Evaluation of an intensive intervention programme to protect children aged 1–5 years from environmental tobacco smoke exposure at home in Turkey

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Abstract

The aim of this randomized-controlled trial was to evaluate the effectiveness of an intensive intervention to reduce children’s environmental tobacco smoke (ETS) exposure at their home compared with a minimal intervention. The target population of the study was the mothers of children aged 1–5 who lived in the Cengizhan district of İzmir in Turkey, who smoked and/or whose spouses smoked. It was found that at least one parent of a total of 182 children smoked and 80 of these mothers were taken into stratified sampling based on the number of the smoking parents. Mothers were visited at their homes. During the initial visit, they were educated and urine samples were taken from their children. Following this initial visit, mothers were randomized to the intensive intervention (n = 38) or the minimal intervention group (n = 40). The levels of cotinine in the intensive intervention (P = 0.000) and minimal intervention (P = 0.000) groups in the final follow-up were significantly lower than the initial levels. The proportion of mothers reporting a complete smoking ban at home in the final follow-up was higher in the intensive intervention group than the minimal intervention group (P = 0.000). The education provided during the home visits and the reporting of the urinary cotinine levels of the children were effective in lowering the children’s exposure to ETS at their home.

Introduction

The World Health Organization (WHO) has reported that almost half the children in the world (nearly 700 million) are exposed to cigarette smoke [1, 2]. According to the International Union Against Cancer, involuntary exposure of children to environmental tobacco smoke (ETS) at home, where they spend most of their time, is an important and preventable cause of morbidity [1].

A number of studies have indicated that a complete home smoking ban is the most effective way of protecting children from ETS at their home [3–7]. However, there is not yet any legal enforcement regarding smoking at home. Therefore, the frequency of complete home smoking ban is, to a large extent, determined by social approval of smoking behaviour and by the attitude of parents [7, 8]. Studies conducted in Europe indicate that the percentage of smoking bans at home ranges from 60% to 87% [9]. In Turkey, where smoking is highly prevalent, children’s exposure to tobacco smoke is an important public health problem [10–13]. According to the WHO data, the prevalence of smoking among Turkish adults was 52% for men and 19% for women. [14]. Studies carried out in different cities of Turkey indicate that the proportion of children with at least one parent who smokes varies between 71% and 87% [11–13], and the frequency of complete home smoking ban is quite low (16–17%) [13, 15]. In a study carried out on children...
diagnosed with asthma, it was reported that the frequency of complete home smoking ban was only 35% [16].

Interventions which focus on parental attitudes and behaviour towards smoking at home are of great importance in lowering the disease and mortality rates caused by ETS [17, 18]. Behavioural interventions have been classified by Valanis et al. [19] as minimal, low and high intensity, whereas Klerman divided the interventions into two types: relatively weak (minimal and low intensity) and stronger interventions (high intensity) [20]. In these studies, the effectiveness of strategies which comprised of various components, such as education and brochures, telephone counselling and biomarker feedback, was evaluated [12, 17, 21–27]. Instead of being compared with a control group in which no interventions were carried out, the effectiveness of intervention strategies, which were generally made up of various components, was compared with the effectiveness of low intensity intervention strategies [12, 21–23]. A review of 19 studies assessing interventions to reduce children’s ETS exposure indicated that interventions which include repeated or longer contact are most likely to be successful [24]. However, a more recent review made by Priest et al. [28] found limited support for more intensive counselling interventions delivered to parents.

In order to assess the efficiency of parent-based educational programmes, it is common to use self-reported variables such as the number of cigarettes smoked and home smoking bans as well as biological measurements such as cotinine analyses in urine, serum and saliva [12, 17, 23, 25, 27–32]. Differences in pharmacokinetic parameters such as respiration rate and daily urine volumes may influence measurements such as urinary cotinine in very young children. One significant advantage of urine is that the concentration of cotinine and other nicotine metabolites is several-fold higher than in serum or saliva, which can provide enhanced sensitivity for detection of low-level exposures to ETS. Measurement of cotinine alone is sufficient for assessing exposures to ETS, especially for younger children [30].

