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Citation

Martínez-Sánchez, Jose M., Montse Ballbè, Marcela Fu, Juan C. Martín-Sánchez, Mark Gottlieb, Esteve Saltó, Constantine I. Vardavas, Richard Daynard, Gregory N. Connolly, and Esteve Fernández. 2014. "Attitudes towards Electronic Cigarettes Regulation in Indoor Workplaces and Selected Public and Private Places: A Population-Based Cross-Sectional Study." PLoS ONE 9 (12): e114256. doi:10.1371/journal.pone.0114256. <http://dx.doi.org/10.1371/journal.pone.0114256>.

Published Version

doi:10.1371/journal.pone.0114256

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RESEARCH ARTICLE

Attitudes towards Electronic Cigarettes Regulation in Indoor Workplaces and Selected Public and Private Places: A Population-Based Cross-Sectional Study

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Citation: Martínez-Sánchez JM, Ballbè M, Fu M, Martín-Sánchez JC, Gottlieb M, et al. (2014) Attitudes towards Electronic Cigarettes Regulation in Indoor Workplaces and Selected Public and Private Places: A Population-Based Cross-Sectional Study. PLoS ONE 9(12): e114256. doi:10.1371/journal.pone.0114256

Editor: Chris Bullen, The University of Auckland, New Zealand

Received: June 26, 2014

Accepted: November 5, 2014

Published: December 3, 2014

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Data Availability: The authors confirm that all data underlying the findings are fully available without restriction. All relevant data are in the body of the paper and tables. The individual anonymized database is in the Supporting Information files.

Funding: This project was funded by Instituto de Salud Carlos III, Government of Spain (RTICC RD06/0020/0089, RD12/0036/0053, BAE 14/00014, and PI12/01114), and Ministry of Universities and Research, Government of Catalonia (grant 2014SGR999). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: All authors declare that they have no conflicts of interest.

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Abstract

Background: Currently, there is an intensive debate about the regulation of the use of electronic cigarettes (e-cigarettes) in indoor places. The aim of this study was to assess the attitudes toward e-cigarette use in indoor workplaces and selected public and private venues among the general population in Barcelona (Spain) in 2013–2014.

Methods: This is a cross-sectional study of a representative sample of the population of Barcelona (n=736). The field work was conducted between May 2013 and February 2014. We computed the prevalence and the adjusted odds ratios (OR) derived from multivariable logistic regression models.

Results: The awareness of e-cigarettes was 82.3%. Forty five percent of respondents did not agree with the use of e-cigarettes in public places and 52.3% in workplaces. The proportion of disapproval of the use of e-cigarettes in indoor places was higher at 71.5% for schools and 65.8% for hospitals and health care centers; while the prevalence of disapproval of e-cigarette use in homes and cars was lower (18.0% and 32.5%, respectively). Respondents who disagreed on the use of e-cigarettes in indoor workplaces were more likely to be older (OR=1.64 and 1.97 for groups 45–64 and ≥65 years old, respectively), those with a high

educational level (OR=1.60), and never and former smokers (OR=2.34 and 2.16, respectively). Increased scores in the Fagerström test for cigarette dependence were also related to increased support for their use.

Conclusions: Based on this population based study, half of the general population of Barcelona does not support the use of e-cigarettes in indoor workplaces and public places, with the percentage reaching 65% for use in schools, hospitals and health care centers. Consequently, there is good societal support in Spain for the politicians and legislators to promote policies restricting e-cigarettes use in workplaces and public places, including hospitality venues.

Introduction

Secondhand smoke (SHS) exposure is responsible of 1% (603,000 deaths per year) of mortality worldwide [1]. Several countries have implemented smoke-free bans in all indoor workplaces and public places in order to protect the non-smoker population, including children, from the harmful health effects of the SHS exposure as noted by Article 8 of the World Health organization, Framework Convention on Tobacco Control [2]. Scientific evidence has shown that these bans reduce the SHS exposure and the burden of disease among non-smokers [3]. Particularly, smoke-free legislation has been associated with a decrease in hospital admissions for cardiovascular and respiratory diseases among adults [4], and with a reduction of preterm birth and hospital attendance for asthma among children [5].

