Proportions of and trends in exposure to pro-tobacco and anti-tobacco advertisements among young adolescents aged 12–16 years in 142 countries and territories, 1999–2018: an analysis of repeated cross-sectional surveys

Chuanwei Ma, Hui Yang*, Jiahong Sun, Min Zhao, Costan G Magnussen, Bo Xi*

Summary

Background The proportions and trends in exposure to pro-tobacco and anti-tobacco advertisements among young people remain unknown globally. We determined recent (2010–18) proportions of exposure to pro-tobacco and anti-tobacco advertisements among young adolescents and their secular trends from 1999 to 2018.

Methods In this analysis of repeated cross-sectional surveys, we used the most recent data from 142 countries and territories (hereafter referred to as countries) collected between Jan 1, 2010, and Dec 31, 2018, comprising 710 191 participants, to assess the proportions of exposure to pro-tobacco and anti-tobacco advertisements among young adolescents aged 12–16 years. Data from 120 countries that had performed two or more Global Youth Tobacco Surveys between Jan 1, 1999, and Dec 31, 2018, comprising 1 482 031 participants, were used to assess trends in the proportions of exposure to pro-tobacco and anti-tobacco advertisements over time. A χ^2 test analysis was used for proportion comparisons between subgroups. Exposure to pro-tobacco and anti-tobacco advertisements were calculated as proportions using sampling weights, strata, and primary sampling units.

Findings The most recent global proportion of past 30-day exposure to tobacco advertisements among young adolescents was 433 585 (64·6%) of 710 191 (95% CI 63·5–65·7; all final percentages were weighted) for messages on electronic media, 206 766 (33·1%) of 710 191 (31·9–34·4) for exposure at the point of sale, and 63 385 (10·2%) of 710 191 (9·7–10·6) for owning something with a tobacco brand logo. The most recent global proportion of exposure to anti-tobacco advertisements was 431 862 (63·6%) of 710 191 (62·3–64·9) for messages on electronic media and 227 658 (34·1%) of 710 191 (32·8–35·3) for exposure to gathering activities. The majority of included countries showed a decreasing trend in exposure to tobacco advertisements (111 [93%] of 120) and anti-tobacco advertisements (110 [92%] of 120) between 1999 and 2018.

Interpretation Among young adolescents, exposure to tobacco advertisements remains high, and exposure to anti-tobacco advertisements is not high enough. The proportion of young adolescents exposed to pro-tobacco and anti-tobacco advertisements had decreased over time in the majority of included countries. These findings underscore the importance of strict implementation of regulation on tobacco control including strengthening anti-tobacco marketing and prohibiting tobacco marketing.

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See **Comment** page e491

For the Chinese translation of the asbtract see **Online** for appendix 1

*Co-first authors

Department of Epidemiology (C Ma MSc, H Yang BSc, J Sun MD, Prof B Xi MD) **and Department of Nutrition and Food Hygiene** (M Zhao MD), **School of Public Health, Qilu Hospital, Cheeloo College of Medicine, Shandong University, Jinan, China; Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia** (C G Magnussen PhD); **Research Centre of Applied and Preventive Cardiovascular Medicine, University of Turku, Turku, Finland** (C G Magnussen); **Centre for Population Health Research, University of Turku and Turku University Hospital, Turku, Finland** (C G Magnussen)

Correspondence to:
Prof Bo Xi, Department of Epidemiology, School of Public Health, Qilu Hospital, Cheeloo College of Medicine, Shandong University, Jinan 250012, China
xibo2007@126.com

Introduction

Tobacco use is an important preventable risk factor for non-communicable disease and premature death worldwide. Data from the Global Youth Tobacco Surveys (GYTS) from 2010 to 2018 showed that the global prevalence of tobacco use in young adolescents aged 13–15 years was high, at 11·3% in males and 6·1% in females.[1] Exposure to tobacco advertisements (eg, seeing people use tobacco in films) is suggested to be one cause of the initiation of tobacco use among young people.[2,3] In addition, Gilpin and colleagues[4] found that a high level of receptivity to tobacco advertisements and promotions among young adolescents aged 12–15 years was associated with a high probability of becoming established smokers 6 years later.

Prohibiting tobacco advertisements and promotion is one of the key measures recommended by the WHO Framework Convention on Tobacco Control (FCTC) to control tobacco use worldwide. To protect people from exposure to tobacco advertisements, effective strategies and measures have been taken in many countries. For example, the comprehensive tobacco-free film and movie rules were introduced in India in 2012, and there was a substantial reduction in the appearance of tobacco imagery in movies.[5] Evidence showed that exposure to the Real Cost anti-tobacco campaign could reduce the

Research in context

Evidence before this study

We searched PubMed to identify all relevant papers on the global proportion of exposure in children or adolescents to pro-tobacco advertisements or anti-tobacco advertisements published between Jan 1, 2000, and Jan 9, 2023, using the keywords: "tobacco advertisements" OR "anti-tobacco advertisements" OR "tobacco marketing" AND "children" OR "adolescents" OR "youth", with no language restrictions. Only old national or regional data (before 2011) had reported the proportion of exposure to tobacco advertisements (eg, 82·8% of adolescents reported seeing actors smoking on television or in films in 2011 in South Africa) or anti-tobacco advertisements among adolescents. In addition, no studies had assessed trends in the proportion of exposure to tobacco advertisements or anti-tobacco advertisements among adolescents.

Added value of this study

We provide the most recent global proportions of, and trends in, exposure to pro-tobacco and anti-tobacco advertisements from 1999 to 2018 among adolescents aged 12–16 years, using data from the Global Youth Tobacco Survey. We found that 73·1% of adolescents reported being exposed to at least one source of tobacco advertisement (especially exposure via electronic media, 64·6%), and 71·0% of adolescents reported being exposed to anti-tobacco advertisements. The proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements decreased in more than 90% of included countries.

Implications of all the available evidence

The proportion of young adolescents exposed to tobacco advertisements worldwide remains high (73·1%), whereas anti-tobacco advertisements have only reached 71·0% of young adolescents. Anti-tobacco marketing and the prohibition of tobacco marketing that form part of control efforts aimed at reducing adolescent tobacco initiation and use worldwide are inadequate and require strengthening.

probability of tobacco use.[6] Unfortunately, the proportion of adolescents exposed to tobacco advertisements remains high in most countries. Data from the 2002–05 GYTS in 25 European countries showed that 18·2% of adolescents aged 13–15 years owned an object with a cigarette brand logo on it, ranging from 10·1% in Turkey to 33·2% in Latvia.[7] Another study using data from the 2013–18 GYTS in 22 African countries suggested that 13·8% of included adolescents were exposed to promotion from the tobacco industry, and 61·2% were exposed to anti-smoking media messages.[8] To our knowledge, however, no previous studies have assessed the most recent proportions and trends in exposure to pro-tobacco and anti-tobacco advertisements among young adolescents aged 12–16 years based on global data.

