REVIEW ARTICLE

Preventive Interventions to Reduce Second-Hand Smoke Exposure among Non-Smoking Pregnant Women: A Systematic Review

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ABSTRACT

The alarming number of smokers have increased public health concerns regarding the effects of second-hand smoke (SHS) on non-smokers, especially amongst pregnant women and unborn babies. This paper aims to review the existing interventions used to reduce SHS exposure amongst non-smoking pregnant women. This review was guided by the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) review method. Published articles were identified through three databases: ProQuest, Science Direct, and Scopus within the 2010–2021 timeframe. Articles related to the intervention to reduce SHS exposure among non-smoking pregnant women were included. Nine studies were identified and reviewed. Most of the preventive interventions primarily focused on pregnant women as the target group, whereas a few interventions directly focused on changing the smoking behaviour of their spouses. This review suggests that using theories as a foundation in designing the intervention effectively reduces exposure to SHS among non-smoking pregnant women. The main limitation as reported by most studies was the lack of biochemical verification. Thus, future intervention should consider both pregnant women and their smoking spouses as the target group and include relevant theories in clinical intervention.

INTRODUCTION

Second-hand smoke (SHS) exposure during pregnancy is recognized as a preventable public health problem as it is associated with numerous adverse effects on the pregnancy and unborn child.[1] The toxic substances in cigarettes cross the placenta and directly affect the foetus, increasing the risk for premature birth, low birth weight, and neonatal morbidity and mortality due to placenta abruption and miscarriage.[2, 3]

Despite the introduction of various smoking cessation strategies, including the prohibition of smoking in public places, provision of smoking cessation services, increased taxation, and strict control on smuggled cigarettes; the number of daily smokers has increased.[4] This alarming number of smokers indicates that SHS preventive interventions must be employed to educate the public on the harmful effects of SHS exposure on pregnant women and their unborn babies, particularly to smoking spouses as a smoking spouse is a major source of SHS exposure, especially at home.[1,5,6]

The pioneer developer of guidelines for preventing and managing SHS exposure during pregnancy recommended that healthcare providers screen for exposure to SHS as early as possible during pregnancy and at every antenatal care visit.[7] It was also suggested that advice and information regarding the risks of SHS exposure should be given to pregnant women, their partners, and other household members.

A recent systematic review used the Workgroup for Intervention Development and Evaluation Research (WIDER) checklist to evaluate behaviour change interventions in reducing SHS exposure toward pregnant women at home.[8] A total of six studies were reviewed based on behaviour change intervention that was applied to pregnant women with the target of changing their husbands' or partners' smoking behaviour. However, this review could not appraise the intervention reporting completely because no study met all three of the WIDER criteria: i) generalisability, ii) feasibility, and iii) scalability. Whilst there were reviews on SHS exposure among pregnant women in previous systematic reviews, none of the combination of clinical and behavioural change interventions to reduce SHS exposure among non-smoking women during pregnancy were reported as significant in developing the most effective intervention. Thus, the purpose of this review is to assess preventive interventions to reduce SHS exposure among non-smoking pregnant women.

METHODOLOGY

Literature Search Strategy

The systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[9]. This review was not registered. The following four steps describe the review process.

Step 1: Identification

A series of electronic databases i.e., ProQuest, Science Direct, and Scopus were used to conduct literature searches. Additional records were identified by examining the reference list of articles retrieved through the database search to ensure no relevant studies were missed. The databases were searched for the following key terms: ("environmental tobacco smoke"), ("passive smoke"), ("second-hand smoke"), ("involuntary smoke"), ("intervention"), ("pregnant women") and ("pregnant"). Four techniques were used to narrow down the search process: phrase searching, wild card, truncation, and Boolean operators such as OR and AND. The search was limited to randomized trials or quasi-randomized trials and before-after studies published between 2010 and 2021. Only journal articles with empirical data were selected, thus review articles, book series, books, and conference proceedings were excluded. To avoid any confusion and difficulty in translating, only articles published in English were selected for review.

Step 2: Screening and Eligibility

The remaining articles resulted after undergoing a screening process for eligibility in which all the articles were examined thoroughly to ensure they fit the established criteria. The initial screening was conducted by two reviewers based on the title and abstract.

