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Lower smoking rates and increased perceived harm of cigarettes among French adults one year after comprehensive tobacco control measures

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ABSTRACT

Context: France has high smoking rates, and recently intensified tobacco control policies spearheaded by the introduction of plain tobacco packaging (PP), and an increase in graphic health warnings (GHW). We examine smoking and e-cigarettes use rates, as well as smoking-related perceptions before (2016) and one year after (2017) comprehensive tobacco control measures.

Methods: DePICT is a two waves cross-sectional national telephone survey of French adults aged 18–64 years (2016: 4456 – 2017: 4114). Data were weighted to be representative of the French adult population. Adjusted prevalence ratios (PR, 95% CI) estimating changes between the two study waves were calculated using multivariate Log-Binomial regression models.

Main Findings: In 2017, as compared with 2016, smoking rates (PR = 0.93 (0.88-0.99) and current e-cigarette use (PR = 0.76 (0.61-0.96)) decreased in France. Further, French adults were more likely to report fear of the consequences of smoking (PR = 1.10 (1.06–1.14)) and that smoking is dangerous (PR = 1.08 (1.06–1.11)). Smokers were also more likely to report that health messages on tobacco products are efficient (PR = 1.18 (1.05–1.32)).

Conclusions: Our study provides early and encouraging results on potential effects of the comprehensive tobacco control strategies in France introduced in 2017, including PP and larger GHW. Our findings also suggest that e-cigarettes did not replace traditional smoking.

1. Introduction

Tobacco remains the largest modifiable health risk factor in Europe where it is responsible of an estimated 700,000 deaths every year, despite declining smoking rates (European Parliament, 2016). This is especially true in France, a country notorious for having one of the highest smoking rates in the Western world (Ng et al., 2014). Smoking is also less stigmatized in France compared to other European countries. For example, in France, public support for tobacco control policies, such as keeping tobacco products out of sight in shops and points of sale or increases in taxes on tobacco products is among the lowest in industrialized countries (Directorate-General for Communication, 2015).

After decades of high smoking rates, which stagnated at about 30% (among 18–75 years old: 2010: 29.7%; 2014: 29.4%; 2015: 29.4%) despite many anti-smoking measures (Pasquereau et al., 2018), France recently amplified tobacco control policies. Comprehensive measures were introduced, including plain tobacco packaging (PP), and an increase in graphic health warnings (GHW) on tobacco products, which were first implemented in 2011. Further, there were increases in the reimbursement of certain nicotine replacement treatments, and planned increases in tobacco taxes. Accordingly, since January 1st, 2017, most tobacco products sold in France are in PP with large GHWs, which are meant to contribute to smoking "denormalization". Further, starting in October 2016, France adapted the British "Stoptober" smoking cessation mass media campaign which encourages smokers to quit smoking (Guignard et al., 2018). With the introduction of these policies, France is now ranked 4th in Europe in terms of tobacco control policies. In 2017, the first significant drop in smoking rates was observed with a 3% decrease in regular smoking among adults as compared with 2016 (Pasquereau et al., 2018).

Perceptions of smoking and smokers are paramount to long-term changes in population levels of tobacco use. To examine the extent to

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which these evolved in the context of the implementation of PP and larger GHW of tobacco products, we conducted the DePICT study, a repeated cross-sectional survey representative of adults living in France before (2016) and one year after (2017) this policy change. We also examine whether tobacco use and e-cigarette use, as well as perceptions of tobacco use, changed after the introduction of plain tobacco packaging. To determine whether these changes were consistent across different sociodemographic groups, we tested for interactions with sex and educational level, since it is possible that women could find PP and larger GHW less appealing than men, and participants with higher education could may be more responsive to messages about the health impacts of smoking (Moodie et al., 2012).

2. Methods

2.1. Depict: study design and recruitment

DePICT (*Description des Perceptions, Images, et Comportements liés au Tabagisme)* is a nationally representative telephone survey of residents of mainland France that took place in two waves one year apart: end of August to mid-November 2016 and 2017. The target population consisted of all French-speakers aged 18–64 years. Interviews were conducted via landline or mobile telephones by trained interviewers working for a polling institute located in the south of Paris. Randomly-generated telephone lists were used to call participants up to 30 times using a computer-assisted telephone interviewing (CATI) system. In households reached by landline, one participant was randomly selected by the CATI system (Kish method).

