Original Article

Factors associated with post-partum smoking relapse in Taiwan: A trial of Smoker's helpline

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A B S T R A C T

Objective: Many women quit smoking during pregnancy resume in postpartum period and difficult to prevent. No studies had focused on their psychosocial response in Taiwan. We analyzed data from a trial of Taiwan Smoker's Helpline (TSH) to determine factors associated with smoking relapse after delivery.
Materials and methods: A prospective cohort was conducted at Taipei City Hospital during Sep. 2014 and Nov. 2015 period. We collected data by self-developed questionnaire combining theory of planned behavior (TPB), Fagerstrom test for nicotine dependence (FTND) and Edinburgh Postnatal Depression Scale (EPDS) from 68 women immediately after delivery, 2 months later and followed up until 6 months. Multivariable logistic models for relapse of smoking at the end of 3rd month and 6th month were created.
Results: At 6th month, 42.6% participants relapsed with odds lower among first parity ($OR = 0.04$, 95% $CI = <0.01-0.54$, $p = 0.015$), having quitting experience in past ($OR = 0.09$, 95% $CI = 0.01-0.84$, $p = 0.019$) and higher perceived behavior control (PBC) ($OR = 0.99$, 95% $CI = 0.98-1.00$, $p = 0.035$), but greater for those with longer smoking duration in past ($OR = 1.29$, 95% $CI = 1.04-1.58$, $p = 0.018$).
Conclusion: Protective and precipitating factors to post-partum's smoking relapse were identified in our study.

Introduction

Many women, quit smoking in pregnancy, relapsed during postpartum period, and it was around 41—65% at the end of 6th month after delivery [1—3]. This event results in health consequences both for women themselves (e.g., increased risks of infertility, ectopic pregnancy, spontaneous abortion, cancers, respiratory and heart diseases [4]) as well as their infants (e.g., sudden infant death syndrome (SIDS) [5], common cold, pneumonia, otitis media, bronchitis, asthma, malfunction of lung [6], neuro-development and behavior deficits [7]). The prevalence of female smoking in Taiwan had plateaued at 3.3—5.1% in recent decades, but it peaked at 9.7—11.7% for the age of 31—40, comprising our most women in childbearing [8]. According to the Taiwan Birth Cohort Study, between 2005 and 2006, 7.7%, 3.5%, and 2.8% of women smoked before and during the early and late pregnancy, respectively, in Taiwan [9]. Researchers also showed that more than two-thirds of the women who stopped smoking during pregnancy relapsed one year after childbirth between 1995 and 1999 [10].

Systemic reviews investigating interventions designed to help pregnant women quit smoking had shown some success [11] but very few had been proved to be effective on how to prevent relapse [12,13] although the use of incentives may offer a promising but controversial outcome [14]. Therefore, identifying factors

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associated with relapse are crucial to develop more effective intervention strategies [15]. Several precipitating factors of smoking relapse after birth were reported from previous studies including nicotine dependence level [16], friends, partners, and family members who smoke, youth, low education attainment, low household income, at work [2], multiparous [3,17,18], depression, stress and anxiety [19], less breast feeding [3], weight concern. Lower overall motivation [20], exaggerated confidence in self-control [21] and social network [2] also played certain roles. Besides, racial and cultural difference mattered [16].

The Taiwanese government implemented the strategy of smoking cessation by using various measures, such as outpatient treatment and services, helplines, social marketing, and campaigns [8]. Taiwan Smokers' Helpline (TSH), founded in 2003 as the first quitting helpline in Asia, has provided services to more than 260,000 individuals until now; its 6-month abstinence rate was 38.71% in 2014 [22]. However, little evidence is present regarding which factors influence women's success in continuing postpartum abstinence after referring them to TSH. Studies have not proven the effectiveness of telephone counseling in reducing the relapse rate, although benefits were observed in terms of reduced depression scores, breastfeeding duration, and increased overall satisfaction [12]. The aim of present study was to understand influential factors relating to smoking relapse during six months after delivery. The study addressed psychosocial factors, namely the attitude, subjective norm, perceived behavior control (PBC) over the environment, and mood, through a TSH trial. By using data from this participant cohort, we ascertained potential determinants that lead to the development of more effective interventions for women in the maintenance of smoking cessation.

