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The Role of Father Involvement and Intimate Partner Violence on Postnatal Depression Among Women With Unintended Pregnancy

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Abstract

This study set out to fill the research gap by including various aspects of father involvement and intimate partner violence (IPV) in the examination of the association between unintended pregnancy and maternal postnatal depression (PND). This study aimed to examine the effect of father involvement and IPV on the association between unintended pregnancy and PND. A sample of 1,083 pregnant women who attended antenatal clinic at selected hospitals in Hong Kong completed two surveys to report on their pregnancy intention, antenatal depression, PND, IPV during pregnancy, their partner's (i.e., father's) involvement during pregnancy and after childbirth, and perceived social support. Comparisons were made between women with unintended pregnancy and those with intended pregnancy, and the effects of unintended pregnancy, father involvement, IPV, and other factors on maternal PND were examined. Results show that women with unintended pregnancy were more likely to report PND, IPV, fear, postnatal stress, lower degree of father involvement, and lower level of social support.

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Unintended pregnancy independently increased the risk of PND by 1.95 times (95% confidence interval [CI] = [1.15, 3.28]), after adjustment for all other variables. When father involvement was included in the regression model, the negative effects of IPV and the related fear on PND became nonsignificant. The positive association between unintended pregnancy and PND was robust. Father involvement might help promote maternal health by reducing the negative effects of IPV on PND.

Keywords
postnatal depression, unintended pregnancy, father involvement, intimate partner violence

Introduction

Postnatal depression (PND) is a major health problem that affects approximately 8% to 19% of women globally (Chaudron, 2003). It has been well demonstrated in literature that PND could lead to various serious negative health consequences on the family as a whole and that it may not only hamper mothers' physical and mental health (World Health Organization, 2008) but also affect the health of other family members including their partners and children (Leung et al., 2011; McPeak, Sandrock, Spector, & Pattishall, 2015).

Known risk factors for PND include a previous history of depression, antenatal depression and anxiety, stressful life events, young age, low socioeconomic status, difficult infant temperament, poor marital relationship, and a lack of social support (Beck, 2001; Dagher & Shenassa, 2012; Darcy et al., 2011; Nakku, Nakasi, & Mirembe, 2006; O'Hara & Swain, 1996; Robertson, Grace, Wallington, & Stewart, 2004). Among all the identified risk factors in literature, unintended pregnancy is one of the most commonly addressed yet under-investigated. Unintended pregnancy is not a rare phenomenon, and it affects almost half of the mothers in the United States and up to one-fourth of the mothers in Asian countries (C. Y. Chan et al., 2013; Finer & Zolna, 2016; Koh, Chui, Tang, & Lee, 2014). Past research has demonstrated the link between unintended pregnancy and maternal PND (Abajobir, Maravilla, Alati, & Najman, 2016; Abbasi, Chuang, Dagher, Zhu, & Kjerulff, 2013; Brito, Alves, Ludermir, & Araújo, 2015); however, findings about the underlying mechanisms are scarce. Latest effort often focuses on the moderating and/or mediating effects of factors such as ethnicity, stress, and anxiety in explaining the association (Abbasi et al., 2013).

In the recent decade, father involvement at different stages of pregnancy and childbirth has attracted increased attention worldwide (K. L. Chan, Emery, Fulu, Tolman, & Ip, 2017). It has been shown that father involvement may be

associated with better maternal health (K. K. L. Chan & Paterson-Brown, 2002; Dudgeon & Inhorn, 2004), paternal health (Plantin, Olykoya, & Ny, 2011), infant health (Teitler, 2001), increased partner satisfaction with their relationship (Bondas-Salonen, 1998), and reduced intimate partner violence (IPV; K. L. Chan et al., 2017). Due to the lack of systematic and comprehensive empirical studies on father involvement and health, the mechanisms underlying the associations between them remain inconclusive. Some preliminary research has suggested several possible pathways. For example, father involvement during and beyond pregnancy may promote paternal health by facilitating development of positive paternal health behaviors, such as cessation of smoking, alcohol consumption, or drug use (Bottorff, Radsma, Kelly, & Oliffe, 2009). These positive health behaviors among fathers do not only promote paternal health; they have been demonstrated to also facilitate both maternal and child health, possibly serving as a protective factor against poor pregnancy and obstetric outcomes, such as preterm birth and low birth weight (Finnbogadottir, Crang, & Persson, 2003).