The majority of interventions designed to reduce young children’s ETS exposure has been conducted in high income countries [17–18, 21, 25, 27–29]. In Turkey, there are only two intervention studies on this subject [12, 16]. In one intervention study, two phone calls and urine cotinine notification were given to the intervention group, whereas only urine cotinine notification was sent to the control group. Intervention was successful in reducing children’s ETS exposure in both of the groups [12]. The other study was conducted on the parents of asthmatic children who were admitted to a respiratory diseases polyclinic. In that study, these children’s parents were normatively educated about the dangers of smoking and the effects of second-hand smoking on asthmatic children. Passive smoke exposure significantly decreased after the education [16].

Hence, studies identifying the strategies used in effective intervention programmes are of major importance for planning programmes to be carried out in societies, such as Turkey. In a recent study carried out in a suburban area of Izmir, Turkey, an intensive intervention was performed aimed at protecting children aged 1–5 from ETS, whose mother and/or father smoked in their home. The aim of this study was to evaluate the efficiency of intensive intervention, consisting of three home visits, two telephone follow-ups and urine cotinine notification, compared with a minimal intervention comprising two home visits and urine cotinine notification.

The hypotheses were (i) urinary cotinine levels of children will be lower than the pre-intervention level after both intensive and minimal intervention, (ii) the percentage of complete home smoking ban will increase after both intensive and minimal interventions, (iii) reduction in urinary cotinine levels of children will be greater in the intensive intervention group than the minimal intervention group, (iv) the increase in the percentage of complete home smoking ban will be greater in the intensive intervention group than the minimal intervention group and (v) the number of cigarettes smoked in the home will decrease after both interventions.
Materials and methods

Study design and study population

In this randomized controlled trial, home ETS exposure levels of children whose mothers received intensive intervention were compared with the pre-intervention levels and home ETS exposure levels of children whose mothers received minimal intervention.

Data were collected between November 2009 and June 2010, in a suburban district of Izmir (Cengizhan), which is the third largest city in Turkey, located in the west of the country. The target population of the research was the mothers of children aged 1–5 who lived in Cengizhan district, who smoked and/or whose spouses smoked. The smoking status of the parents was assessed by asking if they had smoked at least 100 cigarettes in their lifetime and still smoked at least once a week. If it was reported that they had smoked and still smoked at least once a week, they were identified as smokers. Of the 352 parents of children aged 1–5 who were registered at the Cengizhan Municipality Health Center, 284 were contacted by telephone. It was found that 182 children had at least one parent who smoked. All of these parents were smoking manufactured cigarettes with filters. One hundred forty-two children out of the 182 had one parent who smoked and 40 of the children had both a mother and a father who smoked (Fig. 1). The recruitment was aimed at mothers as it would be more difficult to reach the fathers and 80 mothers were included in the study. The sample group was selected by stratified random sampling in considering the number of smoking parents because of the possibility that the effect of education would be different in families where only one of the parents is smoking from the ones where both of the parents are smokers. The final group consisted of 62 mothers who either smoked or had a smoking husband, and 18 mothers who smoked and had a smoking husband.

A substitute list of selected mothers who did not want to participate was formed using the same method. Twelve subjects were replaced with other mothers from the substitute list, including four mothers who did not want to participate in the research, one child from whom a urine sample could not be obtained, and seven mothers who did not meet the participation criteria for the study. In cases where there were two children aged 1–5 in the same home, the older child was included in the research as it was easier to obtain a urine sample. We excluded infants, who were generally breast feeding, to avoid confounded cotinine analyses, as cotinine is passed through breast milk [32, 33], and also due to the difficulty in collecting urine samples from infants.

