Did the Tobacco Control Act Amendment in 1995 affect daily smoking in Finland? Effects of a restrictive workplace smoking policy


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ABSTRACT

Background This study examined changes in adult daily smoking in 1981–2005 in Finland, in order to evaluate the impact of the 1995 Tobacco Control Act Amendment (TCAA) and accompanying measures on the proportion of daily smokers. The main focus of the TCAA was to prohibit smoking at workplaces (designated rooms excluded) in order to protect workers from environmental tobacco smoke.

Methods The study was based on data from annual postal surveys among 15- to 64-year-olds in 1981–2005 (average response rate 73%). The data set for this study comprised men and women aged 25–64 years (n = 73,471). Logistic models were used to test the effect of the 1995 TCAA across employment status while controlling for the effect of changes in the real price of tobacco and in gross domestic product per capita, and adjusting for age, education, secular trend and prevalence of ever-smokers in each birth cohort.

Results Controlling for confounding factors, the odds ratio (OR) for daily smoking after 1995 among employed men was 0.83 (95% CI 0.73–0.94) compared with the OR (1.0) for the period ending 1994. The corresponding figure for employed women was 0.78 (95% CI 0.68–0.91). The results can be interpreted as a positive effect of the 1995 TCAA on employees’ daily smoking. Moreover, a similar decrease in daily smoking was not seen among those not targeted by the TCAA (including farmers, students, housewives, pensioners and the unemployed).

Conclusion Smoking behaviour was and can be influenced by national tobacco policy measures.

Keywords environmental tobacco smoke, public health, smoking

Introduction

Tobacco control policy in Finland has deployed a variety of strategies to reduce smoking in the population, including encouraging quitting and limiting smoking environments. The national Tobacco Control Act (TCA) of 1976, and its amendment in 1995 (Tobacco Control Act Amendment, TCAA) form the main basis of the measures applied. The TCA banned tobacco advertising, outlawed smoking in most public places, including public transport, prohibited tobacco sales to persons under 16 years of age, and introduced mandatory health warnings on packages.1–3 At the beginning of the 1990s, the Ministry of Social Affairs and Health began the process of amending the TCA in order to protect employees from environmental tobacco smoke (ETS).3,4 The result, the 1995 amendment (TCAA), covered all workplaces except restaurants and bars. The TCAA prohibited smoking at workplaces in general with the exception of separately ventilated smoking rooms or individual offices. Some employers, however, had anticipated the TCAA by voluntarily regulating ETS exposure at workplaces before 1995.5 The TCAA also raised the minimum age for buying tobacco products from 16 to 18 years and banned even indirect tobacco advertising and sponsorship. In 2000, the TCAA classified ETS as a carcinogenic substance and made it the absolute responsibility of employers to protect their

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employees from ETS. In 2000, the TCAA was extended to cover restaurants and bars by determining that at least 50% of the public area should be defined as smoke-free if the serving area was 50 square meters or more. A three-year transition period (until July 2003) to implement the changes was granted to owners of restaurants and bars. Since 1st June 2007, smoking has been totally banned in almost all restaurants and bars, with a deferment until June 2009 for the few restaurants having a smoking section with a separate ventilation system.3,4 The implementation sequence of the tobacco control measures in Finland is presented in Table 1.

Several studies have examined the effects of workplace smoking restrictions designed to reduce the harmful effects of ETS on non-smokers.6–10 A Finnish study found that exposure to ETS at work decreased notably between 1985 and 2000 in Finland, particularly following the 1995 amendment.11 Smoking restrictions are generally found to be associated with lower consumption of cigarettes.6,12 A Finnish study at 10 workplaces suggested that the 1995 TCAA was associated with a drop in smoking prevalence among employees.5 Workplaces with smoking bans have smoking cessation rates higher than those where smoking is allowed.13,14,9,15,12

