RESEARCH LETTER

Effect of the introduction of pictorial cigarette pack warnings in Poland: a retrospective analysis of the market sales data of a large convenience store franchise

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Introduction In August 2016, Polish authorities introduced obligatory pictorial cigarette pack warnings.[1] The act resulted from the implementation of the European Union Tobacco Products Directive, which regulates policy regarding tobacco product sale, advertisement, and labeling.[2] Since May 20, 2017, all packages have to contain pictorial warnings covering 65% of the front and back of the package.[1] Previously, cigarette packs in Poland were covered with written warnings such as "Smoking kills." As required per the act, the set of pictures should be changed every 12 months; overall, 3 sets are available. Moreover, the Directive prohibited the sale of packages with fewer than 20 cigarettes. Few studies investigated the real-world impact of the implementation of the Directive in European countries.[3] To date, no study has examined the effect of the regulation in Poland, where 26% of adults are smokers.[4] To fill the gap, we performed an analysis of cigarette market sales data. We aimed to investigate the effect of the introduction of obligatory pictorial cigarette pack warnings on cigarette sales 2 years after the implementation of the regulation.

Methods In this study, we used historical market sales data; thus, no institutional review board approval was required. We retrieved data on cigarette sales from a large retail store franchise in September 2019 (the identity of the chain and more details were disclosed to the Editor-in-Chief). Overall, the entire chain represents 10% to 15% of the convenience store segment in Poland. The store chain preferred not to disclose too many details on sales; thus, we obtained cigarette pack sales data expressed as an index. The index represented the mean sales of cigarette packs adjusted to the number of active stores in each month. The data concerned the sales index from June 2014 to May 2019. The number of active stores increased in the analyzed period: between June and December 2014, the mean number was 3594, 3943 in 2015, 4189 in 2016, 4602 in 2017, 5002 in 2018, and 5434 between January and May 2019. The index of 100 represented the first analyzed month—June 2014. All further datapoints showed an increase (above 100) or a decrease (below 100) in sales in relation to June 2014. The data did not pertain to roll-your-own cigarettes or cigars. Since May 20, 2017, all cigarette packages had to contain pictorial warnings. In our analysis, June 2017 was considered to be the first month in which the intervention was fully implemented. Overall, June 2014 to July 2016 was regarded as the preintervention period, August 2016 to May 2017 as the transition period (treated as the preintervention period in the primary analysis but excluded from calculations in the sensitivity analysis), and June 2017 to May 2019 as the postintervention period. We retrieved the estimation of black market cigarette supply (nondomestic cigarette packs) from cyclical reports of the ALMARES Institute for Consulting and Market Research.[5] The reports did not concern the first quarters of each year; thus, we imputed the missing data by calculating the mean of the 2 adjacent quarters (the precedent and the following quarters). Data on the inflation rate were obtained from Statistics Poland.[6] We extracted the weighted average retail selling price of cigarettes (also called the government consumer price index) from the announcements of the Minister of Finance from the years 2015

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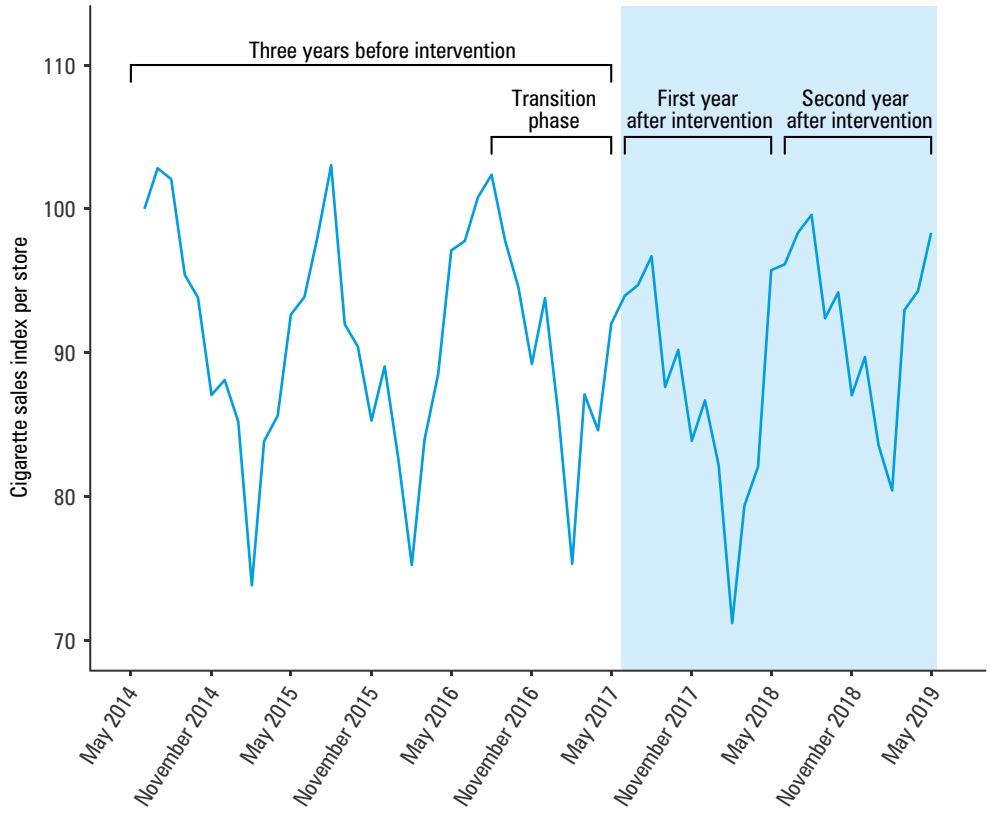

FIGURE 1 Cigarette sales indices per store in a large retail franchise in Poland between June 2014 and May 2019

to 2019. The weighted average retail selling price was expressed as the amount of Polish zloty for 1000 cigarettes.

