Plain tobacco packaging, increased graphic health warnings and adolescents’ perceptions and initiation of smoking: DePICT, a French nationwide study

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ABSTRACT

Background Plain packaging (PP) of tobacco products and increased graphic warnings may contribute to lower attractiveness of smoking, particularly among youths. In France, this policy was introduced on 1 January 2017. We examined changes in smoking-related perceptions and behaviours among a nationwide sample of French adolescents before (2016) and 1 year post (2017) implementation.

Methods DePICT is a two-wave cross-sectional national telephone survey of adolescents aged 12–17 years per study wave (2016: n=2046 2017: n=1999). All participants reported smoking-related perceptions, as well as ever and current tobacco use. Smokers were also asked about their perceptions of tobacco brands.

Data were weighted to be representative of youths in France; this policy was introduced on 1 January 2017.

Results In 2017, as compared with 2016, French adolescents were more likely to report fear of the consequences of smoking (PR=1.06, 95% CI 1.02 to 1.09) and that smoking is dangerous (PR=1.08, 95% CI 1.05 to 1.11). They were also less likely to report that their friends (PR=0.61, 95% CI 0.54 to 0.70) and family (PR=0.51, 95% CI 0.44 to 0.60) accept smoking.

Additionally, smoking initiation significantly decreased (PR=0.93, 95% CI 0.93 to 0.98) and a non-statistically significant drop in current tobacco use was observed (PR=0.93, 95% CI 0.78 to 1.11). Smokers’ attachment to their tobacco brand also decreased (PR=0.47, 95% CI 0.30 to 0.73).

Conclusion Our findings suggest that PP and increased graphic warnings could contribute to changes in smoking norms and rates among adolescents.

INTRODUCTION

To be effective, tobacco control measures should be systematic, comprehensive and include mass media campaigns, taxation policy, access to smoking cessation advice and regulation of promotion of tobacco control.1 One effective policy may be plain packaging (PP) of tobacco products, first implemented in Australia, where it contributed to a significant decrease in the attractiveness of tobacco products and tobacco brands, particularly among youths.2 This evidence has led to the implementation of PP in other countries including France.

In the last two decades, smoking rates in France have remained high, despite multiple regulations and antismoking policies (eg, ban on smoking in public places, increase in tobacco price, ban on sales to minors), with a prevalence of daily smoking among adults stagnating at approximately 30%.3 4 Compared with similar high-income countries such as Great Britain, where smoking rates decreased from 27% in 2000 to 16% in 2016,5 or Germany where smoking rates during this period dropped from 36% to 25%,6 the French tobacco control approach had yielded insufficient results. One of the reasons why smoking levels are not decreasing is because of persistently elevated levels of tobacco initiation among the youth. While only 18% of British children younger than 16 years had tried smoking in 2016,7 in France the estimates in the same age group in 2014 were 49%.8 This might in part be due to positive perceptions of smoking among French adolescents.

In order to change the norms regarding smoking, French authorities recently intensified tobacco control policies, raising taxation of tobacco products in November 2016 (by approximately 5%), increasing the frequency of antismoking media campaigns and adapting the British Stoptober programme which encourages smoking cessation.9 Further, as other European Union countries, France translated the 2014’s European tobacco products directive into national law,10 increasing the size of graphic health warnings on tobacco packs. Concurrently, on 1 January 2017, the government introduced PP of manufactured cigarettes and roll-your-own tobacco packs, implying that all tobacco products sold in France are presented in standardised dark grey packs with uniform font in order to ‘break the tobacco industry’s marketing codes, especially among young individuals’. This intensification in tobacco control policies has coincided with the first decrease in decades in smoking rates among adults in France.11

PP has been linked with a reduction in positive perceptions of the image of cigarette brands, especially among adolescents and women.12 13 This policy has also lead to reductions in smoking prevalence.14 In Australia, the implementation of PP and larger graphic health warnings was associated with reductions in the appeal of tobacco products, and a slight but significant decline in smoking prevalence (0.55%) 3 years postimplementation.15 However, the effect of PP could be different in other settings, including France. First, the prevalence of adult and adolescent smoking in Australia at the time of PP implementation was lower than in France (19%
among adults and 13% among adolescents aged 16–17 years in Australia vs 29% among adults and 32% for adolescents aged 17 years in France. 4, 16–18 Also, both countries apply different taxation and tobacco control strategies and smoking-related stigma may differ between Australia and France. 19, 20

We sought to document and study the evolution of adolescent smoking-related perceptions and behaviour after the intensification of tobacco control policies. Therefore, we compare tobacco-related perceptions, adolescent smokers’ attachment to tobacco brands, and smoking initiation as well as daily smoking rates among adolescents before and after the implementation of PP in France, using data from DePICT (Description des Perceptions, Images, et Comportements liés au Tabagisme), a two-wave repeated cross-sectional nationwide phone survey conducted in 2016 and 2017.