We aimed to estimate the global proportions and trends in exposure to pro-tobacco and anti-tobacco advertisements among young adolescents aged 12–16 years on the basis of data from the GYTS collected between 1999 and 2018. We also aimed to compare the proportions of exposure to pro-tobacco or anti-tobacco advertisements between sex, age group, WHO region, World Bank income categories, current tobacco-use status, parental smoking status, FCTC ratification status, and implementation status of tobacco advertising and promotion bans.

Methods

Study design and participants

In this analysis of repeated cross-sectional surveys, data on exposure to pro-tobacco and anti-tobacco advertisements among young adolescents aged 12–16 years were extracted from the nationally representative, school-based, and self-administered GYTS carried out in 142 countries and territories (hereafter referred to as countries). The research protocol of GYTS was developed by WHO and the US Centers for Disease Control and Prevention (CDC). GYTS is a cross-sectional survey that uses standardised sampling methods and questionnaires, thus enabling comparison between and within countries. All countries used a two-stage sampling strategy, in which schools were randomly selected in the first stage, and classes were randomly selected from the selected schools in the second stage. All students in the selected classes were eligible and invited to complete the questionnaire voluntarily. All participating adolescents and their parents gave informed consent in all included countries. Further information on the GYTS is described by the CDC.[9] Ethical approval for our study was waived by the ethics committee of Shangdong University because of the open-access and deidentified individual participant data.

We used the most recent data collected in the 142 countries from 2010 to 2018 to assess the proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements. Additionally, we used data from 120 countries that had done at least two GYTS between 1999 and 2018, to assess the trends in the proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements over that time period. The minimum values of the year difference between the first and last surveys were 3 years, the median 11 years, and the maximum 18 years. We excluded and included country data in our analyses on the basis of several criteria (appendix 2 p 1).

See Online for appendix 2

Definition of exposure to pro-tobacco and anti-tobacco advertisements

Tobacco advertisement exposure was assessed on the basis of the following three questions: "During the past 30 days, did you see any people using tobacco on television, in videos, or movies?", "During the past 30 days, did you see any advertisements or promotions for tobacco products at points of sale (such as stores, shops, kiosks, supermarkets, markets, restaurants, and convenience stores)?", and "Do you have something (for example, t-shirt, pen, backpack) with a tobacco product brand logo on it?", with exposure defined as an affirmative response to any of the above questions. Anti-tobacco advertisement exposure was assessed on the basis of the following two survey questions: "During the past 30 days, did you see or hear any anti-tobacco media messages on television, radio, internet, billboards, posters, newspapers, magazines, or movies?" and "During the past 30 days, did you see or hear any anti-tobacco messages at sports events, fairs, concerts, or community events, or social gatherings?", with exposure defined as an affirmative response to either of these two questions. It should be noted that information on exposure to tobacco advertisements at points of sale was collected from 2009. To ensure the uniformity of the questions in all included countries, the questionnaire was translated into the local language of the specific country and translated back to English.

Additional survey questions and variables

Current tobacco use was defined as using either cigarettes or other tobacco products (eg, chewing tobacco, snuff, dip, cigars, cigarillos, pipe, or e-cigarettes) on at least 1 day during the past 30 days.[1] Parental smoking status was assessed with the question "Do your parents smoke tobacco?". The corresponding answers were neither, father only, mother only, or both. We extracted the income level in each country from the World Bank website[10] on the basis of the most recent survey year of the GYTS. We then extracted the FCTC ratification years in each country from WHO FCTC.[11] We also extracted years of the tobacco advertising and promotion bans implementation recommended by FCTC in each country from the WHO report on the global tobacco epidemic 2019.[12]

Statistical analysis

Exposure to tobacco advertisements and anti-tobacco advertisements were calculated as a proportion and 95% CI in each country by using the sampling weights, strata, and primary sampling units provided by participating countries from the dataset. The original sampling weights in the dataset were used to calculate the weighted proportions in each country, and the recalculated weights (dividing original weight by the sum of original weight and then multiplying by the subpopulation in each country) were used to calculate the overall and subgroup (eg, sex, age group, WHO region, World Bank income categories, current tobacco use status, parental smoking status, FCTC ratification status, and implementation status of tobacco advertising and promotion bans) proportions. χ^2 test was used to examine the differences in proportions between subgroups. We used the Bonferroni method for the correction of multiple comparisons to indicate a statistically significant difference. Poisson regression analysis with a robust error-variance estimator after adjusting for survey year, sex, and age (as a continuous variable) was used to examine the trends in the proportions of binary pro-tobacco or anti-tobacco advertisement exposure in each country in consideration of all surveys between 1999 and 2018.[13] Trend patterns were classified into three categories (up, the regression coefficient [β]>0 and $p<0\cdot05$; down, $\beta<0$ and $p<0\cdot05$; and unchanged, $p\geq0\cdot05$ no matter what the β value was). It should be noted that when performing subgroup analysis by age or sex, these two variables were not adjusted. All data analyses were done using SAS 9.4. A two-sided $p<0\cdot05$ was considered statistically significant.

Role of the funding source

The funder of the study had no role in the study design, data collection, data analyses, data interpretation, or writing of the report.

Results

This study included 710 191 young adolescents aged 12–16 years (females 362 573 [51·1%] and males 347 618 [48·9%]) from 142 countries with data on exposure to pro-tobacco and anti-tobacco advertisements in 2010–18. Of these 142 countries, 22 (15%) were located in the African region, 30 (21%) in the American region, 24 (17%) in the Eastern Mediterranean region, 33 (23%) in the European region, nine (6%) in the South-East Asian region, and 24 (17%) in the Western Pacific region (appendix 2 pp 2–7).

Using the most recent data from 142 countries collected from Jan 1, 2010, to Dec 31, 2018, 433 585 (64·6%; weighted) of 710 191 adolescents (95% CI 63·5–65·7) reported seeing people using tobacco on electronic media during the past 30 days, 206 766 (33·1%) of 710 191 (31·9–34·4) reported seeing advertisements at points of sale, 63 385 (10·2%) of 710 191 (9·7–10·6) reported owning something with a tobacco brand logo, and 490 006 (73·1%) of 710 191 (72·1–74·0) reported being exposed to at least one source of tobacco advertisement; 431 862 (63·6%) of 710 191 (62·3–64·9) reported seeing or hearing anti-tobacco messages in the media, 227 658 (34·1%) of 710 191 (32·8–35·3) reported seeing or hearing anti–tobacco messages during gathering activities (eg, sports events, fairs, concerts, community events, or social gatherings), and 484 365 (71·0%) of 710 191 (69·8–72·2) reported being exposed to at least one source of anti–tobacco advertisement (table 1). The proportions of adolescents exposed to pro-tobacco and anti-tobacco