As two interviews could not be completed, the analysis was conducted on 78 children (97.5% participation rate). After the initial home visit, mothers were chosen for the intensive intervention group \( n = 40 \) or the minimal intervention group \( n = 40 \) (Fig. 1), depending on the children parents’ smoking status, which was categorized as one or both parents who smoked.

Variables

Descriptive variable

Descriptive variables included the child’s gender, the number of siblings, whether the child had received a diagnosis of disease, the mother’s perception of her child’s health status (very good, good and moderate) and the parents’ smoking status. In addition, the number of days a week that the mother and/or father smoked and the number of cigarettes smoked in a day were also determined.

Primary efficacy variables

There were two primary efficacy variables in this study. The first one was the difference between urinary cotinine levels prior to and following the intervention. The second one was the presence of complete home smoking bans. Households were categorized as having complete home smoking bans (no smoking allowed) if mothers reported that no one was allowed to smoke anywhere at any time in the home.

Secondary efficacy variables

The secondary efficacy variables were the number of cigarettes smoked on a normal day, the number of
cigarettes smoked in the home during the last 7 days, the number of days out of the last 7 days on which cigarettes were smoked at home, the total number of cigarettes smoked at home during the last 7 days, the number of days that the mother and/or father smoked at home during the last 7 days, and the number of cigarettes that the mother and/or father smoked at home during the last 7 days.

**Intervention procedures**

Figure 2 shows the intervention period of the research. On the initial home visit which lasted approximately 45 min each, mothers were interviewed in order to complete the initial form and were trained using brochures, which were also left at their homes so that the whole family, especially the childrens’ fathers, could read them. During the
visits, urine samples were collected from the children. After the initial home visit, mothers were allocated to either the intensive or the minimal intervention groups. Five behavioural change techniques were used during the intervention: (i) providing information, (ii) goal setting behaviour (not smoking in the home) and outcome (to reduce children’s ETS exposure), (iii) use of follow-up prompts, (iv) educating to use prompts (i.e. hanging ‘no smoking’ warning signs in the home) and (v) environmental restructuring (i.e. removing ashtrays in the house) [34]. Home visiting and telephone callings have been done by the first author. Inpracticality of face-to-face interviews with fathers is the constraint of the research. Considering the high prevalence of fathers’ smoking, a language that appeals to fathers has been used in the pamphlet. Mothers have been asked to show fathers the

<table>
<thead>
<tr>
<th>Initial Home Visit: (n=80)</th>
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<tbody>
<tr>
<td>Initial form</td>
</tr>
<tr>
<td>Education, give a brochure, urine sample</td>
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</tbody>
</table>

Randomize

1 month

**Intensive Intervention Group** (n=38)*

<table>
<thead>
<tr>
<th>Second home visit:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate follow-up form</td>
</tr>
<tr>
<td>To informe urinary cotinine level</td>
</tr>
</tbody>
</table>

*Two interviews could not to completed

2 weeks

First telephone follow-up call

2 weeks

Second telephone follow-up call

1 month

**Final Home Visit:**

| Final follow-up form, urine sample |

<table>
<thead>
<tr>
<th>Minimal Intervention Group (n=40)</th>
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</thead>
<tbody>
<tr>
<td>To informe urinary cotinine level by mail</td>
</tr>
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</table>

3 month

**Second home visit:**

<table>
<thead>
<tr>
<th>Final follow-up form</th>
</tr>
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<tbody>
<tr>
<td>urine sample</td>
</tr>
</tbody>
</table>

**Fig. 2.** Study flow diagram.
document that discusses cotinine levels, and in the follow-up interviews it was found that all fathers had seen the document.

According to the targeted learning objectives, at the end of the education given in the first visit the participants must be able to (i) define ETS, (ii) explore the health risks of ETS exposure for their children, (iii) explore why children are at higher risk and (iv) list the measures that should be implemented for a smoke-free house. The education and brochures were prepared and given to 10 mothers from similar social backgrounds who were registered with a family health unit in a different region, and after the necessary adjustments were made, the final version of the training brochure was produced.

