

Secondhand Smoke Exposure During Pregnancy and Mothers' Subsequent Breastfeeding Outcomes: A Systematic Review and Meta-Analysis

by Windy Wariki

Submission date: 11-Sep-2019 10:26AM (UTC+0700)

Submission ID: 1170598852

File name: ring_pregnancy_and_mothers_subsequent_breastfeeding_outcomes.pdf (1.69M)

Word count: 6316

Character count: 35611

SCIENTIFIC REPORTS

OPEN

Secondhand Smoke Exposure During Pregnancy and Mothers' Subsequent Breastfeeding Outcomes: A Systematic Review and Meta-Analysis

Received: 6 March 2018
Accepted: 7 May 2019
Published online: 12 June 2019

Daichi Suzuki^{1,2}, Windy M. V. Wariki³, Maiko Suto⁴, Noyuri Yamaji², Yo Takemoto⁵, Mosfequr Rahman⁶ & Erika Ota²

Secondhand smoke exposure of non-smoking women during pregnancy is associated with a higher risk of adverse birth outcomes. However, the available evidence regarding the association between expectant mothers' secondhand smoke exposure and breastfeeding outcomes remains limited. This systematic review aimed to examine associations between secondhand smoke exposure of nonsmoking women during pregnancy with the initiation, prevalence, and duration of breastfeeding compared to women who were breastfeeding and had not been exposed to secondhand smoke. Women who smoked during pregnancy were excluded. We included case-control, cross-sectional, and cohort studies with a comparison control group. Medline CINAHL, and EMBASE were searched in January 2017. After screening 2777 records we included eight prospective cohort studies. The risk of bias assessment tool for non-randomized studies indicated a high risk of outcome assessment blinding. Meta-analysis of two studies established that the odds of discontinuation of any breastfeeding before six months were significantly increased in the secondhand smoke exposed women (pooled odds = 1.07 [95%CI = 1.01, 1.14], two studies, 1382 women). Therefore, secondhand smoke might be associated with discontinuing any breastfeeding before six months. More research is necessary to understand the association between secondhand smoke and the initiation, prevalence and duration of breastfeeding.

According to the WHO 2016 report, the tobacco smoking epidemic is one of the largest public health problems globally and the number of non-smokers exposed to secondhand smoke (SHS) has been steadily increasing¹. Smoking during pregnancy is known to induce low birth weight^{2,3}, fetal growth retardation³, delayed immune development⁴, and reduction in all phases of an infant's sleep cycle⁵. This is because nicotine diffuses into fetal blood, amniotic fluid, and breast milk and negatively affects neurological development. Therefore, the fetuses and infants of mothers who smoke are at high risk of ill health because of exposure to nicotine³. Of additional concern is that maternal SHS exposure is also associated with adverse birth outcomes such as low birth weight^{2,6-11}, still-birth¹², preterm birth^{8,11,13}, spontaneous abortion^{12,13}, and birth defects¹³.

Although it is widely known that breastfeeding for the first six months reduces the risk for some adverse events for the infant, the available evidence is limited for the association between SHS and the impact on breastfeeding initiation, prevalence and duration. A study in the US reported that pregnant women who were exposed to SHS had a significantly shorter time (24.9 weeks) of any breastfeeding duration compared to unexposed pregnant

¹Josai International University, Faculty of Nursing, Department of Nursing, 1 Gumyo, Kanehara-shi, Chiba, 2838555, Japan. ²St. Luke's International University, Graduate School of Nursing Science, Global Health Nursing, 10-1 Akashi-cho, Chuo-ku, Tokyo, 1040044, Japan. ³Sam Ratulangi University, Faculty of Medicine, Kampus UNSRAT Bahu, Kleak, Malalayang, Kota Manado, Sulawesi Utara, 95115, Indonesia. ⁴National Center for Child Health and Development, Department of Health Policy, 2-1-1 Okura, Setagaya-ku, Tokyo, 1578535, Japan. ⁵Juntendo University, Department of Obstetrics and Gynecology, 2-1-1 Hongo, Bunkyo-ku, Tokyo, 1130033, Japan. ⁶University of Rajshahi, Department of Population Science and Human Resource Development, Rajshahi, 6205, Bangladesh. Correspondence and requests for materials should be addressed to E.O. (email: ota@slcn.ac.jp)

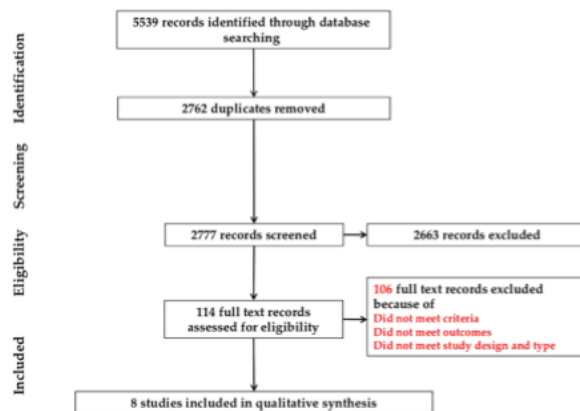


Figure 1. Process of selection of studies has been shown in PRISMA flow diagram.

women (29.9 weeks). However, there was no significant association with exclusive breastfeeding duration (2.7 weeks for unexposed vs. 2.1 weeks for exposed)¹⁴. The purpose of this systematic review to examine the associations between secondhand smoke exposure of nonsmoking women during pregnancy with initiation, prevalence, and duration.

Methods

Search strategy and selection criteria. The electric database of MEDLINE via Ovid SP and PubMed, CINAHL, and EMBASE were used to searching as these keywords “secondhand smoke”, “pregnant women”, “case-control”, “cohort”, and “cross-sectional” on January 29, 2017 without any limitations for language and time, or publication status. We collected keywords from literature review, experts’ opinion, and controlled vocabulary (Medical Subject Headings = MeSH, Excerpta Medica = Emtree, and CINHAL Headings). A medical information specialist developed the search strategy and reported in Appendix 1. The search results were de-duplicated. Two researchers independently screened titles and abstracts.

We defined SHS exposure as contact with SHS from smokers at homes, work places, and other public places. Exclusion criteria included studies of the following: mothers who previously smoked and stopped prior to their pregnancy, pregnant women who smoked during pregnancy, and non-comparative studies. We assessed the association between SHS exposure for women during pregnancy and initiation of breastfeeding, exclusive breastfeeding duration/prevalence or rate, and any or partial breastfeeding duration/prevalence.