	Number of countries	Sample size	Tobacco advertisements				Anti-tobacco advertisements		
			Seeing people use tobacco on electronic media (n=433 585)	Seeing advertisements at points of sale (n=206 766)	Having something with a tobacco brand logo (n=63 385)	Any of the three advertisement exposures (n=490 006)	Seeing or hearing anti-tobacco messages on media (n=431 862)	Seeing or hearing anti-tobacco messages on gathering activities (n=227 658)	Any of the two advertisement exposures (n=484 365)
Total	142	710 191	64·6% (63·5–65·7)	33·1% (31·9–34·4)	10·2% (9·7–10·6)	73·1% (72·1–74·0)	63·6% (62·3–64·9)	34·1% (32·8–35·3)	71·0% (69·8–72·2)
Age group									
12–14 years	142	427 647	64·4% (63·0–65·8)	33·8% (32·3–35·3)	9·5% (9·0–10·1)	72·9% (71·7–74·1)	63·9% (62·4–65·3)	34·2% (32·8–35·6)	71·3% (70·0–72·6)
15–16 years	142	282 544	64·9% (63·6–66·3)	31·8% (30·5–33·1)	11·4% (10·7–12·0)	73·4% (72·2–74·6)	63·0% (61·5–64·5)	33·8% (32·3–35·3)	70·4% (69·0–71·8)
p value	..	..	0·53	0·019	<0·0001*	0·46	0·26	0·62	0·21
Sex									
Male	142	347 618	64·4% (63·1–65·7)	35·6% (34·1–37·2)	12·0% (11·4–12·7)	73·9% (72·8–75·0)	62·9% (61·4–64·4)	36·1% (34·7–37·5)	71·3% (70·0–72·5)
Female	142	362 573	64·8% (63·4–66·2)	30·5% (28·9–32·0)	8·2% (7·7–8·7)	72·1% (70·9–73·4)	64·3% (62·7–65·8)	31·9% (30·4–33·4)	70·7% (69·3–72·1)
p value	..	..	0·63	<0·0001*	<0·0001*	0·010	0·10	<0·0001*	0·38
WHO region									
Africa	22	82 196	52·0% (49·7–54·2)	24·2% (22·5–25·9)	10·6% (9·7–11·5)	61·1% (59·0–63·2)	63·0% (60·7–65·3)	29·0% (27·6–30·4)	68·1% (66·0–70·1)
Americas	30	89 997	65·4% (63·1–67·7)	32·5% (30·7–34·3)	9·8% (9·1–10·6)	73·0% (71·0–74·9)	51·9% (50·0–53·8)	36·4% (33·6–39·3)	64·1% (61·7–66·6)
Eastern Mediterranean	24	55 723	69·2% (66·6–71·9)	42·5% (39·0–46·0)	12·5% (11·3–13·7)	79·3% (77·1–81·4)	64·6% (61·8–67·4)	36·4% (32·9–39·9)	74·3% (72·2–76·5)
Europe	33	244 326	67·9% (66·0–69·8)	24·1% (22·7–25·5)	9·0% (8·3–9·7)	74·5% (72·8–76·2)	55·4% (54·1–56·8)	20·9% (19·7–22·1)	60·5% (59·1–61·9)
South-East Asia	9	24 380	67·5% (64·8–70·1)	35·8% (33·1–38·5)	9·3% (8·3–10·4)	75·6% (73·3–77·8)	74·8% (72·5–77·1)	40·2% (37·8–42·7)	79·2% (77·2–81·2)
Western Pacific	24	213 569	64·3% (63·0–65·7)	32·7% (31·1–34·3)	7·7% (7·0–8·5)	73·6% (72·5–74·7)	72·0% (70·6–73·5)	28·3% (27·0–29·5)	76·8% (75·7–77·9)
p value	..	..	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*
World Bank income category									
Low	18	54 551	60·1% (57·3–63·0)	27·2% (24·1–30·3)	10·4% (9·4–11·4)	68·1% (65·5–70·8)	68·0% (65·5–70·5)	37·8% (35·3–40·4)	72·8% (70·7–75·0)
Lower middle	41	132 710	63·0% (61·0–64·9)	37·2% (34·9–39·4)	10·1% (9·3–10·9)	72·9% (71·2–74·6)	66·9% (64·9–68·8)	30·7% (28·7–32·6)	73·4% (71·8–75·0)
Upper middle	49	417 753	66·7% (64·9–68·5)	31·6% (30·2–33·0)	10·3% (9·7–10·9)	74·1% (72·6–75·6)	58·8% (56·7–60·9)	37·5% (35·3–39·7)	69·0% (66·8–71·2)
High	34	105 177	73·5% (72·1–75·0)	32·9% (30·8–35·1)	9·1% (8·2–10·1)	81·4% (80·3–82·4)	57·4% (55·8–59·0)	26·5% (24·0–28·9)	64·6% (62·7–66·4)
p value	..	..	<0·0001*	<0·0001*	0·42	<0·0001*	<0·0001*	<0·0001*	<0·0001*
Current tobacco use									
Yes	142	92 649	69·8% (68·0–71·6)	45·0% (42·8–47·1)	22·3% (21·0–23·6)	82·2% (80·8–83·6)	62·4% (60·1–64·7)	39·7% (37·4–42·0)	72·4% (70·1–74·7)
No	142	614 862	63·9% (62·7–65·0)	31·5% (30·2–32·9)	8·4% (8·0–8·8)	71·7% (70·7–72·8)	63·7% (62·4–65·1)	33·2% (31·9–34·5)	70·8% (69·6–72·0)
p value	..	..	<0·0001*	<0·0001*	<0·0001*	<0·0001*	0·22	<0·0001*	0·18
Parental smoking status									
Neither	109	247 007	63·9% (62·6–65·2)	30·5% (29·3–31·6)	9·3% (8·8–9·8)	71·7% (70·5–72·9)	64·6% (63·4–65·8)	36·3% (34·9–37·6)	72·3% (71·3–73·4)
Father only	109	111 647	72·6% (71·2–73·9)	40·2% (38·4–42·0)	11·2% (10·4–12·0)	80·2% (79·1–81·3)	68·3% (67·1–69·6)	39·0% (37·3–40·7)	76·0% (74·9–77·1)
Mother only	109	26 583	74·1% (71·7–76·4)	34·1% (31·5–36·6)	14·9% (12·9–16·9)	81·7% (79·7–83·6)	60·9% (57·9–63·8)	40·4% (36·8–44·0)	71·4% (68·9–73·9)
Both	109	49 185	71·7% (69·3–74·1)	37·1% (34·9–39·3)	18·3% (16·5–20·1)	81·6% (79·8–83·4)	61·3% (58·6–64·0)	41·3% (38·4–44·3)	72·3% (70·1–74·6)
p value	..	..	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*	<0·0001*
FCTC ratification									
Yes	123	662 037	65·9% (64·7–67·1)	32·0% (30·6–33·4)	10·3% (9·8–10·8)	73·7% (72·7–74·8)	65·4% (64·2–66·6)	36·2% (34·9–37·6)	73·3% (72·3–74·3)
No	19	48 154	58·2% (55·4–60·9)	37·9% (35·8–40·0)	9·4% (8·5–10·3)	69·6% (67·1–72·1)	54·4% (51·3–57·5)	23·1% (21·1–25·0)	59·2% (56·3–62·1)
p value	..	..	<0·0001*	<0·0001*	0·088	0·0022	<0·0001*	<0·0001*	<0·0001*
Implementation status of tobacco advertising and promotion bans recommended by FCTC									
Yes	28	193 912	56·9% (54·7–59·1)	26·5% (24·8–28·2)	12·2% (11·0–13·4)	66·0% (64·0–68·1)	62·8% (60·9–64·7)	29·6% (28·0–31·1)	68·2% (66·5–69·9)
No	114	516 279	65·6% (64·4–66·8)	34·2% (32·8–35·5)	9·9% (9·4–10·3)	74·0% (73·0–75·0)	63·7% (62·3–65·1)	34·7% (33·3–36·1)	71·4% (70·0–72·7)
p value	..	..	<0·0001*	<0·0001*	0·0002*	<0·0001*	0·46	<0·0001*	0·0037

