

Electronic cigarette awareness, use, and perception of harmfulness in Brazil: findings from a country that has strict regulatory requirements

Conhecimento e uso de cigarros eletrônicos e percepção de risco no Brasil: resultados de um país com requisitos regulatórios rígidos

Concienciación sobre el cigarrillo electrónico, uso, y percepción de sus efectos dañinos en Brasil: resultados de un país que cuenta con estrictos requisitos normativos

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Abstract

Given the uncertainties regarding electronic cigarettes' (e-cigs) impact on health, in 2009 Brazil prohibited sales, importation or advertisements of these products until manufacturers are able to show they are safe and/or effective in smoking cessation. This study sought to analyze: (1) awareness of electronic cigarettes, ever-use and recent use; (2) perception of harmfulness of electronic cigarettes when compared with conventional cigarettes; and (3) correlates of awareness and perception of harmfulness. This is a cross-sectional study among Brazilian smokers (≥ 18 years) using the Wave 2 replenishment sample of the Brazilian International Tobacco Control Policy Evaluation Survey. Participants were recruited in three cities through a random-digit dialing sampling frame between October 2012 and February 2012. Among the 721 respondents, 37.4% ($n = 249$) of current smokers were aware of (e-cigs), 9.3% ($n = 48$) reported having ever tried or used (e-cigs) and 4.6% ($n = 24$) reported having used them in the previous six months. Among those who were aware of (e-cigs), 44.4% ($n = 103$) believed they were less harmful than regular cigarettes (low perception of harmfulness). "Low perception of harmfulness" was associated with a higher educational level and with having recently tried/used (e-cigs). Despite restrictions to (e-cigs) in Brazil, 4.6% of sample smokers reported having recently used them. Health surveillance programs in Brazil and other countries should include questions on use and perceptions of (e-cigs) considering their respective regulatory environments.

Electronic Cigarettes; Nicotine; Tobacco Products

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Introduction

Use of electronic nicotine delivery systems (ENDS), of which e-cigarettes (e-cigs) are the most popular, is increasing rapidly in some countries¹. The tobacco control community is fiercely divided on issues of e-cigs safety, efficacy for smoking cessation^{2,3} whether e-cigs promote youth uptake of cigarette smoking^{4,5}, and how these devices should be regulated^{6,7,8,9,10}. Despite this lack of evidence, many countries around the world have banned e-cigs¹¹; and, in the absence of long-term quality data upon which an evidence-based recommendation could be made, the WHO Framework Convention on Tobacco Control (WHO-FCTC) recommended that regulations should: “*impede ENDS promotion and prevent uptake by non-smokers, pregnant women, and youth; minimize potential health risks to ENDS users and non-users; prohibit unproven health claims from being made about ENDS; and protect existing tobacco-control efforts from commercial and other vested interests of the tobacco industry*”¹².

In 2009 the Brazilian Health Regulatory Authority Agency (Anvisa)¹³ published a resolution which made it illegal to sell, import, or advertise ENDS “*unless the manufacturer provides scientific evidence on the safety of the device as a substitute for conventional tobacco products and/or effectiveness as a cessation aid*”. The resolution covers different kinds of ENDS, liquid cartridges, and accessories regardless of their nicotine content¹³. To date, there have been no applications made to Anvisa under the resolution. Thus, since 2009, e-cig’s sale have been illegal in Brazil. However, there is evidence that e-cigs are being sold illegally online¹⁴ and by street vendors^{15,16,17,18,19}.

Given the presence of e-cigs in Brazil, it is important to measure the e-cig use and perceptions among Brazilian smokers. The objectives of this study were to examine the following key measures among a probability sample of smokers in three major Brazilian cities: (1) e-cigs awareness, ever-use, and recent use (≤ 6 months), (2) perceptions of the harmfulness (POH) of e-cigs compared to regular cigarettes, and (3) correlates of awareness and POH.

Methods

Study design and procedures

A cross-sectional analysis was conducted using the Wave 2 replenishment-only smoker sample of the *Brazilian International Tobacco Control Policy Evaluation Survey* (ITC Brazil). Details of the methodology are reported elsewhere^{20,21}. At Wave 2 new respondents were recruited via a random-digit dialing sampling frame in three cities (Rio de Janeiro, São Paulo, and Porto Alegre) to replace respondents from Wave 1 who were lost to follow up. The interviews were administered in Portuguese by telephone between October 2012 and February 2013.

