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Smoking trends in Mexico, 2002 – 2016: Before and after the ratification of the World Health Organization's Framework Convention on Tobacco Control.

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Abstract

Introduction—Mexico was the first Latin American country to ratify the Framework Convention on Tobacco Control (FCTC) in 2004, after which it implemented some key FCTC policies (e.g., taxes, smoke-free, pictorial warnings, ad bans). This study assessed trends in the prevalence of current, daily, and nondaily smoking in Mexico before and after the implementation of key FCTC policies.

Methods—Data were analyzed from two comparable, nationally representative surveys (i.e., The National Survey of Addictions 2002, 2011, and 2016 and the Global Adult Tobacco Survey 2009 and 2015). The pooled sample comprised 100,302 persons aged 15 to 65 years old. Changes in the prevalence of current, daily, and nondaily smoking were assessed.

Results—From 2002 to 2016, the prevalence of current smoking fell 11% (from 21.5% to 19.0%). The decrease was registered between 2002 and 2009, and after that, a slight increase was observed (from 16.5% to 2009 to 19% in 2016). The prevalence of daily smoking decreased by about 50% between 2002 to 2016 (from 13.5% to 7.0%) with most of the decrease occurring by 2009. Conversely, the prevalence of nondaily smoking increased by 35% between 2009 to 2016 (from 8.8% to 11.9%).

Conclusions—Full implementation of the FCTC is necessary to further reduce smoking. Specific interventions may be needed to target nondaily smokers, who now comprise more than half of current smokers in Mexico.

Keywords

Low/Middle-income country; public policy; surveillance and monitoring

INTRODUCTION

In 2004, Mexico became the first country in Latin America to ratify the World Health Organization's Framework Convention on Tobacco Control (FCTC).¹ After signing the FCTC in 2004, the tobacco excise tax increased from 58.9% of the final price in 2007 to 68.8% in 2011,^{2–5} leading to an increase in the real price per pack of 20 cigarettes of 44% (\$MX29.9 in 2007 to \$MX 42.7 in 2011), after which taxes and prices have remained stable.^{4,6,7} The 2008 General Law on Tobacco Control (GLTC) included other key FCTC-recommended policies.^{8,9} Cigarette advertising was banned through all channels except point of sale, adult-only venues (e.g., bars) and adult-oriented magazines.⁸ Since 2010, pictorial health warnings were required on at least 30% of the front of cigarette packages, with textual warnings on 100% of the back and one side of the pack.¹⁰ The GLTC only allows smoking in restrictive designated smoking areas (e.g., with extensive exhaust systems and physically separated from paths traversed by nonsmokers).^{8,11} However, the GLTC was passed the same day as the comprehensive smoke-free law in Mexico City,¹² which caused some confusion around implementation in Mexico City and the rest of the country. Concerns about pre-emption remained until the Supreme Court ruled in favor of the Mexico City legislation in September 2009.¹² This likely contributed to the slow, incomplete adoption and implementation of smokefree regulations in other states.^{13–16} Since 2011, no other national-level policies have been adopted.

Meanwhile, the tobacco industry has continued to lobby the legislature, primarily to avoid further tobacco tax increases.¹⁶ At the same time, the industry introduced innovative cigarettes with flavor capsules in the filter, whose market share has rapidly increased, as in many other Latin American countries.^{17–20} Furthermore, e-cigarette marketing and sales in Mexico are banned, similar to Uruguay and Brazil,²¹ although consumption is relatively high among adult smokers (4.7%) and youth (i.e., 12% of 8th graders).^{22–24} Mexico is a key country in Latin American because of its size and economic importance in the region. Therefore, the case study of Mexico's FCTC experience in the context of the rapidly changing landscape of nicotine products may help inform policy development in other settings, particularly other low- and middle-income countries.

Longitudinal studies of Mexican smokers indicate the effectiveness of FCTC policies,^{7,25–28} yet the population-level effects of these policies on smoking prevalence remain understudied. This study assesses changes in the prevalence of current, daily, and nondaily smoking in Mexico from 2002 to 2016 using nationally representative surveys over the implementation period for key FCTC policies.