Materials and methods

In this study, data for explanatory variables and outcomes were collected at baseline and the subsequent 6 months, respectively. Women who quit smoking for more than 1 week during pregnancy were recruited immediately after childbirth at the hospital's wards. All participants were assessed using a questionnaire specifically developed through an instrument development process [23] and an extended theory of planned behavior (TPB) [24]. We included the Fagerstrom Test for Nicotine Dependence (FTND) and Edinburgh Postnatal Depression Scale (EPDS). The inclusion criterion for participants was women who ever smoked before but self-reported to have quit during pregnancy with an expired air carbon monoxide level of 8 ppm or less at first interview after delivery [25]. They were randomly assigned to either receive telephone counseling and management (TSH group) or general supportive care (GSC group). The original survey and later intervention were ethically approved by the Institutional Review Board of Taipei City Hospital (IRB No: TCHIRB-1030606-E).

Between September 2014 and November 2015, 72 women were voluntarily recruited from the postpartum ward of Taipei City Hospital Fuyou Branch, and the primary endpoint data were collected from 68 of them. After randomization, we enrolled 37 participants in the TSH group and 35 in the GSC group, but 6 denied intervention. Participants in the TSH group received telephone counseling sessions during the first 2 months postpartum as a standard procedure to minimize the operational variation. A well-trained counselor was assigned to each participant as the case manager, and 15–20-min discussion through outbound phone calls was held to assess their past history and current obstacles in physiological, emotional, and social aspects to maintain smoking abstinence. Several contingent calls were made in the following 5–8 weeks; the average total calls reached 4.6 ± 1.5 times, and the average duration for each call was 4.1 ± 1.7 min.

Before randomization, the following data were collected from participants: maternal age; educational attainment; marital status; religious belief; full-time occupation; residential location; household income; parity, sex and weight of the baby; weight gain during pregnancy; completeness of prenatal visits; age at first smoking; smoking duration in the past; quitting experience; smoking status of the spouse, partner, or other family members; expectancy of breastfeeding; addiction scored using the FTND; and depression scored using the EPDS. We also investigated the smoking pattern during pregnancy and classified them into three types: early quitter (EQ) for those who quit at early pregnancy and no smoking afterwards, late quitter (LQ) for those who quit after early pregnancy and no smoking afterwards, Occasional smoker (OS) for those who ever quit but occasional smoking at the end of pregnancy. Moreover, we assessed psychosocial variables, including the attitude, subjective norm, and perceived behavior control by using 15, 13, and 27 questions, respectively. Each question was scored using 2-dimensional multiples, which were designed using the Likert 5-point scale; examples of questions include "Can smoking harm your baby during the postpartum period?" "If above statement happened, is it good or bad according to your judgment?" "What would your husband think about you resuming smoking?" "Would you oblige to his will?" and "Would you smoke when your baby is sleeping? And "How difficult is it to abstain from smoking in above situation?"

Our primary outcome of this trial was smoking relapse at 6 months postpartum by using a self-reported questionnaire, and relapse was defined as 7 consecutive days of smoking [26]. The secondary outcome was psychosocial changes at 2 months postpartum, as assessed using part of the same questionnaire assessing the attitude, subjective norm, and perceived behavior control and EPDS scores. In this study, multivariable logistic models were constructed to determine the associations between baseline characteristics of participants and relapse at 3 and 6 months postpartum. First, univariate associations were tested on all variables, and stepwise backward elimination was used for significant variables ($p < 0.05$). Second, variables, which showed no association at the univariate level, were individually entered into the models to determine if they were subsequently associated with smoking relapse at each time point. The TSH intervention was included as a priori confounder. Furthermore, randomization of the TSH and GSC groups was tested on baseline data by using Mann–Whitney, and chi-squared tests. We subsequently investigated the differences between both groups considering psychosocial variables at baseline and 2 months by using the Mann–Whitney test. All analyses were conducted using SPSS 23.0 (IBM SPSS, Chicago, USA) and SAS System for Windows, Version 9.3 (SAS Institute, Cary, NC, USA).