DePICT was approved by the ethical review committee of the French National Institute of Health and Medical Research (INSERM, CEEI-IRB 00,003,888).

2.2. Measures

2.2.1. Tobacco and E-Cigarettes Use

Participants were asked about their lifetime, current regular (≥one cigarette/day) or occasional use of tobacco. They were also asked about their lifetime ("Have you ever used an e-cigarette?") and current use of e-cigarettes ("Do you currently use an e-cigarette?").

2.2.2. Smoking-related perceptions

Multiple smoking-related perceptions were examined using items from the French National Health survey (Peretti-Watel et al., 2014) and questionnaires administered in Australia to evaluate the impact of plain tobacco packaging.(BMJ, 2015; Wakefield et al., 2015) Participants were asked whether they feared the health consequences of smoking, if they thought that smoking is harmful, how their family and friends perceive smoking, if they think that smokers are socially less accepted than non-smokers. Answers were rated using a Likert scale (strongly agree, agree, no opinion/neutral, somewhat disagree, strongly disagree). Answers were later dichotomized according to their distribution (see Supplementary Material 1).

Current smokers (daily and occasional) who reported smoking at least one tobacco brand regularly were asked about their attachment to their main brand ("I am very attached to this brand"), their opinion regarding its name ("I like its name"), and the perceived harmfulness of this brand compared to others ("My brand is less bad than other brands"). All answers were also rated on a Likert scale and dichotomized according to their distribution (see Supplementary Material 1).

2.2.3. Socio-Demographic Characteristics

Socio-demographics included characteristics which have previously been linked to smoking or e-cigarette use: sex, age, educational level, and the household living situation (single person living alone Y/N), and country of birth (France Y/N).

2.3. Analysis

For each wave, data were weighted based on the probability of being selected through the Kish method (the ratio of the number of eligible individuals to the number of telephone lines in a household), and to match the structure of the French population in 2016 with respect to sex, age, education, region of residency and smoking experimentation rates, using data from the National Institute of Statistics and Economic Studies (INSEE) and the National Health Survey (Pasquereau et al., 2017). Taking into account the probability of being selected through the Kish method, we used the SAS raking macro to estimate a weight value for each participant, such that the weighted distribution of the listed variables in the overall sample is comparable to that of the 2016 French population (Izrael et al., 2000). Weights were used in all subsequent analysis. Multivariate Log-Binomial regression model were used to estimate prevalence ratios (PRs) between the two study waves, adjusting for socio-demographic characteristics. All statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc), statistical significance was set to 0.05.

2.4. Testing for interactions

We tested for statistical interactions between study waves and a) sex and b) educational level for smoking and e-cigarettes use, and we stratified analyses when a statistically significant interaction was found.

3. Results

More than 4000 adults were recruited for each study wave, with a total sample of 8470 adults (2016: 4456 - 2017: 4114). Main characteristics of our weighted sample are presented in Table 1.

3.1. Cigarette smoking and E-Cigarette use (Table 2 and Fig. 1)

Across the two study waves, approximately 28.5% of the weighted sample were daily smokers (2016: 30% - 2017: 27%), and 5.1% were occasional smokers (2016: 4.7% - 2017: 5.5%). Smoking rates (daily and occasional vs non-smokers and ex-smokers) decreased significantly in 2017 compared to 2016 with an adjusted PR = 0.93 (CI 95%, 0.88-

Table 1
Characteristics of the DePICT study sample (weighted to be representative of the French population in 2016 on the following variables: sex, age, educational level, and living alone, %). France, 2016–2017 (unweighted n, 2016: 4456 - 2017: 4114).