Quality assessment and data extraction. The first author (DS) assigned three dyads (DS & NY; DS & YT and DS & MS) to screen all articles. Next, five dyads, (initial three as DS & WW and DS & MR) independently performed quality assessment and data extraction. We used the *risk of bias assessment tool for non-randomized studies (RoBANS)*¹⁵ to assess the risk of bias. Where extracted data and the quality assessment resulted in a discrepancy, the reviewing authors discussed or consulted with all the authors (D.S., W.W., M.S., N.Y., Y.T., M.R., and E.O.) in the team to reach a consensus.

Data synthesis and analysis. A meta-analysis was performed on studies with similar outcomes. We assessed the effects of secondhand smoke exposure from active smokers assessing outcomes an odds ratio (OR) was used for dichotomous data, and a student’s t distribution with weighted mean difference (WMD) or standardized mean difference (SMD) was used for continuous data. The results were presented as means and standard deviation with 95% confidence intervals (CI). Data were analyzed using Review Manager (RevMan 5.3.5). Probability (*p*) values of less than 0.05 indicated statistical significance.

Moreover, exclusive breastfeeding is often measured up to six months because complementary feeding starts around same time. Therefore, we set the outcome measurement point up to six months.

Results

Description of studies. Our database search identified a total of 5539 records of which 2762 were duplicates and removed. Of the 2777 records screened, 2663 were excluded during the screening because they were irrelevant to our research question. Using the inclusion and exclusion criteria, we selected 114 texts for assessment. All studies involving smoking cessation in either parent, control participants composed of women who were not exposed to SHS, and pregnant women who smoked during pregnancy, as well as non-comparative studies were then excluded. A total of 106 studies were excluded because of different populations, exposures, outcomes, and study designs. As a result, eight studies were included in the review for data extraction. The selection process of studies is shown in the Preferred Reporting Items Systematic Review Meta-analysis (PRISMA) flow diagram (Fig. 1).

The characteristics of the included studies are shown in Table 40. The studies were published between 1997 and 2014. Two studies were conducted in Poland, and the other six studies were carried out in the United States, Brazil, Iran, Egypt, Taiwan, and Hong Kong^{16–23}.

#	Trial name Year	Country	Setting	Characteristics of Participants			Study Design	Exposure place	Outcome measurement tools	Outcome measurement time	Outcome Assessed
				SHS Exposure	Non SHS exposure	Mean age of Participants Mean \pm SD					
1	Baheiraei ²³	Tehran, Iran	5 centers of neonatal thyroid screening within 3–5 days after delivery	170	170	Exposed 27.43 \pm 4.34 Non-Exposed 26.56 \pm 4.06	Prospective cohort study	Home	self-report and telephone interview	6 months	Exclusive breastfeeding duration and prevalence
2	Chou ¹⁹	Central Taiwan	3 hospitals and community health centers	262	290	—*	Prospective cohort study	Home	interview	6 months	Any or partial breastfeeding rate
3	Horta ²¹	Pelotas, Brazil	5 urban maternity hospitals	496	554	—*	Prospective cohort study	Home	structured interview	6 months	Any or partial breastfeeding rate
4	Jedrychowski ¹⁷	Krakow, Poland	Ambulatory prenatal clinics and healthy pregnant women in 1st-2nd trimester of pregnancy	332	109	Non-Exposed 27.74 \pm 5.48 Low Exposure 28.11 \pm 3.31 High Exposure 26.68 \pm 3.75	Prospective cohort study	Home	Self-report and Interview	6 months	Breastfeeding duration
5	Kwok ¹⁸	Hong Kong	All 49 governmental maternal and child health centers	4839	1951	—***	Prospective cohort study	Home	self-administered	3 months	Prevalence of breastfeeding
6	Lemke ²⁰	Tennessee, USA	Tennessee Children's Respiratory Initiative	257	194	Exposed 24 [21, 28] ** Non-Exposed 28 [24, 32] **	Prospective cohort study	Home	Self-report and structured Interview	—	Any or partial breastfeeding rate
7	Salama ¹⁶	Assiut city, Egypt	Maternal Health Center of Assiut University Hospital	100	100	Exposed 22.56 \pm 3.9 Non-Exposed 22.83 \pm 3.5	Prospective cohort study	—***	Questionnaire by the help of well-trained nurse	1 month	Any or partial breastfeeding rate
8	Wdowiak ²²	Lublin, Poland	Clinic for Obstetrics and Gynaecology at the Medical University in Lublin	20	130	—*	Prospective cohort study	Work place	—*	After delivery	Initiation of breastfeeding

Table 1. Characteristics of the included studies. *Data was shown by category. Mean age not described. **Median [IQR]. ***Not described.

All studies were prospective cohort studies. The outcomes were: initiation of breastfeeding and problems with breastfeeding²², breastfeeding duration¹⁷, prevalence of breastfeeding^{16,18–21}, and breastfeeding duration and prevalence of breast feeding²³.

The outcome measurement of breastfeeding duration for four studies was six months after delivery^{17,19,21,23}. The other measurement points were: three months in Hong Kong¹⁸; one month after delivery in Egypt¹⁶, and after delivery in Poland²². The measurement point was not described in the study from the USA²⁰.

Risk of bias assessment. The results of the risk of bias assessment are shown in Figs 2 and 3. There was a high risk of blinding of the outcome assessment because of the reporting bias of self-report measurements (Table 2).

Synthesized meta-analysis and findings. Four of the eight studies^{16,17,21,23} assessed the association between SHS exposure and discontinuation of breastfeeding. However, only two studies^{17,21} could be synthesized to indicate the association between SHS and discontinuation of any breastfeeding before six months with 95% CIs. Also, in these two studies, SHS exposure was defined as exposure by any household member. The result of our meta-analysis (Fig. 4) showed there was a significant increased risk of discontinuation of any breastfeeding before six months of those who were exposed to SHS during pregnancy (pooled ORs = 1.07 [95%CI: 1.01–1.14]; $p = 0.02$; $I^2 = 34\%$, 1382 women, 2 studies). Moreover, the results of meta-analysis (Fig. 4) shown that one study was weighted mostly (96%) due to the imprecision. The other two studies^{16,23} also reported breastfeeding duration. However, the study in Iran²³ only showed the average breastfeeding duration by day. The study in Egypt¹⁶ measured three outcomes of breastfeeding at one month after delivery. Those two studies used different measurement points and assessments of the outcomes. Therefore, they were excluded from the meta-analysis and instead described narratively.