Data are presented as percentages (95% CI) unless otherwise stated. χ^2 test was used to examine the differences in proportions between age groups, sex, WHO regions, groups of World Bank income category, groups of FCTC ratification status, groups of implementation status of tobacco advertising and promotion bans recommended by FCTC, groups of current tobacco use, and groups of parental smoking status. FCTC=Framework Convention on Tobacco Control. *p<0·0009 (0·05/56) on the basis of the Bonferroni method for the correction of multiple comparisons was used to indicate a statistically significant difference. All proportions and their 95% CIs were calculated considering weights provided by the GYTS.

Table 1: **Proportions of adolescents aged 12–16 years exposed to different types of pro-tobacco and anti-tobacco advertisements**

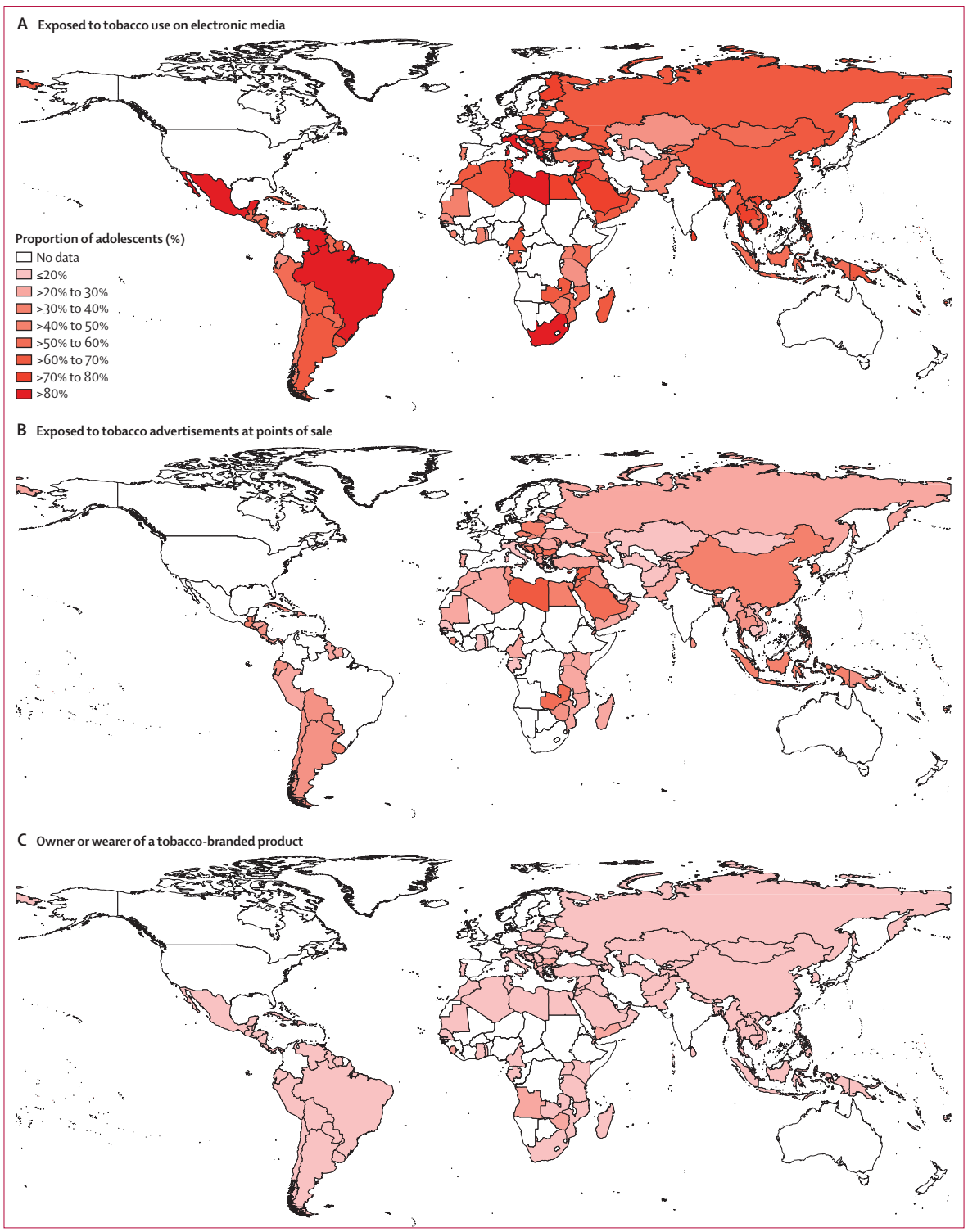

Figure 1: **Proportion of adolescents aged 12–16 years exposed to tobacco advertisements from the Global Youth Tobacco Surveys conducted in 142 countries in 2010–18**

advertisements varied by country (figures 1, 2; appendix 2 pp 8–13). The proportion of sources of tobacco advertisement exposure were lower (7·7–8·0%) among countries that had implemented tobacco advertising and promotion bans than in countries that had not (except in the case of owning something with a tobacco logo; table 1).