Step 3: Data Extraction

Then, the selected articles were assessed independently by two reviewers for full text via the SIGN checklist. The tool had specific appraisal questions to assess a study's methodological quality and determine the extent to which a study had addressed the possibility of bias in its design, conduct, and analysis. Articles were only included in the review if all reviewers agreed on them. If there was any disagreement, a third reviewer would be invited to appraise the paper.

Step 4: Data analysis

A total of nine (9) studies were evaluated as part of the qualitative synthesis. The data was extracted by reading through the abstracts, then followed by reading the full articles to identify the theme based on objectives, patterns, and similarities.

RESULT

Study Selection

A total of 2342 articles were identified through a search of the databases using the search items. Screening of these records through the abstract and full-text review resulted in a total of nine papers that met the inclusion criteria for qualitative synthesis. The flow diagram in Figure 1 shows the details of the process by which the studies were identified, screened, and included in this review.

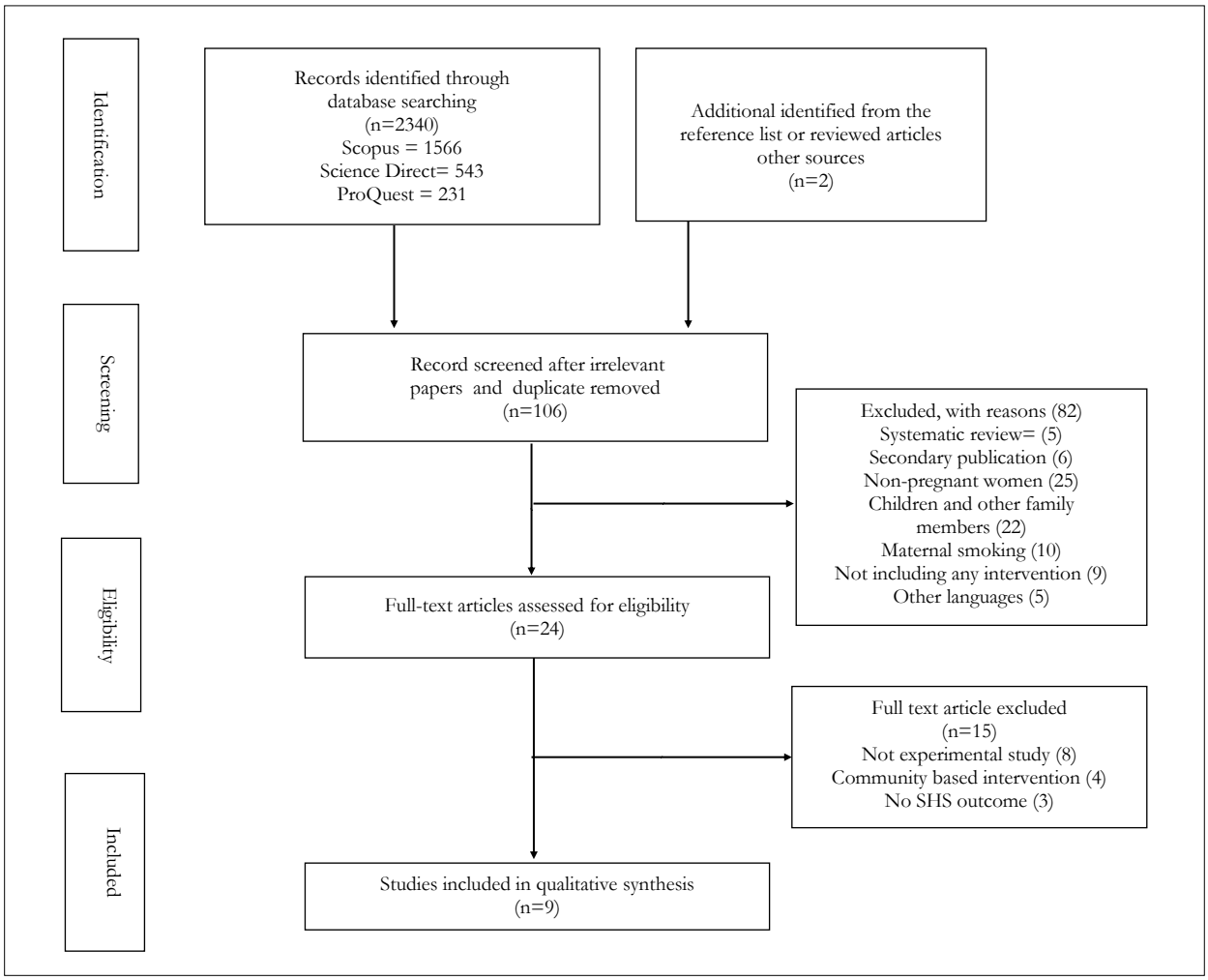

Figure 1 Flow diagram for literature search on SHS exposure among non-smoking pregnant women

