A randomized trial to promote health belief and to reduce environmental tobacco smoke exposure in pregnant women

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Abstract

Exposure to environmental tobacco smoke (ETS) is widespread among women in Iran. This study aimed to explore the impact of education on health belief and environmental tobacco smoke exposure in pregnant women. This randomized trial was administrated to 130 pregnant women exposed to ETS. The face-to-face education was provided for the intervention group after completing the questionnaire compiled on the constructs of the health belief model and self-reports of weekly ETS exposure. The theoretical constructs and weekly ETS exposure were compared in the study groups at the intake, third, fourth and fifth sections. In the intervention group, perceived susceptibility/severity and perceived benefits increased and the weekly ETS exposure decreased on the third as opposed to the first section (P < 0.05). Perceived susceptibility/severity and benefits significantly correlated with weekly ETS exposure in the intervention group (P < 0.05). The findings of this study point to the fact that education about the impacts of ETS exposure of pregnant women is an effective way to increase the theoretical constructs according to the health belief model and is associated with a reduction of ETS exposure. But this is not sufficient for making smoke-free homes.

Introduction

Although the smoking prevalence rate for Iranian women is low, the high smoking prevalence rate for Iranian men makes exposure to secondhand smoke (SHS) an important risk factor to women’s health [1, 2]. According to Yunesian prevalence of habitual smoking among the adult male population older than 19 years was 21.3 versus 3.4% for women [3]. According to the Iranian culture, families and relatives get together in houses. This social habit in conjunction with the careless behavior of smokers results in a higher prevalence rate of environmental tobacco smoke (ETS) exposure of women. Moreover, women have traditionally accepted the fact that men smoke in their presence [4]. Territorial survey reported that 24% of women were exposed to SHS [3].

Therefore, ETS is still a ‘women’s issue’ because of the negative impact of exposure to ETS on the health of women. For women, pregnancies represent a period of particular vulnerability, during which exposure to ETS may adversely affect the developing fetus. Toxic substances from SHS cross the placenta to directly affect the fetus. The harmful effects of prenatal ETS exposure on the fetus have been documented in studies, and include pregnancy loss, low birth weight preterm delivery, fetal death and other negative health outcomes [5–16].

Exposure to SHS is a significant problem for women in Middle East countries and there are many barriers to women attending to their own...
well-being. The findings from the above studies underscore the need to reduce the exposure of pregnant women to ETS. Therefore, providing smoke-free environments interventions that result in lifestyle changes for pregnant women continues to be a challenge to health care providers.

Though in prenatal care education, pregnant women are advised to avoid ETS exposure, SHS exposure is still a health problem for pregnant women in Iran. Therefore, it is crucial to understand how best to motivate pregnant women exposed to environmental tobacco smoke to take preventive measures.

Most intervention studies have concentrated on helping pregnant women to quit smoking [17] but little has been done, however, to help pregnant women increase the chance to live in smoke-free homes.

The Health Belief Model (HBM) has been applied to a broad range of health concerns in women’s health and indicated that the HBM serves as an effective framework for tailoring educational interventions promoting preventive behaviors in women [18–20]. Because of women’s sensitivity during pregnancy to factors affecting fetal health [21], HBM may offer an effective foundation for the development of tailored educational interventions promoting permanent avoidance to ETS exposure in pregnant women.

Health concerns might be important predictors of preventive attempts [22, 23]. If pregnant women were educated about the impact of the harmful effects of ETS exposure, they might go through a rational decision-making process [22, 24], focusing on their perceived risks of exposure to ETS of their fetus and begin to worry about the consequences of smoking and be prompted to avoid it. Application of the HBM as a tool to explain the change in health behavior and as a guiding framework for health behavior interventions further enhances the merits for its use in examining maternal and child health issues [25–27].

The original model postulated that preventive health behaviors may be predicted by the following individual perceptions: (i) perceived susceptibility to a disease or illness, (ii) perceived severity of a particular condition, (iii) perceived barriers, which may prevent action and (iv) perceived benefits of the recommended behavior. A while later, the concept of self-efficacy and belief in one’s ability to perform health-protective behaviors were added to the model [28].

Within the construct of the HBM, if a pregnant mother thinks or feels that her baby is susceptible to harm as a result of her actions, then the mother perceives that her baby is susceptible to her ETS exposure.

This study was designed to test the following hypotheses: (i) health education for increased perception of the risk of ETS exposure for pregnancy outcome can affect HBM constructs and (ii) health education is associated with lower ETS exposure.