Given that the above factors are closely associated with unintended pregnancy and PND (Crempien, Rojas, Cumsille, & Oda, 2011; Walsh, Keyes, Koenen, & Hasin, 2015; Wang et al., 2017), father involvement may act as a protective factor for reducing the risk of PND among mothers with unintended pregnancy. Yet, existing research has failed to investigate the influence of father involvement during pregnancy and after childbirth, an alterable variable, on such associations. This study set out research questions to fill the research gap by investigating the role of father involvement in the association between unintended pregnancy, IPV, and maternal PND. The research hypotheses include the following: (a) unintended pregnancy is associated with maternal PND, IPV, and lower level of social support and (b) father involvement reduces the negative effects of IPV on PND.

Method

Study Design and Sample

This study was conducted within a sample of mothers who had attended the antenatal check-up during 2016 and 2017 in four major public hospitals in Hong Kong. A baseline survey was conducted on the sample during their pregnancy, and a follow-up survey was conducted around 4 weeks postpartum. Sample recruitment was population based. During the study period, all pregnant women with less than 24 weeks of gestation who showed up in the antenatal clinic in one of the four research sites, namely, Kwong Wah Hospital, Queen Elizabeth Hospital, Queen Mary Hospital, and Prince Wales

Hospital, were considered eligible and invited to participate in the study. To ensure the representativeness of the sample, no limit on ethnicity or nationality was set. Those who could not understand Chinese or English, which were the main languages used in this study, were excluded from the sample. Pregnant women excluded due to language barrier comprised less than 1% of the total number of eligible participants. In addition, about 1% of the eligible participants who were below the age of 18 years and those who were unable to give informed consent were excluded.

Data Collection Procedures

All subject recruitment and data collection procedures were approved by the Institutional Review Board of the Hospital Authority Research Ethics Committees of all the four selected hospitals, and there was no important change made after the commencement of the study. Participation in the study was voluntary, informed consent was provided, and anonymity and confidentiality of information was guaranteed. Once identified as abused, participants were encouraged to seek help and were provided with the necessary information for referral. Health professionals at the four hospitals were trained and available for assistance in case of emergency.

During the study period, all eligible pregnant women who attended the antenatal clinic of the four hospitals were informed about the study details and participant's rights in private rooms in the hospitals. In particular, they were ensured that refusal to participate would not affect any service they received at the hospitals. Eligible women who agreed to participate provided written consent and completed the baseline survey that assessed their antenatal depression, IPV experiences, pregnancy intention, and demographic characteristics in the private room. Participants also indicated their preferred methods of contact for the follow-up survey after giving birth to their children (e.g., via phone, by mail, by e-mail, etc.).

About 4 weeks after their expected date of delivery, participants were contacted for the follow-up survey. They were asked to complete a structured questionnaire that assessed their PND, anxiety, stress level, IPV experience, health-related quality of life (HRQoL), perceived social support, and the degree of father involvement in their pregnancy. During the follow-up survey, participants were reminded again their right to refuse participation, to terminate the interview, and to ignore any item either verbally or in printed form. Anonymity and confidentiality were assured. No incentives were given to the participants. Although there was no potential harm expected, medical and health professionals at the four hospitals were available for assistance in case of emergency.

Study Variables and Measures

Antenatal and PND. Mothers' levels of depressive symptoms experienced during pregnancy and after childbirth were assessed with the Chinese version of the 10-item Edinburgh Postnatal Depression Scale (CEPDS; Lee et al., 2018). Items were rated on a Likert-type scale from 0 to 3. Total scores ranged from 0 to 30, with higher scores indicating more severe depression levels. This study employed a cutoff score of 10, which was recommended to screen for PND in the general Chinese population in Hong Kong (Lee et al., 2018). The CEPDS demonstrated good reliability in this study, with a Cronbach's alpha of .85.

