tavakoly B, Taylor G, et al. Understanding tobacco industry pricing strategy
9
10 and whether it undermines tobacco tax policy: the example of the UK cigarette market.
11
12 *Addiction* 2013;108(7):1317-26. doi: 10.1111/add.12159
13
- 14
15 13. Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence
16
17 from the tobacco documents and implications for tobacco company marketing strategies.
18
19 *Tob Control* 2002;11 Suppl 1:I62-72.
20
- 21
22 14. Brock B, Choi K, Boyle RG, et al. Tobacco product prices before and after a statewide
23
24 tobacco tax increase. *Tob Control* 2016;25(2):166-73. doi: 10.1136/tobaccocontrol-2014-
25
26 052018
27
- 28
29 15. Alamar B, Mahmoud L, Glantz SA. Cigarette Smuggling in California: Fact and Fiction.
30
31 Tobacco Control Policy Making: United States. San Francisco: Center for Tobacco
32
33 Control Research and Education, UC San Francisco, 2003.
34
- 35
36 16. Hirono KT, Smith KE. Australia's \$40 per pack cigarette tax plans: the need to consider
37
38 equity. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2016-053608
39
- 40
41 17. David PA. Clio and the Economics of QWERTY. *The American Economic Review*
42
43 1985;75(2):332-37.
44
- 45
46 18. Hiilamo H, Glantz SA. Implementation of effective cigarette health warning labels among
47
48 low and middle income countries: state capacity, path-dependency and tobacco industry
49
50 activity. *Soc Sci Med* 2015;124:241-5. doi: 10.1016/j.socscimed.2014.11.054
51
- 52
53 19. World Health Organization. WHO report on the global tobacco epidemic 2015, dataset.
54
55 Geneva, 2015.
56
57

- 1
2
3 20. Yurekli A, de Beye J. Design and administer tobacco taxes. World Bank economics of
4 tobacco toolkit ; no. 4. design and administration. Washington D.C.: World Bank, 1999.
5
6
7
8 21. McDaniel PA, Intinarelli G, Malone RE. Tobacco industry issues management organizations:
9 creating a global corporate network to undermine public health. *Global Health* 2008;4:2.
10
11
12
13
14
15
16 10.1186/1744-8603-4-2 [published Online First: 2008/01/19]
17
18 22. International Tobacco Documentation Centre. International fiscal guide to tobacco. World
19
20
21
22
23 23. World Bank. Country and Lending Groups., 2016.
24
25 24. Blecher E, van Walbeek C. An Analysis of Cigarette Affordability. Paris: International
26
27
28
29 25. Marshall MG, Cole BR. Global Report 2014. Conflict, Governance and State Fragility. :
30
31
32
33
34
35
36
37 26. World Health Organization. 2014 global progress report on implementation of the WHO
38
39
40
41 27. Crosbie E, Sebrie EM, Glantz SA. Tobacco industry success in Costa Rica: the importance of
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
- Center for Systemic Peace 2014 [Available from:
<http://www.systemicpeace.org/SFI/matrix2010c.pdf> accessed 31 Jan 2014.
- Framework Convention on Tobacco Control, 2014.
- FCTC article 5.3. *Salud Publica Mex* 2012;54(1):28-38. doi: S0036-36342012000100005
[pii] [published Online First: 2012/01/31]
- Tobacco Control: Overcoming decades of industry dominance. *Salud Publica Mex*
2016;58(1):62-70.

- 1
2
3 29. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations
4
5 in Uruguay: transnational tobacco control network versus Philip Morris International.
6
7 *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2017-053690
8
9
- 10 30. Crosbie E, Sosa P, Glantz SA. The importance of continued engagement during the
11
12 implementation phase of tobacco control policies in a middle-income country: the case of
13
14 Costa Rica. *Tob Control* 2017;26(1):60-68. doi: 10.1136/tobaccocontrol-2015-052701
15
16
- 17 31. Bump JB, Reich MR. Political economy analysis for tobacco control in low- and middle-
18
19 income countries. *Health Policy Plan* 2013;28(2):123-33. doi: czs049 [pii]
20
21
22 10.1093/heapol/czs049 [published Online First: 2012/05/16]
23
24
- 25 32. Leischow SJ, Ayo-Yusuf O, Backinger CL. Converging research needs across framework
26
27 convention on tobacco control articles: making research relevant to global tobacco
28
29 control practice and policy. *Nicotine Tob Res* 2012;15(4):761-6. doi: nts199 [pii]
30
31
32 10.1093/ntr/nts199 [published Online First: 2012/09/20]
33
34
- 35 33. Sanders-Jackson AN, Song AV, Hiilamo H, et al. Effect of the Framework Convention on
36
37 Tobacco Control and voluntary industry health warning labels on passage of mandated
38
39 cigarette warning labels from 1965 to 2012: transition probability and event history
40
41 analyses. *Am J Public Health* 2013;103(11):2041-7. doi: 10.2105/AJPH.2013.301324
42
43 [published Online First: 2013/09/14]
44
45
- 46 34. Uang R, Hiilamo H, Glantz SA. Accelerated Adoption of Smoke-Free Laws After
47
48 Ratification of the World Health Organization Framework Convention on Tobacco
49
50 Control. *Am J Public Health* 2016;106(1):166-71. doi: 10.2105/AJPH.2015.302872
51
52
- 53 35. Hiilamo H, Glantz S. FCTC followed by accelerated implementation of tobacco advertising
54
55 bans. *Tob Control* 2016 doi: 10.1136/tobaccocontrol-2016-053007
56
57

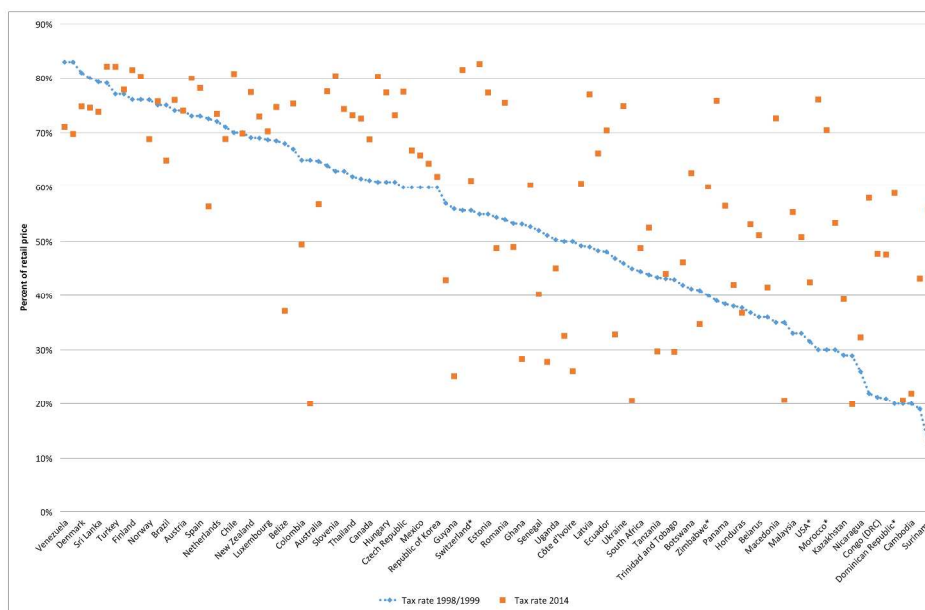
- 1
2
3 36. Mahoney J. Path Dependence in Historical Sociology. *Theory and Society* 2000;29:507–48.
4
5
6 37. Blecher E. Targeting the affordability of cigarettes: a new benchmark for taxation policy in
7
8 low-income and-middle-income countries. *Tob Control* 2010;19(4):325-30. doi:
9
10 10.1136/tc.2009.030155
11
12 38. Blecher E, Ross H, Leon ME. Cigarette affordability in Europe. *Tob Control* 2013;22(4):e6.
13
14 doi: 10.1136/tobaccocontrol-2012-050575
15
16 39. Gilmore AB, Fooks G, Drope J, et al. Exposing and addressing tobacco industry conduct in
17
18 low-income and middle-income countries. *Lancet* 2015;385(9972):1029-43. doi:
19
20 10.1016/S0140-6736(15)60312-9
21
22
23 40. Wipfli H. The Global War on Tobacco. Mapping the World's First Public Health Treaty.
24
25 Baltimore: Johns Hopkins University Press 2016.
26
27
28 41. Blecher E, Ross H, Stoklosa M. Lessons learned from cigarette tax harmonisation in the
29
30 European Union. *Tob Control* 2014;23(e1):e12-4. doi: 10.1136/tobaccocontrol-2012-
31
32 050728
33
34
35 42. Campaign for Tobacco-Free Kids. Tobacco tax success story: United Kingdom. Washington,
36
37 2012.
38
39
40 43. Sinha DN, Gupta PC, Kumar A, et al. The poorest of poor suffer the greatest burden from
41
42 smokeless tobacco use: A study from 140 countries. *Nicotine Tob Res* 2017 doi:
43
44 10.1093/ntr/ntx276
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

For peer review only

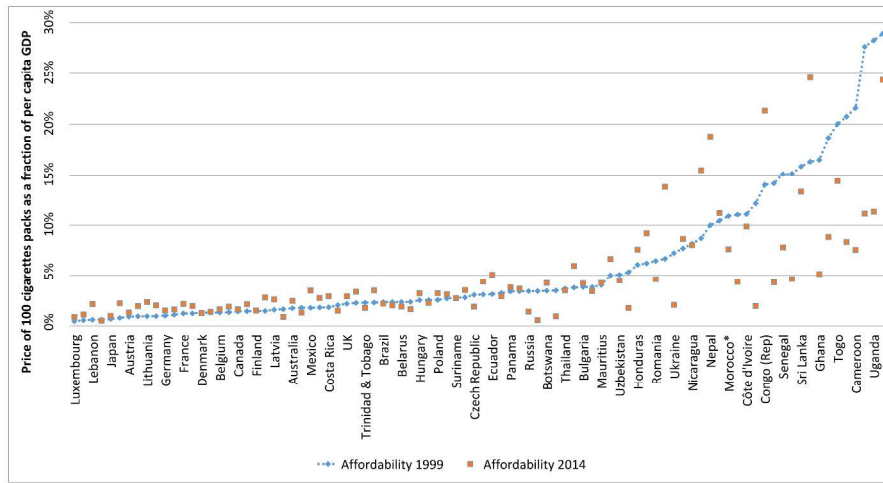


* Country has not ratified FCTC.

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)

view only

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-021340.R2
Article Type:	Research
Date Submitted by the Author:	13-Jun-2018
Complete List of Authors:	Hiilamo, Heikki; University of Helsinki, Department of Social Research, social and public policy; VID Specialized University, Oslo, Norway , •Faculty of Theology, Diaconia and Leadership Studies Glantz, S; University of California, San Francisco, Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Global health
Keywords:	tobacco industry, tobacco taxation, FCTC

SCHOLARONE™
Manuscripts

only

1
2
3 **LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON**
4
5 **TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON**
6
7
8
9
10

11
12 Heikki Hiilamo^{ab}, PhD
13

14 Stanton Glantz^c, PhD
15

16
17 ^a VID Specialized University, Oslo, Norway

18 ^b Social and public policy, Department of Social Research, 00014 University of Helsinki,
19 Finland, heikki.hiilamo@helsinki.fi

20 ^cCenter for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy
21 Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
22 University of California San Francisco, San Francisco, CA 94143-1390, stanton.glantz@ucsf.edu
23
24
25
26

27 Corresponding Author:
28 Heikki Hiilamo, Professor
29 University of Helsinki
30 Department of Social Research
31 Snellmaninkatu 10
32 00014 Helsingin yliopisto
33 Finland
34 Tel. +358403587203
35 Fax. +358294124835
36 heikki.hiilamo@helsinki.fi
37
38
39

40 Word count 3425
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 minimum 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 use¹⁻³. 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 Control⁵ (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 guidelines⁶ 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 increases² 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 trade² 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 Australia¹⁶, 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.

