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Research article

The effect of health education on second-hand smoke knowledge and exposure among pregnant women in Jordan: A quasi-experimental study

Nesrin N. Abu-Baker [a,*], Lina A. Al Diabat [a], Karimeh Alnuaimi [b]

[a] School of Nursing, Community and Mental Health Department, Jordan University of Science and Technology, P. O. Box 3030, Irbid 22110, Jordan
[b] School of Nursing, Maternal and Child Health Department, Jordan University of Science and Technology, P. O. Box 3030, Irbid 22110, Jordan

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ABSTRACT

Second-Hand Smoke (SHS) is a significant health issue. For non-smoker pregnant women, SHS exposure can lead to harmful consequences on the fetus. This study aimed to examine the effectiveness of a health education program in decreasing SHS exposure and increasing pregnant women's knowledge of its harmful effects. A quasi-experimental (pretest-posttest control group) design and the second-hand exposure questionnaire (SS-A) were used. A convenience sample of 136 pregnant Jordanian women from the antenatal clinic was recruited and assigned to an intervention group (n = 70) and a control group (n = 66). The intervention group received a health education program, while the control group received the usual antenatal care. The data were collected from October to December 2018. The results revealed that the highest exposure to SHS was in the home setting, with an average of 8.7 ± 2.21 hours daily for both groups. After the educational program, there were significantly lower scores of exposure and a higher score of knowledge in the intervention group, compared to the control group ($p < 0.001$). There was also a significant decrease in the scores of exposure and a significant increase in the score of knowledge of the intervention group from pretest to posttest ($p < 0.001$). The study provides evidence about the importance of a program to educate pregnant women about the negative impact of SHS. Nurses need to assess SHS exposure and provide health education for pregnant women.

1. Introduction

Second-Hand Smoke (SHS) is a preventable and significant health issue, as it is considered one of the most harmful sources of indoor air pollution [1]. For non-smoker pregnant women, SHS exposure can lead to harmful consequences on the fetus, such as spontaneous abortion, pre-term birth, low birth weight, and fetal death [1, 2]. Globally, more than 600,000 deaths per year are caused by SHS, 28% of them among children [3]. In the USA, more than 1,000 neonatal deaths occur annually due to maternal exposure to SHS [4].

Generally, pregnant women have a high level of exposure to SHS in many countries, which increases with the increased number of active smokers in different settings such as home, transportation, workplace, social and public places. However, public and workplaces have become smoke-free settings since 2014 [1]. In Jordan, 70% of Jordanian men are thought to be smokers. Laws prohibiting smoking in public places are widely disregarded. Also, 68% of adults in Jordan and 62% of young people are regularly exposed to second-hand smoke [5]. This high level of tobacco consumption is attributed to a lack of enforcement of existing anti-smoking laws, a shortage of qualified experts to support smoking cessation, a lack of knowledge regarding avoidance behaviors by non-smokers, and a gap in the knowledge about the health effects of and attitudes towards SHS exposure [6].

Exposure to SHS is still a 'women's health issue', as men smoke five times more than women, especially in the low and middle-income countries [7]. This, in turn, causes adverse consequences on women's health, mainly during pregnancy. Earlier studies indicated that the home setting is the most common environment in which SHS exposure occurs [8, 9, 10]. For example, In Greece, a study among 1291 pregnant women showed that the prevalence of SHS exposure was 94%, where 72% of the women were exposed at home and 64% in a public place [8]. In Bangladesh, a study using a Demographic and Health Survey among 17, 749 women reported that 46.7% of women were exposed to SHS at home [9]. In Jordan, researchers interviewed 300 women in the postpartum period and found that SHS exposure happened mainly at home, with 52.7% reporting that they had at least one active smoker [10].

Different interventions were conducted during the antenatal care period to promote maternal and birth outcomes in various low-income

* Corresponding author.
E-mail address: nesrin@just.edu.jo (N.N. Abu-Baker).