**Intensive intervention**

An intermediate follow-up survey form was administered to the mothers during the second home visit, which occurred within 1 month after the initial visit. The parents were also informed about the urinary cotinine levels of the samples taken from the children in the course of the initial home visit.

The mothers were telephoned twice within an interval of 2 weeks to learn the smoking status at home. One month after the second telephone interview, the final home visit was carried out, the final follow-up survey form was administered to the mothers, and a second urine sample was obtained from the children.

**Minimal intervention**

This group was notified by mail of the urinary cotinine levels of their children’s samples obtained during the initial home visit. Three months after the initial visit, the second visit was performed, the follow-up form was completed, and a second urinary sample was taken from the children.

**Data collection**

Three forms (initial, intermediate follow-up and final follow-up) were utilized in order to collect data, and urinary cotinine measurements were taken (Fig. 2).

**Initial form**

The initial form was composed of questions under four headings: features related to the children, smoking status of parents, children’s exposure to ETS at their home and the use of home smoking bans.

**Intermediate and final follow-up forms**

These forms included questions regarding the smoking status of parents, the child’s exposure to ETS at their home and smoking rules at home. In order to make a comparison between the intermediate and final follow-up, all questions other than sociodemographic variables were asked to follow up in the same way. The intermediate follow-up survey form was administered to the intensive intervention group on the second home visit; the final follow-up survey form was administered to both groups on the last home visit.

**Urinary cotinine**

Urine samples were collected from children using a standard urine collection cup. When children were not toilet-trained, urine samples were obtained using a urine pocket. Following collection, the urine samples were stored at −20°C until analysed. Urinary cotinine was analysed with an enzyme immunoassay. Cotinine levels were calculated in terms of ng/ml. The cotinine assay was a liquid ready-to-use homogeneous enzyme immunoassay based on the competition of a cotinine-labelled enzyme, glucose-6-phosphate dehydrogenase (G6PDH), and the free cotinine in the urine for a fixed amount of cotinine-specific antibody-binding sites. The enzyme G6PDH activity was determined spectrophotometrically at 340 nm by measuring its ability to convert nicotinamide adenine dinucleotide (NAD) to NADH. The laboratory was blind to participants’ identity and group assignment [35].

**Analysis**

Stratified randomization, applied in defining the intervention groups, was carried out using the SAS (statistical analysis system) program. A Chi-square test, $t$-test, variance analysis and McNemar and
Fisher exact tests were used in the analysis of data. Furthermore, in cases where differences among variables in the variance analysis were identified in dependent groups, Bonferroni correction and t-analysis were carried out with the aim of determining the source of the difference.

Changes in urinary cotinine levels were calculated by subtracting the initial cotinine level from the final follow-up cotinine level and the difference between groups in terms of change was analysed using a t-test. The co-variance was analysed using the General Linear Model to examine the differences between initial cotinine levels and levels in the final follow-up in the intensive and minimal intervention groups associated with secondary efficacy variables. Statistical significance was set at \( P < 0.05 \) and the data were analysed using SPSS 16.0.

Ethical approval

Ethical approval was obtained from Ege University Faculty of Medicine Research Ethics Committee for the realization of the research (Decision No: 09-3 1/16). To conduct the study in the Cengizhan district, the necessary approval was obtained from Health Affairs Directorate of the Municipality of Izmir.

Results

There were no statistically significant differences between the intensive and minimal intervention groups in terms of children’s descriptive characteristics or exposure to ETS at home assessed in the initial home visit (Table I).

The differences in cotinine levels between the initial visit and the final follow-up for the intensive and minimal intervention groups are shown in Fig. 3. According to these data, the decrease in the level of cotinine in the final follow-up was higher in the intensive intervention group than the minimal intervention group. However, this difference was not statistically significant on the t-test \( (P = 0.831) \).