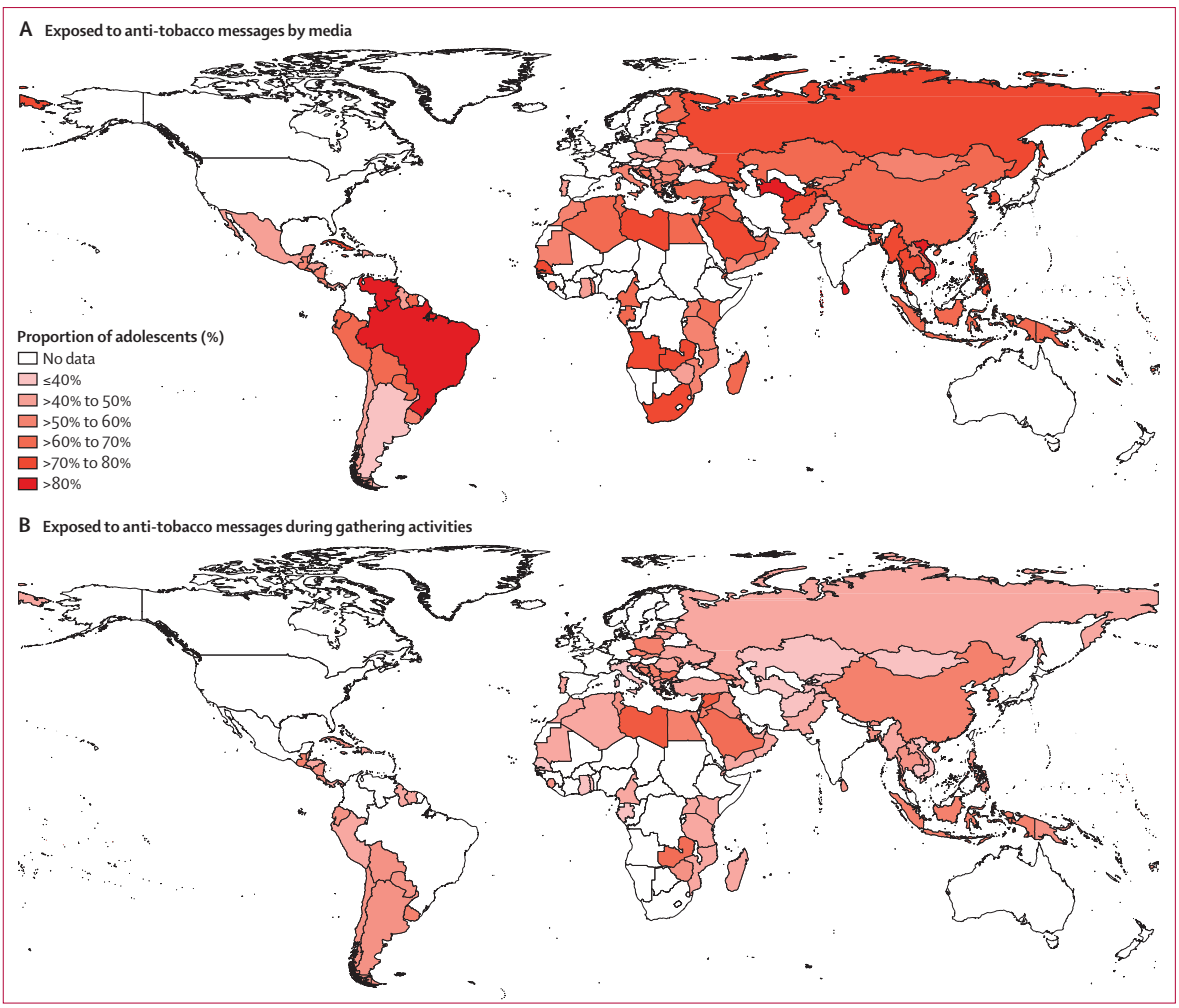

Figure 2: **Proportion of adolescents aged 12–16 years exposed to anti-tobacco advertisements from the Global Youth Tobacco Surveys conducted in 142 countries in 2010–18**

The proportions of pro-tobacco and anti-tobacco advertisement exposure during the past 30 days varied by WHO region, World Bank income category, tobacco use status, parental smoking status, FCTC ratification status, and implementation status of tobacco advertising and promotion bans recommended by FCTC (table 1; appendix 2 pp 14–15).

Overall, 322 842 (46·8%) of 710 191 adolescents (45·8–47·8) reported being exposed to one source of tobacco advertisement, 150 691 (23·5%) of 710 191 (22·5–24·5) reported being exposed to two sources of tobacco advertisements, and 19 575 (2·8%) of 710 191 (2·5–3·0) reported being exposed to three sources of tobacco advertisements (appendix 2 pp 16–18). The proportion exposed to several sources of tobacco advertisements varied by country and tobacco use status (appendix 2 pp 19–31). The proportions exposed to two or three sources of tobacco advertisements were higher among tobacco users (two sources, 25 500 [30·5%] of 92 649, 28·9–32·1 and three sources, 6244 [7·1%] of 92 649, 6·2–8·1) versus non-tobacco users (two sources, 124 059 [22·5%] of 614 862, 21·4–23·6 and three sources, 12 859 [2·2%] of 614 862, 2·0–2·4), and were higher in countries that had not ratified the FCTC (two sources, 12 491 [27·1%] of 48 154, 25·4–28·8 and three sources, 1860 [3·8%] of 48 154, 3·1–4·4) versus those that had ratified the FCTC (two sources, 136 960 [22·7%] of 662 037, 21·6–23·9 and three sources, 17 405 [2·6%] of 662 037, 2·3–2·8). The proportion of non-exposure to tobacco advertisements was higher in countries that had implemented tobacco advertising and promotion bans (64 108 [34·0%] of 193 912, 31·9–36·0) than in countries that had not (150 289 [26·0%] of 516 279, 25·0–27·0; appendix 2 pp 16–18).

Overall, 329 840 (45·5%) of 710 191 (44·4–46·4) adolescents reported being exposed to one source of anti-tobacco advertisement, and 148 475 (25·5%) of 710 191 (24·3–26·6) reported being exposed to two sources of anti-tobacco advertisements (appendix 2 pp 32–34). Although the proportions exposed to one or two sources