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regions, with mixed success [1]. For example, a recent systematic review has examined nine studies that involved interventions aimed at reducing SHS exposure of pregnant women. Educational interventions have focused mainly on pregnant women. Intervention delivery was mixed, ranging from brief discussions to sessions with role play. Effective interventions involved multiple follow-ups, and there was no standardized method of assessing exposure to SHS. Scholars have concluded that there was mixed evidence for the effectiveness of these interventions, and multi-component interventions appeared to be more effective [11]. In Srilanka, a study was conducted among thirty clusters of 25 women, randomized into control and intervention groups. The intervention group was exposed to educational sessions about adverse impacts of SHS knowledge, views towards SHS exposure, and the right to exist without house smoking. The results established the feasibility of the intervention which was conducted in the lower-middle-income country, proved effective in increasing women's knowledge and empowered women to live without household smoking [12].

In Jordan, there is a lack of evidence about the knowledge level among pregnant women regarding the adverse outcomes of SHS on maternal and fetal health, how to avoid smoking from family members, and how to implement smoke-free home rules [10]. Health care professionals, especially midwives and nurses, have an essential role in providing health education. The implementation of such programs may lead to improved maternal and neonate health and contribute to decreasing maternal and neonatal morbidity and mortality. The results of this study may encourage and motivate policymakers to develop guidelines and policies to reduce SHS exposure. This study aimed to (1) examine the levels of SHS exposure and the knowledge of its harmful effect on pregnancy outcomes and to (2) examine the effectiveness of the health education program in decreasing SHS exposure and increasing the knowledge of its harmful effect among pregnant Jordanian women.

2. Method

2.1. Study design and setting

A quasi-experimental (pretest-posttest control group) design was used. Data collection for both groups was carried out in the maternal outpatient clinic at a government teaching hospital in Northern Jordan. On average, about 50–60 pregnant women visit this clinic daily and receive antenatal care from a registered midwife and an obstetrician. The standard care delivered in this prenatal clinic comprises obtaining the