Apart from smoking restrictions, the price of tobacco, controlled mainly by excise taxes, has been widely promoted as an effective tobacco control policy tool to encourage quitting, reduce consumption among remaining smokers and decrease smoking initiation.16 Although tobacco prices in Finland were raised substantially in 1975–76, subsequent annual increases have been modest or even negligible.17,18 Variations in the purchasing power of the population may also have an influence on smoking behaviour.18 In the early 1990s, after a long period of economic growth, Finland endured its most severe economic depression since the end of World War II. Unemployment increased from 3% to 17%19 and the gross domestic product (GDP) declined by 15% over the period 1990–93.20 The slump challenged the national tobacco control policy, too, as unemployed persons seem less eager than others to quit smoking.21

Variations in the prevalence of smoking in a population may also be partly due to the succession of birth cohorts with different smoking histories. Previous studies in Finland have established marked differences in the proportion of ever-smokers between birth cohorts, indicating variation in the rate of smoking initiation during past decades.22,23 The general cohort trends observed over time indicate a decrease in male and an increase in female smoking. The cohorts that deviated from these general trends were those born in 1916–25 (reaching smoking initiation age during World War II), in 1931–35 (initiation age in the post-war depression) and in 1946–50 (the ‘baby-boomer’ generation).22,24,25

Changes in the educational structure of the population may also affect the prevalence of smoking. Studies have shown that the differences in smoking across educational groups of Finnish men and women are striking, especially since the mid-1980s.25 The higher educated smoke the least and the differences between educational groups have widened.26,27

<table>
<thead>
<tr>
<th>Year</th>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976 TCA</td>
<td>Tobacco control Act (TCA)</td>
<td>- restricted smoking in public places - prohibited the sale of tobacco to persons under 16 years of age - introduced health warnings to tobacco packages - set upper limits on harmful substances of tobacco products - provided to be used a portion (at least 0.45%) of the tobacco tax revenue for smoking prevention - banned advertising (total advertising ban in 1978)</td>
</tr>
<tr>
<td>1976 Amendment of TCA (TCA)</td>
<td>- the main aim of the TCA was to protect people from environmental tobacco smoke (ETS) at work and in public places - employers had a duty to make sure that employees were not exposed to environmental tobacco smoke - prohibited smoking at workplaces (smoking was allowed only in separately ventilated rooms) - prohibited smoking in the school playgrounds - the explicit ban on indirect advertising for tobacco products - prohibited the sale of tobacco to persons under 18 years of age</td>
<td></td>
</tr>
<tr>
<td>2000 TCAA</td>
<td>- classification of environmental tobacco smoke (ETS) as a carcinogen - required restaurants to reserve at least half of the area as smoke-free - smoking was also banned at the service counters of bars and restaurants</td>
<td></td>
</tr>
<tr>
<td>2003 TCAA</td>
<td>- a three-year transition period to implement the changes in restaurants and bars ended</td>
<td></td>
</tr>
<tr>
<td>2007 TCAA</td>
<td>- almost all of Finland’s restaurants, bars, pubs and cafes smoke-free since mid-2007 with a deferment until June 2009 for the few restaurants having a smoking section with a separate ventilation system—smoking inside restaurants is allowed only in special isolated and ventilated booths</td>
<td></td>
</tr>
</tbody>
</table>

For national health policy planning, it is important to know what kind of impact specific tobacco control measures have had on smoking trends. In this study, we focused on gender specific trends and patterns of daily smoking among Finns of working age. In particular, we attempted to assess the effects of the Finnish 1995 TCAA, controlling for education, differences in ever-smoking between birth cohorts, the real price of tobacco and GDP per capita, on subsequent trends in daily smoking in 1981–2005. As the 1995 TCAA focused on smoking restrictions at workplaces, our baseline hypothesis was that its implementation should have caused a decline in daily smoking, particularly among those employed in sectors other than farming or forestry, where the restrictions do not apply.