METHODS

Sample

Data come from two comparable nationally representative cross-sectional surveys: 2002, 2011, and 2016 administrations of the National Survey on Addictions (NSA); and the 2009 and 2015 administrations of the Global Adult Tobacco Survey (GATS). These household surveys used multi-stage sampling schemes to provide national-level estimates of tobacco use. Methodological details of each survey have been published previously.^{29–33} Pooling data across surveys resulted in a sample of 100,302 15 to 65 year olds (NSA 2002 n=10,418; GATS 2009 n=12,294; NSA 2011=14,298; GATS 2015=12,777; NSA 2016 n=50,515).

Measures

Current, Daily and Nondaily Smoking prevalence definition: Current smokers reported smoking daily (daily smokers) or less often (nondaily smokers). Questions were slightly different across the surveys: *Do you currently smoke tobacco on a daily basis, less than daily, or not at all?* (GATS 2009, GATS 2015, NSA 2016); *How often do you currently smoke?* (NSA 2011); and *In the past 30 days, have you smoked tobacco?* (NSA 2002), with those who indicated yes being asked *Approximately, how many cigarettes were smoked daily in the past 30 days?* (I don't smoke daily; 1–5; 6–10; 11–20; 20+ cigarettes). Responses to each question were recoded to indicate daily or nondaily smoking frequency. GATS did not ask whether participants had smoked 100-lifetime cigarettes, so this criterion was not used to define smoking status.

Sociodemographic Variables: Sex (female/male), age (15–17, 18–24, 25–34, 35–44, 45–54, 55–65), highest educational attainment (primary or less, secondary, high school, university or more), and place of residence (urban/rural) were all assessed.

Analysis

Prevalence and 95% confidence intervals were estimated for current, daily, and nondaily smoking, adjusting for the sampling designs. Two-sample independent t-tests were used to determine differences in these estimates across years for key pre/post milestones in policy implementation (2002 vs. 2009; 2009 vs. 2016; 2002 vs. 2016) both overall and within sociodemographic strata Trends in prevalence are measured relative to the initial level. Statistical analyses were conducted using Stata 15.

RESULTS

Overall, the prevalence of current smoking decreased in relative terms by 11% (from 21.4% to 19.0%) between 2002 from 2016, about 13% in men (from 33.9% to 29.5% men) and about 19% in women (from 11.5% to 9.3%). Over this period, reductions were statistically significant for higher education groups (i.e., university or more=29.6% to 20.7%; high school=26.6% to 21.2%) and among those aged 35–44 (25.4% to 18.8%) and 45–54 (23.1% to 18.1%). Overall, the relative decrease was limited to the period from 2002 to 2009 (–22.9%), after which prevalence increased by 11.5% (2009=16.5%; 2016=19%). From 2002 to 2016, daily smoking decreased by approximately 50% (2002=13.5%; 2016=6.6%).

The relative change in the percentage of daily smokers was generally consistent across sex, age, level of education, and residence. By contrast, from 2009 to 2016, the prevalence of non-daily smoking increased by about a third in both men (2009=13.8%; 2016=18.4%) and women (2002=4.4%; 2016=6.0%). Increases were generally consistent across sociodemographic groups.

DISCUSSION

Our results indicate that the prevalence of current smoking and daily smoking in Mexico decreased from 2002 to 2016, which covers the period from before to after FCTC ratification and policy implementation. However, most of the declines in the prevalence of smoking (2002=21.4%; 2009=16.5%; 2016=19.0%) and daily smoking (2002=13.5%; 2009=7.7%; 2016=7.0%) had occurred by 2009. This decrease was associated with a series of tobacco tax increases between 2000 and 2009 (i.e., the ad-valorem excise tax increased from 100% of the final retail price in 2000 to 160% in 2009).⁴ There was one further increase in 2011 due to the application of the specific tax of \$MX 0.35 per cigarette, but our results indicate no meaningful change in daily smoking after 2009 and only a slight decrease in the average of cigarettes smoked per day (CPD) among daily smokers (9.4 CPD in 2009 to 7.7 CPD in 2015).³² By contrast, the prevalence of non-daily smoking increased from 2002 to 2016 (2002=7.9%; 2009=8.8%; 2016=11.9%). Historically, Mexican smokers have a relatively light smoking pattern, with a high proportion of nondaily smokers.^{34,35} Our results indicate that this pattern has increased over time, offsetting the declines in daily smoking that were found before 2009. It is important to highlight that nondaily smoking is still dangerous: low cigarette consumption is associated with higher all-cause and cause-specific mortality compared to not smoking.^{36–37}

Tobacco control policy implementation in other jurisdictions has been accompanied by downshifts in smoking frequency,^{38–42} and policies likely account for the similar downshift found in Mexico. In other jurisdictions, however, these shifts have been accompanied by an overall decline in smoking prevalence, which, in Mexico, appears relatively stable since 2009.