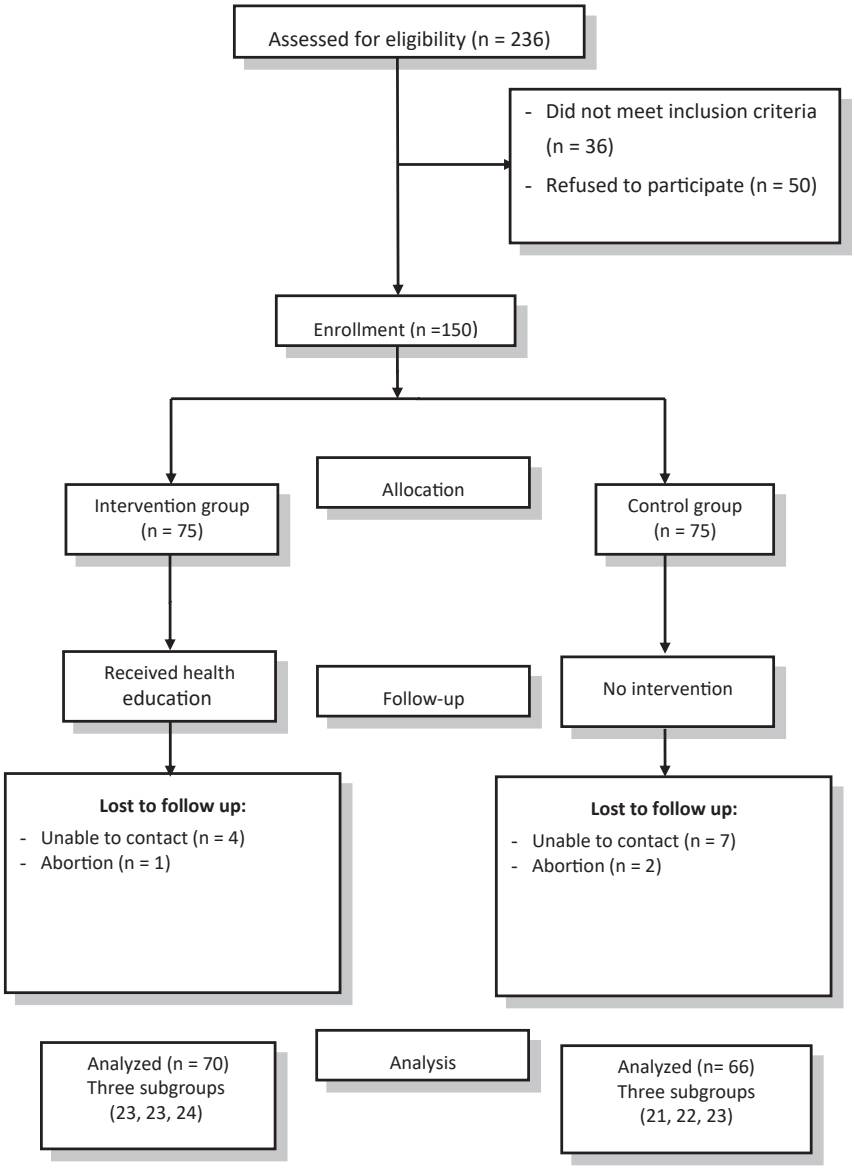

Figure 1. Total sample size.

current and previous obstetrical history, determining any existing complications, assessing fetal growth using the ultrasound, observing blood pressure, estimating gestational age by the midwife, testing urine and blood, and offering health education regarding family planning as well as breastfeeding [13]. Yet, they receive no education in terms of SHS exposure during pregnancy.

2.2. Population and sample

The population of this study consisted of pregnant women in their first and second trimester of pregnancy, who visited the outpatient clinic at the selected governmental hospital. The criteria for inclusion consisted of women who were pregnant and in the first or second trimester, have a smoker at home (either a husband or another household member), has a smartphone, and can read and write Arabic. Pregnant women who have any medical problems or smokers were excluded from the study. The researcher used a convenience sampling technique for women who were available at the time of recruitment, met the inclusion criteria, and agreed to participate in the selected clinic. Two days of the week were assigned to recruit the intervention group and another two days to recruit the control group. Participants were assigned, as a result, into three control groups and three intervention groups. Meetings with these groups were held at the clinic. For this study, 150 women were approached, and 136 women remained. The sampling process is shown in Figure 1.

2.3. Measurement

Second-hand exposure questionnaire SS-A developed by Misailidi et al. (2014) [14] was used after obtaining the author's permission and after minor modification, translation, and back translation, to adapt it to the Jordanian culture and achieve the study purposes. The SS-A measures SHS exposure in public and social places, transportation, work, and home. The SS-A questionnaire was valid, as there was a significant agreement with the nicotine measurement ($z = 2.961$, $p = 0.003$). In addition, factor analysis of the initial questions suggested that three subscales (social, work, and home SHS exposure) explained 71% of the variance factoring criteria indicating a satisfactory construct validity (KMO = 0.67; Bartlett's test $\chi^2 = 2829$; $p < 0.001$). The SS-A questionnaire was also reliable as the scores of the two forms of the instrument were highly correlated ($p < 0.001$) and there were no statistically significant differences between them ($z = -1.88$, $p = 0.06$) [14]. In the current study, content validity was examined by a panel of experts in Nursing from Jordan University of Science and Technology and they reviewed and approved all items to measure SHS exposure with minor editing. In addition, Cronbach's alpha was calculated to check the internal consistency of reliability and it was .75.