Characteristic		2016	2017
Sex	Female	50.9%	50.9%
	Male	49.1%	49.1%
Age	18-24	13.3%	13.3%
	25-34	20.3%	20.3%
	35-44	21.8%	21.8%
	45-54	23.0%	23.0%
	55-64	21.6%	21.6%
Educational level	At least a three-year university degree	18.1%	18.1%
	High School or two-year university degree	33.2%	33.2%
	No High school diploma (< Bac)	48.7%	48.7%
Living alone	Yes	39.1%	39.1%
	No	60.1%	60.1%
Born in France	Yes	87.8%	89.7%
	No	12.2%	10.3%
Smoking status	Non smokers	43.3%	45.9%
	Former smokers	22.0%	21.7%
	Occasional smokers	4.7%	5.5%
	Regular smokers	30%	26.8%
Current use of e-cigarettes	No	96.1%	97%
	Yes	3.9%	3.0%

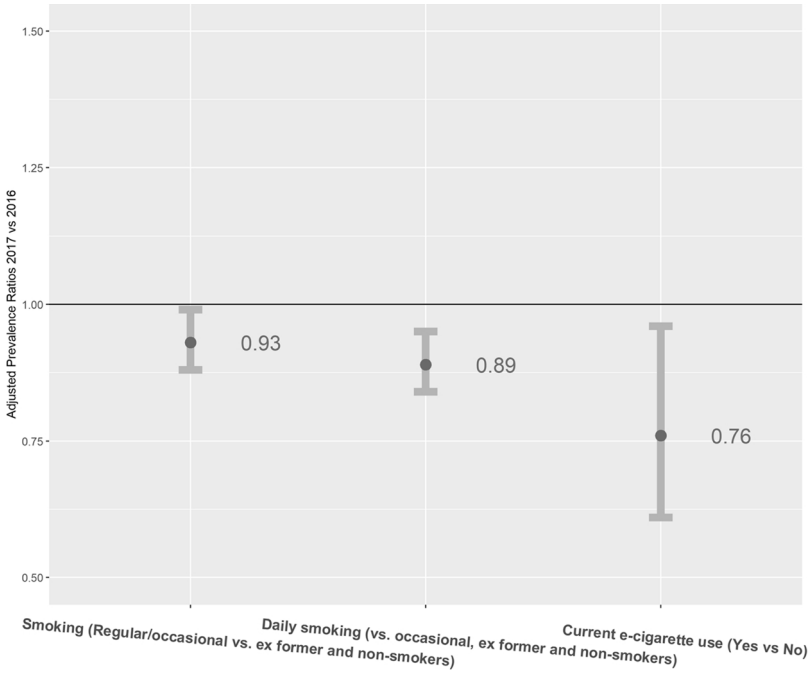

Fig. 1. Changes in smoking and e-cigarette use among French adults. DePICT study, France, 2016–2017, n = 8468 (complete cases). Weighted adjusted prevalence ratios.
Note: Adjusted for age, sex, educational level, living alone, and country of birth.

Table 2
Changes in smoking and e-cigarette use among French adults. DePICT study, France, 2016–2017, n = 8468 (complete cases). Weighted adjusted prevalence ratios.

Outcome	Prevalence ratio 2017 vs. 2016 *	p*
Smoking (Regular/occasional vs. former and non-smokers)	0.93 (0.88 - 0.99)	0.02
Daily smoking (vs. occasional, former and non-smokers)	0.89 (0.84 - 0.95)	0.0006
Current e-cigarette use (Yes vs No)	0.76 (0.61 - 0.96)	0.02

* Adjusted for age, sex, educational level, living alone, and country of birth.

0.99). This decrease seemed to be driven by a drop in daily smoking (daily smokers vs all other categories, PR = 0.89 (Cl 95% 0.84 – 0.95). The prevalence of adults reporting regular e-cigarette use dropped from 3.9% in 2016 to 3.0% in 2017, which was statistically significant (adjusted PR = 0.76 (CI 95%, 0.61-0.96)). The number of dual users dropped from 7.81% to 5.35% from 2016 to 2017 (Table 3)

3.2. Smoking-related perceptions

Results of multivariate log-binomial regression analyses examining changes in smoking-related perceptions are presented in Table 4 and Fig. 2.