Several reasons may explain the stability in the prevalence of current smoking in Mexico, despite the downshift in smoking frequency in recent years. Tobacco industry interference has disrupted implementation of smoke-free policies.¹⁶ In particular, the GLTC allows smoking in designated areas, which may reduce compliance even in the 11 states that have adopted comprehensive smoke-free laws.¹² Furthermore, the industry's 2011 introduction and subsequent rapid growth of cigarettes with flavor capsules^{17,19} appear to appeal to and add perceived value (e.g., smoother, more stylish, lesser perceived harm) to smoking for smokers of all ages.^{17–19} While this innovation may have added value to smoking that helped offset the cost of the last tax increase in 2011, further periodic increases in taxes may be necessary, especially given the evidence for the effectiveness of earlier tax increases. Also, the relatively small health warning on the front of the pack (30%) should be increased to align with FCTC guidelines.^{28,43,44}

E-cigarettes could also explain partly the flattening of the trends. Although e-cigarettes are banned, the prevalence of e-cigarette use is not-negligible among some subgroups of current smokers (adolescents (9%), young adults (9%), female smokers (6%), and smokers with higher socioeconomic status (7%).^{22–24} As in other countries, the strongest correlate of e-cigarette use is being a current smoker (4.7% current smokers vs. 0.4% nonsmokers).²² Nevertheless, it is not clear whether e-cigarette use has kept some people from quitting cigarettes,⁴⁵ since e-cigarette use is relatively recent, use is relatively low among current smokers (4.7%) and former smokers (1.1%). Indeed, the introduction of e-cigarettes has been associated with a decline in youth and young adult smoking prevalence in other countries where e-cigarette use is more prevalent.⁴⁶ To evaluate how e-cigarettes influence smoking patterns in Mexico, further research is needed, particularly on how lighter smokers use e-cigarettes. Indeed, psychological dependence⁴⁷ and potential genetic factors may help explain low levels of consumption among populations of Mexican heritage,⁴⁸ whose ancestors used tobacco for centuries before European colonization of the Americas. Our study has several limitations. The surveys we analyzed had different focus, with GATS being an international survey that only asks about tobacco, whereas the NSA gathers information not only about tobacco, but also about drug and alcohol use, and violence. Nevertheless, the NSA survey asks about tobacco before other topics. Furthermore, both surveys are nationally representative and used similar sampling designs, helping to minimize issues around their comparability. Similar conclusions are reached if we had just compared estimates from the NSA alone (i.e., 2002, 2011, 2016). Another potential limitation was our inability to analyze results by income level because income was not available in all surveys. Instead, we used education as a proxy for socioeconomic status, which is likely to be correlated with income. The differential changes we found in daily smoking over time by education (i.e., greater decreases with higher educational attainment, although the equivalent prevalence in recent years) are thus likely to also occur across income groups; however, further confirmation is warranted.^{32,49}

Conclusions

To accelerate tobacco control, it is necessary to expand current policies and enhance compliance with existing tobacco control policies and laws in Mexico. Full implementation of FCTC policies should give priority to continued tax increases, comprehensive smoke-free laws, increasing the size of health warnings, enhancing access to cessation therapies for nondaily and daily smokers, and banning all tobacco advertising and promotion. Further strategies are also needed to address the complexity of the rapidly changing landscape of nicotine products, including prohibition of flavors, especially flavor capsules.