Moreover, Jedrychowski *et al.*¹⁷ analyzed blood cotinine levels of mothers as an outcome measure for breastfeeding duration. The results of multiple regression analysis showed that mothers with higher blood cotinine levels had significantly higher odds of discontinuing any breastfeeding before six months (ORs = 1.08 [95%CI: 0.61–1.90];

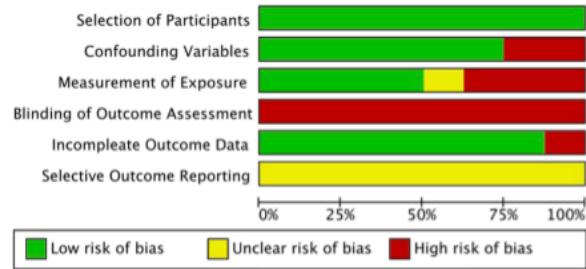


Figure 2. Risk of bias graph review authors' judgements about each risk of bias item presented as percentages across all included studies.

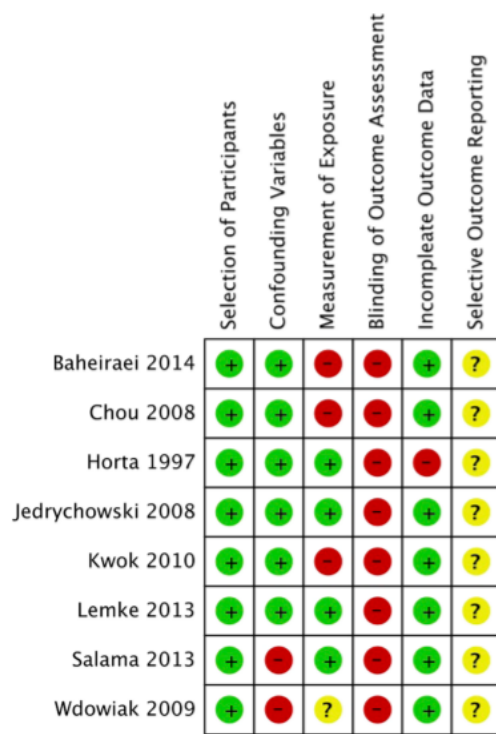


Figure 3. Risk of bias summary review authors' judgements about each risk of bias item for each included study.

$p > z = 0.79$; 0.05–0.15 ng/mL of cotinine) vs. (ORs = 2.42 [95%CI: 1.42–4.14]; $p > z = 0.00$; >0.15 ng/mL of cotinine). However, other studies did not use blood cotinine measures, therefore, we used self-reported data of SHS status in the analysis.

Exclusive breastfeeding duration. Two of the eight studies assessed the relation of the risk of SHS exposure and shortening of exclusive breastfeeding duration^{17,23}. Both studies defined the SHS exposure at home and measurement points were six months after delivery. Also, measurement outcomes were the same average duration of exclusive breastfeeding but the method of measuring outcomes was different. The study in Iran reported that the average exclusive breastfeeding period was 27 days shorter at the end of six months for those who were exposed to SHS during pregnancy compared to those who were not exposed²³. A study in Poland reported that there was a significant inverse association between higher maternal blood cotinine levels and exclusive breastfeeding duration ($r = -0.195$, $p < 0.0001$ [Mean (SD)] = [26.86 (21.69) weeks])¹⁷.

Breastfeeding prevalence or rate. Five studies assessed the association between SHS exposure and breastfeeding prevalence^{16,18–20,23}. One study measured the prevalence of exclusive breastfeeding²³, two studies measured the prevalence of any breastfeeding^{19,20}, one study measured prevalence of breastfeeding but did not define the

#	Study	Bias	Author's judgement	Support for judgement
1	Baheiraei ²³	Selection of Participants	Low	Data collected from questionnaire and interview. However, no description about the interviewers. Outcome is self-report measurement.
		Confounding Variables	Low	
		Measurement of Exposure	High	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
2	Chou ¹⁹	Selection of Participants	Low	Interviewer were nurses at health center. However, no description about pre-study training. Outcome is self-report measurement.
		Confounding Variables	Low	
		Measurement of Exposure	High	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
3	Horta ²¹	Selection of Participants	Low	Outcome is self-report measurement. There were some missing data. However, not described.
		Confounding Variables	Low	
		Measurement of Exposure	Low	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	High	
		Selective Outcome Reporting	Unclear	
4	Jedrychowski ¹⁷	Selection of Participants	Low	Outcome is self-report measurement.
		Confounding Variables	Low	
		Measurement of Exposure	Low	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
5	Kwok ¹⁸	Selection of Participants	Low	Used the self-administered questionnaire. Outcome is self-report measurement.
		Confounding Variables	Low	
		Measurement of Exposure	High	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
6	Lemke ²⁰	Selection of Participants	Low	Outcome is self-report measurement.
		Confounding Variables	Low	
		Measurement of Exposure	Low	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
7	Salama ¹⁶	Selection of Participants	Low	Major variables were confirmed. However, not in analysis phase. Outcome is self-report measurement.
		Confounding Variables	High	
		Measurement of Exposure	Low	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	
8	Wdowiak ²²	Selection of Participants	Low	Major variables were confirmed. However, not in analysis phase. The Apgar scale used to assess the baby conditions. However, no details of outcome measure were described. Outcome is self-report measurement.
		Confounding Variables	High	
		Measurement of Exposure	Unclear	
		Blinding of Outcome Assessment	High	
		Incomplete Outcome Data	Low	
		Selective Outcome Reporting	Unclear	

Table 2. Judgment of risk of bias assessment.

types of breastfeeding and need for supplementation¹⁶, and one study measured the prevalence of partial breastfeeding⁷⁸ for any length or exclusive breastfeeding up to three months¹⁸. There were two studies^{19,23} that measured the prevalence⁴⁰ of breastfeeding for the first six months by SHS exposure and non-SHS exposure. Those two studies found that the prevalence of breastfeeding was lower among women who were exposed to SHS during pregnancy. The study in Iran revealed that 22.8% of mothers with SHS exposure breastfed for six months compared to 50.7% with non-SHS exposure²³. A study in Taiwan¹⁹ measured the prevalence of breastfeeding for the first six months by comparing SHS exposure versus non-SHS at home and the work place. The results indicated that breastfeeding

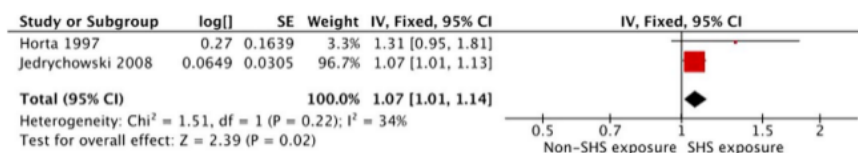


Figure 4. Impact of discontinuation of breastfeeding at 6 months.