The questionnaire of the current study consisted of four main components: demographic variables, obstetric history, second-hand smoke exposure, and SHS knowledge level. Demographic data consisted of age, level of education of women, level of education of the husband, occupation, and monthly household income. Obstetric history consisted of family history of chronic diseases, maternal health problems, neonatal problems of previous babies, gestational age by last menstrual period, weight before pregnancy, parity, gravidity, hemoglobin level, and number of previous abortions. Second-hand smoke exposure history consisted of second-hand exposure at home, work, transportation, friend's or relative's house, and in public places. The items in each section included: If smoking was permitted in this setting, the answers were yes = 1 and no = 2. If yes, the average number of nearby smokers, the average number of cigarettes they smoked, and the average time they spent with these smokers. A total score was calculated for each part, the higher the score, the higher the SHS exposure. Finally, the knowledge part included the following six items: (1) “do you know that passive smoking has harmful effects on the health of pregnant women and their fetuses?” (2) “do you know the benefits of a smoke-free environment at home?", if yes, (3) "what are the benefits of a smoke-free environment at home?” (4)", what do you need to do when you have a smoker in the same room with you? " (5) " do you recommend that smokers at your home should not smoke?", and (6) "what are the risks of smoking during pregnancy?” The knowledge part was analyzed using a scoring system by giving every pregnant woman one point for the correct answer and a zero point for the incorrect answer. However, items number three and six were given one point for the incomplete answer and two points for the complete answer. The total score for this scale ranged from 0 to 8, with higher scores representing a greater knowledge level.

Medical records were also used to obtain data about maternal health problems, neonatal problems, hemoglobin level, and gestational age by last menstrual period.

2.4. Ethical considerations and data collection procedure

The data were collected after gaining approval from the Institutional Review Board of Jordan University of Science and Technology (Ref # 65/117/2018) and from the Ministry of Health (MOH). All participants were informed about the purpose of the study and their permission was sought for accessing their medical records. Written informed consents were obtained from all participants and no identifiable data were collected. The second author, who is a registered female midwife, met the clinic manager to gain permission for data collection. Pregnant women who were presented at the time of data collection, met the inclusion criteria, and agreed to participate were enrolled. All participants' contact details were obtained for further arrangements and appointments. For follow-up purposes, six groups were created on WhatsApp. The researcher communicated with each group to set a proper date and time for the pretest, which coincided with the day of the educational session for the intervention groups. The intervention groups completed the pretest questionnaires before the conduct of educational sessions on three occasions, and the posttest questionnaires, after two months on three occasions as well. The control groups completed the pretest questionnaires on three occasions, and these groups completed the posttest after two months over three occasions. Totally, data were collected on 12 occasions from October to December 2018. Any woman absent from her group at the time of data collection was asked to join the following group. All interviews were conducted in a quiet room in the selected clinic by the same researcher. The questionnaire was completed by participants and took 15–20 min. The researcher was available during this time to answer any question. All obstetric and demographic data were obtained by the same researcher from the medical records, under the supervision of the nurse manager in the clinic.

3. Educational program

3.1. Intervention group

Health Education was the major intervention strategy in this study. As recommended by Rice et al. (2018) [15], the health education program lasted for two months. It comprised a 2-hour education session and a distribution of written materials. Follow-up with women was carried out using WhatsApp for two months. All used materials that were discussed in the session and available as written materials were adopted from the “WHO recommendations for the prevention and management of tobacco use and second-hand smoke exposure in pregnancy” [16], while messages, photos, and videos were displayed from different scientific resources and websites [17, 18, 19]. The second author presented the materials in the Arabic language (the mother tongue of the participants). All authors (bilingual teachers) translated and back-translated the materials. While a panel of experts examined the materials for content validity.

The researcher used interactive lectures with PowerPoint presentations and discussions with participants, to increase the level of knowledge among them regarding SHS. Basic information was provided regarding the definition of SHS exposure, the adverse effects of SHS exposure for both the mother and the fetus, the benefits of a smoke-free

environment, and how to decrease their exposure to SHS. Examples of strategies taught to pregnant women for avoiding SHS exposure were: tell those around you that you had decided to stay away from SHS exposure, ask them seriously to smoke outdoor, avoid going to places such as restaurants, cafes, and houses of relatives who smoke, provide your home with adequate ventilation to get rid of any smoke-polluted air and inform your spouse or smokers around you about the harmful effects of SHS exposure on pregnant women and the fetus. Brochures were also distributed to pregnant women after completion of the educational session for the intervention groups and after the posttest for the control groups. The brochures were guide for pregnant women to avoid SHS exposure. Further, text -messages and videos were sent via WhatsApp containing tips on how to prevent exposure to SHS in the environment of the pregnant woman. Three to four messages were sent each week to remind participants about the educational materials. In addition, answers were provided to any question about SHS and other pregnancy-related topics through text-messages five days a week during the intervention. The researcher noticed the highly interactive level of chat during this period.