References

1. United Nations Treaty Collection. 4. WHO Framework Convention on Tobacco Control. Available on: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IX4&chapter=9&lang=en
2. Tobacco tax success story mexico. Available on: https://www.tobaccofreekids.org/assets/global/pdfs/en/success_Mexico_en.pdf

3. Guerrero-López CM, Muños-Hernández JA, Sáenz de Miera-Juárez B, Reynales-Shigematsu LM. [Tobacco consumption, mortality and fiscal policy in Mexico]. *Salud Publica Mex.* 2013;55 Suppl 2:S276–81. Spanish. [PubMed: 24626704]
4. Waters H, Saenz de Miera B, Ross H, et al. The economics of tobacco and tobacco taxation in Mexico. Paris, France: International Union Against Tuberculosis and Lung Disease, 2010.
5. Ley del Impuesto Especial sobre Producción y Servicios. Diario Oficial de la Federación, 30 de Diciembre de 1980. Reforma al artículo 2o., 19 Noviembre de 2010. Ley aprobada. Available on: http://www.diputados.gob.mx/LeyesBiblio/ref/lieps/LIEPS_ref39_19nov10.
6. Levy D, Fleischer NL, Meza RM, Saenz de Miera B, Zavala-Arciniega L, Reynales-Shigematsu LM, Thrasher JF. *Mexico SimSmoke: The Effects of Tobacco Control Policies on Smoking Prevalence and Tobacco Attributable Deaths in Mexico* (in press)
7. Saenz de Miera B, Thrasher JF, Reynales-Shigematsu LM, Hernández-Ávila M, Chaloupka FJ. Tax, price, and cigarette brand preferences: A longitudinal study of adult smokers from the ITC Mexico Survey. *Tobacco Control.* 23:i80–i85. 2014. doi: 10.1136/tobaccocontrol-2012-050939. [PubMed: 24114563]
8. Ley General para el Control del Tabaco. Artículo 16, apartado VI. Diario Oficial de la Federación. 30/04/2008 Congreso General, México, DF Available on: <http://www.diputados.gob.mx/LeyesBiblio/doc/LGCT.doc>.
9. World Health Organization. WHO report on the global tobacco epidemic, 2017. Country Profile Mexico https://www.who.int/tobacco/surveillance/policy/country_profile/mex.pdf?ua
10. Salud pública y tabaquismo, volumen II. Advertencias sanitarias en América Latina y el Caribe. Instituto Nacional de Salud Pública [Último acceso: agosto 2017] Available on: https://www.insp.mx/images/stories/Produccion/pdf/130226_reporteTabacoVol2.pdf
11. Barrientos-Gutiérrez T [Scientific and technical evaluation of Mexico's General Law for Tobacco Control]. *Salud Publica Mex.* 2010;52 Suppl 2:S277–82. Spanish [PubMed: 21243199]
12. Crosbie E, Sebríé EM, Glantz SA. Strong advocacy led to successful implementation of smokefree Mexico City. *Tob Control.* 2011 1;20(1):64–72. doi: 10.1136/tc.2010.037010. [PubMed: 21059606]
13. WHO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies. Geneva: World Health Organization; 2017 License: CC BY-NC-SA 3.0 IGO. Available on: <http://apps.who.int/iris/bitstream/handle/10665/255874/9789241512824-eng.pdf;jsessionid=65246AE8D23B16AA1F49BFBD3AFFEC6?sequence=1>
14. WHO. 2016 global progress report on implementation of the WHO Framework Convention on Tobacco Control. Available on: http://www.who.int/fctc/reporting/2016_global_progress_report.pdf?ua
15. Zavala-Arciniega L, Gutiérrez-Torres DS, Paz-Ballesteros WC, Reynales-Shigematsu LM, Fleischer NL. Factores asociados con la exposición al humo de tabaco de segunda mano en lugares públicos y privados en México. *Encodat* 2016. *Salud Publica Mex.* 2019;61 10.21149/987
16. Reynales-Shigematsu LM, Wipfli H, Samet J, Regalado-Pineda J, Hernández-Ávila M. Tobacco control in Mexico: a decade of progress and challenges. *Salud Publica Mex.* 2019 May-Jun;61(3):292–302. doi: 10.21149/9360 [PubMed: 31276348]
17. Moodie C, Thrasher JF, Cho YJ, Barnoya J, Chaloupka F. Flavour capsule cigarettes continue to experience strong global growth. *Tobacco Control.* In press.
18. Thrasher JF, Islam F, Barnoya J, Mejía R, Valenzuela MT, Chaloupka FJ. Market share for flavor capsule cigarettes is quickly growing, especially in Latin America. *Tobacco Control.* 26(4):468–470. 2017. [PubMed: 27329114]
19. Thrasher JF, Abad-Vivero EN, Moodie C, O'Connor RJ, Hammond D, Cummings KM, Yong H-H, Salloum RG, Czoli C, Reynales-Shigematsu LM. Cigarette brands with flavor capsules in the filter: Trends in use and brand perceptions among smokers in the USA, Mexico and Australia, 2012–2014. *Tobacco Control.* 25(3):275–283. 2016. [PubMed: 25918129]
20. Abad-Vivero EN, Thrasher JF, Arillo-Santillán E, Pérez-Hernández R, Barrientos-Gutierrez I, Kollath-Cattano C, Mejía R, Sargent JD. Recall, appeal, and willingness to try cigarettes with flavor capsules: Assessing the impact of a tobacco product innovation among early adolescents. *Tobacco Control.* 25(e2): e113–e119. 2016 Global Adult Tobacco Survey, Panama 2013 Pan-