Methods

Data

The National Public Health Institute (KTL) has monitored health behaviour among Finnish adults annually since 1978, using independent, annual cross-sectional postal surveys. A random sample (n = 5000) of the 15- to 64-year-old Finnish population has been drawn each year, based on the National Population Register. The questionnaire, mailed from April to June, with one reminder in 1978–85, two reminders in 1986–97 and three reminders in 1998–2005, has stayed essentially unchanged over the years. The average response rate among men is 68% and among women 78%. A more detailed data description has been published elsewhere. 23,27 This study included data on 25- to 64-year-old respondents from 1981 to 2005. The analysis was restricted to this age range because in Finland nearly all daily smokers have started smoking before the age of 21 years and rarely at 25 years or older. Hence, among persons older than 25 years, the variation in the rates of daily smoking is mainly accounted for by smoking cessation. Thus, the total data set comprised 34,642 men and 38,829 women.

Respondents’ self-reported smoking status was derived using three, since 1996 four, questions: ‘Have you ever smoked?’ ‘Have you ever smoked regularly (i.e. almost every day for at least one year)?’, ‘When did you last smoke?’ and since 1996 ‘Have you ever smoked at least 100 times?’. In the analyses, daily smoking applied to those respondents who said that they had smoked regularly/daily for at least one year, and who indicated having smoked during the day they filled the questionnaire or the previous day.

Employment status was derived from the respondent’s own reported occupation status during the study year. Two pooled categories were created for the analyses: (i) employed persons in sectors other than farming or forestry (later simply ‘the employed’) and (ii) others (farmers, students, housewives, pensioners and unemployed). The distribution of employment status of the respondents in each study period is presented in Table 2.

In order to indicate exposure to the 1995 TCAA, a dummy variable was included in the model. The value zero was assigned for the years prior to 1995 and the value one from 1995 onwards for this dummy variable. Percentage changes from the preceding year in the real price of tobacco and in the GDP were also included. Educational level was depicted by dividing each one-year birth cohort into tertiles according to years of formal schooling. In the model, education was used as a continuous variable (values 0, 1 and 2 where 0 = the lowest tertile). The level of ever-smoking in each one-year birth cohort was calculated separately for each education group. The level of ever-smoking, age and study year were included as continuous variables.

Statistical methods

Gender specific logistic regression models were used to assess the specific contributions of employment status, age, general secular trend, education, cohort-specific ever-smoking, change in real tobacco price, change in GDP per capita, the 1995 TCAA and the interaction between the 1995 TCAA and employment status. The results of the logistic models are presented as odds ratio with their 95% confidence interval.

To illustrate the effect of the 1995 TCAA on daily smoking, the predicted smoking rate was calculated on the basis of the model in two ways: (i) including all the variables in the model, and (ii) as the preceding model but setting the value for the TCAA dummy to zero for the entire study period, i.e. removing the downward shift in the smoking rate in 1995. We then compared the observed rates of daily smoking and the two sets of predicted rates by employment status in order to assess the magnitude of the TCAA’s impact.

Results

The prevalence of daily smoking was inversely related to age and to the level of education, and positively related to the level of smoking in each birth cohort among both genders. Change in real price of tobacco was not associated with the prevalence of smoking but a mild positive association was found with the change in GDP per capita. The interaction between the 1995 TCAA and employment status was statistically significant (P < 0.001) in both genders. Among men,
employment status was not associated with daily smoking before 1995 but after that smoking was more common in the ‘other’ group. Women employed in sectors other than farming or forestry smoked more commonly than other women before 1995 but after that the difference reversed. The coefficient describing the TCAA’s impact was statistically significant among employed males ($P = 0.003$), while there was no effect on daily smoking among other males ($P = 0.41$). Among employed females, the effect of the TCAA in reducing daily smoking was also statistically significant ($P = 0.001$). The coefficient describing the TCAA’s impact was also statistically significant ($P = 0.04$) among female farmers, students, housewives, pensioners or the unemployed, but in this case the trend of daily smoking was increasing (Table 3).