Study sample

The Wave 2 replenishment smoker sample was a probability-based representative sample of 727 adults (≥ 18 years) who currently smoked cigarettes at least once a month and had smoked at least 100 cigarettes; six were excluded because they did not answer the question about awareness of e-cig. The response and cooperation rates were 22.8% and 98.9%, respectively.

For this report, we analyzed only the replenishment smoker sample because of differences in how “recent e-cig use” was assessed in the replenishment survey vs. the contact survey (those who had participated in the previous survey wave). In addition, the demographic profiles of the two samples were very different (Table 1). These differences negated the possibility of combining the two samples. We chose to conduct analyses for this paper on the replenishment sample because it consisted of probability samples of each of the three cities, and, thus, inferences could be drawn about the population of smokers in each of the three cities.

Table 1

Differences in demographic and smoking-related variables between the Wave 2 recontact 1 and replenishment samples. *Brazilian International Tobacco Control Policy Evaluation Survey (ITC-Brazil), Wave 2.*

	Recontact		Replenishment	
	n	Proportion (%)	n	Proportion (%)
Overall	495	-	727	-
Gender **				
Male	192	38.8	237	32.6
Female	303	61.2	490	67.4
Age-group (years continuous) ***	495	45.9	727	50.8
City #				
Rio de Janeiro	190	38.4	207	28.5
São Paulo	150	30.3	272	37.4
Porto Alegre	155	31.3	248	34.1
Schooling (years) ##				
Elementary school or less	68	14.1	135	18.7
Incomplete high school	143	29.6	264	36.5
High school or further	273	56.3	324	44.8
Income ###,###				
Low	100	23.5	221	35.9
Moderate	226	53.1	292	47.5
High	100	23.4	102	16.6
Planning to quit ##				
More than 6 months (or not at all)	171	39.7	343	54.2
Within the next 6 months	260	60.3	290	45.8
Smoking frequency ##,§				
Daily smoker moderate/low HSI §	249	50.3	518	71.2
Daily smoker high/very high HSI §	95	19.2	172	23.7
Nondaily smoker	26	5.3	37	5.1
Ex-smoker	125	25.2	-	-

HSI: Heaviness of Smoking Index.

* Included current smokers at Wave 1 who were contacted again at wave 2 and had quit smoking between Wave 1 and Wave 2;

** p-value for χ^2 test for differences in distributions between recontact and replenishment samples < 0.05;

*** p-value for F test for differences in means between recontact and replenishment samples < 0.001;

p-value for χ^2 test for differences in distributions between recontact and replenishment samples < 0.01;

p-value for χ^2 test for differences in distributions between recontact and replenishment samples < 0.001;

Monthly income: low \leq 3 minimum wages/month, moderate = 3-9 minimum wages/month, and high \geq 10 minimum wages/month;

§ Smoking frequency: 1 = non-daily smoker, 2 = daily "light to moderate" smoker, 3 = daily "heavy" smoker; where HIS was derived for daily smokers only; HSI \leq 3 = light to moderate smoking, and HSI 4-6 = high to very high smoking.

Measures

Demographic variables included: sex, age, education (elementary school or less, incomplete high school, high school) and monthly household income that was classified as low (< 3 minimum wages, meaning less than BRL 1,866, equivalent to < USD 894), moderate (3-9 minimum wages, meaning an income between BRL 1,866 and BRL 5,598, equivalent to an income between USD 894 and USD 2,683), or high (10 or more minimum wages, meaning an income of BRL 5,598 or higher, equivalent to USD 2,683 or higher).

The smoking-related variables included: smoking frequency (1 = non-daily smoker, 2 = daily “light to moderate” smoker, 3 = daily ‘heavy’ smoker) where daily smokers were those who smoked regular cigarettes at least once a day; Heaviness of Smoking Index (HSI) ^{22,23}, a scale for measuring nicotine dependence level consisting of two items (the number of cigarettes smoked per day and time to first cigarette of the day), was derived for daily smokers only, with an overall score ranging between 0-6 (HSI \leq 3 = light to moderate smoking, and HSI 4-6 = high to very high smoking); and intentions to quit smoking (within 6 months vs. longer/not at all).