Since 2007, the popularity of electronic cigarettes (e-cigarettes) has grown rapidly around the world. Among the general population of the United States (US) [6] the prevalence of ever-use, according to a web-based survey, showed a twofold increase between 2010 and 2011 (from 3.3% to 6.2%). This double increase was also observed in US adolescents [7] and in middle and high school students [8] between 2011 and 2012. In Europe, there is certain variability in the prevalence of use among studies, depending on the population and the questions used in the surveys [9–12]. According to a secondary analysis of the 2012 Eurobarometer, 7% of the European citizens tried the e-cigarettes with experimentation significantly higher among current smokers [13]. Moreover, the use of e-cigarettes with nicotine is estimated in 62.5% among ever-users of e-cigarettes according to a study conducted in a representative sample of the general population in Spain [12].

There are two key messages that are promoted by a number of e-cigarettes companies to promote their use: 1) their utility to quit or to reduce the tobacco consumption, and 2) the possibility to use them in workplaces and other public places where smoking is not allowed. According to a systematic review of e-cigarettes' advertisements in websites, the main message highlights their health benefits, whereas 88% claimed that e-cigarettes could be used anywhere [14].

The rise of e-cigarette use and the ability to use them anywhere, due to a regulatory void, is hypothesized to potentially be a gateway to renormalize smoking in indoor public places. Moreover, as first generation disposable e-cigarettes look like conventional cigarettes, thus they could imply the message that smoking is an accepted behavior. Hence, health researchers, legislators, and some regulatory agencies have suggested that the use of e-cigarettes in workplaces and other public places should be prohibited, as is done with combustible tobacco products.

To our knowledge, there is lack of evidence about public support for e-cigarette use in indoor workplaces and other public venues. The objective of this study is to assess the support and correlates of e-cigarette use in indoor workplaces and selected public and private venues among the general population in Barcelona (Spain) in 2013–2014.

Methods

The Determinants of Cotinine phase 3 project (dCOT3, website: <http://bioinfo.iconcologia.net/es/content/estudio-dcot3>) is a longitudinal study of a representative sample of the adult (≥ 16 years old) non-institutionalized population of the city of Barcelona (Spain) ($n=1245$, 694 women and 551 men). The baseline survey was conducted in 2004–2005 and its detailed design is provided elsewhere [15, 16]. We followed-up all the adult participants who responded to the face-to-face questionnaire in 2004–2005 and agreed to participate in a new study in the future. The ethics committee of the Bellvitge University Hospital approved the study protocol and the written informed consent. All participants signed the written informed consent. At the beginning of 2013, we did a linkage with the Insured Central Registry of Catalonia (Registre Central d'Assegurats, RCA) in order to update the vital status and contact information (addresses and telephone numbers) of all participants. We restricted the follow-up to the participants who continued living in the city of Barcelona and its province in 2013.

For the present study we restricted the analysis to this cross-sectional data. We traced 1,010 people out of the 1,245 participants in the baseline study using the RCA (101 have died, 49 migrated out of the province of Barcelona, and 85 did not give consent to be followed or were <18 years old in 2004–2005). In February 2013, we sent a letter informing about the main results of the study of 2004–05 and that an interviewer would visit them at home to administer another face-to-face questionnaire. The follow-up survey was conducted between May 2013 and February 2014. 72.9% agreed to participate, 18.5% refused participation, 7.2% were not localized, and 1.3% had died. The final sample analyzed was 736 individuals (336 men and 400 women). There were no statistically significant differences between the participants and the people lost in the follow-up according to sex, level of education, and smoking status. However, the final sample overestimates the older people compared to the current distribution of the

population in Barcelona. For this reason, we weighted the data according to the age distribution of Barcelona in 2013.