duration of the SHS exposure group was also shorter compared to the non-SHS group. Those exposed to SHS during the one to five months postpartum period at home had a significantly shorter prevalence of breastfeeding compared to those who were not exposed to SHS. However, there was no significant difference between exposure and prevalence of breastfeeding at six months (AOR = 1.11, [95% CI = 0.44–2.80], 552 women)¹⁹. In addition, the study in the United States found that breastfeeding among the SHS exposure group was lower compared to the non-SHS exposure group (47% vs. 65%, $p < 0.001$)²¹. However this study did not describe the measurement point of the outcomes²⁰. The study in Egypt compared the associations between SHS exposure and non-SHS exposure on: breastfeeding continuation, supplementation need, and breastfeeding discontinuation¹⁷. For the SHS exposure group there was a significant decrease in the prevalence of breastfeeding continuation and an increase in the prevalence of supplementation need and breastfeeding discontinuation (SHS exposure vs. non-SHS exposure = 67% vs. 79%; 24% vs. 20%; 9% vs. 1%; $p = 0.008$)¹⁶. The study in Hong Kong¹⁹ assessed the SHS exposure before or during the early postnatal period by seven SHS exposure situations: prior to pregnancy or not exposed, at postnatal or during pregnancy to the postnatal period, and daily or occasionally. However, they did not describe the exact time of exposure. For occasional exposure 5.2%, and for daily exposure 3.0%. The percentage of partially breastfed for any length of time or exclusively breastfed for less than three months was: 37.7% never exposed, 41.5% occasional, and 44.9% daily exposure¹⁸.

Initiation of breastfeeding. The study in Poland²² identified the relation of SHS exposure and the occurrence of lactation. This study compared SHS exposed versus non-SHS exposed women during pregnancy and measured the occurrence of lactation by three categories: lactation occurred after delivery, low milk supply, and lactation did not occur. However, there was no significant difference between SHS exposure and initiation of breastfeeding (exposed mother vs non-exposed mother; lactation occurred = 80% vs 88.5%; low milk supply = 15% vs 10%; no lactation occurred = 5% vs 1.5%; $p = 0.45$, 20 vs 130 women).

Discussion

To our knowledge, this is the first systematic review to assess the association between SHS and breastfeeding. Maternal SHS exposure during pregnancy is significantly associated with an increased discontinuation of any breastfeeding before six months. Also, SHS exposure during pregnancy was associated with shorter breastfeeding duration, and a lower prevalence of breastfeeding. However, we did not synthesize the association of SHS and breastfeeding duration and initiation of breastfeeding and there was no significant association between SHS and initiation of breastfeeding.

Smoking or parenteral nicotine is already known to be associated with low prolactin concentrations²⁴. Prolactin is important for metabolic homeostasis and is associated with the lactating mammary gland, by increasing milk proteins, lactose, and lipids²⁵. It is important to note that one animal study reported that nicotine was one of risk factors for the inhibition of prolactin release²⁶. In addition, tobacco smoke includes more than 4,500 chemicals that are already known to be harmful for humans²⁷. SHS actually poses a higher risk than mainstream smoke because SHS is a combination of mainstream smoke, that which is exhaled by the smoker and side stream smoke, that smoke which is emitted from the cigarette between puffs. The side stream smoke includes a higher number of chemicals than mainstream smoke²⁸. Therefore, exposure to SHS includes the inhalation of the nicotine or other chemicals, which also affects the smoker. In consideration of these mechanisms and our findings, we surmise that during second hand smoke exposure nicotine or other chemicals are inhaled resulting in the inhibition of prolactin release.

Furthermore, this finding reveals that the duration of breastfeeding among women exposed to second hand smoke tends to be shorter than WHO's recommendation²⁹. WHO/UNICEF recommended infants needed exclusive breastfeeding until six months and then should continue for up to two years old or beyond and complemented with solid food; breastfeeding provides essential nutrition for the infant's growth and it is an easy way to provide for the protective effects²⁷. Breastfeeding can lessen respiratory diseases, diarrhea^{29,30}, increase the infant's growth³⁰, and enhance fetal neurodevelopment²⁹. Exclusive breastfeeding would be a cost-effective way to protect the infant³¹. Also, the benefit of long-term breastfeeding has already been known to reduce the incidence of obesity/overweight (Pooled OR = 0.74, [95% CI = 0.70–0.78], 105 studies) and type two diabetes (Pooled OR = 0.65, [95% CI = 0.49–0.86], 11 studies)³².

Hence, the indications that SHS can affect breastfeeding duration implies that further research is needed to inform public health strategies that could prevent adverse effects of SHS on maternal and child health. Given the benefits of breastfeeding for infant health, an appropriate prevention anti-smoking campaign is critical. In addition, another prevention strategy that protects breastfeeding mothers from SHS is the enactment of a tobacco free law or a tobacco prevention framework like WHO's MPOWER packages³³. MPOWER includes six components that protect people from tobacco smoke. MPOWER measures already covered 43% the population globally³⁴. Vietnam reported on its smoking ban in public places after they implemented the MPOWER program. They

Summary of findings: 21					
Effects of Secondhand Smoke on Breastfeeding in Nonsmoking Pregnant Women: A Systematic Review and Meta-Analysis					
Patient or population: Nonsmoking Pregnant Women					
Setting: Poland, United States, Brazil, Iran, Egypt, Taiwan, and Hong Kong					
Intervention: SHS exposure					
Comparison: Non-SHS exposure					
Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)
	Risk with Non-SHS exposure	Risk with SHS exposure			
Discontinuing Breastfeeding at 6 months	0 per 1,000	0 per 1,000 (0 to 0)	1.07 (1.01 to 1.14)	2 observational studies	⊕⊕○○ LOW

Table 3. Summary of findings of discontinuing breastfeeding at 6 months. *The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). CI: Confidence interval; MD: Mean difference; OR: Odds ratio; HR: Hazard Ratio. **GRADE Working Group grades of evidence. High certainty:** We are very confident that the true effect lies close to that of the estimate of the effect. **Moderate certainty:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. **Low certainty:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect. **Very low certainty:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

noted that challenges to this complex problem must be addressed on multiple fronts to protect the people from SHS³⁵. The government needs to promote precautionary measures to implement public health strategies and advise on the impact of SHS exposure to health³⁶.