METHODS

DEPICT: study design and recruitment

DePICT recruited French-speaking children aged 12–17 years, residing in metropolitan areas of France. Participants were recruited by trained interviewers from randomly generated telephone lists. Landline and mobile phone numbers were called up to 30 times by trained professionals using a computer-assisted telephone interviewing system. The oral consent of at least one parent was required.

DePICT recruited both adolescents (12–17 years) and adults (18–64 years, data not shown), using somewhat different methodologies in order to over-represent adolescents in the final sample, because changes in tobacco-related perceptions and behaviours in that age group were of paramount interest. We describe the way in which we recruited both populations (adolescents and adults), even though the present study focuses particularly nor occasionally).

Perceptions of tobacco brands

Participants rated: (1) Their fear of the health consequences of smoking. (2) The dangerousness of smoking. (3) Their friends’ and family’s acceptance of smoking. (4) If smokers are less socially accepted than non-smokers on a Likert Scale (strongly agree, somewhat agree, neither agree nor disagree, tend to disagree, totally disagree). Responses were then coded dichotomously (agree vs disagree). The exact phrasing of these questions, which are also routinely used in the French National Health Survey, 19 and the way in which they were recoded are presented as online supplementary materials.

Smoking experimentation and current smoking

Participants were asked about their lifetime and current (daily and occasional) use of tobacco, smoking experimentation (having tried smoking at least once, even a single puff) and current daily smoking (≥1 cigarette/day, yes/no). Respondents indicating they had ever smoked but were not current smokers were classified as experimenters (ever smokers who are not current smokers) (yes/no). We distinguished two definitions of ‘smoking experimenters’: (1) All experimenters, comprised of current, and former smokers as well as experimenters (those who tried smoking at least once but never smoked neither regularly nor occasionally). (2) ‘current experimenters’ combining current smokers and experimenters (vs former-smokers and non-experimenters). Occasionally or daily smokers were classified as current smokers (yes/no).

Sociodemographic characteristics and other covariates

We also assessed participants’ age, sex and educational setting (general vs technical/vocational training). Parental characteristics previously shown to be linked to adolescents smoking 20–22 were also measured: family situation (parents living together: yes/no), occupational grade (at least one parent with a high occupational grade: yes (manager, executive,...)/no (middle-level manager, technician, clerk, manual worker,...), and parental smoking (at least one parent smokes regularly: yes/no). Since participants were interviewed by telephone, we also asked them whether one of their parents was present next to them during the interview.

Statistical analysis

Data were weighted to match the structure of the French population aged 12–17 years with respect to sex, age, educational setting, the parents’ socioeconomic status (at least one parent working as a manager or equivalent) and family characteristics (parents living together or not). Weighting was based on data published by the National Institute of Statistics and Economic
Studies23, 24 and on the same structure of the population (2016). Log-binomial regression models were used to estimate prevalence ratios (PRs) between the two study waves, adjusting for the listed covariates. All statistical analyses were conducted using SAS V9.4 (SAS Institute); statistical significance was set at p=0.05.

Testing for interactions
We tested for statistical interactions between study waves, and (1) Sex. (2) Smoking status. (3) Age group. (4) Educational setting and we stratified analyses when a significant interaction term was found.

RESULTS
Main characteristics of our weighted sample are presented in table 1.

Across the two study waves, 28.8% of adolescents reported that they were not afraid of the consequences of smoking, and 81.3% said that smoking is dangerous; 16.3% reported that their family members had a positive attitude towards tobacco and 20.9% that their friends were favourable to smoking.

Results of multivariate log-binomial regression analyses examining changes in smoking-related perceptions and smoking experimentation are presented in table 2. Overall, participants’ attitudes and beliefs concerning smoking were more negative in 2017 than in 2016: adolescents were more likely to report that smoking is dangerous (PR=1.08, 95% CI 1.05 to 1.11) and to be afraid of the consequences of smoking (PR=1.06, 95% CI 1.02 to 1.09). They were also less likely to report that their family (PR=0.51, 95% CI 0.44 to 0.60) and friends (PR=0.61, 95% CI 0.54 to 0.70) have positive opinions of smoking. However, there was no change in participants’ perception of smokers’ social acceptance (PR=1.06, 95% CI 0.95 to 1.18).