	Number. of countries	Sample size	Exposure to tobacco advertisements		Non exposure to tobacco advertisements		p value
			Exposure to anti-tobacco advertisements (n=361 924)	Non-exposure to anti-tobacco advertisements (n=133 365)	Exposure to anti-tobacco advertisements (n=118 945)	Non-exposure to anti-tobacco advertisements (n=95 957)	
Total	142	710 191	55·9 (54·7–57·1)	17·2 (16·2–18·2)	15·1 (14·5–15·7)	11·8 (11·2–12·5)	<0·0001*
Age group							0·25
12–14 years	142	427 647	56·1 (54·7–57·4)	16·8 (15·7–17·9)	15·2 (14·5–15·9)	11·9 (11·1–12·7)	..
15–16 years	142	282 544	55·6 (54·0–57·1)	17·9 (16·8–19·1)	14·9 (14·1–15·7)	11·6 (10·9–12·4)	..
Sex	..	..	..	..	..	..	0·045
Male	142	347 618	56·6 (55·3–57·9)	17·4 (16·2–18·6)	14·7 (14·0–15·4)	11·3 (10·6–12·1)	..
Female	142	362 573	55·2 (53·7–56·6)	17·0 (15·9–18·1)	15·5 (14·7–16·3)	12·3 (11·5–13·1)	..
WHO region							<0·0001*
Africa	22	82 196	47·3 (45·3–49·3)	13·8 (13·0–14·6)	20·8 (19·4–22·1)	18·1 (16·1–20·1)	..
Americas	30	89 997	50·9 (48·6–53·3)	22·2 (19·9–24·4)	13·2 (12·2–14·2)	13·7 (12·3–15·1)	..
Eastern Mediterranean	24	55 723	62·3 (59·7–64·9)	17·0 (15·1–18·9)	12·0 (10·4–13·6)	8·7 (7·7–9·6)	..
Europe	33	244 326	46·3 (45·0–47·7)	28·3 (26·7–29·9)	14·2 (13·0–15·3)	11·2 (10·4–12·0)	..
South-East Asia	9	24 380	63·8 (61·5–66·1)	11·8 (10·0–13·6)	15·4 (14·0–16·7)	9·0 (7·7–10·4)	..
Western Pacific	24	213 569	60·3 (59·2–61·4)	13·4 (12·5–14·3)	16·5 (15·7–17·4)	9·8 (9·1–10·5)	..
World Bank income							<0·0001*
Low	18	54 551	55·5 (53·0–58·0)	12·7 (10·8–14·6)	17·4 (16·0–18·7)	14·5 (12·8–16·2)	..
Lower middle	41	132 710	57·5 (55·6–59·3)	15·5 (14·2–16·7)	15·9 (14·7–17·2)	11·1 (10·1–12·2)	..
Upper middle	49	417 753	54·8 (52·7–56·8)	19·4 (17·6–21·2)	14·2 (13·4–15·1)	11·6 (10·5–12·7)	..
High	34	105 177	55·0 (53·1–56·8)	26·4 (24·6–28·2)	9·6 (9·0–10·3)	9·0 (8·3–9·6)	..
Parental smoking status							<0·0001*
Neither	109	247 007	56·2 (54·8–57·5)	15·6 (14·9–16·2)	16·2 (15·4–16·9)	12·1 (11·4–12·8)	..
Father only	109	111 647	64·2 (62·8–65·6)	16·0 (15·1–16·8)	11·8 (11·1–12·6)	8·0 (7·3–8·6)	..
Mother only	109	26 583	60·8 (58·1–63·6)	21·0 (18·7–23·2)	10·7 (9·1–12·2)	7·5 (6·3–8·7)	..
Both	109	49 185	61·4 (58·8–64·0)	20·4 (18·4–22·4)	10·9 (9·6–12·3)	7·3 (6·2–8·3)	..
FCTC ratification							<0·0001*
Yes	123	662 037	58·0 (56·9–59·2)	15·7 (14·9–16·5)	15·3 (14·7–15·9)	10·9 (10·3–11·6)	..
No	19	48 154	45·2 (42·8–47·6)	24·6 (21·7–27·4)	14·0 (12·3–15·7)	16·3 (14·6–17·9)	..
Implementation of tobacco advertising and promotion bans recommended by FCTC							<0·0001*
Yes	28	193 912	50·7 (48·7–52·7)	15·3 (14·4–16·3)	17·5 (16·4–18·6)	16·4 (14·9–18·0)	..
No	114	516 279	56·6 (55·3–57·9)	17·5 (16·4–18·5)	14·8 (14·1–15·4)	11·2 (10·5–11·9)	..

Data are presented as percentages (95% CI) unless otherwise stated. χ^2 test was used to examine the differences in proportions between age groups, sex, WHO regions, groups of World Bank income category, groups of FCTC ratification status, groups of implementation status of tobacco advertising and promotion bans recommended by FCTC, groups of current tobacco use, and groups of parental smoking status. FCTC=framework convention on tobacco control. *p<0·0063 (0·05/8) on the basis of the Bonferroni method for the correction of multiple comparisons was used to indicate a statistically significant difference.

Table 2: **Proportions of combined categories of exposure to pro-tobacco and anti-tobacco advertisements among adolescents aged 12–16 years**

of anti-tobacco advertisements varied by country, the proportions were not different between those currently and not currently using any tobacco product in most countries (appendix 2 pp 35–46). We observed no differences between age groups and sexes (appendix 2 pp 32–34). The proportion of adolescents exposed to several sources of anti-tobacco advertisements varied by WHO region, World Bank income category, parental smoking status, ratification status of the FCTC, and implementation status of the tobacco advertising and promotion bans (appendix 2 pp 32–34, 47).

Overall, 361 924 (55·9%) of 710 191 adolescents (54·7–57·1) reported being exposed to both pro-tobacco and anti-tobacco advertisements; 133 365 (17·2%) of 710 191 (16·2–18·2) reported being exposed to tobacco advertisements only, 118 945 (15·1%) of 710 191 (14·5–15·7) reported being exposed to anti-tobacco advertisements only, and 95 957 (11·8%) of 710 191 (11·2–12·5) reported neither exposure (table 2). The proportions of combined categories of exposure to pro-tobacco and anti-tobacco advertisements varied by country (appendix 2 pp 48–54). The proportions also