Limitation

Potential mechanisms. Despite our systematic approach to reviewing the extant research on the effects of SHS on breastfeeding there are several limitations that should be addressed. First, only two studies were eligible for meta-analysis. The body of evidence showed low quality and small sample sizes that influenced this review's quality. Also, outcome measures were of low or very low quality (Table 3). One of the reasons we assessed the quality of evidence as low was because no participants of the studies were blinded to the outcome assessment and it was impossible to have blinded that outcome assessment. There is always the possibility that participants' reports were untrue if they know the outcome measurement however given the general lack of understanding about the impact of SHS on breastfeeding it is not likely.

Second, WHO estimated the prevalence of tobacco smoking of those over 15 years old by each WHO region finding that Europe and the Western Pacific regions were over 20% in 2015³⁷. In this review, we included some studies that were conducted in these high smoking prevalence areas and most of the studies that we included were middle to high income countries³⁸. Of the two studies eligible for the systematic review and meta-analysis it was found that the higher smoking prevalence was consistently related to lower income levels especially in lower income countries. There was only one study from Africa³⁹ where most countries were categorized as lower income countries. Also, Casetta *et al.*³⁹ reported 59% were statistically significant higher ORs of smoking in low-income compared to high-income and middle-income compared to high-income (Pooled OR = 1.69, [95% CI = 1.49–1.92], for low- vs. high-income) vs. (Pooled OR = 1.31, [95% CI = 1.20–1.43], for middle- vs. high-income). In addition, there might be a lack of valid information about smoking data because of the weak data collecting system and infrastructure especially in African and in parts of the Asian region. Therefore, results might change when additional studies are conducted in African and Asian countries categorized as low- or low-middle income countries.

Third, this review included only studies conducted in seven countries: Poland, USA, Brazil, Iran, Egypt, Taiwan, and Hong-Kong. However, according to the WHO there is a higher prevalence of male tobacco smokers in: Indonesia (76.2%), Jordan (70.2%), Kiribati (63.9%), Sierra Leone (60%), and the Russian Federation (59%)⁴⁰ and there were no studies conducted in these countries. By contrast, in some of the countries where there were studies, they had already enacted a tobacco free law or policy, for example Hong-Kong has had a tobacco control office since 2001⁴¹. The Family Smoking Prevention and Tobacco Control Act in USA began in 2009 and various states enacted public smoking restrictions from the mid-1980s⁴². Therefore, if studies were conducted in those countries with a high prevalence of male smokers, it might reveal an additional number of pregnant women exposed to SHS and yield different results.

Finally, there are also, some socio-economics indicators, other than SHS, related to longer breastfeeding duration such as mothers who were older, well-educated, married, and in a higher-income bracket compared to lower-income³⁹. Mothers who had professional and unprofessional supports had extended breastfeeding duration⁴³. Therefore, we need to consider socio-economic status and other potential factors such as the availability of professional supports when examining the association of SHS and mothers' breastfeeding outcomes.

Future research is required to understand the complex social, psychological and physiological processes involved to prevent the adverse effect of SHS on maternal and child health. Additional research may reveal how SHS exposure is more dangerous for maternal-child health. It will also provide policy arguments for the implementation of public strategies such as smoke free laws. Smoking cessation programs for fathers is one of the ways to

protect women and children from SHS exposure especially if it is an intervention from health care professionals⁴⁴. Therefore, there is a need for the implementation of more educational programs or counseling for fathers before delivery in the hospital or health facilities.

Conclusion

This was a systematic review and meta-analysis of the effects of SHS for women during pregnancy on breastfeeding outcomes. SHS exposure during pregnancy was associated with discontinuation of any breastfeeding before six months compared to no exposure of SHS during pregnancy. However, of the thousands of research articles found only two had sufficient comparability of methods for synthesis and even then the quality of evidence was low indicating that higher quality research is strongly recommended.