1
2
3 WHO established the MPOWER measures in 2008 to scale up key FCTC demand
4
5 reduction measures including tobacco taxes. MPOWER emphasizes that “increasing the price of
6
7 tobacco through higher taxes is the single most effective way to encourage tobacco users to quit
8
9 and prevent children from starting to smoke.”² A key finding of the 2015 MPOWER report was
10
11 that taxes were the least implemented MPOWER measure with only 10% of the world’s
12
13 population (living in 33 countries) covered by taxes of at least 75% of retail price². This paper
14
15 assesses the association of FCTC ratification with implementing tobacco taxes by analyzing
16
17 changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we
18
19 assess the role of state capacity and previous tax and price levels^{17 18} on taxes in 2014.
20
21
22
23

24 **METHODS**

25 **Data**

26
27 Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties,
28
29 value added tax, and other taxes were obtained from the World Health Organization Report on
30
31 the Global Tobacco Epidemic 2015 public dataset for 2014.¹⁹ This dataset includes information
32
33 collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold
34
35 brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on
36
37 the taxation of cigarettes (and when possible, most commonly used tobacco products) was
38
39 collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we
40
41 used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based
42
43 on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most
44
45 popular brand was used to calculate the tax rate.
46
47
48
49
50

51 We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64
52
53 countries that reported the share of cigarette taxes (including value added tax, VAT) as a
54
55
56
57
58
59
60

1
2
3 percentage of the retail price of a pack of cigarettes²⁰ supplemented by the tobacco industry's
4
5 International Tobacco Documentation Centre's²¹ 1998 *International Fiscal Guide to Tobacco*
6
7 that mapped international taxation, price and tariff policies.²²
8
9

10 Tobacco tax rate is the portion of the price represented by all taxes (including VAT for
11
12 the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables
13
14 derived from MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015:*
15
16 *Raising Taxes on Tobacco:* (1) taxes that totaled at least 75% of retail price, the highest
17
18 MPOWER standard², and (2) taxes that totaled at least 50% of retail price, the second highest
19
20 standard.² FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and
21
22 MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops
23
24 below 75% or 50%, the government would increase taxes so that the tax share would go above
25
26 75% or 50%.
27
28
29

30
31 To analyze the income level of the countries we used World Bank (WB) 2016 gross
32
33 national income (GNI) categories:²³ low-income countries were defined as those with a GNI per
34
35 capita of \$1,045 or less in 2014; middle-income economies, \$1,046 to \$12,735; high income,
36
37 \$12,736 or more. Lower-middle-income and upper-middle-income economies were separated at
38
39 a GNI per capita of \$4,125. Since our sample included only eight low-income countries, after
40
41 cross tabulation analysis we combined low income and lower middle-income categories in the
42
43 regression analysis. We used information on cigarette prices expressed in nominal US dollars in
44
45 1998/1999.
46
47
48

49 We analyzed the association of FCTC with affordability of cigarettes by using the
50
51 fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of
52
53 the most sold cigarette brand. This method is a more comprehensive and representative measure
54
55
56
57

1
2
3 of income across countries in different income levels than, for example surveys of wages.²⁴We
4 used price data described above and World Bank data for GDP per capita for 1999 and 2014.²³ In
5
6 addition, we used the growth of GDP per capita from 1999 to 2014²³ ($[(2014 \text{ GDP} - 1999$
7
8 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the
9
10 assumption that cigarettes would be more affordable in 2014 among those countries where the
11
12 rise in income level was the fastest. We assume that changes in GDP over the 16-year period
13
14 reflect changes in disposable income.
15
16
17

18 19 **Other Variables**

20
21 To study the willingness and ability of states to implement public policies we used
22
23 Marshall and Cole's²⁵ state fragility index. This index scores all countries with population above
24
25 500,000 in four performance dimensions: security, political, economic, and social. Previous
26
27 literature has shown that state fragility matters for implementing effective cigarette health
28
29 warnings.^{17 18} The index gives higher scores for more fragile countries (Sudan scored 23 while
30
31 the 15 most stable countries scored 0) but does not place countries into different categories. We
32
33 averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less
34
35 likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries
36
37 which score higher on Marshall and Cole's state fragility index.
38
39
40
41

42 We studied the role of previous tax and price levels on tax rate in 2014 with two
43
44 variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in
45
46 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in
47
48 1998/1999 were more likely to have high tax rates in 2014.
49
50

51 **Statistical Analysis**

1
2
3 Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as
4 the outcome variable. We studied the effect of FCTC by calculating the number of years since
5 FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the
6 FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of
7 the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United
8 States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican
9 Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already
10 had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded
11 from the analysis.
12
13
14
15
16
17
18
19
20
21
22
23

24 Our analysis has 80% statistical power (with $\alpha=.05$) to detect an OR by a factor of 1.25
25 (or 0.80) associated with FCTC ratification.
26
27

28 We also used logistic regression to analyze the effect of the FCTC on cigarette
29 affordability by assigning a value of 1 for those countries where cigarettes were less affordable
30 in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between
31 state capacity and FCTC ratification to see if more fragile countries were slower in ratifying
32 FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with
33 extensive tobacco control measures.
34
35
36
37
38
39
40
41

42 We used R functions `glm` and `minEffect.VSMc.logistic` from `powerMediation` for the
43 analysis.
44
45

46 **Patient and Public Involvement**

47 Patients or public were not involved in the study.
48
49

50 **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%
<p>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.</p>						

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)

Variable	Tobacco tax \geq 75% of retail price (high)		Tobacco tax \geq 50% of retail price	
	Odds ratio	95% CI	Odds ratio	95% CI
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). 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% CI
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	
* $P \leq 0.05$, ** $P \leq 0.01$, 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 concerns² 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

1
2
3 terms of security, political, economic, and social development may not have administrative and
4 technical capacity to implement high tobacco taxes.²⁷⁻³⁰ We did not detect an interaction between
5 state capacity and time since FCTC ratification, which indicates that weak state capacity as such
6 may not prevent countries from ratifying FCTC. Promoting the FCTC should include
7 strengthening of the basic functions of government.^{31 32}

8
9
10
11
12
13
14
15 Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax
16 rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries
17 that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The
18 results indicate a path-dependency in tobacco taxation policies.³³⁻³⁵ The passing of tobacco tax
19 policies is a contingent event that sets into motion institutional patterns that have deterministic
20 properties.³⁶ The result emphasizes the importance of intensifying efforts to implement high
21 tobacco taxes especially in countries with originally low tax rates.

22
23
24
25
26
27
28
29
30
31 Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75%
32 tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have
33 reached the target with regular inflationary adjustments. This association may also reflect a
34 possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes
35 are already relatively expensive. This could also result from tobacco industry lobbying.^{2 7-9}
36
37
38
39
40
41
42 FCTC Article 6 and its implementation guidelines expressly emphasize health goals in
43 determining tobacco taxation but governments may try to maintain popular support through
44 adopting small tobacco tax increases instead of large increases. It is also possible that that it is
45 easier for a country to reach the 75% tax rate if the price was low before the tax increase.

46
47
48
49
50
51 Consistent with earlier studies on cigarette affordability, cigarettes were more affordable
52 in 2014 than in 1999 despite tax increases.^{2 24 37 38} Our paper includes data collected well after
53
54
55
56
57

1
2
3 2010, so we were able base our analysis on a longer time horizon than earlier analyses and
4
5 thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC
6
7 earlier on average had less affordable cigarettes in 2014. The results seem to contradict the
8
9 earlier finding of the non-significant association of FCTC ratification with having high cigarette
10
11 taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough
12
13 to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were
14
15 more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC
16
17 ratification remains statistically significant.
18
19

20
21 There are many different ways that one could define an “effective” tax rate, including
22
23 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1).
24
25 The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC
26
27 had on tax policy, we used the WHO’s own standard of success as defined in MPOWER. The
28
29 MPOWER measures for effective tax rates are arbitrary and different measures could be also
30
31 used.
32
33
34

35
36 Our results emphasize the role of economic development in preventing cigarettes from
37
38 becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if
39
40 taxes are kept constant.²⁴ This development is reflected in our result where rapid per capita
41
42 GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014.
43
44 Among those 14 countries where the per capita GDP increased more than 300% in 15 years,
45
46 cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate
47
48 targets, for example 50% of retail price, is that they do not take into account the effect of rising
49
50 incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes
51
52 generally increases with the average level of income, especially in developing countries.²⁴
53
54
55
56
57

1
2
3 Lack of state capacity was associated with both lower odds for having high tobacco taxes
4 and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile
5 countries, while taxes are high and cigarettes less affordable in more stable countries. As of
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

1
2
3 Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so
4
5 would make it more difficult for tobacco companies to downshift tax increases.
6
7

8 **Limitations**

9
10 Assessing the change in tax as a share of price over time can be complicated.¹⁹
11
12 Determination of tax rates as a proportion of total cigarette retail price is dependent on changes
13
14 in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax
15
16 on cigarettes, the share of excise and total taxes in the retail price could remain the same or
17
18 shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share
19
20 of taxes in the final retail price might increase, even if there is no change in the tax levied on a
21
22 pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not
23
24 enough, given that the FCTC did not specify 50/75% tax rates as a requirement.
25
26
27

28
29 To establish a baseline before FCTC we used tobacco tax and price data from two
30
31 different sources, World Bank survey from 1999²⁰ and the International Tobacco Documentation
32
33 Centre's²¹ 1998 *International Fiscal Guide to Tobacco*. Both data sources include information
34
35 on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping
36
37 price information indicates the data was collected in a substantially uniform manner. The
38
39 correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement
40
41 error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more
42
43 dramatically than cigarette prices. Given the more reliable international standing we deemed the
44
45 World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by
46
47 the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all
48
49 data sources including WHO data for 2014,¹⁹ but were unable to confirm that definitions
50
51 remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco
52
53
54
55
56
57
58
59
60

1
2
3 taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the
4 share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in
5 reducing demand for tobacco. Earlier research has shown the tobacco industry may
6 simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on
7 premium brands.¹² The higher the level of the excise and other taxes the less room for tobacco
8 industry price differentiation strategies. We were not able to analyze how countries' tax policies
9 have accounted for country-specific price and income elasticities.

10
11
12 In this study we were not able to assess the causal effects. Besides the variables used in
13 this study other factors such as economic cycles, political leadership and tobacco control activity
14 outside of FCTC may have affected the outcome variables.

15
16
17 Our analysis focused only on cigarettes ignoring other categories of tobacco products,
18 some of which (for example bidi) are more prevalent in more fragile countries such as
19 Bangladesh and India⁴³. Since we had data only from two time points we were not able to assess
20 trends in tax, price and affordability in prior periods.