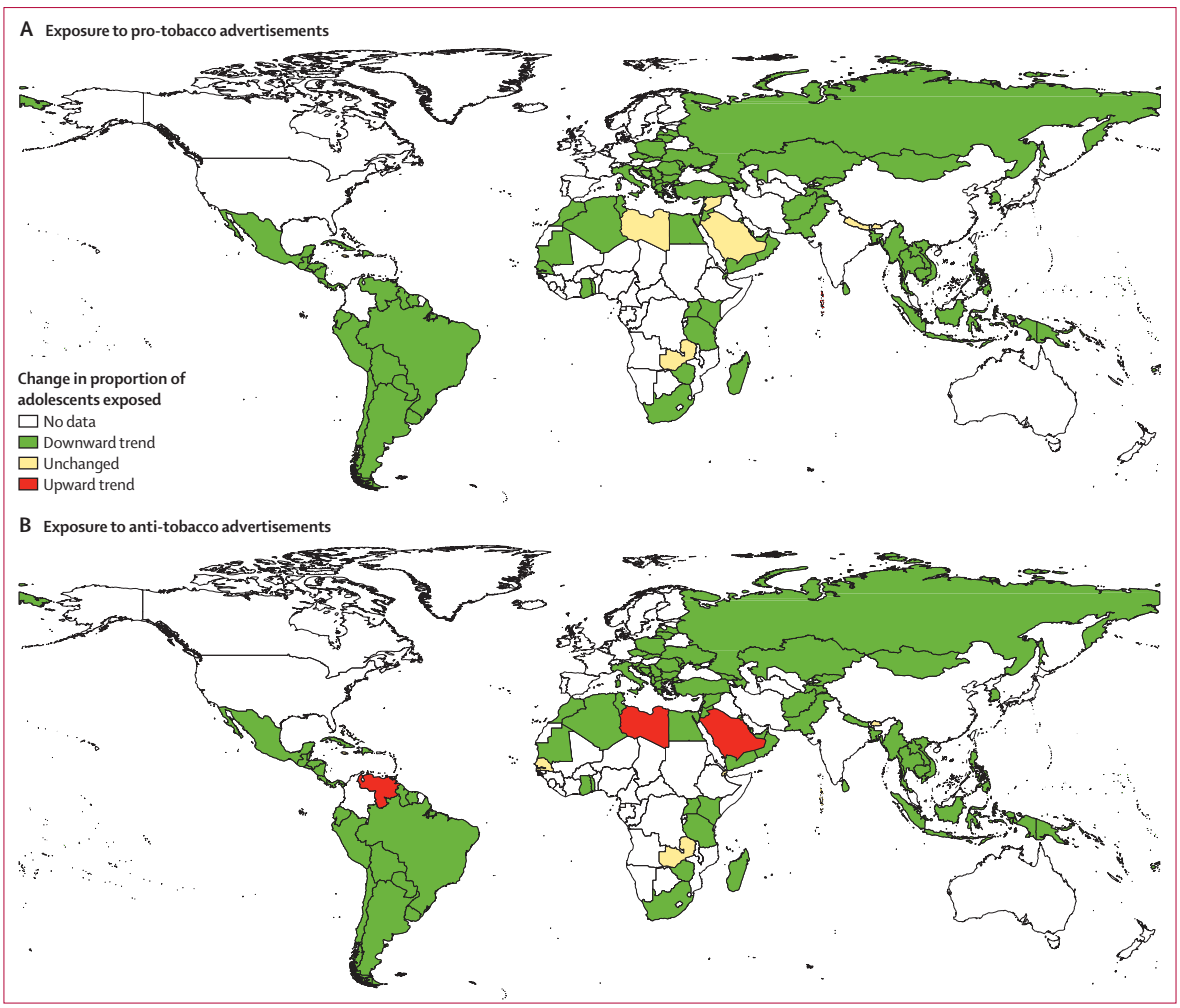

Figure 3: **Secular trends in proportions of pro-tobacco and anti-tobacco advertisements exposure among adolescents aged 12–16 years in 120 countries from 1999 to 2018**

varied by WHO region, World Bank income category, parental smoking status, ratification status of the FCTC, and implementation status of the tobacco advertising and promotion bans (table 2).

In this study, 120 countries (of 142 countries used for proportion description) did at least two surveys from Jan 1, 1999, to Dec 31, 2018. 1482031 young adolescents aged 12–16 years were included to assess trends in the proportions exposed to pro-tobacco and anti-tobacco advertisements from 1999 to 2018. Trends in the proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements varied across countries (figure 3; appendix 2 pp 55–65). From 1999 to 2018, among 120 countries, the proportion exposed to tobacco advertisements decreased in 111 (92·5%) countries, increased in two (1·7%) countries, and remained unchanged in seven (5·8%) countries. Similarly, the proportion exposed to anti-tobacco advertisements also decreased in 110 (91·7%) countries, increased in three (2·5%) countries, and remained unchanged in seven (5·8%) countries (table 3). Although, the difference was not statistically significant (p=0·51), the decrease in proportion of exposure to anti-tobacco advertisements in countries that had implemented the tobacco advertising and promotion bans (23 [88·5%] of 26) was lower versus those that had not (87 [92·6%] of 94; table 3). Of note, we found that nearly all included countries that had implemented tobacco advertising and promotion bans showed decreasing trends in the proportions of exposure to pro-tobacco and anti-tobacco advertisements (appendix 2 pp 66–67).

Overall, the proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements decreased markedly from 1999 to 2018, with a decrease of 11·8% (10·5–13·1; calculated per five calendar-years) in seeing people using tobacco on electronic media, a decrease of 2·4% (1·8–3·1) in owning something with a tobacco brand logo, a decrease in 8·9% (7·8–10·1) in seeing or hearing anti-tobacco messages on the media, and a decrease in 14·1% (12·3–15·8) in seeing or hearing

anti-tobacco messages at gathering activities (appendix 2 pp 68–69).

Discussion

On the basis of the most recent data from 142 countries collected in 2010–18, we observed that 73·1% of adolescents reported being exposed to one or more source of tobacco advertisements whereas 71·0% reported that they were exposed to one or more source of anti-tobacco advertisements. Variation was substantial across the included countries. We found that the proportion of tobacco advertisement exposure had decreased in the majority of countries. The proportion of adolescents exposed to anti-tobacco advertisements tended to be higher among FCTC-ratified countries than in non-ratified countries. Another important finding was that nearly all included countries that had implemented tobacco advertising and promotion bans showed a decreasing trend in the proportion of exposure to tobacco advertisements.

We found that the most common way for adolescents to be exposed to tobacco advertisements was through electronic media. Similarly, Madkour and colleagues[14] found that more than 75% of adolescents aged 13–15 years reported seeing actors smoking on television or in movies in all five north African countries in 2005–07. In addition, we found that the proportion of adolescents that reported seeing people using tobacco on electronic media was similar between the sexes and age groups. However, the proportion of adolescents who were exposed increased as country income level increased, being much higher in the Eastern Mediterranean and European regions (*vs* African region). This result might be explained by the high access to media (eg, television and internet at home) in higher-income countries. These findings suggest that exposure of adolescents to tobacco advertisements, especially from electronic media and in higher-income countries, remains a major public health problem.

Advertisements at the point of sale was the second main way that adolescents reported being exposed to tobacco advertisements. Braun and colleagues[15] found that 66·3% of adolescents reported being exposed to cigarette advertisements at points of sale in Argentina. Retailers, particularly tobacco retailers, near schools have attracted wide attention in many countries. Wang and colleagues[16] reported that more than 25% of stores (within 100 m of schools) had exterior tobacco advertisements and almost all the advertisements were designed for young people (ie, displaying cigarettes within 1 m of the floor, and displaying cigarettes near toys and candies). These findings suggest that banning tobacco retail sales near schools might be an effective measure to decrease the possibility of exposure to tobacco advertisements at the point of sale for young people.

Although 63·6% of adolescents reported seeing or hearing anti-tobacco messages in the media and 34·1% at gathering activities, 29·0% of adolescents who were not exposed to any source of anti-tobacco advertisements in our study remained. Stevens and colleagues[6] found that exposure to the Real Cost anti-tobacco campaign could reduce the chance of tobacco use. These findings suggest that a more comprehensive implementation of a sustainable anti-tobacco advertising campaign should be put into effect. Additionally, electronic cigarettes are used as an alternative method for smoking cessation among adult smokers because they have been advertised as less harmful to health than conventional cigarettes in recent years.[17] Evidence has shown that the use of electronic cigarettes among adolescents in many countries is popular.[18] These data

	Number of countries	Tobacco advertisements			Anti-tobacco advertisements		
		Down	Up	Unchanged	Down	Up	Unchanged
Total	120	111 (92%)	2 (2%)	7 (6%)	110 (92%)	3 (2%5)	7 (6%)
Sex							
Male	120	111 (92%)	2 (2%)	7 (6%)	105 (87%)	1 (<1%)	14 (12%)
Female	120	108 (90%)	0	12 (10%)	107 (89%)	4 (3%)	9 (7%)
Age group							
12–14 years	120	110 (92%)	1 (<1%)	9 (7%)	107 (89%)	4 (3%)	9 (7%)
15–16 years	120	110 (92%)	1 (<1%)	9 (7%)	105 (87%)	1 (<1%)	14 (12%)
WHO region							
Africa	14	13 (93%)	0	1 (7%)	12 (86%)	0	2 (14%)
Americas	29	28 (97%)	0	1 (3%)	27 (93%)	1 (3%)	1 (3%)
Eastern Mediterranean	23	20 (87%)	0	3 (13%)	20 (87%)	2 (9%)	1 (4%)
Europe	29	29 (100%)	0	0	29 (100%)	0	0
South-East Asia	9	5 (56%)	2 (22%)	2 (22%)	6 (67%)	0	3 (33%)
Western Pacific	16	16 (100%)	0	0	16 (100%)	0	0
World Bank income							
Low	14	13 (93%)	0	1 (7%)	14 (100%)	0	0
Lower middle	36	32 (89%)	1 (3%)	3 (8%)	31 (86%)	0	5 (14%)
Upper middle	43	40 (93%)	1 (2%)	2 (5%)	39 (91%)	2 (5%)	2 (5%)
High	27	26 (96%)	0	1 (4%)	26 (96%)	1 (4%)	0
Current tobacco use							
Yes	120	101 (84%)	1 (<1%)	18 (15%)	95 (79%)	1 (<1%)	24 (20%)
No	120	108 (90%)	1 (<1%)	11 (9%)	109 (91%)	3 (2%5)	8 (7%)
FCTC ratification							
Yes	104	95 (91%)	2 (2%)	7 (7%)	94 (90%)	3 (3%)	7 (7%)
No	16	16 (100%)	0	0	16 (100%)	0	0
Implementation status of tobacco advertising and promotion bans recommended by FCTC							
Yes	26	24 (92%)	1 (4%)	1 (4%)	23 (88%)	1 (4%)	2 (8%)
No	94	87 (93%)	1 (1%)	6 (6%)	87 (93%)	2 (2%)	5 (5%)