Fig. 1 presents the observed prevalence of daily smoking and the prevalence predicted by the logistic models among the employed described in Table 3, as well as the prediction based on the logistic model where the 1995 TCAA dummy is restricted to zero, i.e. omitting the effect of policy change. During the period following implementation of the 1995 TCAA, the proportion of daily smokers among the employed was lower than expected on the basis of the trend prediction where the effect of TCAA was zero among men and women. The downward effect of TCAA on the proportion of daily smokers as implied by our model was almost four percentage points in both genders (Fig. 1).

Table 2 Distribution of employment status (%) of the respondents in Finland’s annual Adult Health Behaviour Survey 1981–2005, by gender and survey years and number of respondents in different study period

<table>
<thead>
<tr>
<th>Year/gender</th>
<th>Employed$^a$ (%)</th>
<th>Farmer$^b$ (%)</th>
<th>Student$^b$ (%)</th>
<th>House-wife/home-maker$^b$ (%)</th>
<th>Pensioned$^b$ (%)</th>
<th>Unemployed$^b$ (%)</th>
<th>Employment status information missing$^b$ (%)</th>
<th>Total (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981–83</td>
<td>71.4</td>
<td>13.4</td>
<td>1.2</td>
<td>0</td>
<td>10.2</td>
<td>2.2</td>
<td>1.6</td>
<td>5169</td>
</tr>
<tr>
<td>1984–86</td>
<td>71.7</td>
<td>11.7</td>
<td>1.9</td>
<td>0</td>
<td>11.0</td>
<td>3.0</td>
<td>0.8</td>
<td>4128</td>
</tr>
<tr>
<td>1987–89</td>
<td>72.2</td>
<td>10.4</td>
<td>1.8</td>
<td>0</td>
<td>12.9</td>
<td>2.3</td>
<td>0.4</td>
<td>4453</td>
</tr>
<tr>
<td>1990–92</td>
<td>72.6</td>
<td>8.9</td>
<td>2.2</td>
<td>0.1</td>
<td>12.1</td>
<td>3.7</td>
<td>0.3</td>
<td>4280</td>
</tr>
<tr>
<td>1993–94</td>
<td>65.4</td>
<td>6.4</td>
<td>2.1</td>
<td>0</td>
<td>12.7</td>
<td>10.5</td>
<td>3.0</td>
<td>2639</td>
</tr>
<tr>
<td>1995–96</td>
<td>63.2</td>
<td>6.6</td>
<td>2.3</td>
<td>0.3</td>
<td>13.2</td>
<td>12.2</td>
<td>2.2</td>
<td>2753</td>
</tr>
<tr>
<td>1997–99</td>
<td>66.3</td>
<td>5.4</td>
<td>1.9</td>
<td>0.2</td>
<td>12.9</td>
<td>9.2</td>
<td>4.3</td>
<td>3944</td>
</tr>
<tr>
<td>2000–02</td>
<td>68.7</td>
<td>6.3</td>
<td>1.8</td>
<td>0.1</td>
<td>11.6</td>
<td>7.2</td>
<td>4.3</td>
<td>3788</td>
</tr>
<tr>
<td>2003–05</td>
<td>76.2</td>
<td>2.5</td>
<td>0.9</td>
<td>0.1</td>
<td>11.1</td>
<td>6.4</td>
<td>2.8</td>
<td>3488</td>
</tr>
<tr>
<td>Total</td>
<td>70.2</td>
<td>8.4</td>
<td>1.8</td>
<td>0.1</td>
<td>11.9</td>
<td>5.7</td>
<td>2.1</td>
<td>34642</td>
</tr>
</tbody>
</table>