We assumed that participants were aware of e-cigarettes when they answered affirmatively the question: “Do you know what an e-cigarette is?” We also gathered information on ever-use of e-cigarettes using the question: “Have you ever used e-cigarettes?” The possible answers to this question were: “yes, currently”, “yes, in the past”, “I have only tried e-cigarettes”, and “I have never used e-cigarettes”. We considered ever-users of e-cigarettes those people who answered “yes, currently”, “yes, in the past” and “I have only tried e-cigarettes”.

Information on support to the use of e-cigarettes in indoor venues was asked only to those who were aware of them (82.3% of the sample: 606 participants). We used the following question: “To what extent do you agree or disagree with allowing the use of e-cigarettes in the following indoor settings?” The indoor settings considered were: all public places, workplaces, hospitals and other health care centers, schools, the hospitality sector (bars, restaurants pubs, and nightclubs), public transports, taxis, planes, and private venues (home and private vehicles). The possible answers for these questions were: “totally agree”, “agree”, “neither agree nor disagree”, “disagree”, and “totally disagree”. We considered that participants supported the regulation of e-cigarette use in the different venues studied when they answered “totally disagree” or “disagree”. Finally, we asked about the support for the sale of e-liquids containing nicotine using the question: “Do you agree with the marketing of e-cigarettes with nicotine?” The answer for this question was also: “totally agree”, “agree”, “neither agree nor disagree”, “disagree”, and “totally disagree”. We considered participants who opposed to the sale and marketing of e-cigarettes with nicotine when they answered “totally disagree” or “disagree”.

We calculated the proportion of people according to the attitudes towards e-cigarette regulation. We fitted multivariable logistic regression models adjusted for sex, age, and educational level to calculate the odds ratios (OR) with their 95% confidence intervals (CI). All analyses were stratified for sex, groups of age (≤ 44 years old, 45–64 years old, and ≥ 65 years old), educational level -categorized as low (no qualification up to middle school diploma), intermediate (high school), and high (university degree)-, cigarette smoking status (current smokers, former smokers, and never smokers), ever e-cigarette users (yes and no), and level of nicotine dependence measured with the Fagerström test for cigarette dependence (FTCD) [17] for current cigarette smokers (categorized into low-medium dependence for scores between 0 and 5, and high dependence for scores between 6 and 10) [18]. We used SPSS v.21 for all the statistical analyses.

Results

Awareness of e-cigarettes among the study population was 82.3% (95%CI: 79.5–85.1). There were statistically significant differences between people aware and not aware of e-cigarettes according to age, educational level, and current smoking

Table 1. Socio-demographic differences between the people aware and not aware of e-cigarettes.

	Yes, I have heard of electronic cigarettes n=606	No, I have not heard of electronic cigarettes n=130	p-value
Sex			0.141*
Men	47.5 (43.5–51.5)	40.5 (32.1–48.9)	
Women	52.5 (48.5–56.5)	59.5 (51.1–67.9)	
Age			<0.001*
≤44 years old	46.3 (42.3–50.3)	13.8 (7.9–19.8)	<0.001**
45–64 years old	35.7 (31.9–39.5)	17.7 (11.1–24.3)	
≥65 years old	18.0 (15.0–21.1)	68.5 (60.5–76.4)	
Educational level			
Low	11.7 (9.2–14.3)	45.8 (37.2–54.4)	<0.001*
Intermediate	38.9 (35.1–42.8)	31.3 (23.3–39.3)	<0.001**
High	49.3 (45.4–53.3)	22.9 (15.7–30.1)	
Smoking status			<0.001*
Never smoker	35.3 (31.5–39.1)	60.3 (51.9–68.7)	
Former smoker	34.7 (30.9–38.4)	32.1 (24.0–40.1)	
Current smoker	30.0 (26.4–33.7)	7.6 (3.1–12.2)	

*Chi square **Chi square test for trend.

doi:10.1371/journal.pone.0114256.t001

status. Higher levels of awareness were found among younger people, higher education levels, and current smokers (table 1).