References

1. World Health Organization. *WHO Media center Tobacco Fact sheet*, <http://www.who.int/mediacentre/factsheets/fs339/en/> (2016).
2. Leonardi-Bee, J., Smyth, A., Britton, J. & Coleman, T. Environmental tobacco smoke and fetal health: systematic review and meta-analysis. *Arch Dis Child Fetal Neonatal Ed* **93**, F351–361, <https://doi.org/10.1136/adc.2007.133553> (2008).
3. National Institute on Drug Abuse. *Tobacco/Nicotine and E-Cig*, <https://www.drugabuse.gov/drugs-abuse/tobacconicotine-e-cigs> (2018).
4. Vila Candel, R., Soriano-Vidal, F. J., Hevilla Cucarella, E., Castro-Sanchez, E. & Martin-Moreno, J. Tobacco use in the third trimester of pregnancy and its relationship to birth weight. A prospective study in Spain. *Women & Birth: Journal of the Australian College of Midwives* **28**, e134–139 (2015).
5. Mennella, J. A., Yourshaw, L. M. & Morgan, L. K. Breastfeeding and smoking: short-term effects on infant feeding and sleep. *Pediatrics* **120**, 497–502, <https://doi.org/10.1542/peds.2006.118.4.488> (2007).
6. Jaddoe, V. W. *et al.* Active and passive maternal smoking during pregnancy and the risks of low birthweight and preterm birth: the Generation R Study. *Paediatric and perinatal epidemiology* **22**, 162–171 (2008).
7. Hawsawi, A. M., Bryant, L. O. & Goodfellow, L. T. Association between exposure to secondhand smoke during pregnancy and low birthweight: a narrative review. *Respiratory Care* **60**, 135–140 (2015).
8. Khader, Y. S., Al-Jur, N., Alzubi, I. M. & Lataifeh, I. The association between second hand smoke and low birth weight and preterm delivery. *Matern Child Health J* **15**, 453–459, <https://doi.org/10.1007/s10995-010-0599-2> (2011).
9. Zhou, S. *et al.* Physical, behavioral, and cognitive effects of prenatal tobacco and postnatal secondhand smoke exposure. *Current Problems in Pediatric & Adolescent Health Care* **44**, 219–241 (2014).
10. Benkaddour, Y. A., Fatih, B., Majidi, F. & Soummami, A. Passive smoking and other principal risk factors associated with low birth weight. *Open Journal of Obstetrics and Gynecology* **6**, 390 (2016).
11. Leonardi-Bee, J., Britton, J. & Venn, A. Secondhand smoke and adverse fetal outcomes in nonsmoking pregnant women: a meta-analysis. *Pediatrics* **127**, 734–741, <https://doi.org/10.1542/peds.2010.3041> (2011).
12. Lindbohm, M.-L., Sallm, x, N. M. & Taskinen, H. Effects of exposure to environmental tobacco smoke on reproductive health. *Scandinavian journal of work, environment & health* **28**, 84–96 (2002).
13. Rosen-Carole, C. B., Auinger, P., Howard, C. R., Brownell, E. A. & Lanphear, B. Low-level prenatal toxin exposures and breastfeeding duration: a prospective cohort study. *Maternal and child health journal*, <https://doi.org/10.1007/s10995-017-2346-4> (2017).
14. Kim, S. Y. *et al.* Testing a tool for assessing the risk of bias for nonrandomized studies showed moderate reliability and promising validity. *Journal of Clinical Epidemiology* **66**, 408–414, <https://doi.org/10.1016/j.jclinepi.2012.09.016>.
15. Salama, R. H. M., Abdel-Aal, D. E. D. M., Eshra, D. K., Nagieb, S. & Arief, A. F. Clinical and biochemical effects of environmental tobacco smoking during pregnancy outcome. *Indian Journal of Clinical Biochemistry* **28**, 368–373 (2013).
16. Jedrychowski, W. *et al.* Prenatal exposure to passive smoking and duration of breastfeeding in nonsmoking women: Krakow inner city prospective cohort study. *Archives of Gynecology & Obstetrics* **278**, 411–417 (2008).
17. Kwok, M. K., Schooling, C. M., Lam, T. H. & Leung, G. M. Paternal smoking and childhood overweight: evidence from the Hong Kong "Children of 1997". *Pediatrics* **126**, e46–56 (2010).
18. Chou, S. Y., Hsu, H. H., Kuo, H. H. & Kuo, H. W. Association between exposure to environmental tobacco smoke (ETS) and breastfeeding behaviour. *Acta Paediatrica* **97**, 76–80 (2008).
19. Lemke, M., Hartert, T. V., Gebretsadik, T. & Carroll, K. N. Relationship of secondhand smoke and infant lower respiratory tract infection severity by familial atopy status. *Annals of Allergy, Asthma, & Immunology* **110**, 433–437 (2013).
20. Horta, B. L., Victora, C. G., Menezes, A. M. & Barros, F. C. Environmental tobacco smoke and breastfeeding duration. *American Journal of Epidemiology* **146**, 128–133 (1997).
21. Wdowiak, A., Wiktor, H. & Wdowiak, L. Maternal passive smoking during pregnancy and neonatal health. *Ann Agric Environ Med* **16**, 309–312 (2009).
22. Baheiraei, A., Ghafoori, F., Rahimi Foroushani, A. & Nedjat, S. The effects of maternal exposure to second-hand smoke on breastfeeding duration: A prospective cohort study. *Journal of Public Health (Germany)* **22**, 13–22 (2014).
23. Baron, J. A., Bulbrook, R. D., Wang, D. Y. & Kwa, H. G. Cigarette smoking and prolactin in women. *British Medical Journal (Clinical Research ed.)* **293**, 482–483 (1986).
24. Ben-Jonathan, N., Hugo, E. R., Brandeborn, T. D. & LaPensee, C. R. Focus on prolactin as a metabolic hormone. *Trends in Endocrinology & Metabolism* **17**, 110–116, <https://doi.org/10.1016/j.tem.2006.02.005> (2006).
25. Blake, C. A. & Sawyer, C. H. Nicotine blocks the suckling-induced rise in circulating prolactin in lactating rats. *Science* **177**, 619–621 (1972).
26. World Health Organization. *Global strategy on infant and young child feeding*. (2002).
27. Sopori, M. L. Effects of cigarette smoke on the immune system. *Nature Reviews Immunology* **2**, 372–377 (2002).
28. Dorea, J. G. Maternal smoking and infant feeding: breastfeeding is better and safer. *Maternal & Child Health Journal* **11**, 287–291 (2007).
29. Thakur, S. K. *et al.* Effect of nutrition education on exclusive breastfeeding for nutritional outcome of low birth weight babies. *Eur J Clin Nutr* **66**, 37–41, <https://doi.org/10.1038/ejcn.2011.182> (2012).
30. Eidelman, A. I. *et al.* Breastfeeding and the use of human milk. *Pediatrics* **129**, e827–e841 (2012).
31. Horta, B. L., Loret de Mola, M., Victora, C. G. Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes: a systematic review and meta-analysis. *Acta Paediatrica* **104**, 30–37, <https://doi.org/10.1111/apa.13135> (2015).
32. Minichiello, A., Lefkowitz, A. R., Firestone, M., Smylie, J. K. & Schwartz, R. Effective strategies to reduce commercial tobacco use in Indigenous communities globally: A systematic review. *BMC Public Health* **16**, 21, <https://doi.org/10.1186/s12889-015-2645-x> (2016).
33. World Health Organization. *WHO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies*. (2017).

35. Minh, H. V. *et al.* Tobacco control policies in Vietnam: review on MPOWER implementation progress and challenges. *Asian Pacific Journal of Cancer Prevention: APJCP* **17**, 1–9 (2016).
36. Farber, H. J., Nelson, K. E., Miller, J. A. & Walley, S. C. Public policy to protect children from tobacco, nicotine, and tobacco smoke. *Pediatrics* **136**, 998–1007, <https://doi.org/10.1542/peds.2015-3109> (2015).
37. World Health Organization. WHO global report on trends in prevalence of tobacco smoking 2000–2025. (World Health Organization, Geneva, 2018).
38. World Bank. *World development indicators*, <https://data.worldbank.org/products/wdi> (2018).
39. Casetta, B. *et al.* Association between cigarette smoking prevalence and income level: a systematic review and meta-analysis. *Nicotine & Tobacco Research* **19**, 1401–1417, <https://doi.org/10.1093/ntr/ntw266> (2017).
40. World Health Organization. *Prevalence of tobacco smoking*, http://gamaps.server.who.int/gho/interactive_charts/tobacco/use/atlas, (2016).
41. The government of the Hong Kong special administrative region, tobacco control office. tobacco control legislation, https://www.gov.hk/english/main/main_tco/main_tco.html (2012).
42. Department of Health & Human Services. *Be TobaccoFree.gov*, <https://betobaccofree.hhs.gov/laws/index.html>.
43. Meedya, S., Fahy, K. & Kable, A. Factors that positively influence breastfeeding duration to 6 months: A literature review. *Women and Birth* **23**, 141–145, <https://doi.org/10.1016/j.wombi.2010.02.002> (2010).
44. Daly, J. B. *et al.* Interventions by health care professionals who provide routine child health care to reduce tobacco smoke exposure in children: A review and meta-analysis. *JAMA Pediatrics* **170**, 138–147, <https://doi.org/10.1001/jamapediatrics.2015.3342> (2016).