Pregnancy intention. Mothers were asked whether their current pregnancy was intended or not with a yes/no item. Responses were then classified as "intended pregnancy" or "unintended pregnancy" in this study.

IPV during pregnancy. Mothers' experiences of IPV during pregnancy were measured using four items modified from the Chinese version of the Abuse Assessment Screen (AAS; Tiwari et al., 2007). Items were rated on a yes/no (0/1) scale. Three of the four items assessed mothers' experiences of psychological aggression, physical assault, and sexual coercion by their partner during pregnancy, and one assessed whether the mothers experienced fear from the IPV.

Father involvement during pregnancy and after childbirth. Father involvement was assessed with 10 items developed in this study. The items recorded the degree that the fathers provided emotional support for the mothers (one item; that is, whether the fathers would comfort their partner when she felt sad), the degree that they provided instrumental assistance on daily housework (six items; for example, taking care of pregnant women's diet, feeding the newborns, helping replace the diapers, etc.), the frequency of attending antenatal check-ups with the expectant mothers (one item), the frequency of attending parent education classes (one item), and the frequency of seeing ultrasound pictures during check-ups with the mothers (one item). The items assessing father involvement in daily housework and emotional support were rated on a 4-point scale from 1 to 4, with higher scores indicating higher degree of involvement. The father involvement in daily housework demonstrated good reliability in this study, with a Cronbach's alpha of .86.

Postnatal anxiety and stress. Postnatal anxiety and stress levels were assessed using the Chinese version of the Depression, Anxiety, and Stress Scale (DASS; Moussa, Lovibond, & Laube, 2011). The seven-item Anxiety and the

seven-item Stress subscales were used, and all items were rated on a 4-point scale, with higher scores indicating more severe anxiety or stress. The Anxiety and Stress subscales showed good reliabilities in this study, with Cronbach's alpha of .75 and .84, respectively.

Postnatal HRQoL. Mothers' postnatal HRQoL was assessed with the 12-item Short-Form Health Survey (SF-12; Lam, Tse, & Gandek, 2005). Scores on the SF-12 were computed as two separate composite scores: one for physical health–related QoL (PCS) and the other for mental health–related QoL (MCS). Both PCS and MCS ranged from 0 to 100, with higher scores indicating better health-related QoL. The SF-12 achieved a Cronbach's alpha of .85, indicating good reliability in this study.

Perceived social support. Mothers' perceived social support was measured using the Chinese version of the 12-item Multidimensional Scale of Perceived Social Support (MSPSS-C; Chou, 2000). Three sources of support were assessed, including support from family (four items), support from friends (four items), and support from some significant others (four items). Items were rated on a 7-point scale from 1 to 7. The total score ranged from 12 to 72, with higher scores indicating higher levels of perceived support. The reliability of the overall scale and the subscales was good, with Cronbach's alpha ranging from .90 to .94.

Demographic characteristics. During the baseline survey, mothers' demographic characteristics were recorded. These variables included their age, highest education attainment, employment status, marital status, monthly household income, whether they had any chronic health conditions (e.g., diabetes mellitus, heart disease, cancer, etc.), and whether they were receiving social security assistance from the government.

Statistical Analyses

In this study, all statistical analyses were conducted with SPSS 24.0 using a significance level of 0.05. The demographic characteristics, as well as the pregnancy intention, of the mothers were summarized using descriptive statistics. The demographic characteristics were then compared between the two groups with intended pregnancy and unintended pregnancy using chi-square tests and *t* tests. The mean scores of the scales assessing depression, anxiety, stress level, HRQoL, and social support were summarized by descriptive statistics and compared between the two groups using *t* tests. However, the proportions of mothers with CEPDS scores higher than the cutoff of 10, the proportion of mothers reporting IPV, and the proportion of fathers being

involved during the pregnancy and after childbirth were compared between groups using the chi-square tests.