Table 2 shows the proportion of people who disagreed with the use of e-cigarettes in indoor workplaces, selected public places, and in hospitality venues (those who answered to “disagree” or “totally disagree” with using e-cigarettes). Overall, 45.0% disagreed with the use of e-cigarettes in any indoor public place, with the lack of support for their use. This figures were significantly higher among older people (OR=1.64 and 1.97 for groups 45–64 and ≥65 years old, respectively), those with a high educational level (OR=1.60), and among never and former smokers (OR=2.34 and 2.16, respectively). The lowest percentage of disagreement for using e-cigarette in all public places was found among current smokers with high scores in the FTCD (17.9%) and among the ever e-cigarette users (27.6%). The percentage of people who disagreed with the use of e-cigarettes in indoor workplaces was 52.3%, which was statistically significantly higher among non-smokers (never and former), smokers with low-medium cigarette dependence, and never e-cigarette users (table 2). The highest percentages of disagreement with the use of e-cigarettes were found for schools and hospitals and health care centers (71.5% and 65.8%, respectively). The percentage was 46.7% for hospitality venues (bars, restaurants, pubs, and nightclubs) (table 2).

The lowest percentages of disagreement for using e-cigarettes were found for private venues (18.0% at homes and 32.5% in private vehicles). Men, young people (≤44 years old), and people with intermediate educational level showed

Table 2. Percentages (%), odds ratio (OR), and 95% confidence interval (95%CI) of people who disagree with allowing the use of electronic cigarettes (who were “disagree” and “totally disagree” with their use) in workplaces, some public places, and hospitality venues.

	n	t		Workplaces		Hospitals and other health care centers		Schools		Bars and restaurants		Pubs and nightclubs	
		%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Overall	606	45.0	–	52.3	–	65.8	–	71.5	–	46.7	–	46.8	–
Sex													
Men	288	41.1	1	50.0	1	60.2	1	65.9	1	42.8	1	43.7	1
Women	318	48.3	1.32 (0.94–1.87)	54.4	1.19 (0.85–1.66)	70.8	1.64 (1.14–2.35)	76.6	1.77 (1.21–2.58)	50.2	1.31 (0.93–1.84)	49.5	1.23 (0.88–1.73)
Age													
≤44 years old	280	39.9	1	52.1	1	64.0	1	69.3	1	45.1	1	46.1	0.88 (0.53–1.45)
45–64 years old	216	49.2	1.64 (1.11–2.42)	53.6	0.87 (0.52–1.44)	67.5	1.35 (0.89–2.02)	74.6	1.45 (0.94–2.24)	49.0	1.28 (0.87–1.87)	48.2	1.03 (0.62–1.72)
≥65 years old	109	50.0	1.97 (1.17–3.33)	51.0	1.02 (0.61–1.70)	67.0	1.78 (1.03–3.10)	71.0	1.64 (0.92–2.91)	47.0	1.27 (0.76–2.10)	46.0	1
Educational level													
Low	71	41.2	0.82 (0.45–1.47)	47.1	0.98 (0.55–1.74)	50.0	1	55.9	1	45.6	1.18 (0.66–2.10)	45.6	1.20 (0.68–2.14)
Intermediate	236	40.6	1	46.5	1	63.1	2.18 (1.20–3.95)	71.2	2.46 (1.34–4.51)	39.8	1	40.3	1
High	299	49.4	1.60 (1.09–2.33)	58.2	1.63 (1.12–2.35)	71.8	3.47 (1.89–6.38)	75.6	3.27 (1.76–6.09)	52.4	1.72 (1.19–2.50)	52.4	1.67 (1.15–2.41)
Smoking status													
Never smoker	214	52.0	2.34 (1.50–3.64)	61.1	2.32 (1.51–3.56)	72.1	2.58 (1.65–4.04)	78.4	2.87 (1.79–4.61)	54.0	2.56 (1.65–3.98)	54.9	2.71 (1.74–4.22)
Former smoker	210	51.4	2.16 (1.38–3.40)	54.7	1.77 (1.14–2.73)	74.6	2.95 (1.85–4.70)	77.8	2.76 (1.70–4.49)	53.9	2.59 (1.65–4.06)	53.4	2.59 (1.66–4.06)
Current smoker	182	30.0	1	39.5	1	48.9	1	55.9	1	30.4	1	30.4	1
FTCD													
Low-Medium (0–5)	150	32.4	2.30 (0.77–6.80)	44.1	3.42 (1.24–9.42)	52.1	2.48 (0.99–6.22)	57.4	1.75 (0.71–4.31)	34.5	4.77 (1.34–16.92)	34.5	4.77 (1.34–16.92)
High (6–10)	32	17.9	1	20.0	1	33.3	1	46.7	1	10.3	1	10.3	1
Ever use of e-cigarettes													
No	546	47.0	1.94 (1.05–3.59)	54.6	2.24 (1.25–4.00)	67.9	1.92 (1.09–3.39)	73.1	1.85 (1.03–3.32)	48.8	1.97 (1.08–3.56)	49.2	2.43 (1.32–4.47)
Yes	60	27.6	1	33.3	1	48.3	1	56.9	1	30.0	1	26.7	1