All smoking experimentation (including current smokers and former smokers) decreased from 26.3% in 2016 to 20.8% in 2017, the prevalence of non-smokers who had tried smoking also decreased from 13.7% to 9.6% (table 1). Multivariate log-binomial regression analyses showed that all experimentation rates among adolescents decreased by 4% in 2017 compared with 2016 (PR=0.96, 95% CI 0.93 to 0.98) after controlling for confounding variables (table 2). This estimate did not change when we modified the definition of smoking experimentation. Daily and occasional smoking rates dropped from 11.6% in 2016 to 10.5% in 2017, however this decrease was not statistically significant in multivariate analyses (PR=0.93, 95% CI 0.78 to 1.11).

After adjusting for covariates (table 3), current smokers were less likely to be attached to their tobacco brand in 2017 compared with 2016 (PR=0.47, 95% CI 0.30 to 0.73). They were also less likely to report liking the name of that brand (PR=0.73, 95% CI 0.62 to 0.86) and less likely to think that their brand is less harmful than other brands (PR=0.47, 95% CI 0.32 to 0.70).

We found statistically significant interactions between study wave and sex, age, socioeconomic status, schooling type and smoking with regard to smoking-related perceptions and/or experimentation.

### Table 1 Characteristics of the Description des Perceptions, Images, et Comportements liés au Tabagisme (DePICT) Study sample (weighted, %), France, 2016–2017

<table>
<thead>
<tr>
<th>Variable</th>
<th>2016 n=2046</th>
<th>2017 n=1999</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12–13 years</td>
<td>33.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>14–15 years</td>
<td>33.0%</td>
<td>33.0%</td>
</tr>
<tr>
<td>16–17 years</td>
<td>33.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>50.7%</td>
<td>50.7%</td>
</tr>
<tr>
<td>Boys</td>
<td>49.3%</td>
<td>49.3%</td>
</tr>
<tr>
<td><strong>Schooling characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>76.2%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Professional/vocation</td>
<td>23.8%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Parents living together</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>30.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Yes</td>
<td>70.0%</td>
<td>70.0%</td>
</tr>
<tr>
<td>Parental high occupational grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>73.1%</td>
<td>73.1%</td>
</tr>
<tr>
<td>Yes</td>
<td>26.9%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Parental smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>67.9%</td>
<td>78.9%</td>
</tr>
<tr>
<td>Yes</td>
<td>32.1%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Parental presence during the survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>33.1%</td>
<td>31.3%</td>
</tr>
<tr>
<td>Yes</td>
<td>66.9%</td>
<td>68.7%</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular smoker</td>
<td>8.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>3.1%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Former smoker</td>
<td>1.0%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Non-smoker who never tried smoking</td>
<td>73.7%</td>
<td>79.2%</td>
</tr>
<tr>
<td>Non-smoker who tried smoking</td>
<td>13.7%</td>
<td>9.6%</td>
</tr>
</tbody>
</table>

### Table 2 Smoking perceptions and experimentation among adolescents, before and 1 year after the introduction of plain packaging. Description des Perceptions, Images, et Comportements liés au Tabagisme (DePICT) Study, France, 2016–2017, n=3930, prevalence ratios

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Prevalence ratio 2017 versus 2016 *</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fear of the health consequences of smoking (totally agree vs somewhat agree, neither agree nor disagree, rather disagree, I don’t agree at all)</td>
<td>1.06 (1.02 to 1.09)</td>
<td>0.003</td>
</tr>
<tr>
<td>Smoking is dangerous (totally agree vs somewhat agree, neither agree nor disagree, rather disagree, I don’t agree at all)</td>
<td>1.08 (1.05 to 1.11)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Friends accept smoking (completely acceptable, rather acceptable vs no opinion, rather not acceptable, not at all acceptable)</td>
<td>0.61 (0.54 to 0.70)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Family members accept smoking (completely, rather yes vs no opinion, rather not, not at all)</td>
<td>0.51 (0.44 to 0.60)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Smokers are socially less accepted than non-smokers (completely, rather yes vs no opinion, rather not, not at all)</td>
<td>1.06 (0.95 to 1.18)</td>
<td>0.33</td>
</tr>
<tr>
<td>All smoking experimentation (smokers, former smokers and experimenters vs never-experimenters)</td>
<td>0.96 (0.93 to 0.98)</td>
<td>0.002</td>
</tr>
<tr>
<td>Current smoking experimentation (current smokers, experimenters vs former smokers, never experimenters)</td>
<td>0.96 (0.93 to 0.99)</td>
<td>0.002</td>
</tr>
<tr>
<td>Current smoking (yes vs no)</td>
<td>0.93 (0.78 to 1.11)</td>
<td>0.42</td>
</tr>
</tbody>
</table>