American Health Organization Available on: http://www.who.int/tobacco/surveillance/survey/gats/pan_report2013.pdf [PubMed: 27060099]

21. Pan American Health Organization. Report on Tobacco Control in the Region of the Americas, 2018. Washington, D.C.: PAHO; 2018
22. Zavala-Arciniega L, Reynales-Shigematsu LM, Lozano P, Arillo-Santillán E, Rodríguez-Andrade M, Thrasher JF. Patterns of awareness and use of electronic cigarettes in Mexico, a middle-income country that bans them: Results from a 2016 national survey. *Preventive Medicine*. 116: 211–218. 2018. [PubMed: 30261244]
23. Lozano P, Barrientos-Gutierrez I, Arillo-Santillán E, Morello P, Mejia R, Sargent J, Thrasher JF. A longitudinal study of electronic cigarette use and onset of conventional cigarette smoking and marijuana use among Mexican adolescents. *Drug and Alcohol Dependence*. 180: 427–420. 2017. [PubMed: 28988005]
24. Barrientos-Gutierrez I, Lozano P, Arillo-Santillán E, Morello P, Mejia R, Reynales-Shigematsu LM, Thrasher JF. “Technophilia”: A new risk factor for electronic cigarette use among early adolescents? *Addictive Behaviors*. In press.
25. Saenz de Miera B, Thrasher JF, Chaloupka FJ, Waters HR, Hernández-Ávila M, Fong GT. Self-reported price, consumption and brand switching of cigarettes in a cohort of Mexican smokers before and after a cigarette tax increase. *Tobacco Control*. 19: 481–487. 2010 DOI: 10.1136/tc.2009.032177 [PubMed: 20870740]
26. Thrasher JF, Abad-Vivero EN, Sebríe EM, Barrientos-Gutierrez T, Boado M, Yong HH, Arillo-Santillán E, Bianco E. Tobacco smoke exposure in public places and workplaces after smoke-free policy implementation: A longitudinal analysis of smoker cohorts in Mexico and Uruguay. *Health Policy & Planning*. 28:789–798. 2013. doi: 10.1093/heapol/czs118 [PubMed: 23172895]
27. Thrasher JF, Pérez-Hernández R, Arillo-Santillán E, Barrientos-Gutierrez I. Hacia el consumo informado de tabaco en México: Efecto de las advertencias con pictogramas en población fumadora. [Towards informed tobacco consumption in Mexico: Effects of pictorial warning labels in smokers]. *Revista de Salud Pública de México*. 54:242–253. 2012.
28. Thrasher JF, Abad-Vivero EN, Huang L, O'Connor RJ, Hammond D, Bansal-Travers M, Yong H-H, Borland R, Markovsky B, Hardin J. Interpersonal communication about pictorial health warnings on cigarette packages: Policy-related influences and relationships with smoking cessation behavior. *Social Science & Medicine*. 164: 141–149. 2016. [PubMed: 26092600]
29. Instituto Nacional de Estadística, Geografía e Informática. Encuesta Nacional de Adicciones 2002. Available on: https://www.gob.mx/cms/uploads/attachment/file/238948/ENA_2002_Completo.pdf
30. Organización Panamericana de la Salud; Instituto Nacional de Salud Pública (MX). Encuesta Global de Tabaquismo en Adultos. México 2009. Cuernavaca (México): Instituto Nacional de Salud Pública, 2010 Coeditado con la Organización Panamericana de la Salud, 2010.
31. SSA. Encuesta Nacional de Adicciones 2011 Reporte Tabaco. Disponible en: <http://www.controltabaco.mx/publicaciones/encuesta-nacional-de-adicciones-2011-tabaco>
32. Global Adult Tobacco Survey, México 2015 Cuernavaca, México: INSP/PanAmerican Health Organization, 2010 Available on: [http://media.controltabaco.mx/content/productos/2017/GATS_2015_ESPA%C3%91OL_\(electr%C3%B3nico\)_5_julio6.pdf](http://media.controltabaco.mx/content/productos/2017/GATS_2015_ESPA%C3%91OL_(electr%C3%B3nico)_5_julio6.pdf)
33. Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz; Instituto Nacional de Salud Pública, Comisión Nacional Contra las Adicciones, Secretaría de Salud. Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco 2016–2017: Reporte de Tabaco. Reynales-Shigematsu LM, Zavala-Arciniega L, Paz-Ballesteros WC, Gutiérrez-Torres DS, García-Buendía JC, Rodríguez-Andrade MA, Gutiérrez-Reyes J, Franco-Núñez A, Romero-Martínez M. y Mendoza-Alvarado L Ciudad de México, México: INPRFM; 2017 Disponible en: www.inprf.gob.mx, www.conadic.gob.mx, www.insp.mx
34. Swayampakala K, Thrasher JF, Carpenter M, Reynales-Shigematsu LM, Cupertino P, Berg C, Sansores R. Level of cigarette consumption and quit behavior in a population of low-intensity smokers – Longitudinal results from the International Tobacco Control (ITC) Survey in Mexico. *Addictive Behaviors*. 38: 1958–1965. 2013 [PubMed: 23380491]
35. Asma S, Mackay J, Song SY, Zhao L, Morton J, Palipudi KM, et al., The GATS Atlas. 2015 CDC Foundation, Atlanta, GA.