To examine the associations between unintended pregnancy and PND and the effects of father involvement, IPV during pregnancy, and social support on those associations, a series of multiphase logistic regression analyses with the proportion of mothers with PND (i.e., with CEPDS score higher than 10) as the dependent variable were conducted. In the multiphase logistic regression models, it was hypothesized that the variables in early phases would affect those in later phases, but not the vice versa. In Phase 1, a forward stepwise logistic regression was conducted with all demographic characteristics as independent variables. In Phase 2, pregnancy intention, IPV during pregnancy, and fear resulted from IPV were entered as independent variables. In Phase 3, the different types of father involvement were included in the forward stepwise regression model; while in Phase 4, perceived social support was included as the independent variable. In this study, the Hosmer and Lemeshow (H-L) Test was used to assess the goodness of fit of the logistic regression models (Hosmer & Lemeshow, 2000). A nonsignificant result implied adequacy of the model.

Results

Sample Characteristics

In this study, a total of 1,737 eligible pregnant women agreed to participate and completed the baseline survey, and 1,083 of them remained and completed the follow-up survey, resulting in a retention rate of 62.3%. Demographic characteristics, antenatal depression, anxiety, stress, HRQoL, fear, IPV physical assault, and sexual coercion by their partner during pregnancy were compared between those who completed both surveys and those who completed only the baseline survey, and no statistically significant difference was found. The only difference is on IPV psychological aggression during pregnancy. Those who completed only the baseline survey reported 6% psychological aggression during pregnancy, but those who completed both surveys reported 14%. It does not seem that IPV psychological aggression had impact on the attrition.

Table 1 summarizes the demographic characteristics of the final sample. In this sample, mothers with unintended pregnancy comprised 16.4% (n = 178). The mean age of the overall sample was 31.3 years (SD = 4.6 years). Approximately 78.8% were employed as full-time workers and 93.7% were married or cohabiting with their partner during the study period. Between-group comparisons were conducted between mothers with intended pregnancy and those with unintended pregnancy, and no significant difference was found in any of these demographic characteristics (all $p > .05$).

Table 1. Baseline Demographic Summary of Pregnant Women (*N* = 1,083).

	Comparison by the Planning for Pregnancy						
	All Pregnant Women (*N* = 1,083)		Unintended Pregnancy (*n* = 178)		Intended Pregnancy (*n* = 905)		
Characteristic	*n*	%	*n*	%	*n*	%	*p* value[a]
Age							
M (*SD*)	31.3	(4.6)	32.2	(4.3)	32.0	(4.4)	.461
Educational attainment							.289
<Junior high school	102	9.4	16	9.0	86	9.5	
High school	343	31.7	48	27.0	295	32.6	
>College or university	638	58.9	114	64.0	524	57.9	
Employment status							
Employed	853	78.8	138	77.5	715	79.0	.660
Marital status							.738
Married	982	90.7	163	91.6	819	90.5	
Cohabiting	32	3.0	5	2.8	27	3.0	
Widowed/separated/divorced	6	0.6	2	1.1	4	0.4	
Never married and not having any relationship	53	4.9	7	3.9	46	5.1	
Missing information	10	0.9	1	0.6	9	1.0	
Monthly household income							.668
<HKD14,999 (~USD1,915)	123	11.4	18	10.1	105	11.6	
HKD15,000-HKD39,999 (~USD1,915-USD5,108)	371	34.3	61	34.3	310	34.3	
>HKD40,000 (~USD5,108)	558	51.5	96	53.9	462	51.0	
Missing information	31	2.9	3	1.7	28	3.1	
Chronic health conditions							
With chronic conditions[b]	87	8.0	12	6.7	75	8.3	.534
Social security							
Receiving social security assistance	35	3.2	8	4.5	27	3.0	.504

[a]*p* values obtained from chi-square test or *t* test.
[b]Chronic health conditions which are long-lasting or recurrent, for example, diabetes mellitus, asthma, heart disease, cancer, chronic renal failure, and so on.