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**Materials and methods**

**Participants**

A two-group longitudinal randomized controlled study was conducted of pregnant women having undergone prenatal care. The data were collected from the beginning of November 2008 to the end of August 2010 in 10 health centers in Isfahan, Iran. The Ethics Committee of Isfahan University of Medical Sciences approved the study.

The study population comprised married non-smoker pregnant women with a history of exposure to ETS by their husband. The criteria for inclusion were that women be 16 years of age or older, Iranian nationality, 12 weeks gestation or less based on last menstrual period and having ETS exposure from at least six cigarettes per week or more within 2 months before or since pregnancy. The criteria for exclusion included termination of pregnancy before the third visit, using illicit substances and suffering from mental disorders. All the participants were visited at five sections with 4-week intervals; but the data were collected prospectively at four sections: at intake (pre-intervention) and during the third, fourth and fifth prenatal care visits.

At the beginning of the study administration, the total number of the participants was 130 pregnant women. A total of 91 women (47 women in the intervention group and 44 women in the control group) completed the study with a retention rate of 70%; 15.38% dropped out (because of abortion and lack of interest in continuing with the study) and 14.62% were lost in the follow-up at the third section.
Measures

The questionnaire consisted of several sections: demographics (included age and educational level of women and husbands, monthly income and working condition), weekly number of ETS exposures at home and health belief in ETS exposure. All the variables were measured by self-report. ETS exposure was measured by mean number of cigarettes per week that their husband smoked at home near the participants.

A 15-item questionnaire was developed covering a review of the literature [24] and expert-opinion determinants of HBM constructs. Then, a pilot study leading to the final revision was conducted. Cronbach’s alpha for evaluation of the internal consistencies was 0.82 for perceived susceptibility, 0.79 for perceived severity, 0.78 for perceived benefits and 0.76 for perceived barrier.

The HBM constructs were measured by summing up the participants’ responses to the statements.

Sample statements

Sample statements are as follows: (i) perceived susceptibility—breathing in environment where someone else’s cigarette (SHS) can affect fetal development in pregnant women, (ii) perceived severity—the effect of ETS exposure is a very serious condition, (iii) perceived benefits—during pregnancy, protection from ETS exposure can help the fetus for better growth and (iv) perceived barriers—your husband can smoke next to you at home, even if it bothered you.

To inquire about health beliefs, the women were asked questions about their perceived susceptibility to SHS (four questions), perceived severity of SHS (four questions), perceived benefits of the recommended behavior (five questions) and perceived barriers to protecting themselves from ETS exposure (two questions). The HBM constructs were measured using a five-point Likert scale.

Recruitment and procedures

The prenatal care centers were selected randomly from all registered centers in Isfahan Health advisory. Twenty trained midwives (BS) were involved in this study (two staff members in each center). To select the subjects of each month, 15 days excluding holidays were randomly selected. In these days, eligible pregnant women were screened by the first staff members who were health providers and invited to participate in this study.

All the participants gave written informed consents to become research subjects. Upon completion of the questionnaires (at intake section), all the participants (n = 130) were referred to the second staff members and allocated to receive education intervention or a control group (65 women in each group) by systematic random allocation.

The intervention group was given education about ETS exposure and the control group was given education about prevention against infectious diseases by the second staff members. After 4 weeks, when the women attended the second antenatal checkups, the systematic reinforcement of the messages by second staff members was made (Section 2) but they did not complete a questionnaire. During the third, fourth and fifth prenatal visits, only the questionnaires were completed by the first staff members. The data were collected and subsequently data analyzed in a blinded fashion about study group by the first staff and data analyzer.

Intervention

This intervention study has its theoretical basis in the HBM, which is based on the understanding that a person will take a health-related action if they feel greater susceptibility to the risk of experiencing negative health outcomes [24]. The focus of the intervention is on increase in women’s sense of susceptibility/severity and benefits and reduced perceived barriers and harmful reduction strategies (i.e. removing oneself from ETS situation).

The educational package was prepared by researchers using a review of literature [29, 30] and then proofread by four health educators. The package addressed influence of the toxic substances from SHS crossing the placenta and putting the infant at increased risk of neonatal and prenatal morbidity and mortality. The educational package includes a picture of low birth weight newborns and ways for the toxic substances from SHS to
cross to the fetus. Women were also given a re-
source booklet to use at home. The home resource
booklet used simple and pictorial terms to commu-
nicate knowledge.

The education was conducted verbally and face-
to-face and one-on-one by using poster and slide
shows for 15–20 min. at the first section and 5–10
min at the second section.