All ORs were adjusted for sex, age, and educational level.
 FTCD: Fagerström test for cigarette dependence. OR: Odd Ratio; CI: confidence intervals.

doi:10.1371/journal.pone.0114256.t002

the least disagreement with the e-cigarette use in private venues ([table 3](#)). The percentage of disagreement with the use of e-cigarette in public transport, taxis, and planes was around 60% ([table 3](#)). Overall, we found less disagreement for using e-cigarettes in all public and private venues among current smokers,

particularly among smokers with high scores in FTCD, and ever e-cigarettes users ([table 2](#) and [3](#)).

[Table 4](#) shows the proportion of people who were not in favor of the sale and marketing of e-cigarettes containing nicotine. 47.7% did not support the sale and marketing of e-cigarettes with nicotine, a percentage significantly higher among women (52.1%, OR=1.50; 95%CI: 1.07–2.10), middle aged people (45–64 years old; 55.4%, OR=1.90, 95%CI: 1.30–2.78) and older people (≥ 65 years old; 59.4%, OR=2.16, 95%CI: 1.30–3.59). Smokers, particularly those with high scores in FTCD, and ever e-cigarette users were less likely to disagree with the sale and marketing of e-cigarettes with nicotine ([table 4](#)).

Discussion

This is the first study to assess attitudes towards e-cigarette use in enclosed workplaces, public places (including public transports), and private venues (home and cars) in the general population. According to our data, approximately half of the general population did not agree with the use of e-cigarettes in any public place and indoor workplaces. The higher percentages of disagreement with their use were found for hospitals and other health care centers, and in schools (more than two thirds of the general population). However, lower percentages of disagreement with the use of e-cigarettes were found in the case of private venues (18.0% at homes and 32.5% in private vehicles).

We found that the disagreement with allowing the use of e-cigarettes in schools and in hospitals and health care centers (72% and 66% respectively) was similar to that observed towards extending smoking restrictions of conventional cigarettes to outdoors areas [[19](#), [20](#)]. We found a heterogeneous level of support to the use of e-cigarettes in all indoor areas studied between smokers and non-smokers; current smokers indicated less disagreement with the use of e-cigarettes. The differences between smokers and non-smokers were also found in other studies for the support of smoke-free legislation²¹ and the extension of smoking restrictions to outdoor areas [[19](#), [22](#)].