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 **Conclusions**

36
37 In contrast to advertising restrictions,^{33 35} health warning labels,³³ and smokefree
38 environments,³⁴ FCTC ratification has not been systematically followed regarding higher
39 tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets
40 were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke
41 free environments, health warnings and advertising bans that fall into domain of health
42 government, while Article 6 concerns financial policy, which falls under finance ministries.
43 There need to be further efforts to increase financial ministries' knowledge of and responsibility
44 to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6
4
5 implementation should assign definite targets for tobacco taxes and for the implementation of a
6
7 tax escalator that gradually increases taxes to match the rising income levels. The tobacco
8
9 control community should collaborate with other parts of civil society to intensify efforts to help
10
11 more fragile countries to improve performance in FCTC implementation both through
12
13 strengthening their administrative and technical capacity and through supporting the basic
14
15 functions of government. The FCTC Conference of the Parties should assign definite targets not
16
17 only for tobacco tax rates but also for measures to prevent tobacco products from becoming more
18
19 affordable.
20
21
22

23 **FUNDING**

24
25
26 This work was supported by National Cancer Institute grant CA-087472. The funding
27
28 agency played no role in the conduct of the research or preparation of the manuscript.
29

30 **COMPETING INTERESTS**

31
32
33 There are no competing interests.
34

35 **CONTRIBUTORSHIP**

36
37
38 HH developed the idea for this study and carried out the data collection. HH and SG
39
40 carried out the data analysis and wrote and revised the manuscript.
41

42 **DATA SHARING STATEMENT**

43
44
45 No data is shared since we are using data which is already made public.
46
47
48
49
50
51
52
53
54
55
56
57

REFERENCES

1. World Health Organization. WHO technical manual on tobacco tax administration. Geneva, 2010.
 2. World Health Organization. WHO Report on the Global Tobacco Epidemic 2015: Raising taxes on tobacco. Geneva: World Health Organization, 2015.
 3. Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000;321(7257):358-61.
 4. International Agency for Research on Cancer. IARC handbooks of cancer prevention: tobacco control. Volume 14: effectiveness of tax and price policies for tobacco control Lyon, France: IARC; 2011 [
 5. World Health Organization. Framework Convention on Tobacco Control. Geneva2003.
 6. FCTC/COP/6/7. Guidelines for implementation of Article 6 of the WHO FCTC2014.
 7. Campbell RB, Balbach ED. Cigarette Excise Taxes in Context: Cautionary Lessons from the U.S. Experience. *Int J Health Serv* 2015;45(3):564-77. doi: 10.1177/0020731415584553
 8. Campbell RB, Balbach ED. Building alliances in unlikely places: progressive allies and the Tobacco Institute's coalition strategy on cigarette excise taxes. *Am J Public Health* 2009;99(7):1188-96. doi: 10.2105/AJPH.2008.143131
 9. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control* 2013;22(2):144-53. doi: 10.1136/tobaccocontrol-2011-050098
 10. Campbell R, Balbach ED. Mobilising public opinion for the tobacco industry: the Consumer Tax Alliance and excise taxes. *Tob Control* 2008;17(5):351-6. doi: 10.1136/tc.2008.025338
 11. Koch SF. Quasi-experimental evidence on tobacco tax regressivity. *Soc Sci Med* 2018;196:19-28. doi: 10.1016/j.socscimed.2017.11.004
 12. Gilmore AB, Tavakoly B, Taylor G, et al. Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. *Addiction* 2013;108(7):1317-26. doi: 10.1111/add.12159
 13. Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11 Suppl 1:162-72.
 14. Brock B, Choi K, Boyle RG, et al. Tobacco product prices before and after a statewide tobacco tax increase. *Tob Control* 2016;25(2):166-73. doi: 10.1136/tobaccocontrol-2014-052018
 15. Alamar B, Mahmoud L, Glantz SA. Cigarette Smuggling in California: Fact and Fiction. Tobacco Control Policy Making: United States. San Francisco: Center for Tobacco Control Research and Education, UC San Francisco, 2003.
 16. Hirono KT, Smith KE. Australia's \$40 per pack cigarette tax plans: the need to consider equity. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2016-053608
 17. David PA. Clio and the Economics of QWERTY. *The American Economic Review* 1985;75(2):332-37.
 18. Hiilamo H, Glantz SA. Implementation of effective cigarette health warning labels among low and middle income countries: state capacity, path-dependency and tobacco industry activity. *Soc Sci Med* 2015;124:241-5. doi: 10.1016/j.socscimed.2014.11.054
 19. World Health Organization. WHO report on the global tobacco epidemic 2015, dataset. Geneva, 2015.
 20. Yurekli A, de Beye J. Design and administer tobacco taxes. World Bank economics of tobacco toolkit ; no. 4. design and administration. Washington D.C.: World Bank, 1999.
 21. McDaniel PA, Intinarelli G, Malone RE. Tobacco industry issues management organizations: creating a global corporate network to undermine public health. *Global Health* 2008;4:2. doi: 1744-8603-4-2 [pii]
- 10.1186/1744-8603-4-2 [published Online First: 2008/01/19]

- 1
2
3 22. International Tobacco Documentation Centre. International fiscal guide to tobacco. World taxation,
4 price, tariff and regulatory information. Philip Morris, 1998:2074330579-1410.
5
6 23. World Bank. Country and Lending Groups., 2016.
7
8 24. Blecher E, van Walbeek C. An Analysis of Cigarette Affordability. Paris: International Union Against
9 Tuberculosis and Lung Disease, 2008.
10
11 25. Marshall MG, Cole BR. Global Report 2014. Conflict, Governance and State Fragility. : Center for
12 Systemic Peace 2014 [Available from: <http://www.systemicpeace.org/SFI/matrix2010c.pdf>
13 accessed 31 Jan 2014].
14
15 26. World Health Organization. 2014 global progress report on implementation of the WHO Framework
16 Convention on Tobacco Control, 2014.
17
18 27. Crosbie E, Sebrie EM, Glantz SA. Tobacco industry success in Costa Rica: the importance of FCTC
19 article 5.3. *Salud Publica Mex* 2012;54(1):28-38. doi: S0036-36342012000100005 [pii] [published
20 Online First: 2012/01/31]
21
22 28. Crosbie E, Sosa P, Glantz SA. Costa Rica's implementation of the Framework Convention on Tobacco
23 Control: Overcoming decades of industry dominance. *Salud Publica Mex* 2016;58(1):62-70.
24
25 29. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in
26 Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control*
27 2017 doi: 10.1136/tobaccocontrol-2017-053690
28
29 30. Crosbie E, Sosa P, Glantz SA. The importance of continued engagement during the implementation
30 phase of tobacco control policies in a middle-income country: the case of Costa Rica. *Tob Control*
31 2017;26(1):60-68. doi: 10.1136/tobaccocontrol-2015-052701
32
33 31. Bump JB, Reich MR. Political economy analysis for tobacco control in low- and middle-income
34 countries. *Health Policy Plan* 2013;28(2):123-33. doi: czs049 [pii]
35
36 10.1093/heapol/czs049 [published Online First: 2012/05/16]
37
38 32. Leischow SJ, Ayo-Yusuf O, Backinger CL. Converging research needs across framework convention on
39 tobacco control articles: making research relevant to global tobacco control practice and policy.
40 *Nicotine Tob Res* 2012;15(4):761-6. doi: nts199 [pii]
41
42 10.1093/ntr/nts199 [published Online First: 2012/09/20]
43
44 33. Sanders-Jackson AN, Song AV, Hiilamo H, et al. Effect of the Framework Convention on Tobacco
45 Control and voluntary industry health warning labels on passage of mandated cigarette warning
46 labels from 1965 to 2012: transition probability and event history analyses. *Am J Public Health*
47 2013;103(11):2041-7. doi: 10.2105/AJPH.2013.301324 [published Online First: 2013/09/14]
48
49 34. Uang R, Hiilamo H, Glantz SA. Accelerated Adoption of Smoke-Free Laws After Ratification of the
50 World Health Organization Framework Convention on Tobacco Control. *Am J Public Health*
51 2016;106(1):166-71. doi: 10.2105/AJPH.2015.302872
52
53 35. Hiilamo H, Glantz S. FCTC followed by accelerated implementation of tobacco advertising bans. *Tob*
54 *Control* 2016 doi: 10.1136/tobaccocontrol-2016-053007
55
56 36. Mahoney J. Path Dependence in Historical Sociology. *Theory and Society* 2000;29:507-48.
57
58 37. Blecher E. Targeting the affordability of cigarettes: a new benchmark for taxation policy in low-
59 income and-middle-income countries. *Tob Control* 2010;19(4):325-30. doi:
60 10.1136/tc.2009.030155
38. Blecher E, Ross H, Leon ME. Cigarette affordability in Europe. *Tob Control* 2013;22(4):e6. doi:
10.1136/tobaccocontrol-2012-050575
39. Gilmore AB, Fooks G, Drope J, et al. Exposing and addressing tobacco industry conduct in low-income
and middle-income countries. *Lancet* 2015;385(9972):1029-43. doi: 10.1016/S0140-
6736(15)60312-9

- 1
2
3 40. Wipfli H. The Global War on Tobacco. Mapping the World's First Public Health Treaty. Baltimore:
4 Johns Hopkins University Press 2016.
5 41. Blecher E, Ross H, Stoklosa M. Lessons learned from cigarette tax harmonisation in the European
6 Union. *Tob Control* 2014;23(e1):e12-4. doi: 10.1136/tobaccocontrol-2012-050728
7
8 42. Campaign for Tobacco-Free Kids. Tobacco tax success story: United Kingdom. Washington, 2012.
9 43. Sinha DN, Gupta PC, Kumar A, et al. The poorest of poor suffer the greatest burden from smokeless
10 tobacco use: A study from 140 countries. *Nicotine Tob Res* 2017 doi: 10.1093/ntr/ntx276
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

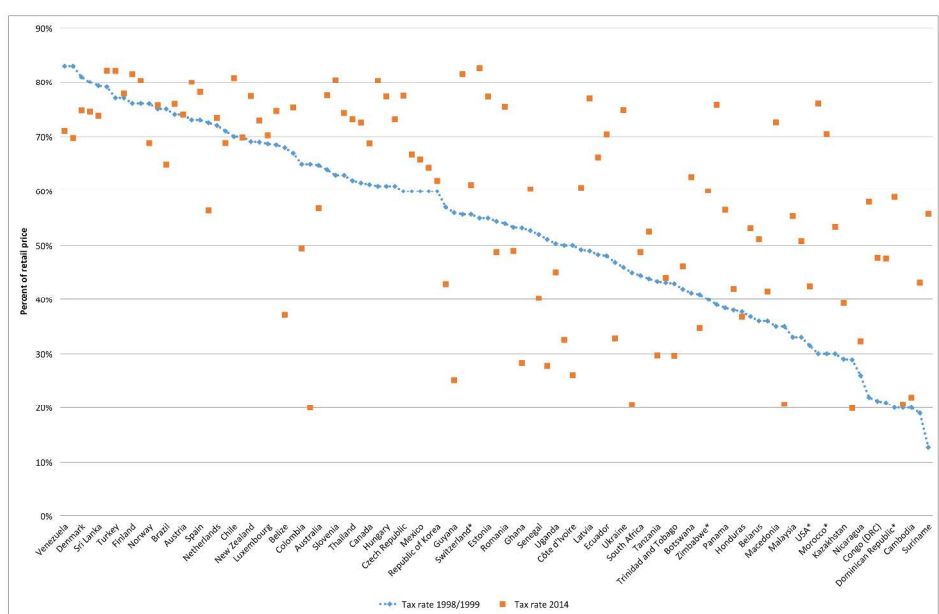
FIGURE CAPTIONS

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.