| Women       |                 |               |                |                             |                 |               |                                          |         |
| 1981–83     | 60.4            | 9.3           | 1.2            | 13.8                        | 11.7            | 2.2            | 1.4                                       | 4850    |
| 1984–86     | 64.5            | 7.8           | 1.6            | 11.8                        | 11.2            | 2.2            | 0.8                                       | 4857    |
| 1987–89     | 67.5            | 6.8           | 2.1            | 9.5                         | 12.0            | 1.7            | 0.4                                       | 4975    |
| 1990–92     | 68.9            | 5.5           | 3.0            | 8.2                         | 11.1            | 2.7            | 0.5                                       | 4916    |
| 1993–94     | 62.9            | 3.9           | 3.7            | 8.2                         | 10.6            | 7.5            | 3.1                                       | 2974    |
| 1995–96     | 63.0            | 4.7           | 3.1            | 8.0                         | 9.8             | 9.4            | 2.0                                       | 3174    |
| 1997–99     | 65.0            | 3.4           | 2.7            | 6.5                         | 9.7             | 9.1            | 3.6                                       | 4532    |
| 2000–02     | 68.1            | 2.9           | 2.5            | 5.7                         | 10.6            | 6.5            | 3.7                                       | 4419    |
| 2003–05     | 69.8            | 2.2           | 1.9            | 5.7                         | 11.1            | 6.8            | 2.5                                       | 4132    |
| Total       | 65.7            | 5.3           | 2.3            | 8.7                         | 11.0            | 5.0            | 1.9                                       | 38829   |

$^a$Employed in other sectors than farming or forestry.

$^b$In analyses the group ‘the others’.

Discussion

Main findings

After the 1995 TCAA, daily smoking among employed men and women was less common than expected on the basis of several explanatory factors, supporting the hypothesis of the lowering effect of the amendment. No parallel change in daily smoking was found among those not directly
affected by the ETS legislation: farmers, students, housewives, pensioners or the unemployed. In fact, among women the prevalence of smoking in the latter group was higher after 1995.

What is known already
Smoke-free worksite policies protect non-smokers from the harmful effects of ETS. In addition, smoke-free worksite policies help smokers to reduce their cigarette consumption or even to quit smoking.30,31

What this study adds
Our results are similar to previous studies in finding that workplace-smoking restrictions have led to decreased smoking among employees.12,13 Tobacco control measures are always partly context specific, so all the studies are valuable. Our results, based on a strong study design with a long sequence of large and nationally representative samples, lend weight to the earlier findings. We also found that the effects of restrictive workplace smoking policy measures were quite similar among both genders of Finnish employees.

Previous studies have shown that public health non-smoking campaigns and coverage of smoking and health in the media were reflected in increased rates of quitting.32,33 We found something similar taking place before the 1995 TCAA in Finland, as the daily smoking rate started to decline already in 1993. The contents and presumed impact of the TCAA provoked wide public discussion prior to its enactment. As the legislative process in Finland consists of a preparatory phase, a period of declarations and finally a parliamentary reading, public interest is usually greatest in the period of declarations and parliamentary reading, and rapidly declines thereafter.34 This may have spurred some of

### Table 3

Differences in the prevalence of daily smoking according to employment status, prevalence of ever smoking in each birth cohort, age, education, study year, change in real tobacco price, change in GDP per capita and the effects of the 1995 Tobacco Control Act Amendment (TCAA) according to employment status by gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
<td>P</td>
<td>OR</td>
</tr>
<tr>
<td>Employment status:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>1.03</td>
<td>0.96–1.10</td>
<td>0.46</td>
<td>0.71</td>
</tr>
<tr>
<td>Level of ever smoking*</td>
<td>1.39</td>
<td>1.33–1.45</td>
<td>&lt;0.001</td>
<td>1.42</td>
</tr>
<tr>
<td>Age</td>
<td>0.74</td>
<td>0.72–0.77</td>
<td>&lt;0.001</td>
<td>0.95</td>
</tr>
<tr>
<td>Education**</td>
<td>0.92</td>
<td>0.88–0.96</td>
<td>&lt;0.001</td>
<td>0.85</td>
</tr>
<tr>
<td>Study year</td>
<td>1.07</td>
<td>0.99–1.16</td>
<td>0.08</td>
<td>1.00</td>
</tr>
<tr>
<td>The change in real price of tobacco</td>
<td>0.91</td>
<td>0.74–1.13</td>
<td>0.40</td>
<td>1.10</td>
</tr>
<tr>
<td>Change in GDP per capita</td>
<td>1.10</td>
<td>0.98–1.23</td>
<td>0.10</td>
<td>1.13</td>
</tr>
<tr>
<td>TCAA 1995 before</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCAA 1995 after</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>0.83</td>
<td>0.73–0.94</td>
<td>0.003</td>
<td>0.78</td>
</tr>
<tr>
<td>Others</td>
<td>1.06</td>
<td>0.92–1.22</td>
<td>0.41</td>
<td>1.19</td>
</tr>
<tr>
<td>(n)</td>
<td>(34 642)</td>
<td></td>
<td></td>
<td>(38 829)</td>
</tr>
</tbody>
</table>