Study characteristics

The studies were conducted in various countries. Eight of the studies were conducted in Asian countries: Iran (n=3), Taiwan (n=3), Saudi Arabia (n=1), and China (n=1); only one study was conducted within the western hemisphere: the United Kingdom (n=1). Due to the heterogeneity of the results such as a limited number of studies on SHS exposure prevention intervention among non-smoking pregnant women, it was not possible to conduct a meta-analysis of these outcomes.

Key descriptions of the studies

The selected articles were assessed using the SIGN checklist (Table 1). Eight studies included in this review used a randomized controlled trial (RCT) design and one study used a quasi-randomized design.

A study was conducted in a hospital setting in Taiwan to assess the effectiveness of the intervention based on the Health Belief Model (HBM) including self-efficacy in preventing SHS exposure among pregnant women.[10] During an antenatal check-up, the trained nurse educated the pregnant women on basic information about the dangers of SHS and then empowered the women by describing how they might decrease their SHS exposure. The study found that educational intervention based on this enlarged HBM successfully improved pregnant women's knowledge, HBM scores, self-efficacy, and ability to avoid and refuse SHS. These results justify that educational intervention by a healthcare provider is beneficial to educating and empowering pregnant women against SHS exposure.

Table I: Assessment of the literature using the SIGN checklist tool.

Checklist items	Chi et al.[10] 2015	Chi et al.[11] 2016	Huang et al.[12] 2013	Kazemi et al.[13] 2011	Sahebi et al.[14] 2017	Yang et al.[15] 2016	Wahabi et al.[16] 2020	Aleman et al.[17] 2017	Soltani et al.[18] 2019
1.1	Y	Y	Y	Y	Y	Y	Y	Y	Y
1.2	Y	Y	Y	Y	Y	Y	Y	Y	Y
1.3	Y	Y	Y	Y	Y	Y	Y	Y	Y
1.4	Y	Y	Y	Y	Y	Y	NA	Y	Y
1.5	Y	Y	Y	C	Y	Y	Y	Y	Y
1.6	Y	Y	Y	Y	Y	Y	Y	Y	Y
1.7	Y	Y	Y	Y	Y	Y	Y	Y	Y
1.8 (< 20% drop out)	Y	Y	N	Y	Y	Y	Y	Y	Y
1.9	Y	Y	Y	Y	Y	Y	Y	Y	Y

*Scored gained/ maximum score, appropriate appraisal for controlled trial was used. (10 criteria).
Y= Yes, N= No, C= Can't say, NA= Not applicable

Another study was done in Taiwan to compare the effectiveness of a group-based educational intervention based on HBM with an individual-based intervention.[11] They found that the group-based intervention significantly improved health beliefs, self-efficacy, and self -reported SHS rejection behaviour. These group-based interventions, which include SHS rejection strategies based on the expanded HBM, should be included in antenatal check-up policies.

A study in Iran revealed that their educational package regarding the impact of SHS exposure on pregnant women was an effective approach to increase the theoretical construct based on HBM and was associated with the reduction of SHS exposure.[13] However, their intervention, which included images of low-birthweight newborns and routes for hazardous compounds from SHS to transfer to the foetus, was ineffective in increasing women's self-efficacy in creating a smoke-free environment.

Another study in Iran, to determine the effectiveness of an educational intervention based on HBM that focused on increasing the perceived threats of a smoking spouse who exposed their pregnant wife to SHS.[13] The study findings suggested that intervention could reduce women's exposure to SHS but not all the constructs of HBM. After the training, men's self-efficacy in avoiding smoking in front of their pregnant spouses remained unchanged.