3.2. Control group

The control groups received regular antenatal care in the antenatal clinics of the selected hospital. General messages about pregnancy and the postpartum period and answers to any inquiry from participants were provided five days a week for two months. No questions or discussions were initiated about SHS with the control group.

3.3. Data analysis

The Statistical Package for Social Sciences (SPSS) version 22 was used for the data analysis procedure. Descriptive statistics including means, standard deviations, frequencies and percentages were used to describe all study variables. An independent sample t-test was conducted to investigate the differences between the control and the intervention groups, and a paired sample t-test was performed to examine the differences within the intervention and control groups before and after the intervention. The statistical significance was set at 0.05.

4. Results

The final sample size of the current study was 136 participants (66 participants in the control and 70 in the intervention group), aged between 17 and 45 years (*mean* = 29.06 ± 5.86). The mean weight before pregnancy was 68.8 ± 10.63 Kilograms and the mean gestational age was 12.1 ± 6.68 weeks. Further, 67.6% (n = 92) of the participants had less than a high school level of education and 69.1% (n = 94) were unemployed. An independent sample t-test was conducted to check if there was a significant difference between the intervention and the control group in terms of the main demographic data and obstetric history. There were no significant differences between the groups in terms of demographic data and obstetric history ($p > .05$) (Table 1).

The results revealed that the highest daily exposure to SHS was the home setting with 100%; 8.80 ± 2.37 h for the control group versus 8.54 ± 2.06 for the intervention group, followed by 30.9% in the workplace; 0.32 ± 1.46 h for the control group versus 0.51 ± 1.54 for the intervention group, and 23% in public places; 0.29 ± 0.58 h for the control group versus 0.33 ± 0.63 for the intervention group (Table 2).

After the educational program, there were significantly higher scores of knowledge (t (134) = −25.47, p < .001) and lower scores of SHS exposure in the intervention group versus the control group [i.e., number of cigarettes t (134) = 8.45, p < .001; and number of hours t (134) =8.82, p < .001], indicating that the educational program was more effective than the regular antenatal care (Table 3).

Within the intervention group, there was a significant increase in the overall score of knowledge (t (69) = −27.69, p < .001), and a significant decrease in the number of cigarettes (t (69) = 7.76, p < .001) and in the hours of exposure (t (69) = 8.97, p < .001), suggesting that the educational program was effective. Within the control group, there was no significant difference in the total score of knowledge (t (65) = −1.93, p = .058). However, there was a significant increase in the number of smokers (t (65) = −2.60, p = .012), number of cigarettes (t (65) = −4.10, p < .001) and hours of exposure (t (65) = −3.57, p < .001) (Table 4).

5. Discussion

This study aimed to examine the levels of SHS exposure and the knowledge of its harmful effects on pregnancy outcomes among Jordanian pregnant women. The study showed that the highest level of SHS exposure was at home; all participants were exposed to SHS for an average of 9 h daily. Having at least one active smoker at home was one of the inclusion criteria in this study, which explains the high home exposure, compared to other Jordanian studies which found that over 50% of pregnant women were exposed to SHS at home. [10, 20] In contrast, home exposure was 46.7% in Bangladesh, [9] 40% in China, [21] and 23% in Iran. [22] Previous studies mainly revealed that the smoke-free policy did not decrease SHS exposure in the home setting, and it is still considered high. [21, 22] Besides, the current study showed that SHS exposure in friend's or relative's houses was 96%, with an average of 2 h weekly. The results of relatively high exposure to SHS in these settings could be justified by Jordanian social norms and culture, where people do not prohibit smoking in these places, especially those with a low level of education as our sample.

In this study, SHS exposure during pregnancy was 31% in the workplace, 44% in transportation, and 23% in public places with an average of half an hour or less daily. In Greece, higher exposure was reported in public places (64%). [8] Similar exposure was reported in Argentina and Uruguay as 36 % of pregnant women were exposed to SHS at work. [23] In China, some higher exposures were also reported (workplace 56%,

Table 1. Comparison of baseline characteristics at the intake section for the intervention and control groups (N= 136).