36. Hackshaw A, Morris JK, Boniface S, Tang JL, Milenkovi D. Low cigarette consumption and risk of coronary heart disease and stroke: meta-analysis of 141 cohort studies in 55 study reports. *BMJ*. 2018 1 24;360:j5855. doi: 10.1136/bmj.j5855 [PubMed: 29367388]
37. Inoue-Choi M, Liao LM, Reyes-Guzman C, Hartge P, Caporaso N, Freedman ND. Association of Long-term, Low-Intensity Smoking With All-Cause and Cause-Specific Mortality in the National Institutes of Health-AARP Diet and Health Study. *JAMA Intern Med*. 2017 1 1;177(1):87–95. doi: 10.1001/jamainternmed.2016.7511 [PubMed: 27918784]
38. Kulik MC, Glantz SA. Similar softening across different racial and ethnic groups of smokers in California as smoking prevalence declined. *Prev Med*. 2019 3;120:144–149. doi: 10.1016/j.ypmed.2019.01.020. [PubMed: 30703378]
39. Lightwood J, Glantz SA, 2013 The effect of the California tobacco control program on smoking prevalence, cigarette consumption, and healthcare costs: 1989–2008. *PLoS One* 8 (2), e47145 [PubMed: 23418411]
40. Kulik MC, Glantz SA, 2016 The smoking population in the USA and EU is softening not hardening. *Tob. Control*. 25 (4), 470–475 [PubMed: 26108654]
41. Sakuma KL, Felicitas J, Fagan P, et al. Smoking Trends and Disparities Among Black and Non-Hispanic Whites in California. *Nicotine Tob Res*. 2015;17(12):1491–1498. doi:10.1093/ntr/ntv032 [PubMed: 25666813]
42. Taylor T, Cooper TV, Hernandez N, Kelly M, Law J, Colwell B. A Smoke-Free Paso del Norte: impact over 10 years on smoking prevalence using the Behavioral Risk Factor Surveillance System. *Am J Public Health*. 2012 5;102(5):899–908. doi:10.2105/AJPH.2011.300346. [PubMed: 22494000]
43. Cho YJ, Thrasher JF, Yong H-H, Szklo AS, O'Connor R, Bansal-Travers M, Hammond D, Fong GT, Hardin J, Borland R. Path analysis of warning label effects on negative emotions and quit attempts: A longitudinal study of smokers in Australia, Canada, Mexico, and the US. *Social Science & Medicine*. 197: 226–234. 2018 [PubMed: 29096946]
44. Anshari D, Yong H-H, Borland R, Hammond D, Swayampakala K, Thrasher JF. Which type of tobacco product warning imagery is more effective and sustainable over time? A longitudinal assessment of smokers in Canada, Australia, and Mexico. *BMJ Open*. 7 13;8(7):e021983 2018.
45. Lozano P, Arillo-Santillán E, Barrientos-Gutiérrez I, Zavala-Arciniega L, Reynales-Shigematsu LM, Thrasher JF. A longitudinal study of e-cigarette use and its association with smoking reduction and cessation intentions among Mexican smokers. *Salud Pública de México*. In press.
46. Levy DT, Warner KE, Cummings KM, Hammond D, Kuo C, Fong GT, ... Borland R (2018). Examining the relationship of vaping to smoking initiation among US youth and young adults: a reality check. *Tobacco Control*. 10.1136/tobaccocontrol-2018-054446
47. Paz-Ballesteros WC, Zavala-Arciniega L, Gutiérrez-Torres DS, Ponciano-Rodríguez G, Reynales-Shigematsu LM. Evaluación de la dependencia física y psicológica al tabaco en fumadores mexicanos adultos, Encodat 2016. *Salud Publica Mex*. 2019;61 10.21149/9858
48. Saccone NL, Emery LS, Sofer T, Gogarten SM, Becker DM, Bottinger EP, et al. Genome-Wide Association Study of Heavy Smoking and Daily/Nondaily Smoking in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). *Nicotine Tob Res*. 2018 3 6;20(4):448–457. doi: 10.1093/ntr/ntx107. [PubMed: 28520984]
49. Zavala-Arciniega L, Paz Ballesteros WC, Mejía Gil SC, Reynales Shigematsu LM. Social determinants of tobacco smoking in Mexico stratified by sex and age. Mexico, Global Adult Tobacco Survey (GATS) 2009 and 2015. *Tobacco Induced Diseases*. 2018;16(1):A783. doi:10.18332/tid/84328.