For peer review only

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

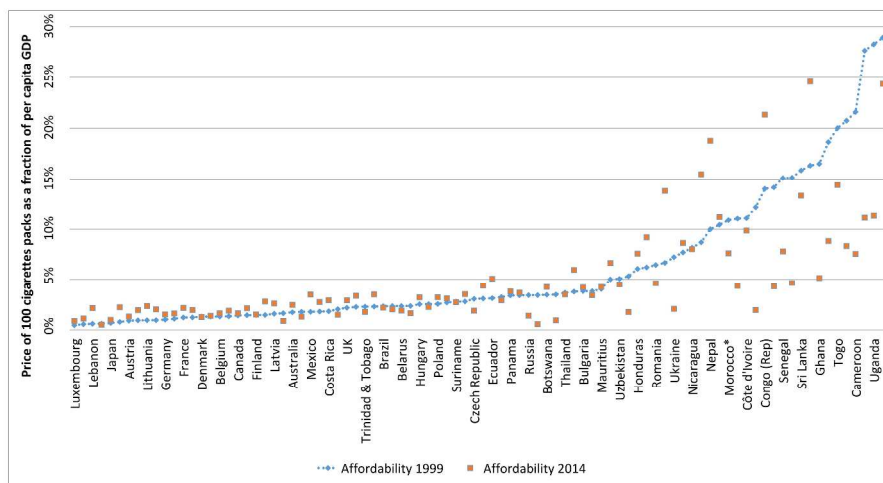


* Country has not ratified FCTC.

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)

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-021340.R3
Article Type:	Research
Date Submitted by the Author:	13-Jul-2018
Complete List of Authors:	Hiilamo, Heikki; University of Helsinki, Department of Social Research, social and public policy; VID Vitenskapelige Hogskole Glantz, S; University of California, San Francisco, Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Global health
Keywords:	tobacco industry, tobacco taxation, FCTC

SCHOLARONE™
Manuscripts

1
2
3 **LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON**
4
5 **TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON**
6
7
8
9
10

11
12 Heikki Hiilamo^{ab}, PhD
13

14 Stanton Glantz^c, PhD
15

16
17 ^a VID Specialized University, Oslo, Norway

18 ^b Social and public policy, Department of Social Research, 00014 University of Helsinki,
19 Finland, heikki.hiilamo@helsinki.fi

20 ^c Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy
21 Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
22 University of California San Francisco, San Francisco, CA 94143-1390, stanton.glantz@ucsf.edu
23
24
25
26

27 Corresponding Author:
28 Heikki Hiilamo, Professor
29 University of Helsinki
30 Department of Social Research
31 Unioninkatu 37
32 00014 Helsingin yliopisto
33 Finland
34 Tel. +358403587203
35 Fax. +358294124835
36 heikki.hiilamo@helsinki.fi
37
38
39

40 Word count 3425
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 use¹⁻³. 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 Control⁵ (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 Guidelines⁶ 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 increases² 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 trade² 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 Australia¹⁶, 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.

1
2
3 WHO established the MPOWER measures in 2008 to scale up key FCTC demand
4
5 reduction measures including tobacco taxes. MPOWER emphasizes that “increasing the price of
6
7 tobacco through higher taxes is the single most effective way to encourage tobacco users to quit
8
9 and prevent children from starting to smoke.”² A key finding of the 2015 MPOWER report was
10
11 that taxes were the least implemented MPOWER measure with only 10% of the world’s
12
13 population (living in 33 countries) covered by taxes of at least 75% of retail price². This paper
14
15 assesses the association of FCTC ratification with implementing tobacco taxes by analyzing
16
17 changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we
18
19 assess the role of state capacity and previous tax and price levels^{17 18} on taxes in 2014.
20
21
22
23

24 **METHODS**

25 **Data**

26
27 Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties,
28
29 value added tax, and other taxes were obtained from the World Health Organization Report on
30
31 the Global Tobacco Epidemic 2015 public dataset for 2014.¹⁹ This dataset includes information
32
33 collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold
34
35 brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on
36
37 the taxation of cigarettes (and when possible, most commonly used tobacco products) was
38
39 collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we
40
41 used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based
42
43 on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most
44
45 popular brand was used to calculate the tax rate.
46
47
48
49
50

51 We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64
52
53 countries that reported the share of cigarette taxes (including value added tax, VAT) as a
54
55
56
57
58
59
60

1
2
3 percentage of the retail price of a pack of cigarettes²⁰ supplemented by the tobacco industry's
4
5 International Tobacco Documentation Centre's²¹ 1998 *International Fiscal Guide to Tobacco*
6
7 that mapped international taxation, price and tariff policies.²²
8
9

10 Tobacco tax rate is the portion of the price represented by all taxes (including VAT for
11
12 the most-sold brand of cigarettes, is our outcome variable. We studied two outcome variables
13
14 derived from MPOWER standards in the *WHO Report on the Global Tobacco Epidemic 2015:*
15 *Raising Taxes on Tobacco:* (1) taxes that totaled at least 75% of retail price, the highest
16
17 MPOWER standard², and (2) taxes that totaled at least 50% of retail price, the second highest
18
19 standard.² FCTC Article 6 does not set targets on tobacco prices. The expectation in FCTC and
20
21 MPOWER is that if the manufacturers increase wholesale prices so that the overall tax rate drops
22
23 below 75% or 50%, the government would increase taxes so that the tax share would go above
24
25 75% or 50%.
26
27
28
29

30
31 To analyze the income level of the countries we used World Bank (WB) 2016 gross
32
33 national income (GNI) categories:²³ low-income countries were defined as those with a GNI per
34
35 capita of \$1,045 or less in 2014; middle-income economies, \$1,046 to \$12,735; high income,
36
37 \$12,736 or more. Lower-middle-income and upper-middle-income economies were separated at
38
39 a GNI per capita of \$4,125. Since our sample included only eight low-income countries, after
40
41 cross tabulation analysis we combined low income and lower middle-income categories in the
42
43 regression analysis. We used information on cigarette prices expressed in nominal US dollars in
44
45 1998/1999.
46
47
48

49 We analyzed the association of FCTC with affordability of cigarettes by using the
50
51 fraction of per capita gross domestic product (GDP) that would be needed to buy 100 packs of
52
53 the most sold cigarette brand. This method is a more comprehensive and representative measure
54
55
56
57

1
2
3 of income across countries in different income levels than, for example surveys of wages.²⁴We
4 used price data described above and World Bank data for GDP per capita for 1999 and 2014.²³ In
5
6 addition, we used the growth of GDP per capita from 1999 to 2014²³ ($[(2014 \text{ GDP} - 1999$
7
8 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the
9
10 assumption that cigarettes would be more affordable in 2014 among those countries where the
11
12 rise in income level was the fastest. We assume that changes in GDP over the 16-year period
13
14 reflect changes in disposable income.
15
16
17

18 19 **Other Variables**

20
21 To study the willingness and ability of states to implement public policies we used
22
23 Marshall and Cole's²⁵ state fragility index. This index scores all countries with population above
24
25 500,000 in four performance dimensions: security, political, economic, and social. Previous
26
27 literature has shown that state fragility matters for implementing effective cigarette health
28
29 warnings.^{17 18} The index gives higher scores for more fragile countries (Sudan scored 23 while
30
31 the 15 most stable countries scored 0) but does not place countries into different categories. We
32
33 averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less
34
35 likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries
36
37 which score higher on Marshall and Cole's state fragility index.
38
39
40
41

42 We studied the role of previous tax and price levels on tax rate in 2014 with two
43
44 variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in
45
46 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in
47
48 1998/1999 were more likely to have high tax rates in 2014.
49
50

51 **Statistical Analysis**

1
2
3 Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as
4 the outcome variable. We studied the effect of FCTC by calculating the number of years since
5 FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the
6 FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of
7 the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United
8 States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican
9 Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already
10 had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded
11 from the analysis.
12
13
14
15
16
17
18
19
20
21
22
23

24 Our analysis has 80% statistical power (with $\alpha=.05$) to detect an OR by a factor of 1.25
25 (or 0.80) associated with FCTC ratification.
26
27

28 We also used logistic regression to analyze the effect of the FCTC on cigarette
29 affordability by assigning a value of 1 for those countries where cigarettes were less affordable
30 in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between
31 state capacity and FCTC ratification to see if more fragile countries were slower in ratifying
32 FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with
33 extensive tobacco control measures.
34
35
36
37
38
39
40
41

42 We used R functions `glm` and `minEffect.VSMc.logistic` from `powerMediation` for the
43 analysis.
44
45

46 **Patient and Public Involvement**

47 Patients or public were not involved in the study.
48
49

50 **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).

	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%
<p>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.</p>						

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)

Variable	Tobacco tax \geq 75% of retail price (high)		Tobacco tax \geq 50% of retail price	
	Odds ratio	95% CI	Odds ratio	95% CI
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). 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% CI
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	
* $P \leq 0.05$, ** $P \leq 0.01$, 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 concerns² 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

1
2
3 terms of security, political, economic, and social development may not have administrative and
4 technical capacity to implement high tobacco taxes.²⁷⁻³⁰ We did not detect an interaction between
5 state capacity and time since FCTC ratification, which indicates that weak state capacity as such
6 may not prevent countries from ratifying FCTC. Promoting the FCTC should include
7 strengthening of the basic functions of government.^{31 32}

8
9
10 Countries with higher tax rates in 1998/1999 were more likely to have at least a 75% tax
11 rate in 2014. Increasing tobacco taxes requires determined action from governments. Countries
12 that had higher tobacco taxes before the FCTC continued to do so also after ratifying it. The
13 results indicate a path-dependency in tobacco taxation policies.³³⁻³⁵ The passing of tobacco tax
14 policies is a contingent event that sets into motion institutional patterns that have deterministic
15 properties.³⁶ The result emphasizes the importance of intensifying efforts to implement high
16 tobacco taxes especially in countries with originally low tax rates.

17
18 Surprisingly, lower, not higher, cigarette prices in 1998/1999 were associated with 75%
19 tobacco tax rates in 2014 (Table 2). Countries with low cigarette prices in 1998/1999 may have
20 reached the target with regular inflationary adjustments. This association may also reflect a
21 possible ceiling effect where governments are reluctant to increase tobacco taxes if the cigarettes
22 are already relatively expensive. This could also result from tobacco industry lobbying.^{2 7-9}
23 FCTC Article 6 and its implementation Guidelines expressly emphasize health goals in
24 determining tobacco taxation but governments may try to maintain popular support through
25 adopting small tobacco tax increases instead of large increases. The health groups play an
26 important role in creating awareness and building capacity for FCTC implementation.^{37 38 30} It is
27 also possible that that it is easier for a country to reach the 75% tax rate if the price was low
28 before the tax increase.