Participants were more likely to report that smoking is dangerous (PR = 1.08, CI 95%, 1.06–1.11) and to be afraid of the consequences of smoking (PR = 1.10 CI 95%, 1.06–1.14) in 2017 compared to 2016. However, no change was detected concerning perceptions of smokers: participants reported comparable rates of social acceptance of smoking and smokers in both study waves.

3.3. Brand perceptions among smokers

Most current smokers (94.4%) had at least one preferred or usual tobacco brand (2016: 93.7%; 2017: 95.1%). After adjusting for covariates, between the two survey waves, there was no difference in current smokers' attachment to their usual brand, or in the perception that this brand is "not as bad" as other brands. The perception that health messages on tobacco products are credible was also comparable between the two study waves, however smokers were more likely to think that these messages were efficient in 2017 than in 2016 (adjusted PR = 1.17 (CI 95%, 1.05–1.31)) (Fig. 3 and Table 5). Smokers were slightly more likely to report liking their tobacco brand's name in 2017 compared to 2016 (adjusted PR = 1.08 (CI 95%, 1.00–1.16)).

3.4. Interactions

There was no statistically significant interaction between sex and study wave for neither smoking nor e-cigarettes use. Further, we found a statistically significant interaction between educational level and study wave in relation to smoking. In stratified analyses, the adjusted PR of smoking

Table 3
Current e-cigarette use according to smoking status. DePICT study, France, 2016–2017. Weighted percentages.

	Current e-cigarette use	2016	2017
Daily Smokers	E-cigarette user (dual user)	7.6%	5.4%
	Non e-cigarette user	92.4%	94.6%
Occasional smokers	E-cigarette user (dual user)	9.1%	5.0%
	Non e-cigarette user	90.9%	95.0%
Former smokers	E-cigarette user	5.0%	5.5%
	Non e-cigarette user	95.0%	94.5%
Non smokers	E-cigarette user	0.1%	0.2%
	Non e-cigarette user	99.9%	99.8%

Table 4
Changes in perceptions of smoking among French adults. DePICT study, France, 2016–2017, n = 8468 (complete cases). Weighted adjusted prevalence ratios.

Outcome	Prevalence ratio 2017 vs. 2016 *	p*
Fear of the health consequences of smoking (Agree vs. Disagree	1.10 (1.06-1.14)	< 0.001
Smoking is dangerous (Agree vs. Disagree)	1.08 (1.06-1.11)	< 0.001
Friends accept smoking (Agree vs. Disagree)	0.97 (0.90-1.05)	0.46
Family members accept smoking (Agree vs. Disagree)	0.93 (0.85-1.02)	0.13
Smokers are socially less accepted than non-smokers (Agree vs. Disagree)	0.99 (0.93-1.05)	0.70

* Adjusted for sex, age, educational level, smoking status, living alone and country of birth.

between the two waves decreased only among those with a high school or two-year university degree (PR = 0.85 (CI 95%, 0.77 - 0.94)).

4. Discussion

Our study compares smoking-related perceptions and behaviors between 2016 and 2017: before and one year after the intensification of tobacco policies in France via the introduction of PP and larger GHW. We found a significant, but modest, drop in smoking, a significant drop in e-cigarettes use, and significant increases in the perceived harmfulness of smoking and in the fear of the health consequences of tobacco use. Smokers were more likely to report that health messages on tobacco products are efficient in 2017 compared to 2016. However, they were also more likely to report liking their brand's name after the tobacco packaging modification. Overall, these results suggest that PP and larger GHW, along with other tobacco control measures, could have contributed to changes in perceptions and in patterns of tobacco use, which could signal a substantial change in smoking behaviors in the future.

4.1. Interpretation

Our findings need to be interpreted in the context of the recent introduction of different tobacco control policies in France, but also in the context of declining tobacco use trends.

The design of our study does not allow us to attribute all the observed changes to these policies; however, it is very plausible that recent tobacco control policies contributed to increasing the perceived harmfulness of tobacco products and in decreasing smoking rates. This would explain the unprecedented drop in smoking rates in France, which had been stagnating for almost a decade (daily smoking rates 29.7% in 2010, 29.4% in 2014 and 2016) (Pasquereau et al., 2018).