In addition, a randomized controlled trial was conducted to assess the effectiveness of counselling based on HBM with an educational brochure versus health education using a brochure only to increase pregnant women's perception of the HBM construct, improve pregnant women's and husbands' behaviour for the avoidance of SHS; and reduce the time pregnant women are exposed to SHS smoke.[14] The study was conducted among 100 pregnant women at University Hospital in Saudi Arabia. The result showed that pregnant women's counselling based on HBM has a minimal effect on reducing their SHS exposure, but it is beneficial in enhancing their understanding and perception of SHS exposure. The study recommended that increased counselling sessions and the use of mass media to reinforce the significance of a smoke -free environment for pregnant women may have had a stronger impact on encouraging women to prevent SHS exposure than a single counselling session. Besides, if the husband had been included in the counselling sessions, the intervention might have been more beneficial.

The multi-component intervention comprised three hospital-based group educational activities; clinician advice at a prenatal check-up, telephone call, and educational material and resources which showed that this intervention group had a better likelihood of improving smoke-free homes and SHS knowledge and attitudes than the control group.[15] The study recommended that future research should encourage husbands to quit smoking so that the main outcome of the study to reduce SHS exposure to non-smoking pregnant women would be achieved.

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Apart from that, there was a study that applied a transtheoretical model (TTM) construct as a framework in their study where the intervention strategies were provided based on the participant's stages of change and level difficulty.[16] The finding showed that there was an improvement in the determinants of change, the post-test score of knowledge, experiential, behavioural process, and self-efficacy in the intervention group as compared to the control group. However, the implementation of this TTM theory has limitations because if they are confronted with new challenges or impediments, behaviour change-based results may return to a lower level of behaviour change.

Another study was done in Argentina and Uruguay to determine the effectiveness of brief counselling sessions based on the "Five As" strategy for smoking cessation (Ask, Advise, Assess, Assist, and Arrange), as well as a brief session related to the rates of SHS exposure during pregnancy.[17] Selected midwives and doctors were trained to carry out the intervention at their respective clinics. The study found that the rate of pregnant women recalling SHS exposure at home did not alter considerably because of the intervention. Pregnant women's views on avoiding SHS were likewise unaffected by the intervention. In both countries, the impact was similar. To achieve such a reduction in SHS exposure, the author concluded that an intensive multi-component intervention containing specialized components or tools to deal with SHS and involving partners and other household members is essential.

In addition, a quasi-randomized study was conducted to assess the effectiveness of family counselling for pregnant women who are exposed to SHS smoke at home using the BASNEF model.[18] The study was conducted on 103 pregnant women and their smoking spouses at health centres in Hamadan, Iran. The study included lectures, group discussions, brainstorming, questions and answers, and instructional brochures about the dangers and negative consequences of smoking on pregnant women and unborn children. They found that men's engagement in maintaining the health of their pregnant wives and unborn children was found to be crucial in raising awareness of the danger of smoking and increasing sensitivity to the need to prevent SHS exposure at home.

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Table II: Result of the literature search and the descriptions of the studies