1
2
3 Consistent with earlier studies on cigarette affordability, cigarettes were more affordable
4
5 in 2014 than in 1999 despite tax increases.^{2 24 39 40} Our paper includes data collected well after
6
7 2010, so we were able base our analysis on a longer time horizon than earlier analyses and
8
9 thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC
10
11 earlier on average had less affordable cigarettes in 2014. The results seem to contradict the
12
13 earlier finding of the non-significant association of FCTC ratification with having high cigarette
14
15 taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough
16
17 to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were
18
19 more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC
20
21 ratification remains statistically significant.
22
23
24
25

26
27 There are many different ways that one could define an “effective” tax rate, including
28
29 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1).
30
31 The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC
32
33 had on tax policy, we used the WHO’s own standard of success as defined in MPOWER. The
34
35 MPOWER measures for effective tax rates are arbitrary and different measures could be also
36
37 used.
38
39

40
41 Our results emphasize the role of economic development in preventing cigarettes from
42
43 becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if
44
45 taxes are kept constant.^{2 24} This development is reflected in our result where rapid per capita
46
47 GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014.
48
49 Among those 14 countries where the per capita GDP increased more than 300% in 15 years,
50
51 cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate
52
53 targets, for example 50% of retail price, is that they do not take into account the effect of rising
54
55
56
57
58
59
60

1
2
3 incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes
4 generally increases with the average level of income, especially in developing countries.²⁴
5
6

7
8 Lack of state capacity was associated with both lower odds for having high tobacco taxes
9 and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile
10 countries, while taxes are high and cigarettes less affordable in more stable countries. As of
11
12 2018, the multinational tobacco companies were targeting countries in Asia and Africa with
13
14 young populations and relatively low smoking prevalence, especially among women.⁴¹
15
16
17
18

19 The tax provisions in the FCTC do not include specific tax targets.⁵ The unwillingness of
20
21 FCTC parties to commit to minimum tax levels during FCTC negotiations is reflected in the lack
22
23 of subsequent action.⁴² FCTC Guidelines for Article 6 implementation recommend that Parties
24
25 should take into account “both price elasticity and income elasticity of demand, as well as
26
27 inflation and changes in household income, to make tobacco products less affordable over time
28
29 in order to reduce consumption and prevalence.”⁵ Our results demonstrate that current policies
30
31 for implementing tobacco taxes fail to meet this recommendation.
32
33
34

35 In our sample cigarettes became more affordable from 1999 to 2014. Taking the FCTC
36
37 Guideline recommendation seriously would entail the Conference of the FCTC Parties assigning
38
39 definite targets not only for tobacco tax rates but also for measures that prevent tobacco products
40
41 from becoming more affordable.
42
43

44 The effect of cigarettes becoming more affordable with rapid income rises can be
45
46 prevented by adopting adequate policies.^{39 40 43} One example is a tax escalator which is adjusted
47
48 to income growth or an equivalent variable that accounts for increases in consumer purchasing
49
50 power.² Such a tax escalator is already in place in the UK.⁴⁴ With automatically increasing
51
52 tobacco taxes by the increase in purchasing power the tobacco companies would increase prices,
53
54
55
56
57

1
2
3 which would prevent tobacco products not becoming more affordable. To allow this process to
4 take place tobacco taxes rates could, at least temporarily, rise even above the 75% standard.
5

6
7 Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so
8 would make it more difficult for tobacco companies to downshift tax increases.
9

10 11 12 **Limitations**

13
14 Assessing the change in tax as a share of price over time can be complicated.¹⁹

15
16 Determination of tax rates as a proportion of total cigarette retail price is dependent on changes
17 in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax
18 on cigarettes, the share of excise and total taxes in the retail price could remain the same or
19 shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share
20 of taxes in the final retail price might increase, even if there is no change in the tax levied on a
21 pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not
22 enough, given that the FCTC did not specify 50/75% tax rates as a requirement.
23
24
25
26
27
28
29
30
31
32

33 The Article 6 Guidelines were adopted in 2014, nine years after the FCTC entered force
34 and may have delayed Parties' attention to implementing tax increases. Other analyses of health
35 warning labels^{18 33} (Article 11), smokefree policies³⁴ (Article 8) and advertising bans³⁵ (Article
36 13), however, demonstrated an effect of FCTC ratification without considering the delay in
37 adoption of the implementing guidelines for these articles.
38
39
40
41
42
43

44 To establish a baseline before FCTC we used tobacco tax and price data from two
45 different sources, World Bank survey from 1999²⁰ and the International Tobacco Documentation
46 Centre's²¹ 1998 *International Fiscal Guide to Tobacco*. Both data sources include information
47 on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping
48 price information indicates the data was collected in a substantially uniform manner. The
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement
4 error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more
5 dramatically than cigarette prices. Given the more reliable international standing we deemed the
6 World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by
7 the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all
8 data sources including WHO data for 2014,¹⁹ but were unable to confirm that definitions
9 remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco
10 taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the
11 share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in
12 reducing demand for tobacco. Earlier research has shown the tobacco industry may
13 simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on
14 premium brands.¹² The higher the level of the excise and other taxes the less room for tobacco
15 industry price differentiation strategies. We were not able to analyze how countries' tax policies
16 have accounted for country-specific price and income elasticities.

17
18
19 In this study we were not able to assess the causal effects. Besides the variables used in
20 this study other factors such as economic cycles, political leadership and tobacco control activity
21 outside of FCTC may have affected the outcome variables.

22
23
24 Our analysis focused only on cigarettes ignoring other categories of tobacco products,
25 some of which (for example bidi) are more prevalent in more fragile countries such as
26 Bangladesh and India⁴⁵. Since we had data only from two time points we were not able to assess
27 trends in tax, price and affordability in prior periods.

28 **Conclusions**

1
2
3 In contrast to advertising restrictions,^{33 35} health warning labels,³³ and smokefree
4 environments,³⁴ FCTC ratification has not been systematically followed regarding higher
5 tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets
6 were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke
7 free environments, health warnings and advertising bans that fall into domain of health
8 government, while Article 6 concerns financial policy, which falls under finance ministries.
9 There need to be further efforts to increase financial ministries' knowledge of and responsibility
10 to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in
11 incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6
12 implementation should assign definite targets for tobacco taxes and for the implementation of a
13 tax escalator that gradually increases taxes to match the rising income levels. The tobacco
14 control community should collaborate with other parts of civil society to intensify efforts to help
15 more fragile countries to improve performance in FCTC implementation both through
16 strengthening their administrative and technical capacity and through supporting the basic
17 functions of government. The FCTC Conference of the Parties should assign definite targets not
18 only for tobacco tax rates but also for measures to prevent tobacco products from becoming more
19 affordable.
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40

41 42 **FUNDING**

43
44 This work was supported by National Cancer Institute grant CA-087472. The funding
45 agency played no role in the conduct of the research or preparation of the manuscript.
46
47
48

49 **COMPETING INTERESTS**

50
51 There are no competing interests.
52
53

54 **CONTRIBUTORSHIP**

1
2
3 HH developed the idea for this study and carried out the data collection. HH and SG
4
5 carried out the data analysis and wrote and revised the manuscript.
6

7
8 **DATA SHARING STATEMENT**
9

10 No data is shared since we are using data which is already made public.
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

REFERENCES

1. World Health Organization. WHO technical manual on tobacco tax administration. Geneva, 2010.
 2. World Health Organization. WHO Report on the Global Tobacco Epidemic 2015: Raising taxes on tobacco. Geneva: World Health Organization, 2015.
 3. Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000;321(7257):358-61.
 4. International Agency for Research on Cancer. IARC handbooks of cancer prevention: tobacco control. Volume 14: effectiveness of tax and price policies for tobacco control Lyon, France: IARC; 2011 [
 5. World Health Organization. Framework Convention on Tobacco Control. Geneva2003.
 6. FCTC/COP/6/7. Guidelines for implementation of Article 6 of the WHO FCTC2014.
 7. Campbell RB, Balbach ED. Cigarette Excise Taxes in Context: Cautionary Lessons from the U.S. Experience. *Int J Health Serv* 2015;45(3):564-77. doi: 10.1177/0020731415584553
 8. Campbell RB, Balbach ED. Building alliances in unlikely places: progressive allies and the Tobacco Institute's coalition strategy on cigarette excise taxes. *Am J Public Health* 2009;99(7):1188-96. doi: 10.2105/AJPH.2008.143131
 9. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control* 2013;22(2):144-53. doi: 10.1136/tobaccocontrol-2011-050098
 10. Campbell R, Balbach ED. Mobilising public opinion for the tobacco industry: the Consumer Tax Alliance and excise taxes. *Tob Control* 2008;17(5):351-6. doi: 10.1136/tc.2008.025338
 11. Koch SF. Quasi-experimental evidence on tobacco tax regressivity. *Soc Sci Med* 2018;196:19-28. doi: 10.1016/j.socscimed.2017.11.004
 12. Gilmore AB, Tavakoly B, Taylor G, et al. Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. *Addiction* 2013;108(7):1317-26. doi: 10.1111/add.12159
 13. Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11 Suppl 1:162-72.
 14. Brock B, Choi K, Boyle RG, et al. Tobacco product prices before and after a statewide tobacco tax increase. *Tob Control* 2016;25(2):166-73. doi: 10.1136/tobaccocontrol-2014-052018
 15. Alamar B, Mahmoud L, Glantz SA. Cigarette Smuggling in California: Fact and Fiction. Tobacco Control Policy Making: United States. San Francisco: Center for Tobacco Control Research and Education, UC San Francisco, 2003.
 16. Hirono KT, Smith KE. Australia's \$40 per pack cigarette tax plans: the need to consider equity. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2016-053608
 17. David PA. Clio and the Economics of QWERTY. *The American Economic Review* 1985;75(2):332-37.
 18. Hiilamo H, Glantz SA. Implementation of effective cigarette health warning labels among low and middle income countries: state capacity, path-dependency and tobacco industry activity. *Soc Sci Med* 2015;124:241-5. doi: 10.1016/j.socscimed.2014.11.054
 19. World Health Organization. WHO report on the global tobacco epidemic 2015, dataset. Geneva, 2015.
 20. Yurekli A, de Beye J. Design and administer tobacco taxes. World Bank economics of tobacco toolkit ; no. 4. design and administration. Washington D.C.: World Bank, 1999.
 21. McDaniel PA, Intinarelli G, Malone RE. Tobacco industry issues management organizations: creating a global corporate network to undermine public health. *Global Health* 2008;4:2. doi: 1744-8603-4-2 [pii]
- 10.1186/1744-8603-4-2 [published Online First: 2008/01/19]