On the other hand, we surprisingly found similar degree of agreement with the use of e-cigarettes in all the public and private venues studied between current smokers and e-cigarettes users. This may be because the primary motivation of these potential users of e-cigarettes may be primarily to quit tobacco consumption or reduce the number of cigarettes smoked and not using these devices in public venues where smoking is banned. In this sense, one study conducted using an Internet panel of ever e-cigarette users showed that the main reasons for their use were the perception that they are less toxic than tobacco (84%) and the desire to quit smoking or avoid relapsing (77%), while only 34% declared to use the e-cigarette to avoid having to go outside to smoke [[23](#)]. Another study conducted by using an Internet panel of 19,000 e-cigarette users also showed that avoiding smoking bans in public places was the reason with the lowest score for initiating the e-cigarette use [[24](#)]. E-cigarettes, however, have been extensively marketed as a

Table 3. Percentages (%), odds ratio (OR), and 95% confidence interval (95%CI) of people who disagree with allowing the use of electronic cigarettes (who are “disagree” and “totally disagree” with their use) in homes, private vehicles, and public transports.

	n	Home		Private vehicles		Public transport		Taxis		Planes	
		%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Overall	606	18.0	–	32.5	–	59.8	–	58.4	–	59.5	–
Sex											
Men	288	16.9	1	30.5	1	54.9	1	53.8	1	54.5	1
Women	318	19.2	1.12 (0.72–1.73)	34.2	1.16 (0.81–1.67)	64.3	1.49 (1.05–2.10)	62.8	1.47 (1.04–2.07)	64.1	1.511 (1.07–2.13)
Age											
≤44 years old	280	13.8	1	24.7	1	57.3	1	56.3	1	58.6	1
45–64 years old	216	23.4	2.01 (1.23–3.29)	38.5	2.03 (1.34–3.06)	62.2	1.37 (0.92–2.02)	60.2	1.28 (0.87–1.89)	60.7	1.20 (0.81–1.77)
≥65 years old	109	18.6	1.48 (0.76–2.86)	42.9	2.48 (1.46–4.23)	61.6	1.62 (0.96–2.75)	61.0	1.64 (0.97–2.77)	60.0	1.48 (0.88–2.50)
Educational level											
Low	71	23.2	1.52 (0.75–3.09)	38.2	1.17 (0.64–2.14)	50.7	1	47.8	1	47.1	1
Intermediate	236	15.5	1	29.5	1	57.1	1.56 (0.87–2.80)	56.2	1.70 (0.95–3.04)	57.1	1.83 (1.02–3.28)
High	299	18.6	1.42 (0.87–2.31)	33.2	1.41 (0.95–2.11)	64.3	2.25 (1.24–4.07)	62.6	2.36 (1.31–4.27)	64.7	2.60 (1.43–4.69)
Smoking status											
Never smoker	214	26.0	4.26 (2.19–8.28)	41.2	3.24 (1.96–5.36)	64.6	2.31 (1.50–3.55)	65.2	2.67 (1.73–4.13)	68.5	3.22 (2.07–5.00)
Former smoker	210	19.4	2.70 (1.36–5.37)	37.6	2.57 (1.54–4.29)	69.9	2.95 (1.88–4.63)	67.9	3.02 (1.93–4.73)	67.9	3.16 (2.01–4.96)
Current smoker	182	7.5	1	16.4	1	43.1	1	40.5	1	39.9	1
FTCD											
Low-Medium (0–5)	150	7.7	0.84 (0.18–4.01)	19.7	–	46.2	2.33 (0.93–5.82)	43.4	2.35 (0.93–5.99)	44.1	3.30 (1.22–8.93)
High (6–10)	32	6.9	1	0.0	–	27.6	1	26.7	1	20.7	1
Ever use of e-cigarettes											
No	546	19.5	3.53 (1.14–10.97)	36.1	16.69 (3.51–79.39)	61.7	1.81 (1.03–3.16)	60.3	1.88 (1.07–3.30)	61.7	2.03 (1.16–3.57)
Yes	60	5.1	1	3.3	1	43.3	1	41.7	1	41.7	1

All ORs were adjusted for sex, age, and educational level.
 FTCD: Fagerström test for cigarette dependence. OR: Odd Ratio; CI: confidence intervals.

doi:10.1371/journal.pone.0114256.t003

way to circumvent clean air policies in public places and enclosed workplaces [14]; this type of advertising could potentially increase dual use, because it may tend to be attractive to current cigarette smokers. Still, there is scarce evidence, quantitative and qualitative, about the real motivation for using e-cigarettes among their users in representative population samples.