Author/ years of publication/ setting	Conceptual/ theoretical framework	Study design/ Sample	Intervention	Data collection	Finding	Limitation
Chi et al.[10] 2015 Taiwan	Health Belief Model (HBM)	● In-depth interviews and a focus group ● Longitudinal Randomized Controlled Trial (RCT) ● Target population: pregnant women at Taipei City Hospital (TCH) ● Divided into 2 groups: Intervention: (n=50) received S0 HS prevention program based on the HBM Control: (n=50) received standard government-mandated counselling care.	● Developed based on expanded HBM incorporating self-efficacy	● Questionnaires- pre-test and one month after the intervention. ● Measured- exhaled carbon monoxide	● Improved ability to avoid and resist SHS exposure	● Standard government-mandated prenatal care was not clearly stated ● No placebo-like intervention for the control group in addition to standard govern-ment-mandated prenatal care. ● Risk for data contamination
Chi et al.[11] 2016 Taiwan	HBM	● 3-arm RCT- group-based vs individual-based interventions and treatment-as-usual group	● Group-based intervention- 50- minute educational group intervention ● Individual-based inter-vention received the same education through a one-on-one training session. ● Component of the intervention was taken from a previous study by Chi et al.[10]	● Questionnaire and exhale CO- at first and second month after the interven-tion	● Group-based- improved in health beliefs, self-efficacy, and self-reported rejection behaviours. ● Individual-based- the improvement in health belief constructs and SHS rejection behav-iours was limited.	● Sampling bias-one hospital only
Huang et al.[12] 2013 Taiwan	Transtheoretical Model (TTM)	● RCT ● Pregnant women and women with young children (< 3 years) at four hospitals in Taiwan ● Intervention group received a TTM-based intervention program ● Control group only received routine care	● Educational material and phone counselling, DVD, Booklet, quizzes, and exercises. ● Accessory tools- stickers, bibs, and door hanger	● Questionnaire-baseline assessment and post-test data.	● The finding showed significant differences in determinants of change, knowledge, behavioural process, and self-efficacy after the intervention.	● Self-reported only ● When confronted with new obstacles or barriers, behav-iour change-based outcomes may revert to a lower level of behaviour change. ● Short-term follow-up ● Detail characteristics or any training provided to research staff and nurses were not mentioned.
Kazemi et al.[13] 2011 Iran	HBM	● Longitudinal RCT ● Non-smoking pregnant women with a history of exposure to SHS by their husbands.	● Based on HBM ● Used educational package (pictorial and resource booklet)	● Pre-intervention, and during the third, fourth and fifth prenatal care visits	● Intervention group- ● Increased in perceived susceptibility/severity and perceived benefits ● Decreased in weekly SHS exposure ● Perceived susceptibil-ity /severity and benefits significantly correlated with weekly SHS exposure	● Does not help in efforts to encourage pregnant women to create a smoke-free home. ● High total of drop-up and small sample size ● Self-reported measure only-risk for recall bias
Sahebi et al.[14] 2017 Iran	HBM	● Interventional randomized study ● Smoking men who have pregnant wives	● Questionnaire ● Self-reported smoking by wives	● Data were collected prospectively in four sections: at intake (pre-intervention) and during the third, fourth, and fifth prenatal care visits.	● Showed a significant reduction in SHS exposure by the change in attitudes, knowledge, and behaviour. ● Significant decreases in the husband's daily cigarette uptake and creating a more smoke-free home.	● Self-reported smoking status (by wives) ● Not measure the level of smoking uptake of the smoking spouse after intervention ● Risk for information bias- ● Low participation rate.

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Author/ years of publication/ setting	Conceptual/ theoretical framework	Study design/ Sample	Intervention	Data collection	Finding	Limitation
Yang et al.[15] 2016 China	-	• Cluster RCT • Pregnant women	• Multi-component intervention	• Questionnaire and biochemical validation-hair nicotine to a random sample of participants.	• Showed a significant reduction in SHS exposure by the change in attitudes, knowledge, and behaviour. • Significant decreases in the husband's daily cigarette uptake and creating a more smoke-free home.	• Biochemical validation-for selected participants' only potential bias
Wahabi et al.[16] 2020 Saudi Arabia	HBM	• Cluster RCT • Pregnant women	• Counselling by 2 health educators • Conducted face to face • 20 min for each study subject. • 4 perceptions of the HBM model were applied • Includes posters and slides shows	• Questionnaire pre and post (4 weeks after intervention) • Control group-Received pamphlet on hazards of SHS exposure • Intervention group-pamphlet and counselling.	• The perception of susceptibility and severity and reduced perception scores of barriers to avoiding SHS exposure showed significantly higher scores after the intervention. • No significant change in the exposure to SHS after the intervention	• The study did not prove that counselling reduced the mother's exposure to SHS (change the duration of exposure to SHS) • No biochemical validation • Short period of follow-up • Generalization of the result is limited- small sample size and only one setting
Aleman et al.[17] 2017 Argentina and Uruguay	-	• Cluster RCT • Pregnant women	• Brief counselling using the "Five As" strategy and brief sessions related to SHS • conducted by trained midwives and physicians. • The control group did not receive any training or intervention	• Questionnaire- before and after 6 months and 18 months of the intervention)	• SHS exposure at home was not considerably reduced. between base-line and follow-up, either in the intervention or control groups.	• SHS exposure was measured by women's recall of their previous exposure • No biochemical validation • Ethical consideration: control group does not receive any intervention
Soltani et al. [18] 2019 Iran	-	• Quasi-randomized study • Pregnant women and their smoking spouses	• Four weekly family counselling sessions • Control group received routine prenatal care	• Questionnaire (before and one month after the last session of counselling)	• The mean scores of all constructs of the BASNEF model in-creased significantly after the intervention	• Short follow-up interval • Ethical consideration: control group does not receive any intervention • Small sample size • No biochemical validation