Acknowledgements

This work was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research (B) Grant Number JP17H04452. Sarah E. Porter RN MPH, MS, PhD provided native English editorial assistance. Also, Financial support for this project has been provided by the Mitsubishi Foundation.

Author Contributions


The authors M.S., N.Y., and Y.T. performed the screening and extraction of data for included studies. W.W. and M.R. conducted data extraction of included studies. W.W., M.S., N.Y., Y.T., and M.R. assessed the quality of study. E.O. supervises the development of concepts, and execution of methodology, analysis and manuscript writing. All authors reviewed and commented the manuscript.

Additional Information

Supplementary information accompanies this paper at <https://doi.org/10.1038/s41598-019-44786-z>.

Competing Interests: The authors declare no competing interests.

Publisher's note: Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2019

Secondhand Smoke Exposure During Pregnancy and Mothers' Subsequent Breastfeeding Outcomes: A Systematic Review and Meta-Analysis

ORIGINALITY REPORT

23%

SIMILARITY INDEX

19%

INTERNET SOURCES

19%

PUBLICATIONS

%

STUDENT PAPERS

PRIMARY SOURCES

1

www.pmc.gov.au

Internet Source

1%

2

ehp.niehs.nih.gov

Internet Source

1%

3

tel.archives-ouvertes.fr

Internet Source

1%

4

www.newcastle.edu.au

Internet Source

1%

5

Joan L. Bottorff, Gayl Sarbit, John L. Oliffe, Cristina M. Caperchione, Danielle Wilson, Anne Huisken. "Strategies for Supporting Smoking Cessation Among Indigenous Fathers: A Qualitative Participatory Study", American Journal of Men's Health, 2018

Publication

1%

6

m.scirp.org

Internet Source

1%

7	researcherslinks.com Internet Source	1%
8	pubs.asha.org Internet Source	1%
9	Rumi Tsukinoki, Yoshitaka Murakami. "Non-communicable disease epidemic: epidemiology in action (EuroEpi 2013 and NordicEpi 2013)", <i>European Journal of Epidemiology</i> , 2013 Publication	1%
10	Siwatt Pongpiachan, Tassanee Paowa. "Hospital out-and-in-patients as Functions of Trace Gaseous Species and Other Meteorological Parameters in Chiang-Mai, Thailand", <i>Aerosol and Air Quality Research</i> , 2015 Publication	<1%
11	Henry Jensen, Henrik Møller, Peter Vedsted. "Characteristics of customary non-attenders in general practice who are diagnosed with cancer: A cross-sectional study in Denmark", <i>European Journal of Cancer Care</i> , 2019 Publication	<1%
12	www.drugsandalcohol.ie Internet Source	<1%
13	sph.hku.hk Internet Source	<1%

14

K. B. Ashford. "Measuring prenatal secondhand smoke exposure in mother-baby couplets", *Nicotine & Tobacco Research*, 12/27/2009

Publication

<1%

15

Sanders, Matthew R., James N. Kirby, Cassandra L. Tellegen, and Jamin J. Day. "The Triple P-Positive Parenting Program: A Systematic Review and Meta-Analysis of a Multi-Level System of Parenting Support", *Clinical Psychology Review*, 2014.

Publication

<1%

16

translational-medicine.biomedcentral.com

Internet Source

<1%

17

P. Telkoparan, U. H. Tazebay. "Iodine in milk: transport, metabolic implications, and relation to endocrine functions", *Wageningen Academic Publishers*, 2013

Publication

<1%

18

www.eaae.rdg.ac.uk

Internet Source

<1%

19

Karla S. Bartholomew. "Policy Options to Promote Smokefree Environments for Children and Adolescents", *Current Problems in Pediatric and Adolescent Health Care*, 2015

Publication

<1%

20

J. A. Knopp-Sihota, C. V. Newburn-Cook, J.

<1%

Homik, G. G. Cummings, D. Voaklander.
"Calcitonin for treating acute and chronic pain of recent and remote osteoporotic vertebral compression fractures: a systematic review and meta-analysis", Osteoporosis International, 2011

Publication

21

pediatrics.aappublications.org

Internet Source

<1%

22

D. E. Kendzor. "Breast feeding is associated with postpartum smoking abstinence among women who quit smoking due to pregnancy", Nicotine & Tobacco Research, 10/01/2010

Publication

23

Natalie Hemsing, Lorraine Greaves, Renée O'Leary, Katharine Chan, Chizimuzo Okoli. "Partner Support for Smoking Cessation During Pregnancy: A Systematic Review", Nicotine & Tobacco Research, 2012

Publication

24

samples.jbpub.com

Internet Source

<1%

25

W.J. de Greef, P.M. Plotsky, J.D Neill. "Dopamine Levels in Hypophysial Stalk Plasma and Prolactin Levels in Peripheral Plasma of the Lactating Rat: Effects of a Simulated Suckling Stimulus", Neuroendocrinology, 1981

26 Wieslaw Jedrychowski, Frederica Perera, Elzbieta Mroz, Susan Edwards et al. "Prenatal exposure to passive smoking and duration of breastfeeding in nonsmoking women: Krakow inner city prospective cohort study", Archives of Gynecology and Obstetrics, 2008
Publication <1%

27 vdocuments.mx
Internet Source <1%

28 gh.bmj.com
Internet Source <1%

29 cphs.huph.edu.vn
Internet Source <1%

30 skemman.is
Internet Source <1%

31 Steven R. Myers, Brooke Barnes, Terry Wright, Christopher Cunningham. "The Relationship between Maternal and Fetal CYP1A1 Genotype in Smokers and Nonsmokers to Benzo(a)pyrene Hemoglobin Adducts", Polycyclic Aromatic Compounds, 2010
Publication <1%

32 www.tandfonline.com
Internet Source <1%

33

Alexander V. Prokhorov, Karen S. Calabro, Irene Tamí-Maury. "Nicotine and Tobacco Use Prevention among Youth and Families", Seminars in Oncology Nursing, 2016

Publication

<1%

34

springerplus.springeropen.com

Internet Source

<1%

35

repositorio.pucrs.br

Internet Source

<1%

36

www.jove.com

Internet Source

<1%

37

hydra.hull.ac.uk

Internet Source

<1%

38

www1.elsevier.com

Internet Source

<1%

39

Hayfaa A Wahabi, Ahmed A Mandil, Rasmieh A Alzeidan, Ahmed A Bahnassy, Amel A Fayed. "The independent effects of second hand smoke exposure and maternal body mass index on the anthropometric measurements of the newborn", BMC Public Health, 2013

Publication

<1%

40

ec.europa.eu

Internet Source

<1%

41

Lara T. Meital, Shaun L. Sandow, Philip C.