Odds ratio (OR) and 95% confidence intervals (CI) of logit-model.

Note: The unit in age and study year is 10 years.
The unit of the change in real price of tobacco is 10%.
The unit of the change in GDP per capita is 10%.

* Ever-smoking in each birth cohort adjusted by education; the unit is 10%.
** Education groups (each birth year divided into tertiles according to education years).
The model: employment status + level of ever-smoking + age/10 + education + (study year)/10 + change in tobacco price + change in GDP per capita + TCAA 1995 + (employment status × TCAA 1995).

Employed in sectors other than farming or forestry.
Others (farmers, students, housewives, pensioners and the unemployed).
the larger companies with greater obligations concerning work safety to start applying restrictions early.\textsuperscript{5} Did the fact that the severest period of the economic depression coincided with the preparatory phase of the 1995 TCAA have an impact?\textsuperscript{35} Apparently not, since GDP (per capita) had only a weak contribution to the prevalence of daily smoking and controlling for it in the model did not remove the effect of the 1995 TCAA.

Limitations of this study

This study relied on self-reported measures of smoking status. An earlier study suggested that self-reports underestimate smoking prevalence.\textsuperscript{36} However, a representative Finnish population study using serum cotinine validation of self-reported smoking indicated a high level of agreement between the two measurements.\textsuperscript{37} We were unable to assess the potential impact of non-response on the results. Our overall response rate was good from 1981 to 2000, however.\textsuperscript{27} A clear decline in response rates emerged only in the present decade. This means that the most significant study years (~1995) were not affected as they had similar response rates. It was not possible for us to control the potential impact of any additional voluntary workplace smoking restrictions on daily smoking prevalence.

Conclusions

Workplace smoke-free policies are an effective means of reducing exposure to ETS.\textsuperscript{38,39} According to earlier studies, employees in workplaces with smoking bans have higher rates of smoking cessation than where smoking is permitted.\textsuperscript{12,40} Smoke-free workplaces not only protect non-smokers from the dangers of ETS, but may also encourage smokers to quit or reduce their cigarette consumption.\textsuperscript{12,30,41} In 2000, the Finnish TCAA classified ETS as carcinogenic, and thus subject to work protection regulations on chemical exposure that require an employer to register persons with ETS exposure and impose penalties for unprotected employees. This, too, may have increased employer compliance with the TCAA. The patterns of daily smoking suggest that the 1995 Amendment of the Finnish Tobacco Act contributed significantly in decreasing daily smoking. Further studies are needed to assess the impact of different tobacco control policy measures on different socioeconomic groups. Moreover, examining other outcome variables in addition to the prevalence of daily smoking (e.g. quit attempts, number

Fig. 1 Male and female daily smokers (%) among employed persons (occupied in sectors other than farming or forestry) by study year (three- or two-year pooled). Observed proportions of daily smokers and those predicted on the basis of the final model and prediction without the effect of the 1995 Tobacco Control Act (TCAA). The model: employment status + ever-smoking + age + education + study year + change in tobacco price + change in GDP + TCAA (Table 3). In the prediction, the effect of the TCAA in the model was assumed to be zero.
of cigarettes smoked per day, occasional smoking) could provide a deeper insight into the effects of legislation.

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