Respondents answered questions about e-cigs:

Awareness: “Have you ever heard of electronic cigarettes or e-cigs?” (Responses: yes or no);

Those who answered yes to the awareness question were asked:

Ever-trial: “Have you ever tried an electronic cigarette?” (Responses: yes or no);

Recent use: “In the last 6 months, have you used or tried any of the following products: e-cigs?” (yes or no);

POH compared to regular cigarettes: “Do you think e-cigs are more harmful than regular cigarettes, less harmful, or are they equally harmful to health?” This variable was then categorized into “e-cigs are less harmful than regular cigarettes” versus “no difference” or “more harmful than regular cigarettes” or “does not know”.

Statistical analyses

Descriptive statistics were estimated using unweighted data. All other estimates were weighted to reflect the population prevalence of e-cigs awareness, ever-trial, and recent use. Logistic regression models estimated the association between sociodemographic and smoking-related covariates on awareness and POH (“less harmful than regular cigarettes” vs. other responses; limited to those aware of e-cigs). Regression models adjusted for: sex, age (continuous), education, income, city of residence, intention to quit, and smoking frequency. Data were analyzed using Stata 12.0 (StataCorp LP, College Station, USA), accounting for the complex sampling design.

Results

Differences in demographic and smoking-related variables between the Wave 2 recontact and replenishment samples are presented in the Table 1.

Replenishment sample – sociodemographic and smoking profile (Table 2): 67.3% of respondents were female, the average age was 50.8 years, and 37.4% of respondents lived in São Paulo City, Brazil. 44.8% reported having attained high school or further degree, and 47.5% earned a moderate monthly household income; 54.2% were planning to quit beyond 6 months (or not quit at all), and 71.2% of respondents were daily “light-moderate” smokers.

Awareness: 37.4% (249/721; 95%CI: 32.8%-42.3%) of current smokers were aware of e-cigs. Younger, better-educated smokers were more likely to be aware of e-cigs than their counterparts (adjusted p-value = 0.042 and < 0.001, respectively) (Table 2). Ever-use: 9.3% (48/721; 95%CI: 6.5%-13.3%) of smokers reported having ever tried e-cigs. Recent use: 4.6% (24/721; 95%CI: 2.8%-7.4%) of smokers reported having used or tried e-cigs in the last 6 months.

POH compared to regular cigarettes: among smokers who were aware of e-cigs, 44.4% (n = 103/249; 95%CI: 36.8%-52.3%) believed e-cigs were less harmful than regular cigarettes (i.e., had “low POH”), 20.6% (n = 57/249) thought they were equally harmful, 2.7% (n = 7/249) thought they were more harmful, and 32.4% (n = 82/249) did not know. “Low POH” was associated with being better-educated, having recently used/tried e-cigs, and being a daily “light-moderate” smoker, as compared to daily ‘heavy’ smoker (adjusted p-values = 0.024, < 0.001, and 0.047, respectively) (Table 3).

Table 2

Crude and adjusted odds ratio (OR) of awareness of e-cigs, by sociodemographic characteristics and smoking behavior. Cigarette smokers only, *Brazilian International Tobacco Control Policy Evaluation Survey (ITC-Brazil) Wave 2 replenishment sample* *

	n	Proportion ** (%)	Awareness of e-cigs (n = 721)		p-value
			Crude OR	Adjusted OR ***	
Overall		37.4	-	-	-
Gender					
Male	236	39.0	Reference	Reference	-
Female	485	35.4	0.86	0.84	0.503
Age-group (years continuous)	721	-	0.97 #	0.98	0.042
City					
Rio de Janeiro	207	33.4	Reference	Reference	-
São Paulo	266	38.8	1.27	0.83	0.564
Porto Alegre	248	39.2	1.29	1.05	0.892
Schooling (years)					
Elementary school or less	134	16.9	Reference	Reference	-
Incomplete high school	261	28.0	1.91	2.24	0.062
High school or further	322	51.2	5.15 ##	5.82	< 0.001
Income ###					
Low	218	27.4	Reference	Reference	-
Moderate	291	33.5	1.33	1.07	0.816
High	102	52.1	2.88	2.02	0.094
Planning to quit					
More than 6 months (or not at all)	342	40.3	Reference	Reference	-
Within the next 6 months	290	32.5	0.71	0.83	0.477
Smoking frequency #					
Daily smoker moderate/low HSI	515	39.0	Reference	Reference	-
Daily smoker high/very high HSI ###	169	31.6	0.72	0.75	0.327
Nondaily smoker	37	37.4	0.93	0.43	0.179

HSI: Heaviness of Smoking Index.