Calder, Fraser D. Russell. "Abdominal aortic aneurysm and omega-3 polyunsaturated fatty acids: Mechanisms, animal models, and potential treatment", Prostaglandins, Leukotrienes and Essential Fatty Acids (PLEFA), 2017

Publication

<1%

42

www.uspreventiveservicestaskforce.org

Internet Source

<1%

43

alabamabreastfeeding.org

Internet Source

<1%

44

Melissa Bartick, Cecília Tomori. "Sudden infant death and social justice: A syndemics approach", Maternal & Child Nutrition, 2018

Publication

<1%

45

Fusun Terzioglu, Handan Boztepe, Pinar Erkekoglu, Asli Er Korucu, Belma Kocer-Gumusel, Omer Kandemir. "The effects of amniotic fluid and foetal cord blood cotinine concentrations on pregnancy complications and the anthropometric measurements of newborns", Journal of Obstetrics and Gynaecology, 2019

Publication

<1%

46

www.defiancecohealth.org

Internet Source

<1%

47	www.cambridge.org Internet Source	<1%
48	www.tobaccopreventioncessation.com Internet Source	<1%
49	discovery.dundee.ac.uk Internet Source	<1%
50	twitter.com Internet Source	<1%
51	Syeda Sarah Jesmin, Mosfequr Rahman. "Social Inequalities and the Context of Vulnerabilities: HIV/AIDS Awareness and Prevention Knowledge among Married Women", Health Care for Women International, 2017 Publication	<1%
52	www.geosci-model-dev.net Internet Source	<1%
53	link.springer.com Internet Source	<1%
54	M. K. Kwok. "Paternal Smoking and Childhood Overweight: Evidence From the Hong Kong "Children of 1997"", PEDIATRICS, 07/01/2010 Publication	<1%
55	www.ncbi.nlm.nih.gov Internet Source	<1%

56

dspace.lboro.ac.uk

Internet Source

<1%

57

Carrie A. Vyhlidal, Amanda K. Riffel, Kathleen J. Haley, Sunita Sharma et al. "Cotinine in Human Placenta Predicts Induction of Gene Expression in Fetal Tissues", Drug Metabolism and Disposition, 2013

Publication

<1%

58

www.openaccessgovernment.org

Internet Source

<1%

59

Diana Sarfati, Tony Blakely, Caroline Shaw, Donna Cormack, June Atkinson. "Patterns of Disparity: Ethnic and Socio-economic Trends in Breast Cancer Mortality in New Zealand", Cancer Causes & Control, 2006

Publication

<1%

60

onlinelibrary.wiley.com

Internet Source

<1%

61

www.archbronconeumol.org

Internet Source

<1%

62

epdf.tips

Internet Source

<1%

63

www.glunis.com

Internet Source

<1%

64

apha.confex.com

	Internet Source	<1%
65	static.rasset.ie Internet Source	<1%
66	www.centeronaddiction.org Internet Source	<1%
67	openaccess.city.ac.uk Internet Source	<1%
68	Markus K. Diener, Keyvan-Tadjalli Mehr, Moritz N. Wente, Meinhard Kieser, Markus W. Buechler, Christoph M. Seiler. "Risk–benefit assessment of closed intra-abdominal drains after pancreatic surgery: a systematic review and meta-analysis assessing the current state of evidence", <i>Langenbeck's Archives of Surgery</i> , 2010 Publication	<1%
69	Horta, B. L., C. G. Victora, A. M. Menezes, and F. C. Barros. "Environmental Tobacco Smoke and Breastfeeding Duration", <i>American Journal of Epidemiology</i> , 1997. Publication	<1%
70	www.science.gov Internet Source	<1%
71	Reveiz, Ludovic, Andrés Felipe Cardona, Edgar Guillermo Ospina, and Ludovic Reveiz.	<1%

"Antibiotics for acute laryngitis in adults",
Cochrane Database of Systematic Reviews
Reviews, 2007.

Publication

72	epicorelhsc.blogspot.com Internet Source	<1%
73	ci.nii.ac.jp Internet Source	<1%
74	ehjournal.biomedcentral.com Internet Source	<1%
75	www.publish.csiro.au Internet Source	<1%
76	www.albertaquits.ca Internet Source	<1%
77	era.library.ualberta.ca Internet Source	<1%
78	comprped.com Internet Source	<1%
79	M. Heys, S. L. Lin, T. H. Lam, G. M. Leung, C. M. Schooling. "Lifetime Growth and Blood Pressure in Adolescence: Hong Kong's "Children of 1997" Birth Cohort", PEDIATRICS, 2012 Publication	<1%
80	A. Humphrey, C. Dinakar. "Maternal Second-	

Hand Smoke Exposure in Pregnancy Is Associated With Childhood Asthma Development", PEDIATRICS, 2014

Publication

<1%

81

Carla M. T. Tiesler, Joachim Heinrich. "Prenatal nicotine exposure and child behavioural problems", European Child & Adolescent Psychiatry, 2014

Publication

<1%

82

Shima Shahjouei, Mohsen Sadeghi-Naini, Zhihui Yang, Firas Kobeissy et al. "The diagnostic values of UCH-L1 in traumatic brain injury: A meta-analysis", Brain Injury, 2017

Publication

<1%

83

G. Banderali, A. Martelli, M. Landi, F. Moretti, F. Betti, G. Radaelli, C. Lassandro, E. Verduci. "Short and long term health effects of parental tobacco smoking during pregnancy and lactation: a descriptive review", Journal of Translational Medicine, 2015

Publication

<1%

84

Ruth Baron, Saskia J. te Velde, Martijn W. Heymans, Trudy Klomp, Eileen K. Hutton, Johannes Brug. "The Relationships of Health Behaviour and Psychological Characteristics with Spontaneous Preterm Birth in Nulliparous Women", Maternal and Child Health Journal,

<1%

2016

Publication

85

Gayle Halas, Annette SH Schultz, Janet Rothney, Pamela Wener et al. "A Scoping Review of Foci, Trends, and Gaps in Reviews of Tobacco Control Research", *Nicotine & Tobacco Research*, 2019

Publication

<1%

86

Prakash Shakya, Khem N. Pokhrel, Linda B. Mlunde, Suyun Tan, Erika Ota, Hironori Niizeki. "Effectiveness of non-steroidal anti-inflammatory drugs among patients with primary hypertrophic osteoarthopathy: A systematic review", *Journal of Dermatological Science*, 2018

Publication

<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off