- 1
2
3 22. International Tobacco Documentation Centre. International fiscal guide to tobacco. World taxation,
4 price, tariff and regulatory information. Philip Morris, 1998:2074330579-1410.
5
6 23. World Bank. Country and Lending Groups., 2016.
7
8 24. Blecher E, van Walbeek C. An Analysis of Cigarette Affordability. Paris: International Union Against
9 Tuberculosis and Lung Disease, 2008.
10
11 25. Marshall MG, Cole BR. Global Report 2014. Conflict, Governance and State Fragility. : Center for
12 Systemic Peace 2014 [Available from: <http://www.systemicpeace.org/SFI/matrix2010c.pdf>
13 accessed 31 Jan 2014].
14
15 26. World Health Organization. 2014 global progress report on implementation of the WHO Framework
16 Convention on Tobacco Control, 2014.
17
18 27. Crosbie E, Sebrie EM, Glantz SA. Tobacco industry success in Costa Rica: the importance of FCTC
19 article 5.3. *Salud Publica Mex* 2012;54(1):28-38. doi: S0036-36342012000100005 [pii] [published
20 Online First: 2012/01/31]
21
22 28. Crosbie E, Sosa P, Glantz SA. Costa Rica's implementation of the Framework Convention on Tobacco
23 Control: Overcoming decades of industry dominance. *Salud Publica Mex* 2016;58(1):62-70.
24
25 29. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in
26 Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control*
27 2017 doi: 10.1136/tobaccocontrol-2017-053690
28
29 30. Crosbie E, Sosa P, Glantz SA. The importance of continued engagement during the implementation
30 phase of tobacco control policies in a middle-income country: the case of Costa Rica. *Tob Control*
31 2017;26(1):60-68. doi: 10.1136/tobaccocontrol-2015-052701
32
33 31. Bump JB, Reich MR. Political economy analysis for tobacco control in low- and middle-income
34 countries. *Health Policy Plan* 2013;28(2):123-33. doi: czs049 [pii]
35
36 10.1093/heapol/czs049 [published Online First: 2012/05/16]
37
38 32. Leischow SJ, Ayo-Yusuf O, Backinger CL. Converging research needs across framework convention on
39 tobacco control articles: making research relevant to global tobacco control practice and policy.
40 *Nicotine Tob Res* 2012;15(4):761-6. doi: nts199 [pii]
41
42 10.1093/ntr/nts199 [published Online First: 2012/09/20]
43
44 33. Sanders-Jackson AN, Song AV, Hiilamo H, et al. Effect of the Framework Convention on Tobacco
45 Control and voluntary industry health warning labels on passage of mandated cigarette warning
46 labels from 1965 to 2012: transition probability and event history analyses. *Am J Public Health*
47 2013;103(11):2041-7. doi: 10.2105/AJPH.2013.301324 [published Online First: 2013/09/14]
48
49 34. Uang R, Hiilamo H, Glantz SA. Accelerated Adoption of Smoke-Free Laws After Ratification of the
50 World Health Organization Framework Convention on Tobacco Control. *Am J Public Health*
51 2016;106(1):166-71. doi: 10.2105/AJPH.2015.302872
52
53 35. Hiilamo H, Glantz S. FCTC followed by accelerated implementation of tobacco advertising bans. *Tob*
54 *Control* 2016 doi: 10.1136/tobaccocontrol-2016-053007
55
56 36. Mahoney J. Path Dependence in Historical Sociology. *Theory and Society* 2000;29:507-48.
57
58 37. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in
59 Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control*
2017;27(2):185-94. doi: 10.1136/tobaccocontrol-2017-053690 [published Online First:
2017/03/25]
60
38. Uang R, Crosbie E, Glantz SA. Tobacco control law implementation in a middle-income country:
Transnational tobacco control network overcoming tobacco industry opposition in Colombia.
Glob Public Health 2018;13(8):1050-64. doi: 10.1080/17441692.2017.1357188 [published Online
First: 2017/08/18]

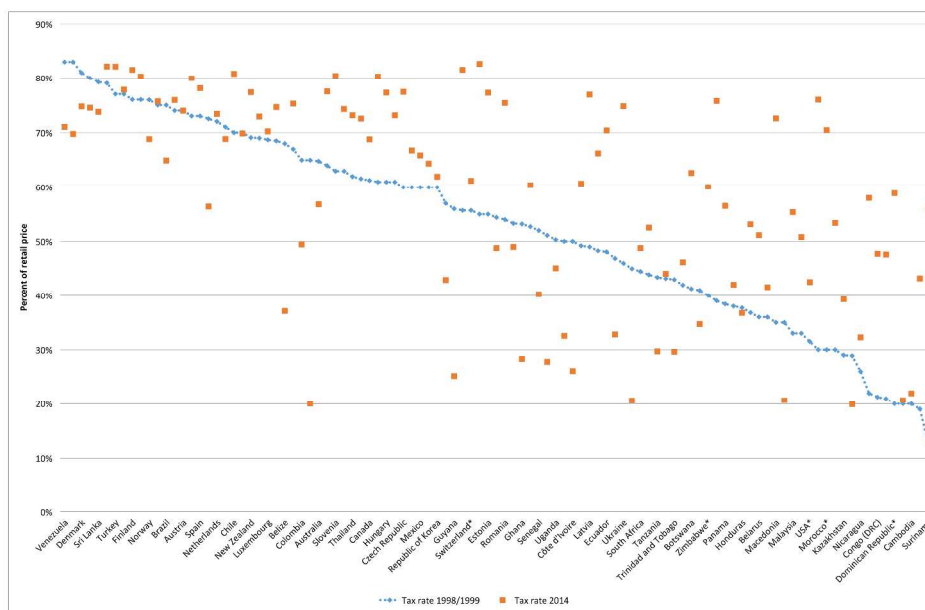
- 1
2
3 39. Blecher E. Targeting the affordability of cigarettes: a new benchmark for taxation policy in low-
4 income and-middle-income countries. *Tob Control* 2010;19(4):325-30. doi:
5 10.1136/tc.2009.030155
6
7 40. Blecher E, Ross H, Leon ME. Cigarette affordability in Europe. *Tob Control* 2013;22(4):e6. doi:
8 10.1136/tobaccocontrol-2012-050575
9
10 41. Gilmore AB, Fooks G, Drope J, et al. Exposing and addressing tobacco industry conduct in low-income
11 and middle-income countries. *Lancet* 2015;385(9972):1029-43. doi: 10.1016/S0140-
12 6736(15)60312-9
13
14 42. Wipfli H. The Global War on Tobacco. Mapping the World's First Public Health Treaty. Baltimore:
15 Johns Hopkins University Press 2016.
16
17 43. Blecher E, Ross H, Stoklosa M. Lessons learned from cigarette tax harmonisation in the European
18 Union. *Tob Control* 2014;23(e1):e12-4. doi: 10.1136/tobaccocontrol-2012-050728
19
20 44. Campaign for Tobacco-Free Kids. Tobacco tax success story: United Kingdom. Washington, 2012.
21
22 45. Sinha DN, Gupta PC, Kumar A, et al. The poorest of poor suffer the greatest burden from smokeless
23 tobacco use: A study from 140 countries. *Nicotine Tob Res* 2017 doi: 10.1093/ntr/ntx276
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

For peer review only

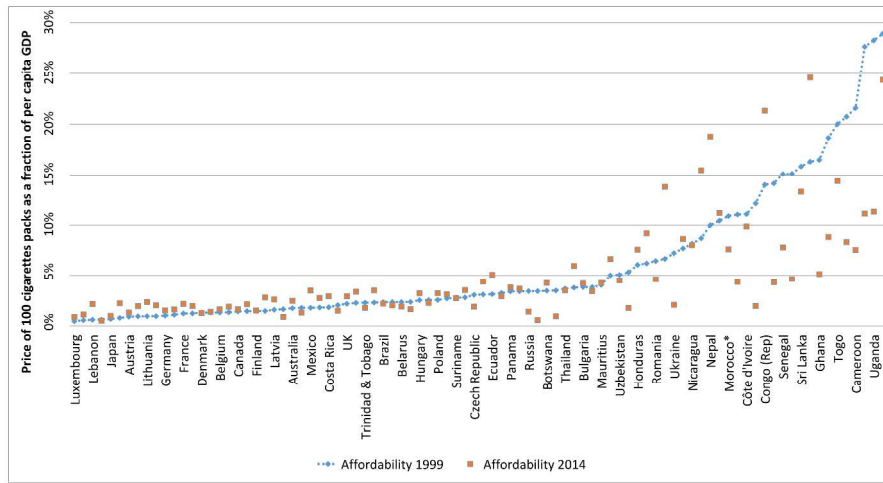


* Country has not ratified FCTC.

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)

view only

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-021340.R4
Article Type:	Research
Date Submitted by the Author:	23-Aug-2018
Complete List of Authors:	Hiilamo, Heikki; University of Helsinki, Department of Social Research, social and public policy; VID Vitenskapelige Hogskole Glantz, S; University of California, San Francisco, Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Global health
Keywords:	tobacco industry, tobacco taxation, FCTC

SCHOLARONE™
Manuscripts

1
2
3 **LIMITED IMPLEMENTATION OF THE FRAMEWORK CONVENTION ON**
4
5 **TOBACCO CONTROL'S TOBACCO TAX PROVISION: GLOBAL COMPARISON**
6
7
8
9
10

11
12 Heikki Hiilamo^{ab}, PhD
13

14 Stanton Glantz^c, PhD
15

16
17 ^a VID Specialized University, Oslo, Norway

18 ^b Social and public policy, Department of Social Research, 00014 University of Helsinki,
19 Finland, heikki.hiilamo@helsinki.fi

20 ^c Center for Tobacco Control Research and Education, Philip R. Lee Institute for Health Policy
21 Studies, Helen Diller Family Comprehensive Cancer Center, Department of Medicine
22 University of California San Francisco, San Francisco, CA 94143-1390, stanton.glantz@ucsf.edu
23
24
25
26

27 Corresponding Author:
28 Heikki Hiilamo, Professor
29 University of Helsinki
30 Department of Social Research
31 Unioninkatu 37
32 00014 Helsingin yliopisto
33 Finland
34 Tel. +358403587203
35 Fax. +358294124835
36 heikki.hiilamo@helsinki.fi
37
38
39

40 Word count 3425
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 use¹⁻³. 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 Control⁵ (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 Guidelines⁶ 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 increases² 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 trade² 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 Australia¹⁶, 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.

1
2
3 WHO established the MPOWER measures in 2008 to scale up key FCTC demand
4
5 reduction measures including tobacco taxes. MPOWER emphasizes that “increasing the price of
6
7 tobacco through higher taxes is the single most effective way to encourage tobacco users to quit
8
9 and prevent children from starting to smoke.”² A key finding of the 2015 MPOWER report was
10
11 that taxes were the least implemented MPOWER measure with only 10% of the world’s
12
13 population (living in 33 countries) covered by taxes of at least 75% of retail price². This paper
14
15 assesses the association of FCTC ratification with implementing tobacco taxes by analyzing
16
17 changes in tax rate using the MPOWER standard and cigarette affordability. In addition, we
18
19 assess the role of state capacity and previous tax and price levels^{17 18} on taxes in 2014.
20
21
22
23

24 **METHODS**

25 **Data**

26
27 Data on the tobacco tax rate, including specific excise, ad valorem excise, import duties,
28
29 value added tax, and other taxes were obtained from the World Health Organization Report on
30
31 the Global Tobacco Epidemic 2015 public dataset for 2014.¹⁹ This dataset includes information
32
33 collected by WHO in-country experts as of 31 December 2014 on the prices of the most-sold
34
35 brand of cigarettes (both in local currency and in US dollars) and cigarette taxes. Information on
36
37 the taxation of cigarettes (and when possible, most commonly used tobacco products) was
38
39 collected from ministries of finance. (Because WHO did not report tax data for Syria in 2014 we
40
41 used the data from 2012 for 2014.) In countries where different taxes applied to cigarettes based
42
43 on length, quantity produced, or type (e.g., filter vs. non-filter), the rate that applied to the most
44
45 popular brand was used to calculate the tax rate.
46
47
48
49
50

51 We obtained baseline pre-FCTC taxes using the 1999 World Bank (WB) survey of 64
52
53 countries that reported the share of cigarette taxes (including value added tax, VAT) as a
54
55
56
57

percentage of the retail price of a pack of cigarettes²⁰ supplemented by the tobacco industry's International Tobacco Documentation Centre's²¹ 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 standard², 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

1
2
3 of income across countries in different income levels than, for example surveys of wages.²⁴We
4 used price data described above and World Bank data for GDP per capita for 1999 and 2014.²³ In
5
6 addition, we used the growth of GDP per capita from 1999 to 2014²³ ($[(2014 \text{ GDP} - 1999$
7
8 GDP]/1999 GDP, GDP expressed in 2014 US dollars) as an independent variable on the
9
10 assumption that cigarettes would be more affordable in 2014 among those countries where the
11
12 rise in income level was the fastest. We assume that changes in GDP over the 16-year period
13
14 reflect changes in disposable income.
15
16
17