DISCUSSION

The literature was limited as only nine studies were found conducted in five different countries. Out of these studies, seven studies were focused on pregnant women as the target group which showed moderate success in achieving the selected outcome.[10-13, 15-17] Another study had directly targeted smoking spouses which suggested that the husband should be involved in a similar educational program to empower men to reduce their wife's SHS exposure and quit smoking.[14] Only one study included both pregnant women and their smoking spouses in preventative intervention to improve the effectiveness of the intervention.[18] Even so, the works of literature showed that participation of both pregnant women and their smoking spouses is an important strategy to help pregnant women protect themselves from SHS exposure and simultaneously encourage their smoking spouses to quit smoking.

Most of the interventions were underpinned by a behaviour change theory framework, for example, TTM and HBM. Fives studies applied the HBM in their intervention which found that more pregnant women became confident to confront their family members to stop smoking in their presence,[10,11] to reduce SHS exposure,[11,13] to improve the health awareness of smoking spouses,[14] and improve the knowledge and perception of SHS exposure.[16] Based on the theory in HBM, if a person feels more vulnerable to an unpleasant health state, they will take health-related action. Only one study used the TTM theory to improve pregnant women's desire to change by enhancing knowledge, experiential and behavioural processes, as well as their self-efficacy. However, most of the studies did not properly describe their theory driving the interventions in detail. Thus, more theory-driven intervention studies are needed to prove the

theories' efficacy in the interventions. Meanwhile, the other three studies applied the clinical intervention where trained healthcare providers are given the responsibility to implement the intervention in a clinic or hospital-based setting.[15,17,18] The works of literature show that the involvement of healthcare providers in giving at least minimal advice on SHS exposure in pregnancy during antenatal visits further supports the idea that combining theory-driven intervention with clinical intervention maximizes the effect of preventive intervention. Hence, additional studies are required to determine the efficacy of the combination of theories and clinical intervention.

Despite the focus on intervention, the works of literature also show that an outcome measure through self-reported SHS exposure will be more reliable if biochemical validation is included. Self-reporting without biochemical results will limit the usefulness in determining the efficacy of the intervention and is regarded as poor quality.[19] Thus, the outcome should be validated using biochemical measurements such as urine, saliva, or hair nicotine to establish intervention efficacy, validate the self-reported outcome, and reduce the risk of information bias. The finding supported the effectiveness of biochemical measurement; it must be highlighted that using exhaled CO (less expensive) as biochemical verification may produce bias and incorrect reporting as CO is sensitive and only detectable in someone who has recently smoked or been exposed to second-hand smoke within the past day. Thus, the carbon monoxide level in exhaled air is not detectable in participants who reported having smoked during the last seven days, especially among occasional smokers or those exposed to fewer SHS since the level of carbon monoxide in the blood drops after eight hours (short half-life).[20] Hence, more studies require using a less expensive yet highly valid test for SHS exposure.

Most of the studies included had a small sample size and significant drop-out rate due to a lack of interest. More qualitative study is required for a better understanding of the challenges in reducing SHS exposure among non-smoking pregnant women. Additionally, more research with longer follow-ups is required to obtain reliable data on the efficacy of interventions and effect sizes.

Effective intervention is necessary to protect pregnant women and their unborn babies from the adverse effects of SHS exposure in their own homes. Thus, there is a need for the healthcare provider, especially those in antenatal clinics and hospitals to consider appropriate care and health education for both pregnant women and their smoking spouses. Training programmes should be implemented by policymakers for health care professionals to improve their competencies and the level of maternal care provided. Future studies with strong methodologies should explore and conduct in developing guidelines for reducing SHS exposure in pregnant women.

CONCLUSION

There appears to be a lack of data in the existing research to determine which intervention was effective in lowering SHS exposure among non-smoking pregnant women. Hence, future studies should consider both pregnant women and their spouses as the target group and consider integrating relevant theories into clinical intervention with biochemical measurement to develop a more effective intervention. It could be the breakthrough in the goal to achieve smoke-free homes.

CONFLICT OF INTEREST

There were no conflicts of interest.