When changes in the number of complete home smoking bans between the initial visit and final follow-up of families in the intensive intervention group were evaluated, 30.6% of the families who had not complete home smoking ban in the initial visit indicated that they had this ban in the final follow-up. This increase was statistically significant \( (P = 0.001) \). Also, in the minimal intervention group, 10.5% of 38 families who were not implementing complete home smoking ban in the initial visit had complete ban in the final follow-up. This increase was not statistically significant \( (P = 0.125) \) (Table II).

In Tables III and IV, the changes in the levels of children’s ETS exposure at home between the initial visit and the follow-ups in the intensive and minimal intervention groups are shown. The number of cigarettes smoked in 1 day was observed to be fewer compared with the initial visit on the intermediate and final home visits in the intensive intervention group. According to the results of variant analysis in dependent groups, the decrease between the follow-ups was also statistically significant \( (P = 0.000) \). According to a t-test applied with the Bonferroni correction, the differences found between the initial visit and the intermediate follow-up \( (P = 0.001) \), the intermediate and final follow-ups \( (P = 0.018) \), and the initial visit and final follow-up \( (P = 0.000) \) were statistically significant. There was a statistically significant difference in the urine cotinine levels obtained from the children assigned to the intensive intervention group between the initial visit and the final follow-up \( (P = 0.000) \). The urinary cotinine level was dramatically reduced in the final follow-up compared with the initial level. There was a decline in the total number of cigarettes smoked at home during the last 7 days \( (P = 0.012) \) and the number of cigarettes smoked by the father at home during the last 7 days \( (P = 0.008) \) (Table III). The difference was statistically significant. According to the Bonferroni correction and t-test result, the differences between the total number of cigarettes smoked at home reported on the initial visit and intermediate follow-up \( (P = 0.001) \), the intermediate and the final follow-ups \( (P = 0.018) \), and the initial visit and final follow-up \( (P = 0.003) \) were statistically significant. In addition, in terms of the number of cigarettes smoked by the father at home over the last 7 days, the differences found between
the initial visit and intermediate follow-up ($P = 0.014$), the intermediate and the final follow-ups ($P = 0.023$), and the initial visit and final follow-up ($P = 0.002$) were statistically significant. In the minimal intervention group, the number of cigarettes smoked at home in 1 day in the final follow-up ($P = 0.002$), the total number of cigarettes smoked during the last 7 days at home ($P = 0.001$), the number of cigarettes smoked by the father at home during the last 7 days ($P = 0.002$) and the
cotinine level \( (P = 0.000) \) showed a decline when compared with the initial visit (Table IV).

The final follow-up results of the two intervention groups given in Tables III and IV were compared and no significant difference between the intensive and minimal intervention groups was found in terms of the number of cigarettes smoked at home in 1 day \( (P = 0.258) \), the total number of cigarettes smoked at home during the last 7 days \( (P = 0.723) \), the number of cigarettes smoked by the father at home \( (P = 0.685) \) and the number of cigarettes smoked by the mother at home during the last 7 days \( (P = 0.258) \) or the cotinine level \( (P = 0.122) \).

**Discussion**

In this population-based randomized controlled trial, we found that the education during the home visit and the reporting of the urinary cotinine levels of the children were effective in lowering the children’s exposure to ETS at their home. To enhance the implementation of smoking bans in the home, the intensive intervention strategy that kept the issue on the agenda by repeating the education through telephone follow-ups and increasing home visits was found to be very effective.

The proportion of smoking bans in the home prior to the intervention indicated that mothers in our study could not protect their children from ETS at home and demonstrated the importance of intervention studies carried out in districts where parents have similar smoking patterns to our study population.