Results

We initially recruited 72 women in this trial; however, 4 among them were lost to follow-up. Therefore, data from only the remaining 68 cases were included for analysis, with 34 and 32 cases comprised the THS and GSC groups, respectively. All variables as stated in questionnaire were tested, and no significance ($p > 0.05$) was observed between both groups (Table 1), indicating adequate randomization. At the end of six months after delivery, 29 of them relapsed to smoke with relapse rate of 42.6% and lowest (29.4%) at type EQ by smoking pattern during pregnancy (Table 2).

At 3 months, in the univariate analysis, participants of first parity and those with higher subjective norm, perceived behavior control scores, type EQ of the smoking pattern during pregnancy had significantly lower odds but those with longer smoking duration had significantly higher odds of smoking relapse (Table 3). However, the smoking duration and subjective norm score did not

Table 1
Demographic characteristics between two groups.

Variable	Total (N = 68)		TSH[a] group (N = 36)		GSC[b] group (N = 32)		p-value
	n	%	n	%	n	%	
Maternal age (Mean ± SD)	32.9 ± 5.2		31.8 ± 5.4		34.2 ± 4.6		0.104
Length of full-time education (yr)							0.942
≤12	29	42.6	16	44.4	13	40.6	
>12	39	57.4	20	55.6	19	59.4	
Religious belief							0.514
Yes	28	41.2	13	36.1	15	46.9	
No	40	58.8	23	63.9	17	53.1	
Occupation of full-time							0.830
Yes	36	52.9	20	55.6	16	50.0	
No	32	47.1	16	44.4	16	50.0	
Average income per month (NT dollar)							0.070
<50,000	28	41.2	19	52.8	9	28.1	
≥ 50,000	40	58.8	17	47.2	23	71.9	
First parity							0.400
Yes	51	75.0	25	69.4	26	81.3	
No	17	25.0	11	30.6	6	18.8	
Gender of baby							0.852
Male	30	44.1	15	41.7	15	46.9	
Female	38	55.9	21	58.3	17	53.1	
Weight gain in pregnancy (kg)							0.235
<15	36	52.9	22	61.1	14	43.8	
≥15	32	47.1	14	38.9	18	56.3	
Prenatal visits (times)							0.069
≧ 10	56	82.4	33	91.7	23	71.9	
< 10	12	17.6	3	8.3	9	28.1	
Smoking duration (year) (Mean ± SD)	12.6 ± 5.7		11.6 ± 5.8		13.7 ± 5.5		0.093
Quitting experience in past							0.808
Yes	34	50.0	19	52.8	15	46.9	
No	34	50.0	17	47.2	17	53.1	
Spouse or partner smoking							0.103
Yes	26	38.2	10	27.8	16	50.0	
No	42	61.8	26	72.2	16	50.0	
Other family member smoking							0.489
Nil	15	22.1	6	16.7	9	28.1	
= 1	36	52.9	21	58.3	15	46.9	
≥2	17	25.0	9	25.0	8	25.0	
Exclusive Breast feeding (month) (Mean ± SD)	2.0 ± 2.1		1.8 ± 2.3		2.3 ± 2.3		0.474
Attitude score (Mean ± SD)	202.1 ± 31.4		204.1 ± 31.1		199.9 ± 32.1		0.543
Subjective norm score (Mean ± SD)	13.2 ± 22.9		15.9 ± 25.7		10.2 ± 19.2		0.525
Perceived control score (Mean ± SD)	387.1 ± 162.6		419.6 ± 165.9		350.6 ± 153.2		0.120
Nicotine dependence score (FTND) (Mean ± SD)	3.1 ± 2.5		2.9 ± 2.6		3.2 ± 2.4		0.572
Depression score (EPDS) (Mean ± SD)	14.5 ± 4.7		14.2 ± 4.9		14.7 ± 4.6		0.630
Smoking pattern in pregnancy							0.278
Occasional Smoker (OS)	18	26.5	7	19.4	11	34.4	
Late Quitter (LQ)	16	23.5	8	22.2	8	25.0	
Early Quitter (EQ)	34	50.0	21	58.3	13	40.6	

Differences were tested using Mann–Whitney and Chi-square test.
[a] Taiwan Smoker's Helpline.
[b] General Supportive Care.