* Question about e-cigs asked in the ITC Brazil survey; awareness: Have you ever heard of electronic cigarettes or e-cigs?

(Responses: yes or no);

** Weighted proportions shown;

*** Multivariate logistic model adjusted by gender, age, city, educational level, income, e-cig use, intention to quit, and smoking frequency.

Smoking frequency (1 = non-daily smoker, 2 = daily "light to moderate" smoker, 3 = daily "heavy" smoker; where HSI was derived for daily smokers only; HSI ≤ 3 = light to moderate smoking, and HSI 4-6 = high to very high smoking);

p < 0.05;

Monthly household income (low (< 3 minimum wages) = less than R\$ 1,866 (equivalent to < USD 894), moderate (3-9 minimum wages) = BRL 1,866-5,598 (USD 894-USD 2,683), or high (10 or more minimum wages) = BRL 5,598 or more (> USD 2,683).

Discussion

This study examined e-cig awareness and use in Brazil, a country with strict regulatory requirements. Brazilian smokers' awareness of e-cigs (37.4%) was lower than in other ITC countries without such requirements (Netherlands, 88%; United States, 73%; Republic of Korea, 79%; and United Kingdom, 54%); but ever-use (9%) was not much lower compared to the same countries (18%, 12%, 10%, and 15%, respectively). In contrast, 2009 data from China, a country with no ban, showed lower awareness (31%) and ever-use (2%), likely attributable to Chinese market factors and earlier survey date (2009) ²⁴. Between-country comparisons should be interpreted with caution because country-specific factors may have contributed to variability.

Table 3

Crude and adjusted odds ratio (OR) of perception of harmfulness (of e-cigs compared to regular cigarettes) related to e-cig use *, by sociodemographic characteristics and smoking behavior. Cigarette smokers only, *Brazilian International Tobacco Control Policy Evaluation Survey* (ITC-Brazil) wave 2 replenishment sample **.

	Perceive e-cigs are less harmful than regular cigarettes (n = 249) ***				
	n	Proportion # (%)	Crude OR	Adjusted OR ##	p-value
Overall		44.4	-	-	
Gender					
Male	89	41.7	Reference	Reference	-
Female	160	48.0	1.29	1.01	0.985
Age-group (years continuous)	249	-	0.99	1.01	0.704
City					
Rio de Janeiro	58	36.0	Reference	Reference	-
São Paulo	96	32.3	0.85	0.65	0.437
Porto Alegre	95	63.1	3.03	1.83	0.287
Schooling (years)					
Elementary school or less	83	19.2	Reference	Reference	-
Incomplete high school	68	40.7	2.89 ###	5.10	0.039
High school or further	156	48.3	3.92 ###	5.25	0.024
Income §					
Low	45	25.7	Reference	Reference	-
Moderate	102	56.4	3.73	2.57	0.114
High	55	41.2	2.02	1.57	0.505
E-cigarette use/trial					
Never	201	37.0	Reference	Reference	-
More than 6 months	24	67.4	3.53	4.10	0.048
6 months or less	24	65.8	3.28 ###	15.5	< 0.001
Planning to quit					
More than 6 months (or not at all)	126	45.2	Reference	Reference	-
Within the next 6 months	89	43.5	0.93	0.74	0.488
Smoking frequency §§					
Daily smoker moderate/low HSI	180	48.4	Reference	Reference	-
Daily smoker high/very high HSI	54	25.9	0.37 ###	0.33	0.047
Nondaily smoker	15	46.5	0.93	0.52	0.594

HSI: Heaviness of Smoking Index.