Table 1.

Prevalence and changes in daily smoking and non-daily smoking among Mexicans, 2002–2016

	2002	2009	Difference (% change), 2002–2009	2011	2015	2016	Difference (% change), 2009– 2016	Difference (% change), 2002–2016
CURRENT SMOKING	21.4	16.5	–4.9 *** (–22.9%)	18.3	17.2	19.0	2.4 ** (11.5%)	–2.5 * (–11.2%)
Sex								
Female	11.5	8.2	–3.3 ** (–28.7%)	10.0	8.8	9.3	1.1 (13.4%)	–2.1 * (–19.2%)
Male	33.9	25.8	–8.1 *** (–23.9%)	27.2	26.2	29.4	3.6 ** (13.9%)	–4.5 ** (–13.0%)
DAILY SMOKING	13.5	7.7	–5.9 *** (–41.0%)	7.6	7.8	7.0	–0.7 (–9.1%)	–6.6 *** (–48.1%)
Sex								
Female	7.1	3.8	–3.3 *** (–46.4%)	3.8	3.9	3.3	–0.5 (–13.2%)	–3.8 *** (–53.5%)
Male	21.6	12.0	–9.6 *** (–44.4%)	11.6	12.1	11.0	–1.0 (–8.3%)	–10.6 *** (–49.1%)
Age								
15–17 years	5.1	3.5	–1.6 (–31.4%)	2.0	1.5	0.9	–2.5 ** (–57.1%)	–4.2 ** (–70.6%)
18–24 years	13.6	8.0	–5.6 ** (–41.2%)	5.6	8.3	6.1	–1.8 (–23.8%)	–7.5 *** (–55.1%)
25–34 years	14.4	7.4	–7.0 *** (–48.6%)	8.3	9.5	7.4	0.0 (0.0%)	–7.0 *** (–48.6%)
34–44 years	16.9	7.3	–9.6 *** (–56.8%)	8.5	6.8	7.6	0.3 (4.1%)	–9.3 *** (–45.0%)
45–54 years	14.9	10.7	–4.2 * (–28.2%)	10.1	9.1	8.5	–2.1 (–20.6%)	–6.4 *** (–43.0%)
55–65 years	11.7	8.5	–3.2 (–27.4%)	9.5	8.3	9.1	0.6 (7.1%)	–2.6 (–22.2%)
Education								
Primary or less	10.0	7.4	–2.6 ** (–26.0%)	8.4	8.1	7.7	0.3 (4.1%)	–2.3 ** (–2.3%)
Secondary	14.2	8.1	–6.1 *** (–43.0%)	7.4	7.7	6.9	–1.2 (–14.8%)	–7.3 *** (–51.4%)
High School	16.4	7.8	–8.6 *** (–52.4%)	6.1	7.1	6.2	–1.5 (–20.5%)	–10.2 *** (–62.2%)
University or more	19.7	7.5	–12.2 *** (–62.0%)	9.3	9.0	7.4	–0.1 (–1.4%)	–12.3 *** (–62.4%)