Social acceptability of banning smoking in indoor public places, and consequently the support towards smoking regulations, has been an important issue for the politicians and legislators during the process of the implementation

Table 4. Percentages (%), odds ratio (OR), and 95% confidence interval (95%CI) of people who are “disagree” and “totally disagree” with the commercialization of electronic cigarettes containing nicotine.

	n	%	OR (95%CI)
Overall	606	47.7	–
Sex			
Men	288	42.5	1
Women	318	52.1	1.50 (1.07–2.10)
Age			
≤44 years old	280	37.5	1
45–64 years old	216	55.4	1.90 (1.30–2.78)
≥65 years old	109	59.4	2.16 (1.30–3.59)
Educational level			
Low	71	59.7	1.47 (0.81–2.65)
Intermediate	236	52.0	1.36 (0.94–1.96)
High	299	41.4	1
Smoking status			
Never smoker	214	56.9	3.57 (2.27–5.62)
Former smoker	210	55.6	3.17 (1.99–5.04)
Current smoker	182	28.0	1
FTCD			
Low-Medium (0–5)	150	30.3	2.33 (0.85–6.40)
High (6–10)	32	18.2	1
Ever use of e-cigarettes			
No	546	52.0	12.56 (4.67–33.76)
Yes	60	8.6	1

All ORs were adjusted for sex, age, and educational level.
 FTCD: Fagerström test for cigarette dependence. OR: Odd Ratio; CI: confidence intervals.

doi:10.1371/journal.pone.0114256.t004

of smoke-free legislation worldwide, particularly in the hospitality sector [3, 25]. Similarly, our data showed a good social climate for promoting the restriction on using e-cigarettes in all workplaces and public places, including hospitality venues. According to the experiences of implementing indoor smoking restrictions in workplaces, the support for smoking bans increased after their implementation among the general population [26], smoker population [27], and for hospitality workers [28–30]. It is important to note that support for smoke-free legislation rises according to the level of tobacco control measures implemented in a particular country [31].

The tobacco industry has recently invested significantly in e-cigarettes, presumably because the sales of this new product has grown rapidly recent years [32] or as a strategy to undermine the public health gains of the last decades in tobacco control. The tobacco industry has always opposed smoke-free legislation and interfered during the debate around implementation of national smoke-free policies in various countries [33, 34]. The principal argument of the tobacco industry against the restriction of smoking in public places are that it threatens

“individual freedom”, has negative economic impact in the hospitality sector, and displaces tobacco consumption from public to private venues, particularly the home. Scientific evidence has however rebutted all these hypotheses raised by the tobacco industry [35, 36].

Currently, there is scarce evidence about the mid- and long-term potential harmful health effects of e-cigarettes among users, particularly among non-users who are passively exposed [37]. However, the public health precautionary principle has led some governmental agencies, such as the US Food and Drug Administration, and the European Commission, to propose or adopt regulations for e-cigarettes. Furthermore, there is also a scientific debate about the ready availability of e-cigarettes to the population [38–40]. According to our data, 48% of the general population did not agree with the sale and marketing of e-liquids with nicotine. Certainly, there have been few, if any, quality controls on the manufacture of the e-cigarettes and their nicotine liquids to guarantee the safety or consistency of the product. Another important issue is the use of e-cigarettes in public places which could threaten the denormalization of tobacco use in indoor public places achieved through smoke-free legislation in the recent years [31, 41, 42]. For this reason, the WHO has recently called to the governments of the countries to restrict e-cigarettes use in all workplaces and public places, including the hospitality sector [43].