*Adjusted for age, sex, schooling characteristics, parents living together, parental high occupational grade, parental smoking and parental presence during the survey. All analyses except ‘smoking experimentation’ and ‘current tobacco use’ were also adjusted for participants’ smoking status.
Imitations on C

Adolescents appear especially likely to be influenced by tobacco and product perceptions and a decrease in smoking pleasure.29 30

In such a complex setting, it is difficult to identify the exact role of each type of tobacco control policy on smoking-related perceptions and behaviour over the course of 1 year, which is a relatively short period. In Australia, the big dip in smoking levels in adolescents and adults was observed 3 years after the introduction of PP,13 and we expect that in France the pattern will be similar. PP will likely contribute to long-term changes in the norms surrounding tobacco use, and changes in perceptions of smoking as well as smoking-related behaviours need to be monitored over the mid term to the long term. A third possible limitation is the possibility of selective non-response to our survey. It is possible that non-smokers were more likely to answer our survey than smokers; however this bias should have been the same in the two study waves. To mitigate this potential selection bias, we statistically weighted the data to render our sample representative of adolescents living in France. The weighted prevalence of smoking we observed in 2016 is comparable to other nationally representative sources of data in France, which is reassuring.26

Limitations
Several limitations of our study need to be noted. First, since PP was introduced at the same time as larger graphic health warnings and other antitobacco measures, we cannot assert that the changes we observed are exclusively related to this policy. These changes probably result from a combination of different interventions. In order to be effective, tobacco control policies should be comprehensive and complementary, yet this makes the identification of the specific effects of each policy component difficult. Moreover, our prepost study design cannot establish a causal effect. Nonetheless, changes in adolescents’ attachment to tobacco brands, which we observed, are likely to be specifically related to the appearance of tobacco products, indicating that PP is effective. Second, we examined changes in smoking-related perceptions and behaviours over the course of 1 year, which is a relatively short period. In Australia, the big dip in smoking levels in adolescents and adults was observed 3 years after the introduction of PP,13 and we expect that in France the pattern will be similar. PP will likely contribute to long-term changes in the norms surrounding tobacco use, and changes in perceptions of smoking as well as smoking-related behaviours need to be monitored over the mid term to the long term. A third possible limitation is the possibility of selective non-response to our survey. It is possible that non-smokers were more likely to answer our survey than smokers; however this bias should have been the same in the two study waves. To mitigate this potential selection bias, we statistically weighted the data to render our sample representative of adolescents living in France. The weighted prevalence of smoking we observed in 2016 is comparable to other nationally representative sources of data in France, which is reassuring.26

Implications
Our study provides early and positive results regarding changes in smoking-related perceptions and behaviours
among adolescents after the implementation of PP of tobacco products in France. While further studies with more robust designs are needed to gain a more thorough understanding of the effects of PP on smoking initiation and daily use rates over time, these encouraging results add to already existing data suggesting the importance of PP as a component of tobacco control policies.

What this paper adds

What is already known on this subject
► Plain packaging (PP) was first introduced in Australia and contributed to decrease the attractiveness of smoking and lower smoking rates.
► France introduced PP in 2017, to counter one of the last existing forms of tobacco advertising and promotion, and decrease the attractiveness of smoking especially among adolescents.

What important gaps in knowledge exist on this topic
► Smoking rates and social acceptance at the time of PP implementation are higher in France than in Australia and the effect of PP could also be different.

What this paper adds
► One year after the implementation of PP in France, we report an increase in the perception of the harmfulness of smoking, a decrease in the social acceptance of smoking among adolescents, a decrease in smoking experimentation and in smokers’ attachment to their tobacco brand. 
► Our results suggest that PP contributes to changes in smoking norms and might contribute to reductions in overall smoking rates.

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Contributors All authors have materially participated in the research and/or the manuscript preparation. MM is the PI of the DePICT study, FE-K, CB and MM were implicated in designing and implementing the study. VMW assisted in planning the analysis. FE-K analysed the data and wrote the first draft of the manuscript, and all authors contributed to and have approved the final manuscript.

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Competing interests None declared.

Patient consent Not required.

Ethics approval DePICT was approved by the ethical review committee of the French National Institute of Health and Medical Research (INSERM, CEE-I-IRB 00003888).

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