Place of residence¹								
Rural	7.5	4.3	–3.2 *** (–42.6%)	4.3	3.6	3.9	–0.4 (–9.4%)	–3.6 *** (–48.0%)
Urban	15.5	8.6	–6.9 *** (–44.5%)	8.5	9.0	7.9	–0.7 (–8.1%)	–7.6 *** (–49.0%)
NONDAILY SMOKING	7.9	8.8	0.9 (14.2%)	10.6	9.3	11.9	3.1 *** (35.2%)	4.1 *** (50.6%)
Sex								
Female	4.3	4.4	0.1 (2.3%)	6.1	4.9	6.0	1.6 ** (36.3%)	1.7 ** (39.5%)
Male	12.3	13.8	1.5 (12.2%)	15.6	14.1	18.4	4.6 *** (33.3%)	6.1 *** (49.6%)
Age								
15–17 years	5.0	6.3	1.3 (26.0%)	8.4	4.5	7.2	0.9 (14.2%)	2.2 * (44.0%)
18–24 years	10.1	12.2	2.1 (20.8%)	16.3	13.6	17.1	4.9 *** (40.1%)	7.0 *** (69.3%)
25–34 years	7.7	10.4	2.7 * (35.1%)	12.0	11.3	14.7	4.3 *** (41.3%)	7.0 *** (91.0%)

	2002	2009	Difference (% change), 2002–2009	2011	2015	2016	Difference (% change), 2009– 2016	Difference (% change), 2002–2016
34–44 years	8.5	8.6	0.1 (1.1%)	10.2	9.9	11.1	2.5 * (27.9%)	2.6 * (29.4%)
45–54 years	8.2	6.9	–1.3 (–15.9%)	7.4	6.5	9.6	2.7 ** (39.1%)	1.4 (17.1%)
54–65 years	5.2	4.0	–1.2 (–23.1%)	5.6	4.7	6.8	2.8 *** (31.0%)	1.6 (30.8%)
Education								
Primary or less	6.2	7.3	1.1 (17.7%)	8.5	8.1	9.4	2.1 ** (28.8%)	3.2 *** (51.6%)
Secondary	7.8	9.2	1.4 (17.9%)	11.5	10.0	12.0	2.7 ** (30.4%)	4.2 ** (53.8%)
High School	10.2	10.5	0.3 (2.9%)	12.6	10.6	14.8	4.3 ** (41.0%)	4.6 ** (45.1%)
University or more	9.9	10.8	0.9 (9.1%)	11.5	8.4	12.9	2.0 (19.4%)	3.0 (30.3%)
Place of residence¹								
Rural	5.0	7.0	2.0 ** (40%)	9.2	6.2	8.9	1.9 ** (27.1%)	3.9 * (78%)
Urban	8.8	9.4	0.6 (6.8%)	11.1	10.1	12.8	3.4 *** (36.2%)	4.0 *** (45.5%)

*
p value<0.05

**
p value<0.01

p value<0.001