Some limitations to our study deserve consideration. The main limitations are the attrition of the cohort in the follow-up and the use of a questionnaire to collect the information. Regarding attrition, although there are not statistically significant differences between the people followed up and people lost according to sex, educational level, and smoking status, however the final sample overestimates the older people compared to the current distribution of the population in Barcelona. We found systematically higher percentage of disagreement among the older population; for this reason, the prevalence of disagreement with the use of e-cigarette in indoor venues might be slightly overestimated. In fact, young people, particularly smokers, were those who showed less disagreement with the use of e-cigarettes in indoor venues. However, we tried to counteract this limitation by weighting the sample according to the age distribution of the population of Barcelona in 2013. On the other hand, we believe that our results underestimated the real attitudes toward allowing the use of e-cigarettes in all indoor venues because we found that 18% of our sample did not know what e-cigarettes are, and did not declare their attitudes towards e-cigarettes use. Moreover, there were statistically significant differences about knowledge on the e-cigarettes according to the age, level of education and current smoking status, being the oldest people (≥ 65 years old), people with low educational level, and never smokers, the strata of population with less knowledge about e-cigarettes (table 1). These strata of population indicated less agreement with allowing the use of e-cigarettes in indoor public places. Furthermore, the awareness of e-cigarettes is growing rapidly [6] and in a few years or months such knowledge will become universal. Hence, our results could be underestimating the likely attitudes toward allowing the use of e-cigarettes in indoor workplaces once knowledge

about them is completely disseminated. Moreover, the different reactions about e-cigarettes regulation by the tobacco control community and public health authorities among different European countries could influence the public opinion in each country. For this reason, generalization of our results to other European countries should be cautious. The use of a questionnaire to collect self-reported information about the attitudes towards using e-cigarettes could be a source of bias. First, we used questions that measured the attitudes toward the use of e-cigarettes in indoors venues as proxy of the attitudes toward e-cigarette regulation. Second, we did not gather the reason why the people agreed or disagreed with the e-cigarette use in indoor places. More studies, particularly qualitative research, are needed to know in-depth the reasons why the general population agree or disagree with the e-cigarette use in public and workplaces. Nevertheless, strengths of our study include the fact that trained interviewers conducted a face-to-face interview at participants' home, thus potentially increasing the internal validity of our results. In addition, this is the first time that information on the agreement of use of e-cigarettes is gathered among the general population in a European Country.

In conclusion, half of the general population did not support the use of e-cigarettes in workplaces and public places, including the hospitality sector. Moreover, the clear majority of the population (2 out of 3 people) disagreed with the use of e-cigarettes in hospital and other health care centers and in schools. Although there is a lack of scientific evidence about the harmful effects of passive exposure to the aerosols released or exhaled from e-cigarettes, avoiding the re-normalization of use of tobacco in indoor public places and a public health precautionary principle are strong arguments to promote e-cigarette regulation in all enclosed public venues without exception, as suggested by the WHO [43]. In this sense, our data show a favorable social climate that should be taken into account by legislators to extend e-cigarette regulation to all workplaces and enclosed public places in Spain.

Acknowledgments

The authors wish to thank Nuria Quirós for her contribution to the follow-up of the participants by means of the linkage of the contact information with those in the Insurance Central Registry of Catalonia. We would like to thank to DYM Market Research for conducted the field work and to Montse Ferré and Lucía Baranda for the coordination of the field work.

Author Contributions

Conceived and designed the experiments: JMMS MB MF ES EF. Performed the experiments: JMMS MB MF ES EF. Analyzed the data: JMMS JCMS EF MF MB. Contributed reagents/materials/analysis tools: JMMS MB MF JCMS ES EF. Wrote the paper: JMMS MB MF JCMS MG ES CIV RD GNC EF. Conceived the study: JMMS EF. Contributed to the design and coordination of the study: MB EF ES

JMMS. Drafted the first manuscript: JMMS. Contributed substantially to the interpretation of the data and the successive versions of the manuscript: JMMS MB MF JCMS MG ES CIV RD GNC EF. Approved final version of manuscript: JMMS MB MF JCMS MG ES CIV RD GNC EF. Principal investigator of the project: JMMS.

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