Table 2
Postpartum smoking relapse by month and pattern during pregnancy.

Postpartum women (n = 68)	1st	2nd	3rd	4th	5th	6th	Relapse rate (%)
type EQ (n = 34)	2	5	8	8	9	10	29.4
type LQ (n = 16)	1	5	7	7	8	9	56.3
type OS (n = 18)	5	7	10	10	10	10	55.6
subtotal	8	17	25	25	27	29	42.6

remain significant in stepwise regression. The final multivariable model showed the baseline variables independently associated with smoking relapse at 3 months. Participants of first parity [odds ratio (OR) = 0.01, 95% confidence interval (CI) = <0.01–0.42, p = 0.016], with quitting experience (OR = 0.03, 95% CI = 0.837–0.999, p = 0.019), and having higher perceived behavior control scores (OR = 0.99, 95% CI = 0.98–1.00, p = 0.021) had significantly lower odds of smoking relapse at 3 months

postpartum. The effect of past smoking duration (OR = 1.27, 95% CI = 0.98–1.64, p = 0.068), subjective norm score (OR = 1.00, 95% CI = 0.93–1.08, p = 0.068), and type EQ of the smoking pattern during pregnancy (OR = 0.08, 95% CI = 0.01–1.20, p = 0.068) did not remain significant when these variables were added to the multivariable model. In the univariate and multivariate analyses of smoking relapse at 6 months postpartum (Table 4), the univariate results revealed that participants of first parity and having higher

Table 3
Univariate and multivariate associations with smoking relapse at 3rd month postpartum by baseline data.

Variables	COR[a]	95% CI	P	AOR[b]	95% CI	P	AOR (stepwise)	95% CI	P
Maternal age	1.05	0.95–1.16	0.367	0.71	0.49–1.01	0.056			
Length of full-time education (yrs)									
≦12	1			1					
>12	1.19	0.44–3.23	0.737	30.5	0.56->999.99	0.093			
Occupation of full-time									
Nil	1			1					
Yes	2.68	0.95–7.55	0.061	7.19	0.50–103.56	0.147			
Average income per month (NT dollars)									
< 50,000	1			1					
≧50,000	0.64	0.24–1.74	0.385	0.07	<0.01–1.86	0.112			
Parity									
Multiple	1			1					
First	0.21	0.06–0.66	0.008	0.01	<0.01–0.42	0.016	0.16	0.04–0.70	0.001
Weight gain in pregnancy (kg)									
≧15	1			1					
<15	1.21	0.45–3.27	0.7	3.84	0.36–41.52	0.269			
Smoking duration in past (yrs.)	1.11	1.01–1.21	0.037	1.27	0.98–1.64	0.068			
Quitting experience in past									
Nil	1			1					
Yes	0.53	0.19–1.44	0.211	0.03	<0.01–0.57	0.019			
Spouse or partner smoking									
Nil	1			1					
Yes	0.65	0.23–1.84	0.42	0.27	0.01–6.98	0.431			
Other family members smoking									
Nil	1			1					
Yes	1.8	0.51–6.42	0.362	2.44	0.04–138.57	0.665			
Exclusive Breast feeding duration (months)	0.93	0.73–1.18	0.556	0.88	0.49–1.56	0.655			
Attitude score	1	0.98–1.01	0.567	1.02	0.99–1.06	0.227			
Subjective norm score	0.98	0.95–1.00	0.044	1	0.93–1.08	0.926			
Perceived control score	0.99	0.99–1.00	<0.001	0.99	0.98–1.00	0.021	0.99	0.99–1.00	0.015
Addiction score (FTND)	1.08	0.88–1.32	0.44	1.11	0.67–1.82	0.694			
Depression score (EPDS)	1.06	0.95–1.18	0.275	1.3	0.95–1.78	0.104			
Smoking pattern during pregnancy									
EQ[c] vs LQ[d]	0.4	0.11–1.40	0.151	1.26	0.12–13.58	0.848	0.5	0.11–2.24	0.362
EQ vs OS[e]	0.25	0.07–0.84	0.024	0.08	0.01–1.20	0.068	0.18	0.04–0.87	0.032
TSH[f] intervention									
Yes	1			1					
Nil	0.89	0.32–2.44	0.819	1.7	0.17–16.79	0.652			