The proportion of smoking bans in the home reported in different studies around the world ranges from 21% to 86%, whereas in some studies carried out in Turkey, this proportion has been reported to be between 16% and 19% [13–16, 23, 36–41]. When

**Table II. Complete smoking ban presence at home in at the first and final home visit of intensive intervention and minimal intervention group**

<table>
<thead>
<tr>
<th></th>
<th>Complete smoking ban at home final home visit</th>
<th>No ban</th>
<th>Total</th>
<th>Statistical analysis (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ban</td>
<td>%a</td>
<td>n</td>
<td>%b</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive intervention group</td>
<td>Ban</td>
<td>2</td>
<td>100.0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No ban</td>
<td>11</td>
<td>30.6</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13</td>
<td>34.2</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Minimal intervention group</td>
<td>Ban</td>
<td>2</td>
<td>100.0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No ban</td>
<td>4</td>
<td>10.5</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6</td>
<td>15.0</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

*aPercentage of lines. bPercentage of column. cMcNemar.*
compared with these rates, the prevalence of home smoking bans prior to the intervention was very low in Cengizhan district (5%). This could be linked to the inclusion of mothers who smoke and/or whose husband smokes. Similarly, many studies have pointed out that smoking parents have a lower frequency of complete home smoking ban [36, 38, 42–44]. Considering that the research was carried out with the mothers of children aged 1–5, the low frequency of complete home smoking ban becomes more important. The frequency of complete home smoking ban with children under 6 years old, especially infants under 1 year old, has been reported to be higher [31, 40, 45]. When the findings of our research are compared with the results of other studies, it can be understood that smoking at home is still generally approved in Turkish society.

According to our findings, the frequency of complete home smoking ban after the intervention increased more in the intensive intervention group compared with the minimal intervention group. The rate of smoking at home and children’s cotinine levels showed a significant decrease in both groups. This reduction was at nearly the same level in both groups. This finding indicates that the education given during the initial home visit and the reporting of the urinary cotinine levels of the children were effective in lowering the children’s exposure to ETS at their home. Low intensity intervention methods have been found to be unsuccessful in reducing children’s exposure to ETS in many studies [23, 25–27, 31, 46]. In this study, a decrease in the cotinine level in the minimal intervention group has led to the conclusion that the content of home visits and intervention including cotinine notification is not as weak as initially thought. Several studies have reported that interventions based only on education where children’s urinary cotinine levels were not assessed did
not provide parents with specific strategies for reducing exposure [26, 27, 46]. The change in both intervention groups in this study suggests that informing parents about children’s exposure to ETS and confirming it using laboratory tests was an efficient strategy. Ekerbicer et al. [12] who performed an intervention study in a Turkish city, Kahramanmaraş, reported that a brief intervention incorporating feedback of children’s urinary cotinine levels via a letter would display a similar positive effect on parents’ attitude on restricting smoking at home as feedback plus intensive counselling. Priest et al. [28] reported that measurement alone may produce sufficient effects of an intervention and the feedback to parents of biological evidence of children’s ETS absorption may be used as a stimulus for parental behaviour change in some interventions. Wilson et al. [47] also pointed out that giving information to parents about their children’s exposure to ETS with laboratory results was more successful than purely education-based interventions. The fact that change in urinary cotinine levels was at the same level in both intervention groups suggests that the notification of the minimal intervention group about cotinine levels via mail had a similar, and even more influential impact than the face-to-face communication in the intensive intervention group. Nevertheless, there are studies which have shown that interventions comprising education and cotinine notification are not effective [23, 25, 48]. However, it should be noted that these studies were carried out in groups whose addiction levels were higher, such as mothers who smoked at least 10 cigarettes a day or those who smoked in spite of having babies aged under 1 year old. This study, on the other hand, was conducted with mothers with older children. The inclusion criteria were that mothers and/or fathers had smoked at least 100 cigarettes throughout their lifetime and still smoked at least once a week. On the other hand, the fact that the intervention groups were not compared with a control group whose cotinine levels were not notified restricts the interpretation of this vital component of the intervention. Other than the age of children and smoking status of parents, many factors such as the size of the sample, statistical analysis, the difference in methods of intervention and parental socio-economic status affect the effectiveness of interventions [23, 25, 28, 48]. For these reasons, interventions to reduce ETS have had mixed success [28].