For example, many pharmacies throughout France took part in smoking cessation campaigns, and there were more than one million visits to the dedicated smoking cessation site, (French Anti-Smoking Initiative, 2019) therefore information on effective treatment was largely communicated. This might have contributed to boosting smoking cessation uptake. Additionally, we observed an increase in the perceived "efficiency" of health messages on tobacco products among smokers, probably due to the introduction of plain packaging and larger GHWs. This change in packaging, and discussion regarding increases in tobacco prices might also have contributed to demoralizing smoking and increasing the perceived fear of smoking which in turn yield a drop-in smoking rates.

Also, although smoking rates declined overall, there was a slight increase in rates of occasional smoking, which might indicate that some daily smokers stopped smoking regularly. The change in smoking patterns requires longitudinal follow-up.

We did not find any change in smokers' attachment to their tobacco brand; however, it is possible that smokers who became less attached to their brand after the introduction of plain packaging and larger GHWs were also more likely to quit smoking. In another study also based in

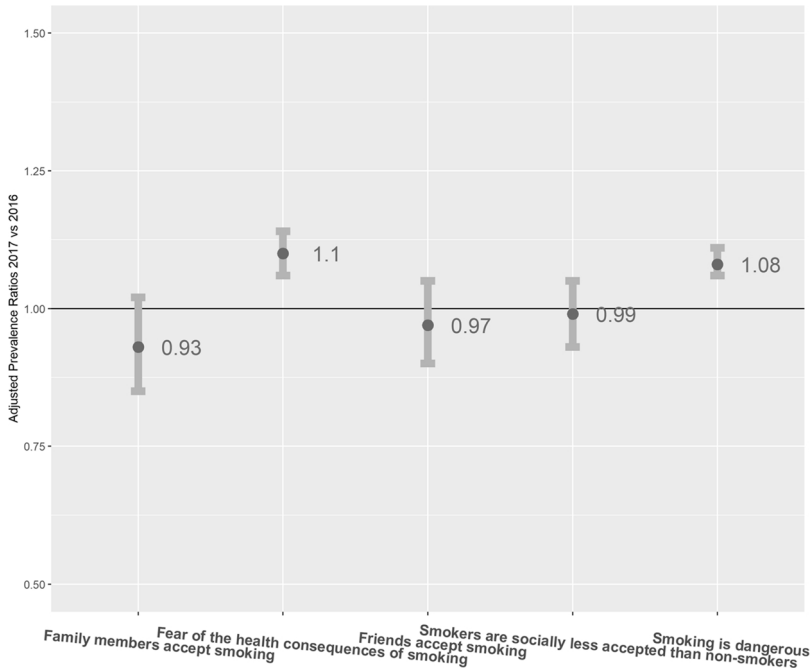

Fig. 2. Changes in smoking and e-cigarette use among French adults. DePICT study, France, 2016–2017, n = 8468(complete cases). Weighted adjusted prevalence ratios. (Agree vs. Disagree).
Note: Adjusted for age, sex, educational level, living alone, and country of birth.