Variables	Intervention group (n = 70) Mean ± SD	Control group (n = 66) Mean ± SD	t	df	p	Mean difference
Age	29.19 ± 6.08	28.92 ± 5.64	−0.26	134	.795	−.26
Number of years of study	12.29 ± 2.57	12.23 ± (2.68)	−0.13	134	.897	−0.06
Monthly Income (JD)*	437.07 ± 178.46	417.12 ± 163.49	−0.68	134	.499	−19.95
Weight before pregnancy (kg)*	67.89 ± 10.70	69.85 ± 10.54	1.08	134	.283	1.96
Number of abortions	0.81 ± 1.12	0.85 ± 1.09	0.18	134	.858	0.03
Gestational age	12.0 ± 4.60	12.24 ± 4.76	0.30	134	.763	0.06
Gravidity number	4.09 ± 1.75	4.02 ± 1.78	−0.23	134	.816	−0.07
Parity number	2.46 ± 1.28	2.29 ± 1.29	−0.77	134	.451	−0.17
Hemoglobin level	10.84 ± 1.62	10.55 ± 1.38	−1.17	134	.244	−0.31

1 Jordanian Dinar (JD) = .71 US Dollar. kg = Kilogram.

Table 2. Extent of exposure to SHS in the five settings for the intervention and control groups (N = 136).

Setting	Exposure component	Control group Mean ± SD	Intervention group Mean ± SD
Household Daily N = 136 (100%)	Number of smokers	1.29 ± 0.55	1.56 ± 0.93
	Number of cigarettes	32.58 ± 15.02	32.09 ± 13.87
	Hours of exposure	8.80 ± 2.37	8.54 ± 2.06
All public places and Social events Daily N = 32 (23%)	Number of smokers	0.36 ± 0.72	0.36 ± 0.68
	Number of cigarettes	0.41 ± 0.89	0.50 ± 1.25
	Hours of exposure	0.29 ± 0.58	0.33 ± 0.63
Friend's or relative's house Weekly N = 130 (95.6%)	Number of smokers	1.73 ± 1.42	1.84 ± 1.33
	Number of cigarettes	5.92 ± 6.19	6.03 ± 4.98
	Hours of exposure	1.88 ± 1.89	2.00 ± 1.96
Transportation Daily N = 60 (44.1%)	Number of smokers	0.56 ± 0.73	0.53 ± 0.61
	Number of cigarettes	0.62 ± 0.86	0.56 ± 0.65
	Hours of exposure	0.52 ± 0.68	0.49 ± 0.53
Workplaces Daily N = 42 (30.9%)	Number of smokers	0.11 ± 0.43	0.29 ± 0.73
	Number of cigarettes	0.46 ± 2.59	0.79 ± 2.04
	Hours of exposure	0.32 ± 1.46	0.51 ± 1.54

Table 3. Independent samples t-test between the intervention and control groups before and after the educational program.

	Control Group Mean ± SD	Intervention Group Mean ± SD	t	df	P	Mean Difference
Knowledge difference Pre-post	.076 ± .32	3.71 ± 1.12	−25.47	134	.000–3.64	3.64
Exposure to people Pre-post	.32 ± .99	.11 ± 1.34	1.00	134	.317 0 .20	0.20
Exposure to cigarettes Pre-post	3.88 ± 7.62	−7.91 ± 8.53	8.45	134	.000 11.79	11.79
Hours of exposure Pre-post	1.05 ± 2.38	−2.57 ± .2.39	8.82	134	.000 3.62	3.62

Table 4. Paired samples t-test within the intervention and control groups before and after educational program.