Statistical analysis
Statistical analysis was performed using SPSS 13.0
(Chicago, IL, USA). The sample size calculation
showed that 44 participants were needed in each
group, using an $\alpha$ of 0.05 and a $\beta$ of 0.80. The
results were reported as geometric mean and stan-
dard deviation or percentages. The categorical data
were analyzed using independent Student’s $t$-tests
and one-way analysis of variance post hoc test
(LSD), chi-square and Pearson’s correlation at the
statistical level of significance of $P < 0.05$.

Results

Comparison of a number of demographic variables
was made of the control ($n = 44$) and intervention
($n = 47$) groups to examine group equivalence at
baseline. There were no statistically significant differ-
ences in the comparisons with the independent sam-
ple $t$-test procedure and chi-square test. These results
demonstrate the relative equivalence of the groups on
these relevant variables (Table I).

To examine the first hypothesis, the theoretical
constructs in both groups were compared by four
sections (Tables II and III). The perceived suscep-
tibility, severity and perceived benefits were differ-
et in the two groups by four sections (Table II).

Analysis using the LSD test (Table III) indicated
that there were no statistically significant differen-
ces in the HBM constructs between the study
groups at the intake section. Therefore, two groups
were equivalent on HBM constructs at the intake
section. Compared with the control group, the in-
tervention group reported significantly higher per-
ceived susceptibility (at the third, fourth and fifth
sections), perceived severity (at the third and fourth
sections) and perceived benefits (at the fourth and
fifth sections) for ETS exposure. But the difference
in the perceived barriers between the groups was
not significant at any section. In the intervention
group, the mean weekly exposure at the third,
fourth and fifth sections was significantly lower
than that for the control group.

<table>
<thead>
<tr>
<th>Table I. Comparison of baseline characteristics at the intake section in study groups</th>
</tr>
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<tbody>
<tr>
<td>Intervention group ($n = 47$)</td>
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<tr>
<td>Age of women (Mean ± SD)</td>
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<tr>
<td>Age of husbands (Mean ± SD)</td>
</tr>
<tr>
<td>Monthly income (Mean ± SD)</td>
</tr>
<tr>
<td>Education level of women</td>
</tr>
<tr>
<td>Less than high school (%)</td>
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<tr>
<td>High school diploma (%)</td>
</tr>
<tr>
<td>University degree (%)</td>
</tr>
<tr>
<td>Education level of husbands</td>
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<tr>
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<tr>
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<tr>
<td>University degree (%)</td>
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<tr>
<td>Working situation</td>
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<tr>
<td>Employed (%)</td>
</tr>
<tr>
<td>Unemployed (%)</td>
</tr>
</tbody>
</table>

n.s., not significant; sig, significance.

$^a$ $t$-test.

$^b$ Chi-square.
In the intervention group, the perceived susceptibility/severity and perceived benefits at the intake section were lower than the third, fourth and fifth sections and were changed from the intake to the third sections. In this group, the changes in HBM constructs from the third to fifth sections were not significant. Unlike women in the control group, in terms of the intake section, women in the intervention group at the third section reported significantly lower weekly ETS exposure, but the mean weekly exposure at the fourth and fifth sections did not change significantly. In the control group, HBM constructs did not change from the intake to the third, fourth and fifth sections. The perceived susceptibility was changed to higher from the third to the fourth sections.

The intercorrelation coefficients of HBM constructs with mean weekly exposure at the third, fourth and fifth sections were calculated for the intervention group (Table II). Consistent with the HBM, the scores on the perceived susceptibility/severity construct at the third, fourth and fifth sections and the perceived benefits construct at the third section were associated with the weekly number of ETS exposures in the intervention group.

At the third section, 11.6% of the intervention group and 8.5% of the control group; at the fourth section, 10.6% intervention group and 9% control group and at the fifth section, 17.4% in the intervention group and 9.5% in the control group were not already exposed to ETS.

**Discussion**

This study was designed to examine the education focused on the crucial harm of ETS to improve
pregnant women’s efforts to reduce ETS exposure. The hypotheses were that women in the intervention group would show more progress in moving forward in health belief and ETS protection than women in the control group. The longitudinal analysis revealed that in treated women, the perceived susceptibility/severity constructs and the perceived benefits construct improved.

Confirming the HBM that individuals must believe they are susceptible to a perceived threat before taking a health-related action, the findings indicated that focusing on the harmful effects of SHS exposure could affect the theoretical constructs and was associated with decreased ETS exposure during pregnancy. Previous studies also revealed that people with higher perceived susceptibility/severity were more likely to protect themselves from ETS [31].