* Among smokers who had ever heard of e-cigs and who were replenished;

** Question about e-cigarettes asked in the ITC Brazil survey; awareness: have you ever heard of electronic cigarettes or e-cigs? (Responses: yes or no); ever-trial: have you ever tried an e-cig? (yes or no); recent use (including recent trial): in the last 6 months have you used or tried any of the following products: e-cigs? (yes or no); and Perception of electronic nicotine delivery systems harmfulness to health compared to regular cigarettes (POH): "do you think e-cigs are more harmful than regular cigarettes, less harmful, or are they equally harmful to health? This variable was then categorized into "e-cigarettes are less harmful than regular cigarettes" versus "no difference" or "more harmful than regular cigarettes" or "don't know";

*** Asked of those who were aware of e-cigs;

Weighted proportions shown;

Multivariate logistic model adjusted by gender, age, city, educational level, income, e-cig use, intention to quit, and smoking frequency;

p < 0.05;

§ Monthly household income low (< 3 minimum wages) = less than BRL 1,866 (equivalent to < USD 894), moderate (3-9 minimum wages) = BRL 1,866-5,598 (USD 894-USD 2,683), or high (10 or more minimum wages) = BRL 5,598 or more (> USD 2,683);

§§ Smoking frequency (1 = non-daily smoker, 2 = daily "light to moderate" smoker, 3 = daily "heavy" smoker; where HIS was derived for daily smokers only; HIS ≤ 3 = light to moderate smoking, and HIS 4-6 = high to very high smoking).

Among smokers who were aware of e-cigs in Brazil, 44.4% believed they were less harmful compared to regular cigarettes. A United States study in 2012-2013 (no ENDS ban) showed that 51% of smokers believed e-cigs were less harmful compared to regular cigarettes²⁵. Data are difficult to interpret, but it appears that a substantial proportion of smokers in countries both with and without strict regulations believe e-cigs are less harmful than regular cigarettes.

This study was the first to examine correlates of e-cigs awareness and POH in Brazil. Younger and better-educated smokers were more likely to be aware of e-cigs, as in other countries²⁶. In Brazil this group has greater access to the Internet²⁷ and may be more frequently targeted by online ads and novelty promotion²⁸. Respondents with 'low POH' were also more likely to be better-educated.

Currently, there is no consensus on the overall population health impact of e-cigs^{29,30}. The overall population impact of e-cigs will depend on a number of factors, none of which have been established to date, including the extent to which e-cigs affect short-term and long-term health, the impact of e-cigs on quitting attempts and success among smokers, whether or not e-cigs promote smoking among youth, and the extent to which the presence of e-cigs and advertising and marketing of these products may produce renormalization of cigarettes and other smoked tobacco products.

Although Brazil currently prohibits e-cig sale, import, and advertising, there is a clause in the Resolution that will permit them if e-cigs are proven safe/effective for smoking cessation. Long-term high quality studies are necessary to inform evidence-based recommendations that can be adopted by WHO-FCTC Member States.

Limitations

Because the data reported in this study are cross-sectional, we could not evaluate pre-Resolution versus post-Resolution e-cig awareness and perceptions. The survey used a telephone landline sampling frame, and smokers without landlines are more likely to be from lower socioeconomic groups and may respond differently compared to smokers from higher socioeconomic groups. The survey did not distinguish between e-cig experimentation vs. sustained use, and did not assess if users legally used e-cigs while outside of Brazil. Three Brazilian cities were surveyed, and thus results may not be generalizable to the entire country.

Conclusions

Despite strict e-cig regulatory requirements in Brazil, 4.6% of the adult smoker sample reported having used an e-cig at least once in the past 6 months. Of those aware of e-cigs, about 44% believed e-cigs were less harmful than regular cigarettes. Long-term high quality studies are necessary to inform evidence-based recommendations that can be adopted by the WHO-FCTC Member States. National health surveillance programs should include questions about ENDS use and perceptions under their respective regulatory environments.

What this paper adds

This study describes e-cig awareness, perceptions of harmfulness, and correlates of these measures in Brazil, a middle-income country with strong tobacco control policies (for the past 20 years) and with strict e-cig regulations (since 2009). It is the first study to examine the correlates of e-cig perceptions in Brazil.