18 19 **Other Variables**

20
21 To study the willingness and ability of states to implement public policies we used
22
23 Marshall and Cole's²⁵ state fragility index. This index scores all countries with population above
24
25 500,000 in four performance dimensions: security, political, economic, and social. Previous
26
27 literature has shown that state fragility matters for implementing effective cigarette health
28
29 warnings.^{17 18} The index gives higher scores for more fragile countries (Sudan scored 23 while
30
31 the 15 most stable countries scored 0) but does not place countries into different categories. We
32
33 averaged scores for 2007, 2010 and in 2013 to test whether more fragile countries were less
34
35 likely to have high tobacco taxes in 2014. By more fragile countries we refer to those countries
36
37 which score higher on Marshall and Cole's state fragility index.
38
39
40
41

42 We studied the role of previous tax and price levels on tax rate in 2014 with two
43
44 variables, tobacco tax rates in 1998/1999 and price of most sold cigarette packs in US dollars in
45
46 1998/1999. We tested whether countries with higher cigarette taxes and higher price cigarettes in
47
48 1998/1999 were more likely to have high tax rates in 2014.
49
50

51 **Statistical Analysis**

1
2
3 Logistic regression was used in separate analyses with 75% and 50% tax rates in 2014 as
4 the outcome variable. We studied the effect of FCTC by calculating the number of years since
5 FCTC ratification as of 2014. We set years since ratification to 0 for countries that ratified the
6 FCTC in 2014 (El Salvador, Ethiopia and Zimbabwe), had signed but not ratified the FCTC as of
7 the end of 2014 (Argentina, Cuba, Haiti, Morocco, Mozambique, Switzerland and the United
8 States), or had not signed or become parties to the FCTC by January 2016 (Andorra, Dominican
9 Republic, Eritrea, Indonesia, Liechtenstein, Malawi, Monaco, Somalia). Countries that already
10 had a tax rate of 50% (final sample used N=44) or 75% (N=88) in 1998/1999 were excluded
11 from the analysis.
12
13
14
15
16
17
18
19
20
21
22
23

24 Our analysis has 80% statistical power (with $\alpha=.05$) to detect an OR by a factor of 1.25
25 (or 0.80) associated with FCTC ratification.
26
27

28 We also used logistic regression to analyze the effect of the FCTC on cigarette
29 affordability by assigning a value of 1 for those countries where cigarettes were less affordable
30 in 2014 than in 1999 and 0 where cigarettes were more affordable. We tested interaction between
31 state capacity and FCTC ratification to see if more fragile countries were slower in ratifying
32 FCTC. We also ran a sensitivity analysis to test if cigarettes are less affordable in countries with
33 extensive tobacco control measures.
34
35
36
37
38
39
40
41

42 We used R functions `glm` and `minEffect.VSMc.logistic` from `powerMediation` for the
43 analysis.
44
45

46 **Patient and Public Involvement**

47 Patients or public were not involved in the study.
48
49

50 **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).

	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%
<p>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.</p>						

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)

Variable	Tobacco tax \geq 75% of retail price (high)		Tobacco tax \geq 50% of retail price	
	Odds ratio	95% CI	Odds ratio	95% CI
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). 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% CI
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	
* $P \leq 0.05$, ** $P \leq 0.01$, 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 concerns² 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

1
2
3 terms of security, political, economic, and social development may not have administrative and
4 technical capacity to implement high tobacco taxes.²⁷⁻³⁰ We did not detect an interaction between
5 state capacity and time since FCTC ratification, which indicates that weak state capacity as such
6 may not prevent countries from ratifying FCTC. Promoting the FCTC should include
7 strengthening of the basic functions of government.^{31 32}

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

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

51 Consistent with earlier studies on cigarette affordability, cigarettes were more affordable
52 in 2014 than in 1999 despite tax increases.^{2 24 39 40} Our paper includes data collected well after
53

1
2
3 2010, so we were able base our analysis on a longer time horizon than earlier analyses and
4
5 thereby confirm well-established trend in cigarette affordability. Countries that ratified FCTC
6
7 earlier on average had less affordable cigarettes in 2014. The results seem to contradict the
8
9 earlier finding of the non-significant association of FCTC ratification with having high cigarette
10
11 taxes. It may well be that the FCTC prompted countries to increase tobacco taxes but not enough
12
13 to obtain 50% or 75% tax rates. It is also possible that countries with already high tax rates were
14
15 more likely to ratify FCTC earlier. If we include 199 tobacco tax rates in the model, FCTC
16
17 ratification remains statistically significant.
18
19

20
21 There are many different ways that one could define an “effective” tax rate, including
22
23 70% tax rate as specified in the WHO Technical Manual on Tobacco Tax Administration (1).
24
25 The MPOWER set a target of 75% of price. Because this is a paper on the effect that the FCTC
26
27 had on tax policy, we used the WHO’s own standard of success as defined in MPOWER. The
28
29 MPOWER measures for effective tax rates are arbitrary and different measures could be also
30
31 used.
32
33
34

35
36 Our results emphasize the role of economic development in preventing cigarettes from
37
38 becoming less affordable. If incomes rise quickly, cigarettes become more affordable even if
39
40 taxes are kept constant.²⁴ This development is reflected in our result where rapid per capita
41
42 GDP growth between 1999 and 2014 was associated with more affordable cigarettes in 2014.
43
44 Among those 14 countries where the per capita GDP increased more than 300% in 15 years,
45
46 cigarettes were less affordable in just three countries. In fact, the weakness of set tobacco tax rate
47
48 targets, for example 50% of retail price, is that they do not take into account the effect of rising
49
50 incomes or industry pricing behavior. Keeping other factors constant the demand for cigarettes
51
52 generally increases with the average level of income, especially in developing countries.²⁴
53
54
55
56
57

1
2
3 Lack of state capacity was associated with both lower odds for having high tobacco taxes
4 and less affordable cigarettes. Tobacco taxes are low and cigarettes are affordable in more fragile
5 countries, while taxes are high and cigarettes less affordable in more stable countries. As of
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

1
2
3 Another option is to set a tax for each brand guaranteeing a 75% tax for every product. Doing so
4
5 would make it more difficult for tobacco companies to downshift tax increases.
6

7 8 **Limitations**

9
10 Assessing the change in tax as a share of price over time can be complicated.¹⁹
11
12 Determination of tax rates as a proportion of total cigarette retail price is dependent on changes
13
14 in tax rates but also on changes in wholesale prices. Consequently, despite an increase in the tax
15
16 on cigarettes, the share of excise and total taxes in the retail price could remain the same or
17
18 shrink depending on how the tobacco companies respond to the tax increase. Similarly, the share
19
20 of taxes in the final retail price might increase, even if there is no change in the tax levied on a
21
22 pack of cigarettes. The FCTC might have prompted countries to increase tobacco taxes but not
23
24 enough, given that the FCTC did not specify 50/75% tax rates as a requirement.
25
26

27
28 The Article 6 Guidelines were adopted in 2014, nine years after the FCTC entered force
29
30 and may have delayed Parties' attention to implementing tax increases. Other analyses of health
31
32 warning labels^{18 33} (Article 11), smokefree policies³⁴ (Article 8) and advertising bans³⁵ (Article
33
34 13), however, demonstrated an effect of FCTC ratification without considering the delay in
35
36 adoption of the implementing guidelines for these articles.
37
38

39
40 To establish a baseline before FCTC we used tobacco tax and price data from two
41
42 different sources, World Bank survey from 1999²⁰ and the International Tobacco Documentation
43
44 Centre's²¹ 1998 *International Fiscal Guide to Tobacco*. Both data sources include information
45
46 on retail price of the most-sold cigarette brand. The high correlation (0.947) for overlapping
47
48 price information indicates the data was collected in a substantially uniform manner. The
49
50 correlation for tax data was lower, 0.676). This lower correlation could indicate a measurement
51
52 error in the datasets or it could indicate that tobacco taxes increased from 1998 to 1999 more
53
54
55
56
57
58
59
60

1
2
3 dramatically than cigarette prices. Given the more reliable international standing we deemed the
4 World Bank survey more reliable than the *International Fiscal Guide to Tobacco* produced by
5 the tobacco industry. We focused on the price and tax for the most-sold cigarette brand on all
6 data sources including WHO data for 2014,¹⁹ but were unable to confirm that definitions
7 remained stable over time. The most-sold cigarette may not fully describe the effect of tobacco
8 taxation to tobacco consumption. We did not analyze the tax structure. Our outcome variable, the
9 share of all tobacco taxes of the most sold brand, does not fully capture the role of taxes in
10 reducing demand for tobacco. Earlier research has shown the tobacco industry may
11 simultaneously absorb the tax increases on its cheapest brands while over-shifting taxes on
12 premium brands.¹² The higher the level of the excise and other taxes the less room for tobacco
13 industry price differentiation strategies. We were not able to analyze how countries' tax policies
14 have accounted for country-specific price and income elasticities.

15
16
17 In this study we were not able to assess the causal effects. Besides the variables used in
18 this study other factors such as economic cycles, political leadership and tobacco control activity
19 outside of FCTC may have affected the outcome variables.

20
21
22 Our analysis focused only on cigarettes ignoring other categories of tobacco products,
23 some of which (for example bidi) are more prevalent in more fragile countries such as
24 Bangladesh and India⁴⁵. Since we had data only from two time points we were not able to assess
25 trends in tax, price and affordability in prior periods.

26 **Conclusions**

27
28
29 In contrast to advertising restrictions,^{33 35} health warning labels,³³ and smokefree
30 environments,³⁴ FCTC ratification has not been systematically followed regarding higher
31 tobacco taxation. FCTC Article 6 does not stipulate specific tax rates. MPOWER tax rate targets

1
2
3 were not introduced before 2008. The more specific FCTC Articles 8, 11 and 13 discuss smoke
4 free environments, health warnings and advertising bans that fall into domain of health
5 government, while Article 6 concerns financial policy, which falls under finance ministries.
6
7
8
9
10 There need to be further efforts to increase financial ministries' knowledge of and responsibility
11 to implement Article 6. Fragile countries are less likely to have high tobacco taxes. Rapid rise in
12 incomes undermines the effectiveness of tobacco taxes. Guidelines for FCTC Article 6
13 implementation should assign definite targets for tobacco taxes and for the implementation of a
14 tax escalator that gradually increases taxes to match the rising income levels. The tobacco
15 control community should collaborate with other parts of civil society to intensify efforts to help
16 more fragile countries to improve performance in FCTC implementation both through
17 strengthening their administrative and technical capacity and through supporting the basic
18 functions of government. The FCTC Conference of the Parties should assign definite targets not
19 only for tobacco tax rates but also for measures to prevent tobacco products from becoming more
20 affordable.
21
22
23
24
25
26
27
28
29
30
31
32
33
34

35 **FUNDING**

36
37 This work was supported by National Cancer Institute grant CA-087472. The funding
38 agency played no role in the conduct of the research or preparation of the manuscript.
39
40
41

42 **COMPETING INTERESTS**

43
44 There are no competing interests.
45
46

47 **CONTRIBUTORSHIP**

48
49 HH developed the idea for this study and carried out the data collection. HH and SG
50 carried out the data analysis and wrote and revised the manuscript.
51
52
53