Data are presented as n (%). Some percentages do not add up to 100% due to rounding. Trend patterns were classified into three categories (up, the regression coefficient [β]>0 and p<0·05; down, β<0 and p<0·05; and unchanged, p≥0·05 no matter what the β value was) based on the trend analyses for each of all the included countries and territories (appendix 2 pp 55–65). FCTC=Framework Convention on Tobacco Control.

Table 3: **Proportions of countries with upward, downward, and unchanged trends in pro-tobacco and anti-tobacco advertisements exposure (from one or more sources) among adolescents aged 12–16 years between 1999 and 2018**

suggest that when implementing tobacco-control regulations, not only should tobacco advertisements be limited and policies to control them be strengthened, especially some new forms or avenues of tobacco advertisements, but emphasis should also be placed on strengthening education programmes among young people to counteract the presumed negative effects of the exposure to tobacco advertisements.

It is worth noting that the proportions of exposure to tobacco advertisements were higher in countries that had ratified the FCTC than in those that had not. This characteristic might be partly explained by the fact that higher proportions of adolescents from countries that had ratified the FCTC (*vs* those that had not ratified the FCTC) reported seeing people using tobacco on electronic media. Most countries that had not ratified the FCTC were classified as low-income and lower-middle-income countries, and adolescents in these countries had low access to media (eg, television or internet at home). In addition, we found that 55·9% of adolescents reported being exposed to both pro-tobacco and anti-tobacco advertisements, suggesting that pro-tobacco and anti-tobacco advertisements might be targeting the same market. Elser and colleagues[19] also found that the proportion of adults aged 18 years or older exposed to tobacco advertisements (41·7%) was similar to that of exposure to anti-tobacco advertisements (45·6%). Great efforts are urgently needed for policy makers to strengthen anti-tobacco advertisements and regulate the tobacco advertisement market.

Encouragingly, the proportion of exposure to tobacco advertisements decreased in 111 (92·5%) of 120 countries over time. However, a discouraging finding was that the proportion of anti-tobacco advertisements decreased in 110 (91·7%) of 120 countries. To date, there were 168 countries that had ratified the FCTC; however, the level of implementation varies by country because of various social, economic, and political factors.[20,21] Previous studies had shown that the FCTC was ideally effective if the policies promoted were fully implemented (eg, through public awareness improvement, social pressures, financial support, and implementation of tobacco advertising and promotion bans especially).[22–24] Of note, the items from the MPOWER package advised by WHO contain potentially effective measures for reducing the global prevalence of tobacco use.[25] One of the important recommendations of MPOWER is that bans on tobacco advertising, promotion, and sponsorship should be enforced. For example, the enforcement of strong anti-tobacco advertising, promotion, and sponsorship policies (eg, banning all tobacco advertisements including virtual advertisements, restricting advertisements at points of sale, and enforcing penalties for non-compliance) has reduced tobacco advertisement exposure among adolescents in South Africa.[26] In addition, the increase in delivery of broadcast anti-tobacco advertisements and ensuring tobacco advertisements bans might be a model for promoting limited tobacco control resources worldwide.[27,28] To our knowledge, this is the first study to assess the trends in proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements according to the implementation status of tobacco advertising and promotion bans worldwide. We found that the proportion of adolescents exposed to tobacco advertisements decreased in 24 (92·3%) of 26 implemented countries. Indeed, bans on tobacco advertising and promotion are cornerstones of comprehensive tobacco-control laws.[20] These findings call for strict policies and legislations to prevent adolescents from being exposed to tobacco advertisements to further reduce adolescent uptake and use of tobacco products.

The main strength of our study is that a standardised questionnaire and sampling strategy was used to collect data, making proportions of exposure to pro-tobacco or anti-tobacco advertisements directly comparable across countries. In addition, all 120 countries had done at least two surveys between 1999 and 2018, which allowed trends to be examined. However, several limitations should be noted. First, data on exposure to pro-tobacco or anti-tobacco advertisements were self-reported, which is subject to recall bias. Second, only adolescents aged 12–16 years were included in our study since the survey in each country coded other age groups as aged 11 years old or younger or 17 years old or older; thus, our estimates should not be generalisable to young people of other ages. Third, some countries did not do a GYTS in the time interval considered in this study. Fourth, the GYTS was a school-based survey, thus limiting the generalisability of our findings to adolescents out of school. Fifth, data in our study were obtained from many different countries, thus there might be between-study heterogeneity. Sixth, social media and other online sources as increasingly common sources of exposure to tobacco images, advertising, modelling, and other content were not included in our analysis because the GYTS did not provide these data. Seventh, the GYTS did not provide data on tobacco advertisement exposure at points of sale before 2009; thus, the trends in this exposure should be explained with caution. Eighth, some other potential variables were not considered that might influence the exposure to tobacco advertisements (eg, access to disposable income) because of unavailable data.

In conclusion, we found that the proportion of adolescents exposed to tobacco advertisements remains high worldwide. The proportions of adolescents exposed to pro-tobacco and anti-tobacco advertisements both decreased between 1999 and 2018 in more than 90% of the 120 countries. Effective implementation of regulations on tobacco control involving strengthening anti-tobacco marketing (particularly on electronic media) and prohibiting tobacco marketing is needed to help limit tobacco use in adolescents.

Contributors

BX designed the study, led the writing of the paper, and was the Principal Investigator. CM designed the study and drafted the first version of the manuscript. HY and CM did the data analysis. HY and CM accessed and verified the data. BX, CGM, JS, MZ, and HY critically revised the manuscript. All authors read and approved the final version of the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

Data collected for this study, including deidentified individual participant data and a data dictionary defining each field in the dataset, as well as additional related documents such as the study protocol, will be available to others upon publication, without any restrictions, from the US Centers for Disease Control and Prevention website at https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?CAID=2.

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