[a] Crude odds ratio.
[b] Adjusted odd ratio.
[c] Early Quitter.
[d] Late Quitter.
[e] Occasional Smoker.
[f] Taiwan Smoker's Helpline.

perceived behavior control score had lower odds but those with longer smoking duration had higher odds of smoking relapse; however, first parity did not remain significant at stepwise regression. In the final multivariable model, women of first parity (OR = 0.04, 95% CI = <0.01–0.54, p = 0.015), with quitting experience (OR = 0.09, 95% CI = 0.01–0.84, p = 0.019), and having higher perceived behavior control scores (OR = 0.99, 95% CI = 0.98–1.00, p = 0.035) had significant lower odds of smoking relapse but those with longer smoking duration in the past (OR = 1.29, 95% CI = 1.04–1.58, p = 0.018) had significantly higher odds of smoking relapse at 6 months postpartum.

Discussion

Unique features were revealed from previous researches in sustaining smoking abstinence at the postpartum period and targeted intervention to prevent relapse remain challenging. Studies have reported that a low number of women quit smoking during pregnancy [27], mainly because of extrinsic motivation; therefore, long-term abstinence is difficult [28]. Recent longitudinal studies conducted from before pregnancy to the postpartum period have reported that the smoking pattern during pregnancy can predict relapse behavior [29], and only less than 20% of women smokers actually quit during pregnancy [1], reflecting their poor response to social norms and stigma anymore, even all kinds of interventions were tried [15]. Therefore, evidence for the efficacy of behavior and pharmacological interventions has been inconsistent [13] and most of them were insufficient from previous meta-analysis [30]. The most effective method for developing successful intervention strategies is through the understanding of contributing factors [31]. Our analysis revealed lower odds of postpartum smoking relapse in participants of first parity, which played a protective role; this result is consistent with previously reported results [2,17]. However, in this trial, quitting experience and shorter smoking duration were influencing factors. Although these factors were not frequently discussed before [24], our finding is intriguing. Moreover, our result highlighted the relevance of perceived behavior control (PBC), which originated from the TPB. Studies have indicated the TPB as one of the most frequently used models for predicting health and social behaviors [32], including smoking during adolescent and pregnancy [33]. Based on the TPB, people's intention to smoke can be predicted by their attitude (total appraisal of behavior), subjective norms (perception of their partners' opinions), and PBC (appraisal of behavior control and perceived ease or difficulty). Our study revealed more favorable PBC, representing more confidence in behavior control will have lower odds of

Table 4
Univariate and multivariate associations with smoking relapse at 6th month postpartum by baseline data.

Variables	COR[a]	95% CI	P	AOR[b]	95% CI	P	AOR (stepwise)	95% CI	P
Maternal age	1.07	0.97–1.18	0.191	0.87	0.70–1.10	0.25			
Length of full-time education (yrs)									
≤12	1			1					
>12	1.4	0.53–3.73	0.498	3.37	0.39–28.99	0.27			
Occupation of full-time									
Nil	1			1					
Yes	1.91	0.72–5.08	0.196	0.49	0.07–3.63	0.48			
Average income per month (NT dollars)									
< 50,000	1			1					
≧50,000	0.99	0.37–2.62	0.977	0.83	0.13–5.30	0.85			
Parity									
Multiple	1			1					
First	0.3	0.09–0.94	0.039	0.04	<0.01–0.54	0.02			
Weight gain in pregnancy (kg)									
≧15	1			1					
<15	1.17	0.45–3.07	0.751	3.27	0.52–20.80	0.21			
Smoking duration in past (yrs.)	1.14	1.03–1.25	0.01	1.29	1.04–1.58	0.02	1.14	1.02–1.28	0.019
Quitting experience in past									
Nil	1			1					
Yes	0.55	0.21–1.44	0.222	0.09	0.01–0.84	0.04			
Spouse or partner smoking									
Nil	1			1					
Yes	0.98	0.36–2.63	0.965	0.56	0.05–6.90	0.65			
Other family members smoking									
Nil	1			1					
Yes	1.15	0.36–3.69	0.814	0.33	0.01–8.57	0.5			
Exclusive Breast feeding duration (months)	1.07	0.85–1.34	0.565	1.57	0.91–2.71	0.1			
Attitude score	1	0.99–1.02	0.953	1.03	1.00–1.06	0.11			
Subjective norm score	0.98	0.96–1.00	0.089	1.01	0.96–1.07	0.67			
Perceived control score	0.99	0.99–1.00	0.001	0.99	0.98–1.00	0.03	0.99	0.99–1.00	0.002
Addiction score (FTND)	1.07	0.87–1.30	0.528	0.73	0.48–1.11	0.14			
Depression score (EPDS)	1.06	0.95–1.18	0.283	1.18	0.93–1.50	0.17			
Smoking pattern during pregnancy									
EQ[c] vs LQ[d]	0.32	0.09–1.11	0.073	0.11	0.01–1.03	0.05			
EQ vs OS[e]	0.33	0.10–1.09	0.07	0.16	0.01–1.91	0.15			
TSH[f] intervention									
Yes	1			1					
Nil	1.32	0.49–3.58	0.583	1.38	0.16–12.24	0.77			