According to a number of studies, education was associated with the smoking cessation in pregnant women [32–35]. Also in Katz et al.’s study [36], pregnant women with ETS exposure in contrast with other women with high-risk behavior were greater in number in reporting that in the future they would continue to use the information and skills that they learned through intervention. But Pletsch [37] reported that counseling with passive smoker

<table>
<thead>
<tr>
<th>I J</th>
<th>Perceived susceptibility</th>
<th>Perceived severity</th>
<th>Perceived benefits</th>
<th>Weekly ETS exp.</th>
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<td>-2.11***</td>
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</table>

Table III. The results of LSD test (two groups by four times)

Mean difference (I–J)

I group, intervention group; C. group, control group; S1, intake section; S3, third section; S4, fourth section; S5, fifth section; weekly ETS exp., weekly ETS exposure.

*P < 0.05 for between-group differences. **P < 0.01 for between-group differences. ***P < 0.001 for between-group differences.
women during pregnancy could not reduce ETS exposure.

We also found that in the intervention group, the perceived severity toward ETS at the fifth section was lower than the perceived severity at the fourth section but the perceived susceptibility was not. This finding may be related to lack of reinforcement of education that could affect perceived severity. Despite reduction in perceived severity at the fifth section, the mean weekly ETS at the fifth section remains low. The result also indicates that the relationship between the number of weekly ETS and perceived susceptibility in the intervention group was significant. These findings indicate that perceived susceptibility is more important for taking assertive action toward ETS in pregnant women.

Another finding of the research was the significant difference of the perceived susceptibility in the control group between the third and fourth sections. The educational effect of completing a questionnaire and routine education during prenatal care can explain this finding. Also, lack of change in mean weekly ETS in this group may indicate that enforcement toward ETS needs perceived susceptibility and severity and even perceived benefits.

Although the findings from this paper are encouraging and suggest that utilization of education concerning serious effects of ETS for women during pregnancy is effective in increasing health belief and reducing ETS exposure, it is not effective in taking assertive action to make a smoke-free environment constituting women’s rights.

Moreover, lack of change in the perceived barrier in the intervention group indicated that women cannot surmount the barrier to the creation of smoke-free environment creation policies at home. These findings may be related to a perceived or real lack of empowerment in our study population for enforcement of smoke-free environment creation policies in their homes. Another explanation may be that traditional Iranian families have been characterized by a system of hierarchical behavior. In the Iranian culture, families and relatives gather in their houses at times of pressure. According to this cultural trait, many women do not avoid ETS at all. Hence, although educational campaigns against the health consequences of ETS can enhance their health belief, future support for Iranian women in the form of empowerment may be needed.

The impact of public educational campaigns can be enhanced by emphasizing action for women to assert their roles as family guardians of health for all household members. Pregnant women should learn the avoidance skills against indoor cigarette smoking. According to Yang et al. [38], 54.4% of pregnant women placed no restriction on their husband’s cigarette smoking at home.

To date, two intervention studies have addressed encouraging non-smoking pregnant women to protect their health and that of their fetus. Loke and Lam conducted a randomized controlled trial in the city of Guangzhou, demonstrating that simple advice by the obstetrician to the non-smoking pregnant women helped more smoking husbands quit in 1 month [39]. Lee [40] conducted a pilot intervention study demonstrating that educating non-smoking pregnant women about SHS and positive communication skills leads to increased self-reports of assertive actions against SHS exposure. Additionally, incorporating smoker husbands in the prenatal education program on ETS can more likely help with effective education [41]. Finally, interventions should incorporate a mass media component designed to (i) increase awareness and acceptance of health risks associated with ETS exposure and (ii) emphasize the benefits of smoke-free environments.

Two study limitations are related to sample size and incomplete data secondary to the use of a longitudinal design with a sample of women that changed their living locations. It was not possible to contact some participants at every data collection point, which resulted in a smaller sample size for a few variables for the longitudinal analyses. A larger sample would have given us more confidence in the study findings. Another important limitation of this study is that SHS exposure is self-reported information. Differences in self-reported amounts of exposure may be due to recall bias. Moreover, women in intervention group may be more likely to report ETS exposure because they are more sensitive to their environment.
Despite the above limitations, this study provides guidance for health providers to promote protective behaviors in pregnant women toward ETS exposure.

Recommendations for further research include study of the barriers to protective behaviors of women against ETS exposure using a different theoretical framework. Further, we need more research about families, and communities where women live so that guidelines might be modified and for interventions to be meaningful and useful for various aggregates of women.

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Conflict of interest statement

None declared.

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