	Pre Mean ± SD	Post Mean ± SD	t	df	p	Mean Difference
Total knowledge	Intervention 4.14 ± 1.08	7.86 ± 0.39	−27.69	69	.000	−3.71
	Control 4.11 ± 1.10	4.18 ± 2.28	−1.93	65	.058	−.076
Total exposure to people	Intervention 4.54 ± 2.18	4.68 ± 2.10	−0.72	69	.476	−.11
	Control 4.04 ± 2.19	4.18 ± 2.28	−2.60	65	.012	−0.32
Total exposure to cigarettes	Intervention 39.96 ± 16.50	32.04 ± 11.82	7.76	69	.000	7.91
	Control 40.01 ± 18.40	43.89 ± 18.43	−4.10	65	.000	−.3.88
Total hours of exposure	Intervention 11.87 ± 3.45	9.30 ± 3.09	8.97	69	.000	2.57
	Control 11.80 ± 4.26	12.85 ± 4.37	−3.57	65	.000	−1.04

public venues 50%, and transportation vehicles 26%), [21] whereas in Canada, a well-developed Western country, much lower exposures were reported (3.1% in a transportation vehicle, 7.3% at work, and 35.7% in public places). [24] The result of the current study might be attributed to the non-implementation of penalties for smoking at work and in public places (especially in transportation), enacted through national legislation. Burki (2019) explained that tobacco smoking is so firmly rooted in the national culture that people think twice before asking a smoker to put out their cigarette in a public space. Further, there is no standardized protocol for monitoring establishments, closing down repeat offenders, or even issuing warnings and fines. [5].

The current study found that after the educational program, knowledge among pregnant women significantly increased, and SHS exposure (cigarettes and hours of exposure) significantly decreased among the intervention group. These findings are in consonance with the results of two previous studies in Sri Lanka and Taiwan, both of which revealed that health education programs were effective in decreasing exposure and increasing knowledge. [12, 25] In this study, health education comprising lecture presentation, brochure distribution and electronic technology use, was effective. The use of electronic technology was helpful in promoting engagement, building access, and disseminating information to all pregnant women. Thus, it is not unusual that expanding the use of technology in education is seen as a leading competitor for 'complex' and increasing knowledge in education. [26] This might be an appropriate method for women, especially for those coming for antenatal visits in a hurry most of the time. Further, it might be appropriate for a country like Jordan, where more than 85% of the population has smartphones. [27] However, the study findings showed that after the educational program, exposure to smoker people did not significantly decrease among the intervention group. This could be explained by the fact that there is a cultural aspect that makes it hard for women to refuse exposure to smoker people, especially at home in the Eastern society.

In the light of the current study, the role of midwives and nurses in antenatal clinics should focus more on assessing the negative consequences of SHS exposure on pregnant women. Hence, training programs should be implemented by policymakers for health care professionals to improve their competencies and the level of maternal care provided.

Health care providers should routinely screen and document SHS exposure during pregnancy. They should also provide information and offer advice to pregnant women and their partners about the harms of SHS. [17, 28] Moreover, policymakers should be stricter in the implementation of smoking bans in public and work settings.

This study has some strengths such as using a quasi-experimental design with pretest-posttest, a control group for comparison, a homogenous sample, and a valid instrument. However, it still has some limitations. For example, the sample for this study was recruited from one governmental hospital only, which limits its generalizability. Secondhand smoke exposure might change over the time of pregnancy; this might influence the posttest measurement and lead to bias. Finally, this study was based on the self-report questionnaire to assess exposure to SHS, which is subject to recall bias. For future research, we recommend measuring SHS exposure based on the nicotine level in blood, examining the effect of using educational programs on long-term exposure practices and birth outcomes of pregnant women, conducting interventional studies in different settings using different sample characteristics, and considering smoking cessation educational programs for smoker husbands.

6. Conclusion

The results of the current study proved the positive effect of the education program in increasing knowledge of pregnant women about the harmful effects of exposure to SHS and reducing exposure to SHS during pregnancy. Midwives and Nurses should integrate such educational programs into regular care provided to pregnant women, where a high percentage of women is exposed to SHS. Using different methods of teaching with new technology is appropriate for Jordanian pregnant women.

Declarations

Author contribution statement

Nesrin N. Abu-Baker: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Lina A. Al Diabat: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Karimeh Alnuaimi: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

The data that has been used is confidential.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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