[a] Crude odds ratio.
[b] Adjusted odd ratio.
[c] Early Quitter.
[d] Late Quitter.
[e] Occasional Smoker.
[f] Taiwan Smoker's Helpline.

postpartum smoking relapse, which was consistent with previous studies conducted during pregnancy but controversial compared with studies conducted in the postpartum period [19] because of the varying process of quitting and coping strategies [34]. These factors should be considered while designing more effective interventions in the future [15].

Studies have reported some other associated factors, which were not observed in our study: for example, nicotine dependence, depression, and breastfeeding. The average FTND in our study was 3.1, indicating that participants with high addiction were excluded because they continued smoking during pregnancy or had already overcome their withdrawal symptoms [34]. Notably, mood, including postpartum depression, showed contrasting effects in previous intervention trials [12,35], because of less effects. The effect of breastfeeding has been contrasting [3]. The most surprising disparity was observed in the effects of smoking by spouses or other family members, which has been reported as a strong predictor [15]. We believe women in our society have strong independent expectations and are not easily influenced by others, which were also observed in subjective norm variable. Considering the smoking pattern during pregnancy, although no association was revealed, it showed that compared with occasional smokers during pregnancy, those who quit at early pregnancy and

maintained abstinence throughout pregnancy have lower odds of relapse at 3 months postpartum (crude OR = 0.25, 95% CI = 0.07–0.84, p = 0.024) but not after adjustment. The result is in concordance with previously reported conflicts and warrants more research in the future [29].

No strong evidence exists stating that women receiving telephone support from providers at maternity services or others were less likely to smoke at the end of pregnancy or during the postnatal period [12]. Although failed to demonstrate differences in the relapse rate by TSH, we need more evidence when implemented by professional staffs and customized program. In future, more comprehensive content involving breastfeeding, nursery skills, psychological health, and social network, are emphasized.

Strengths and limitations

The main limitation of this study was a relatively high refusal rate of intervention (17%) by TSH, and only 72.2% of participants completed the follow-up assessment at 2 months postpartum. Therefore, the effect of the TSH could only be analyzed using limited data. However, as this is the first investigation of the aforementioned effect on this specific population, findings remain interesting and inspiring for future studies. In additional, we used

the TPB to include psychosocial factors as associated predictors; this will increase our understanding of our participants and help to develop more effective interventions in the future.

Conclusions

In this trial, the overall smoking relapse rate in 68 participants was 42.6% at 6 months postpartum, almost equal to the pooled mean based on 11 trials retrieved from 2 Cochrane reviews plus searches of Medline and EMBASE [1]. Among demographic factors, women of first parity and with quitting experience were the strongest predictors of a low relapse rate, whereas longer smoking duration in the past predicted a higher relapse rate. Smoking behavior during pregnancy predicted participant behavior afterward, although after minor adjustment. Therefore, we recommend women smokers to quit as early as possible during pregnancy. Among psychosocial factors, more favorable perceived control over smoking behavior predicted lower relapse, although the adjusted OR was only 0.99.

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Conflicts of interest

There is no conflict of interest.

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