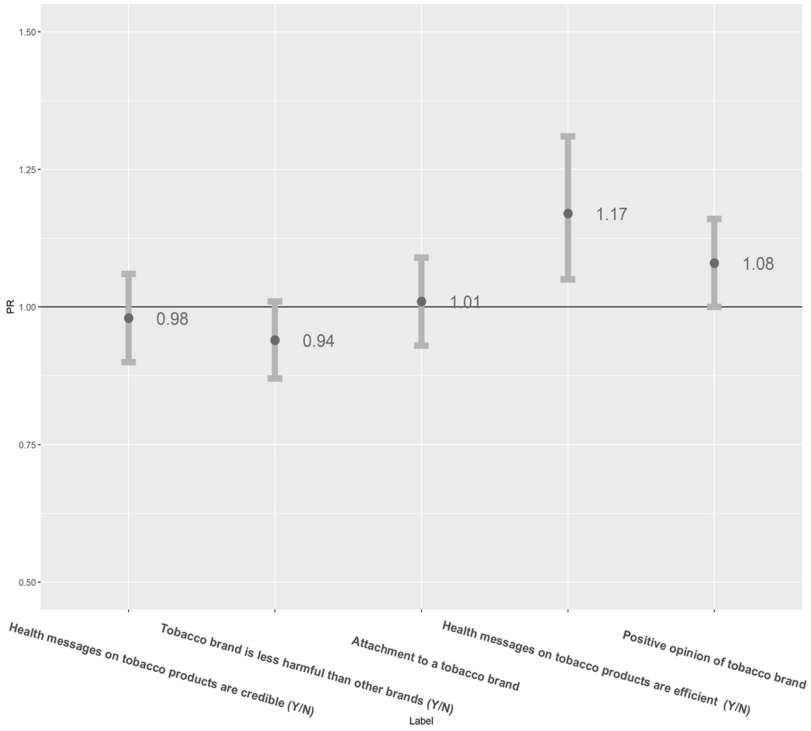

Fig. 3. Changes in smoking-related brand and GHW perceptions among French adult smokers. DePICT study, France, 2016–2017, n = 2260 (complete cases). Weighted adjusted prevalence ratios.

France, we found that adolescents were less attached to their tobacco brand and less likely to like the brand name after PP was introduced (El Khoury-Lesueur et al., 2018a,b). It is possible that PP has more immediate effects on adolescents' perceptions and their identification with tobacco brands, but not among older smokers.

E-cigarette use is mostly concentrated among smokers, and our data suggest that it did not replace smoking during the study period. This is reassuring since smokers who quit by using e-cigarettes could be at a higher risk of relapse (El Khoury-Lesueur et al., 2018a,b). France could have also benefited from the absence of the commercialization of the Juul e-cigarette before December 2018 and trends in e-cigarette use need to be followed-up carefully.

4.2. Limitations

Several limitations of our study should be noted. First, as mentioned above, because of the design, we are not able to attribute the observed changes in perceptions and behaviors to changes in tobacco packaging with certainty. These changes are probably the result of a combination of different tobacco control policies but also declining trends in positive perceptions and in the use of tobacco products. (Tovar et al., 2013) Similar decreases in smoking experimentation and social acceptance of smoking among French adolescent was also observed (El Khoury-Lesueur et al., 2018a,b; Spilka et al., 2018), and are in accordance with our results. Second, our study may have suffered from bias due to selective non-response to our repeated survey, especially if smokers were less inclined to participate. However, to mitigate this potential source of bias, we statistically weighted all analyses to render data and results representative of adults living in France, including smoking experimentation. It may be possible that smokers were more reluctant to participate in the second wave compared to the first because of the perception that the stigmatization of smoking has increased. Nevertheless, our findings are comparable to smoking rates among French adults in 2016 and 2017 reported by the French National Health survey, which is not centered around smoking (Pasquereau et al., 2018).

4.3. Implications

Our study describes unique and important changes in smoking-related perceptions and in prevalence among adults in France, which followed the intensification of tobacco control efforts. These results may help promote comprehensive tobacco control policies in other countries and maintain momentum in tobacco control policies in France.

Role of funding source

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Table 5
Changes in smoking-related brand and GHW perceptions among French adult smokers. DePICT study, France, 2016–2017, n = 2260 (complete cases). Weighted adjusted prevalence ratios.

Outcome	Prevalence ratio 2017 vs. 2016 *	p*
Attachment to a tobacco brand (Agree vs. Disagree) n = 2130	1.01 (0.93-1. 09)	0.82
Positive opinion of tobacco brand's name (Agree vs. Disagree) n = 2130	1.08 (1.00-1.16)	0.04
Perceived tobacco brand harmfulness compared to other brands (less harmful vs. same) n = 2130	0.94 (0.87-1.01)	0.09
Health messages on tobacco products are efficient (Agree vs. Disagree) n = 2260	1.17 (1.05-1.31)	0.006
Health messages on tobacco products are credible (Agree vs. Disagree) n = 2260	0.98 (0.90-1.06)	0.62

* Adjusted for sex, age, educational level, living alone, and country of origin.

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Contributors

All authors have contributed significantly to claim authorship and have seen and approved of the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2019.03.025.

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