Contributors

T. M. Cavalcante, A. S. Szklo and L. M. de Almeida wrote the first draft and revised of the paper. C. A. Perez, J. F. Thrasher, M. Szklo, J. Ouimet, S. Gravely and G. T. Fong contributed to the writing and revision of the paper.

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Resumo

Devido às incertezas sobre o impacto dos cigarros eletrônicos na saúde, o Brasil adotou, em 2009, regulamentação que proibiu venda, importação e propaganda desses produtos até que fabricantes possam demonstrar que são seguros e/ou efetivos na cessação de fumar. O objetivo do estudo foi analisar entre fumantes brasileiros: (1) conhecimento sobre existência de cigarros eletrônicos, uso na vida, e uso recente; (2) percepção de risco sobre cigarros eletrônicos comparados a cigarros convencionais e (3) fatores correlacionados ao conhecimento e percepção de risco. Este é um estudo transversal entre fumantes brasileiros (≥ 18 anos) usando amostra de reposição da Onda 2 do Inquérito Internacional sobre Controle do Tabaco. Os participantes foram recrutados em três cidades por meio de um protocolo de discagem randomizada entre outubro de 2012 e fevereiro de 2013. Entre os 721 respondentes, 37,4% ($n = 249$) dos fumantes atuais conheciam cigarros eletrônicos, 9,3% ($n = 48$) relataram ter experimentado ou usado alguma vez na vida e 4,6% ($n = 24$) ter usado nos últimos 6 meses. Entre os que conheciam cigarros eletrônicos, 44,4% ($n = 103$) acreditavam que eles eram menos nocivos que os cigarros regulares (baixa percepção de risco). A “baixa percepção de risco” foi associada com ter maior nível educacional e com ter experimentado/usado cigarro eletrônico recentemente. Apesar das restrições aos cigarros eletrônicos no Brasil, 4,6% dos fumantes da amostra relataram uso recente. Programas de vigilância em saúde do Brasil e demais países deveriam incluir questões sobre uso e percepções sobre cigarros eletrônicos considerando os respectivos ambientes regulatórios.

Cigarros Eletrônicos; Nicotina;
Produtos do Tabaco

Resumen

Debido a las incertezas sobre el impacto de los cigarrillos electrónicos en la salud, en 2009 Brasil adoptó una regulación que prohibió su venta, importación y propaganda de esos productos hasta que los fabricantes pudiesen demostrar que son seguros y/o efectivos en el abandono del tabaco. El objetivo fue analizar entre fumadores brasileños: (1) conocimiento sobre la existencia de cigarrillos electrónicos, uso en vida, y uso reciente; (2) percepción de riesgo sobre cigarrillos electrónicos, comparados con cigarrillos convencionales; y (3) factores correlacionados con el conocimiento y percepciones de riesgo. Este es un estudio transversal entre fumadores brasileños (≥ 18 años), usando una muestra de reposición de la Oleada 2 de la Encuesta Internacional sobre Control del Tabaco. Los participantes fueron reclutados en tres ciudades, a través de un protocolo de llamadas telefónicas randomizadas entre octubre de 2012 y febrero de 2013. Entre los 721 encuestados que respondieron, un 37,4% ($n = 249$) de los fumadores actuales conocían el cigarrillo electrónico, un 9,3% ($n = 48$) relataron haberlo probado o consumido alguna vez en la vida y un 4,6% ($n = 24$) haberlo usado en los últimos 6 meses. Entre los que conocían los cigarrillos electrónicos, un 44,4% ($n = 103$) creían que ellos eran menos nocivos que los cigarrillos regulares (baja percepción de riesgo). La “baja percepción de riesgo” se asoció con tener un mayor nivel educacional y con haber probado/consumido cigarrillos electrónicos recientemente. A pesar de las restricciones a los cigarrillos electrónicos en Brasil, un 4,6% de los fumadores de la muestra relataron un uso reciente. Los programas de vigilancia en salud de Brasil y demás países deberían incluir cuestiones sobre el uso y percepciones sobre los cigarrillos electrónicos, considerando los respectivos ambientes regulatorios.

Cigarrillos Electrónicos; Nicotina;
Productos de Tabaco

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