Availability of data, code, and other materials

PRISMA Guideline checklist[9]

REFERENCES

1. Siti Munira Y, Khairul Mizan T, Mohammad Idris Z. Avoidance of environmental tobacco smoke among non-smoking pregnant women in Malaysia. Asian J. Agri & Biol. 2018:13-22.
2. Centers for Disease Control and Prevention. Current Cigarette Smoking Among Adults—United States, 2005–2015. Morbidity and Mortality Weekly Report 2015;65(44):1205–1211.
3. U.S Department of Health and Human Services (USDHH).The health consequences of smoking: 50 years of progress. A report of the surgeon general.

U.S Department of Health and Human Services (http:// www.surgeongeneral.gov): 2014
4. Ng M, Freeman MK, & Fleming TD. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA. 2014: 311:183-92
5. Norsa'adah B, Salinah O. The effects of second-hand smoke exposure during pregnancy on the newborn weight in Malaysia. Malay J Med Sci. 2014:21(2): 44-53.
6. Taylor AE, Smith GD, Bares CB, Edwards AC, Munafòa MR. Partner smoking and maternal cotinine during pregnancy: Implications for negative control methods. Drug and Alcohol Dependence. 2014: 139: 159–163
7. World Health Organization. WHO recommendations for the prevention and management of tobacco use and second-hand smoke exposure in pregnancy;2013
8. Dherani M, Zehra SN, Jackson C, Satyanaryana V, Huque R. Behaviour change interventions to reduce second-hand smoke exposure at home in pregnant women – a systematic review and intervention appraisal. BMC Pregnancy and Childbirth. 2017: 17:378
9. Matthew JP, Joanne EM, Patrick MB, Isabelle B, Tammy CH, Cynthia DM et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021: 372:71
10. Chi YC, Wub CL, Chen CY, Lyu SY, Lo FE, Morisky DE. Randomized trial of a second-hand smoke exposure reduction intervention among hospital-based pregnant women. Addictive Behaviour. 2015:117-123
11. Chi YC, Feng S, Yip PSF, Chen JL, Chen YY. Randomized comparison of group versus individual educational interventions for pregnant women to reduce their second-hand smoke exposure. Medicine. 2016: 95:40(e5072)
12. Huang CM, Wu HL, Huang SH, Chien LY. Guo JL. Transtheoretical model-based passive smoking prevention programme among pregnant women and mothers of young children. European Journal of Public Health. 2013: 23(5): 777-782.
13. Kazemi A, Ehsanpour S, Zahrae NS. A randomized trial to promote health belief and to reduce environmental tobacco smoke exposure in pregnant women. Health Education Research. 2011:27(1): 151-159.
14. Sahebi Z, Kazemi A, Loripour M, Shams N. An educational intervention to men for reducing environmental tobacco smoke exposure in their pregnant wives, The Journal of Maternal-Fetal & Neonatal Medicine. 2017.
15. Yang L, Tong EK, Mao Z, Hu TW, Lee AH. A Clustered Randomized Controlled Trial to Reduce Second-hand Smoke Exposure Among Non-smoking Pregnant Women in Sichuan Province, China. Nicotine & Tobacco Research. 2016: 1163–1170.
16. Wahabi HA, Massis A, Fayed AA, Esmaeil SA. Effectiveness of health education in reducing secondhand smoke exposure among pregnant women visiting the antenatal clinic in Saudi Arabia: A randomized controlled trial. Indian J Public Health. 2020; 64:102-8.
17. Alemán A, Morello P, Colomar M, Llambi L, Berrueta M, Gibbons L, Buekens P, Althabe F. Brief Counselling on Secondhand Smoke Exposure in Pregnant Women in Argentina and Uruguay. International Journal of Environmental Research and Public Health. 2017. 14, 28.
18. Soltani F, Barzegar F, Sangestani G, Roshanaii G, Maleki A. The effectiveness of family counselling on reducing exposure to secondhand smoke at home among pregnant women in Iran. Tobacco Prevention & Cessation. 2019: 5: 41
19. Avila-Tang E, Eif JL, Cummings KM. Assessing second-hand smoke exposure with reported measure. Tob Control, 2013: 22:156-63
20. Vancelik S, Beyhun NE, Acemoglu H. Interaction between exhaled CO, smoking status and nicotine dependency in a sample of Turkish adolescents. The Turkish Journal of Pediatrics, 2009: 51, 56-64