Statistical analysis The detailed description of statistical analysis is presented in the Supplementary material.

Results and discussion The mean sales indices before the analyzed intervention were similar: 90.9 (June 2014–May 2015), 89.9 (June 2015–May 2016), and 91.7 (June 2016–May 2017). A year after the introduction of pictorial warnings, there was a decreasing tendency in the mean (SD) cigarette pack sales index (3 years before the intervention: 90.8 [7.8] vs 1 year after the intervention: 87 [7.7]; $P = 0.08$) (FIGURE 1). However, there was no statistical difference between sales indices before and after the intervention (mean [SD] index 2 years after the intervention: 89.6 [7.3]; $P = 0.27$). Sales indices decreased by 5.2% in the first year and increased by 0.5% in the second year after implementation as compared with the year before the intervention. The lowest sales indices were observed in February, whereas the highest were recorded in August. There was no significant effect of pictorial cigarette pack warnings on the cigarette pack sales index after adjustment for time, season, prevalence of nondomestic packs, cumulative inflation rate, and weighted average retail selling price of cigarettes (F [1, 52] = 0.43; $P = 0.52$).

After excluding the transition period, the results of the t test were similar to those of the main analysis (mean [SD] sales index in the preintervention period: 91.1 [8] vs 1 year after: 87 [7.7]; $P = 0.08$; and the preintervention period vs 2 years after: 89.6 [7.3]; $P = 0.25$). In the bootstrapped model, the introduction of pictorial cigarette pack warnings did not affect the cigarette pack sales index adjusted for time, season, prevalence of nondomestic packs, cumulative inflation rate, and weighted average retail selling price of cigarettes (F [1, 52] = 1.063; 95% CI, 0.001–7.201; $P = 0.31$).

To our best knowledge, this is the first study investigating the effect of the introduction of pictorial warnings on cigarette packs in Poland. We found that there was a decreasing tendency in cigarette sales during the first year following the intervention. The effect of the intervention attenuated in the second year, regardless of the required periodical change of the picture set.

Previously, Zhou et al[3] showed that the implementation of pictorial warnings in Sweden resulted in an increase in the smoking cessation quitline calling rate. However, the time of observation was limited to the year of the progressive introduction of packs with pictorial warnings and the following 3 months. In a pre-post survey study, Mannocci et al[7] reported that pictorial warnings introduced by the European Union regulation have a complementary supporting role in smoking cessation. Importantly, the second survey was conducted only 8 to 18 months after implementation.

We hypothesize that cigarette smokers may adapt to the drastic pictures. It has been observed that health policy interventions might be efficient for a short time and respondents become resistant to information labels.[8] For this reason, the act enforced a periodic change of pictures,

which had been previously suggested by experts from the European Commission's Joint Research Centre.[9] Although new pictures might increase individuals' knowledge on smoking, they not necessarily have enough influence on the decision to quit smoking.

Interestingly, we found that the lowest cigarette sales were observed in February. First, February is the month of winter holidays and, therefore, traveling and other factors, such as staying indoors with the family, may decrease sales during this period. Second, the 40-day period preceding Easter, called Lent, usually begins in February. We hypothesize that the religious custom of Lenten sacrifice may motivate some individuals to try to give up smoking. It has been shown that associating religious references with a public campaign on smoking cessation may be beneficial.[10] The highest sales indices were observed during the summer holidays months and, in particular, in August, which is possibly related to spending more time outdoors. Therefore, this period may be the most difficult to find motivation for smoking cessation or not to return to addiction. Nevertheless, these phenomena require further investigation.

Despite the major strength of this study, which lies in the provision of complete longitudinal data from a large retail company, it had certain limitations. First, data were divided by months, not weeks. Therefore, the number of the analyzed datapoints was limited. Second, data came from a single franchise. Third, we analyzed the indices of aggregated sales of cigarette packs without considering the number of cigarettes per package. Fourth, the sales index included data from all active stores, and not a fixed number of the same stores, since June 2014. However, the sales index was adjusted to the dynamically increasing number of facilities. Fifth, data on nondomestic cigarette pack supply lacked the original survey for the first quarters of the analyzed years. We cannot exclude that the first quarter significantly differed from others in terms of cigarette smugglers' activity. Sixth, our analysis did not include the sales of other tobacco products or e-cigarettes, which also pose a health risk.[11] Finally, the regulation assumed that, between August 2016 and May 20, 2017, tobacco companies could already introduce pictorial warnings on cigarette packs.[1] The model did not consider the fact that the intervention did not come into force immediately, and some packs with pictorial warnings appeared in stores earlier. However, a correction would require more detailed data on the percentage of cigarette packs with pictorial warnings before the definitive time of regulation implementation.

Conclusions A year after the implementation of pictorial cigarette pack warnings in Poland, the cigarette pack sales index nominally decreased, but the difference was nonsignificant. The differences diminished in the following year. The regulation might have transiently affected cigarette smoking in Poland. However, the assessment of its long-term effects requires further investigation.

SUPPLEMENTARY MATERIAL

Supplementary material is available at www.mp.pl/paim.

ARTICLE INFORMATION

NOTE The data that support the findings of this study are available from the corresponding author upon reasonable request. Digital identifiers were assigned to MK (ORCID iD, https://orcid.org/0000-0002-4394-0460), JKN (ORCID iD, https://orcid.org/0000-0003-0953-2188), and PB (ORCID iD, https://orcid.org/0000-0002-0563-1624).

CONFLICT OF INTEREST None declared.

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