Although there were no significant differences between the two groups in terms of the number of cigarettes smoked at home or children’s cotinine level following the intervention, the intensive intervention was more successful in terms of the introduction of complete home smoking ban. It was also observed that the intermediate follow-up visits and the telephone call follow-ups were substantial components in terms of increasing the effectiveness of the intervention for introduction of complete home smoking ban. The results of other intervention studies have indicated that interventions which include repeated or longer contact are most likely to be successful in reducing children’s ETS exposure [16, 21, 22–24, 26, 32, 46, 49]. However, according to Priest et al. [28], there is limited support for more intensive counselling interventions. Unlike the intervention study of Ekerbicer et al. [12] who reported the urinary cotinine levels of school children to their parents, our study followed a home-based and face-to-face interview method and the effectiveness of the intervention was assessed according to home smoking bans in addition to the level of cotinine [12]. Another difference of this study is caused by its intervention method, which has a structure suitable to be integrated to child monitoring services of primary care institutions.

In this study, some factors which may have supported or restricted the effect of the intervention methods applied should be emphasized. First, the fact that our intervention occurred at the same time as the period when smoking prohibition in public areas went into effect in Turkey in 2009 and exposure to ETS started to be discussed frequently in the public and the media may have supported the education given to mothers within the study [50, 51]. Another limitation of our study methodology is the possibility of contamination bias, which may have minimized the difference in outcomes between the two groups. As mothers in the intensive and minimal intervention groups had
neighbour relationships, it is very likely that they talked to each other about their children’s cotinine level results. The research group also had some features which may limit the possibility of intervention effectiveness. It has been reported that the likelihood of success in interventions for parents with low socio-economic status is low and they cannot give sufficient importance to the exposure of ETS due to their financial restrictions [6, 23, 52–54]. Our study population was composed of families with low socio-economic status who migrated from socio-economically less developed cities of Turkey; this may limit the generalizability of our results to families with higher socio-economic status.

The results of the study showed that children’s urinary cotinine levels were reduced after the intervention and our first hypothesis was confirmed. However, in the minimal intervention group, there was no statistically significant increase of banning smoking completely in the home and our second hypothesis was not confirmed. The decrease in the urinary cotinine levels of the intensive intervention group was not more than that of the minimal intervention group; reduction took place in a similar way in both groups and our third hypothesis was not confirmed. The percentage of complete home smoking bans in the intensive intervention group increased more compared with that of the minimal intervention group and our fourth hypothesis was confirmed. In conclusion, it was determined that in addition to the common interventions carried out in both groups, the intermediate follow-up via home visits and telephone call follow-ups applied to the intensive intervention group were more influential in increasing smoking bans.

In conclusion, the education provided during the home visits and the reporting of the urinary cotinine levels of the children were found effective in lowering the children's exposure to ETS at their home in both groups. This suggests that health care providers who have contact with parents of young children should be able to implement these interventions to strengthen parents’ ability to reduce children’s ETS exposure and to promote a smoke-free environment.

When considering workforce and cost, urinary cotinine feedback from laboratory results seems difficult to implement within the scope of routine services. On the other hand, using urine analysis to prove that the application of a smoking ban at home would protect the children against the harmful substances in cigarettes may strengthen the effect of the education. Therefore, cotinine level notification may be used as an intervention strategy for parents who smoke without hesitation near their children and who are regarded as ‘challenging’ in health education.

Limitations

There are some limitations to this study. The first is that the study group consists of a small and selected population. Another limitation is the assumption that cotinine levels were associated with ETS exposure at home. The reason why children’s ETS exposure outside the home was ignored is the fact that the mothers, most of whom were housewives, took care of their children at home and spent most of their time at home. The fact that parents knew their children’s urinary cotinine levels would be checked and only the short-term effects of the education were assessed are other biases of the study. However, this possibility of bias is valid for both of the groups.

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Conflict of interest statement

None declared.
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