54 **DATA SHARING STATEMENT**

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

For peer review only

REFERENCES

1. World Health Organization. WHO technical manual on tobacco tax administration. Geneva, 2010.
 2. World Health Organization. WHO Report on the Global Tobacco Epidemic 2015: Raising taxes on tobacco. Geneva: World Health Organization, 2015.
 3. Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000;321(7257):358-61.
 4. International Agency for Research on Cancer. IARC handbooks of cancer prevention: tobacco control. Volume 14: effectiveness of tax and price policies for tobacco control Lyon, France: IARC; 2011 [
 5. World Health Organization. Framework Convention on Tobacco Control. Geneva2003.
 6. FCTC/COP/6/7. Guidelines for implementation of Article 6 of the WHO FCTC2014.
 7. Campbell RB, Balbach ED. Cigarette Excise Taxes in Context: Cautionary Lessons from the U.S. Experience. *Int J Health Serv* 2015;45(3):564-77. doi: 10.1177/0020731415584553
 8. Campbell RB, Balbach ED. Building alliances in unlikely places: progressive allies and the Tobacco Institute's coalition strategy on cigarette excise taxes. *Am J Public Health* 2009;99(7):1188-96. doi: 10.2105/AJPH.2008.143131
 9. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control* 2013;22(2):144-53. doi: 10.1136/tobaccocontrol-2011-050098
 10. Campbell R, Balbach ED. Mobilising public opinion for the tobacco industry: the Consumer Tax Alliance and excise taxes. *Tob Control* 2008;17(5):351-6. doi: 10.1136/tc.2008.025338
 11. Koch SF. Quasi-experimental evidence on tobacco tax regressivity. *Soc Sci Med* 2018;196:19-28. doi: 10.1016/j.socscimed.2017.11.004
 12. Gilmore AB, Tavakoly B, Taylor G, et al. Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. *Addiction* 2013;108(7):1317-26. doi: 10.1111/add.12159
 13. Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11 Suppl 1:162-72.
 14. Brock B, Choi K, Boyle RG, et al. Tobacco product prices before and after a statewide tobacco tax increase. *Tob Control* 2016;25(2):166-73. doi: 10.1136/tobaccocontrol-2014-052018
 15. Alamar B, Mahmoud L, Glantz SA. Cigarette Smuggling in California: Fact and Fiction. Tobacco Control Policy Making: United States. San Francisco: Center for Tobacco Control Research and Education, UC San Francisco, 2003.
 16. Hirono KT, Smith KE. Australia's \$40 per pack cigarette tax plans: the need to consider equity. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2016-053608
 17. David PA. Clio and the Economics of QWERTY. *The American Economic Review* 1985;75(2):332-37.
 18. Hiilamo H, Glantz SA. Implementation of effective cigarette health warning labels among low and middle income countries: state capacity, path-dependency and tobacco industry activity. *Soc Sci Med* 2015;124:241-5. doi: 10.1016/j.socscimed.2014.11.054
 19. World Health Organization. WHO report on the global tobacco epidemic 2015, dataset. Geneva, 2015.
 20. Yurekli A, de Beye J. Design and administer tobacco taxes. World Bank economics of tobacco toolkit ; no. 4. design and administration. Washington D.C.: World Bank, 1999.
 21. McDaniel PA, Intinarelli G, Malone RE. Tobacco industry issues management organizations: creating a global corporate network to undermine public health. *Global Health* 2008;4:2. doi: 1744-8603-4-2 [pii]
- 10.1186/1744-8603-4-2 [published Online First: 2008/01/19]

22. International Tobacco Documentation Centre. International fiscal guide to tobacco. World taxation, price, tariff and regulatory information. Philip Morris, 1998:2074330579-1410.
23. World Bank. Country and Lending Groups., 2016.
24. Blecher E, van Walbeek C. An Analysis of Cigarette Affordability. Paris: International Union Against Tuberculosis and Lung Disease, 2008.
25. Marshall MG, Cole BR. Global Report 2014. Conflict, Governance and State Fragility. : Center for Systemic Peace 2014 [Available from: <http://www.systemicpeace.org/SFI/matrix2010c.pdf> accessed 31 Jan 2014.
26. World Health Organization. 2014 global progress report on implementation of the WHO Framework Convention on Tobacco Control, 2014.
27. Crosbie E, Sebrie EM, Glantz SA. Tobacco industry success in Costa Rica: the importance of FCTC article 5.3. *Salud Publica Mex* 2012;54(1):28-38. doi: S0036-36342012000100005 [pii] [published Online First: 2012/01/31]
28. Crosbie E, Sosa P, Glantz SA. Costa Rica's implementation of the Framework Convention on Tobacco Control: Overcoming decades of industry dominance. *Salud Publica Mex* 2016;58(1):62-70.
29. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control* 2017 doi: 10.1136/tobaccocontrol-2017-053690
30. Crosbie E, Sosa P, Glantz SA. The importance of continued engagement during the implementation phase of tobacco control policies in a middle-income country: the case of Costa Rica. *Tob Control* 2017;26(1):60-68. doi: 10.1136/tobaccocontrol-2015-052701
31. Bump JB, Reich MR. Political economy analysis for tobacco control in low- and middle-income countries. *Health Policy Plan* 2013;28(2):123-33. doi: czs049 [pii] 10.1093/heapol/czs049 [published Online First: 2012/05/16]
32. Leischow SJ, Ayo-Yusuf O, Backinger CL. Converging research needs across framework convention on tobacco control articles: making research relevant to global tobacco control practice and policy. *Nicotine Tob Res* 2012;15(4):761-6. doi: nts199 [pii] 10.1093/ntr/nts199 [published Online First: 2012/09/20]
33. Sanders-Jackson AN, Song AV, Hiilamo H, et al. Effect of the Framework Convention on Tobacco Control and voluntary industry health warning labels on passage of mandated cigarette warning labels from 1965 to 2012: transition probability and event history analyses. *Am J Public Health* 2013;103(11):2041-7. doi: 10.2105/AJPH.2013.301324 [published Online First: 2013/09/14]
34. Uang R, Hiilamo H, Glantz SA. Accelerated Adoption of Smoke-Free Laws After Ratification of the World Health Organization Framework Convention on Tobacco Control. *Am J Public Health* 2016;106(1):166-71. doi: 10.2105/AJPH.2015.302872
35. Hiilamo H, Glantz S. FCTC followed by accelerated implementation of tobacco advertising bans. *Tob Control* 2016 doi: 10.1136/tobaccocontrol-2016-053007
36. Mahoney J. Path Dependence in Historical Sociology. *Theory and Society* 2000;29:507-48.
37. Crosbie E, Sosa P, Glantz SA. Defending strong tobacco packaging and labelling regulations in Uruguay: transnational tobacco control network versus Philip Morris International. *Tob Control* 2018;27(2):185-94. doi: 10.1136/tobaccocontrol-2017-053690 [published Online First: 2017/03/25]
38. Uang R, Crosbie E, Glantz SA. Tobacco control law implementation in a middle-income country: Transnational tobacco control network overcoming tobacco industry opposition in Colombia. *Glob Public Health* 2018;13(8):1050-64. doi: 10.1080/17441692.2017.1357188 [published Online First: 2017/08/18]

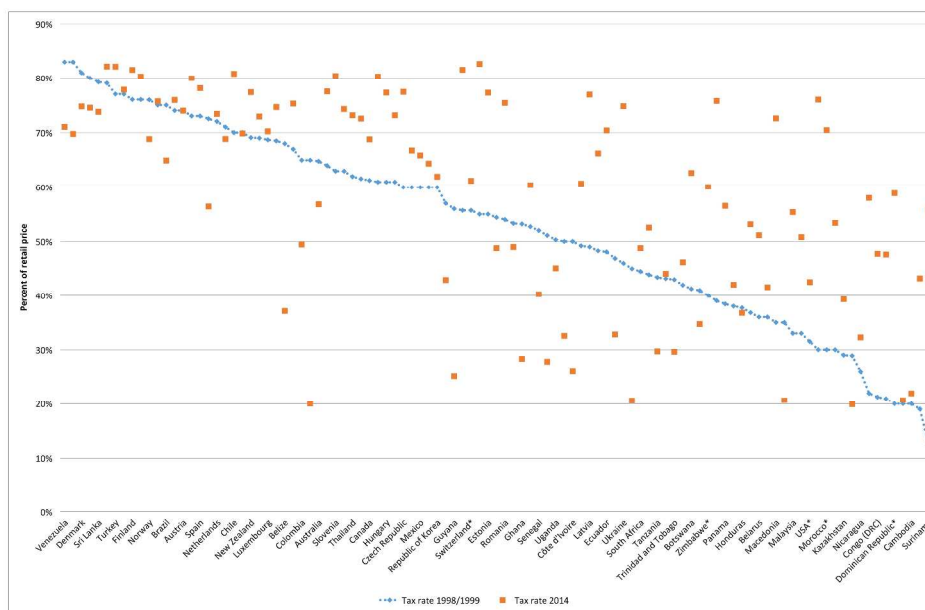
- 1
2
3 39. Blecher E. Targeting the affordability of cigarettes: a new benchmark for taxation policy in low-
4 income and-middle-income countries. *Tob Control* 2010;19(4):325-30. doi:
5 10.1136/tc.2009.030155
6
7 40. Blecher E, Ross H, Leon ME. Cigarette affordability in Europe. *Tob Control* 2013;22(4):e6. doi:
8 10.1136/tobaccocontrol-2012-050575
9
10 41. Gilmore AB, Fooks G, Drope J, et al. Exposing and addressing tobacco industry conduct in low-income
11 and middle-income countries. *Lancet* 2015;385(9972):1029-43. doi: 10.1016/S0140-
12 6736(15)60312-9
13
14 42. Wipfli H. The Global War on Tobacco. Mapping the World's First Public Health Treaty. Baltimore:
15 Johns Hopkins University Press 2016.
16
17 43. Blecher E, Ross H, Stoklosa M. Lessons learned from cigarette tax harmonisation in the European
18 Union. *Tob Control* 2014;23(e1):e12-4. doi: 10.1136/tobaccocontrol-2012-050728
19
20 44. Campaign for Tobacco-Free Kids. Tobacco tax success story: United Kingdom. Washington, 2012.
21
22 45. Sinha DN, Gupta PC, Kumar A, et al. The poorest of poor suffer the greatest burden from smokeless
23 tobacco use: A study from 140 countries. *Nicotine Tob Res* 2017 doi: 10.1093/ntr/ntx276
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

For peer review only

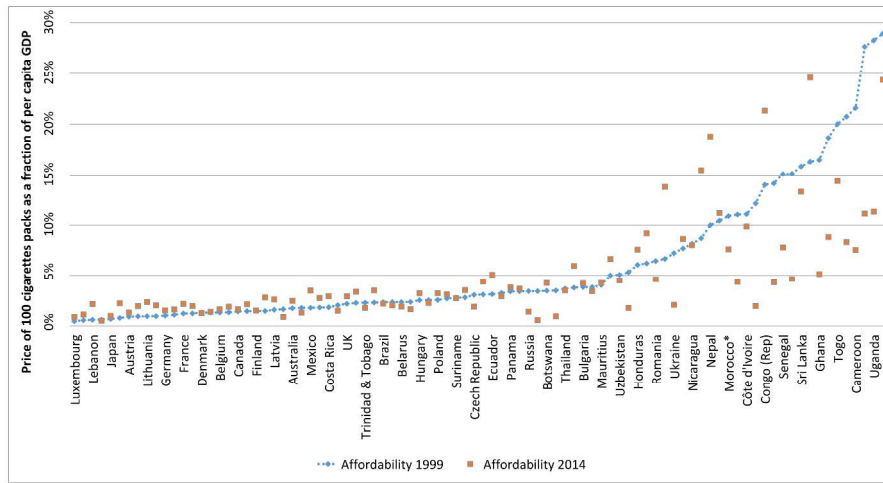


* Country has not ratified FCTC.

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)

view only