Comparisons Between Mothers With Intended Pregnancy and Those With Unintended Pregnancy

Table 2 shows the mean scores, *SD*, prevalence rates, and the between-group comparison results of all study variables. Overall, the mean CEPDS scores during pregnancy and after childbirth were 6.83 (*SD* = 4.74) and 4.20 (*SD* = 4.09), respectively. The mean scores for instrumental support

Table 2. Comparisons of the Mean Scores and Standard Deviations of Study Instruments, by the Planning for Pregnancy.

	Comparison by the Planning for Pregnancy						
	All Pregnant Women (*N* = 1,083)		Unintended Pregnancy (*n* = 178)		Intended Pregnancy (*n* = 905)		
Instrument	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p* value
Depression, CEPDS							
Antenatal, during pregnancy	6.83	4.74	6.62	4.71	6.87	4.75	.522
Postnatal, after childbirth	4.20	4.09	5.04	4.94	4.04	3.88	.011
Father involvement during pregnancy							
Daily housework	18.50	3.39	17.31	3.61	18.74	3.30	<.001
Emotional support	3.26	0.62	3.07	0.70	3.30	0.60	<.001
Frequency of antenatal check-ups with partner	6.58	4.43	5.51	4.27	6.79	4.43	<.001
Frequency of attending parent education classes	1.95	2.63	1.28	2.07	2.09	2.71	<.001
Frequency of seeing ultrasound pictures during check-ups with partner	3.29	3.39	2.22	2.74	3.50	3.46	<.001
Intimate partner violence (IPV) during pregnancy, AAS							
Psychological, *n* (%)	153	(14.1)	39	(21.9)	114	(12.6)	.001
Physical, *n* (%)	10	(0.9)	1	(0.6)	9	(1.0)	.581
Sexual, *n* (%)	4	(0.4)	0	(0)	4	(0.4)	.374
Any type of IPV, *n* (%)	155	(14.3)	40	(22.5)	115	(12.7)	.001
Fear aroused by IPV, *n* (%)	38	(3.5)	11	(6.2)	27	(3.0)	.034
Health-related quality of life (HRQoL) after childbirth, SF-12							
Physical health	50.35	6.31	49.53	6.89	50.51	6.18	.057
Mental health	52.57	8.00	51.60	8.96	52.77	7.79	.106
Anxiety and stress after childbirth, DASS							
Anxiety	1.23	1.69	1.46	1.92	1.18	1.63	.072
Stress	2.69	2.93	3.17	3.26	2.60	2.86	.031
Social support, MSPSS							
Overall	71.51	10.69	69.03	12.67	71.99	10.19	.004
Family	23.85	4.13	22.69	5.15	24.08	3.86	.001
Friends	23.78	3.99	23.11	4.70	23.91	3.83	.034
Significant others	23.88	4.01	23.24	4.71	24.01	3.85	.040

Note. CEPDS = the Chinese Edinburgh Postnatal Depression Scale; IPV = intimate partner violence; AAS = Abuse Assessment Screen; HRQoL = Health-Related Quality of Life; SF-12 = the 12-Item Short-Form Health Survey; DASS = Depression, Anxiety, and Stress Scale; MSPSS = Multidimensional Scale of Perceived Social Support.

on daily housework and emotional support among the fathers were 18.50 (*SD* = 3.39) and 3.26 (*SD* = 0.62), respectively. The overall prevalence of IPV during pregnancy was 14.3%, and 3.5% reported fear resulted from

Table 3. Comparisons of the Proportion of Women Who Reported CEPDS Score Cutoff by the Planning for Pregnancy.

	Comparison by the Planning for Pregnancy						
	All Pregnant Women (*N* = 1,083)		Unintended Pregnancy (*n* = 178)		Intended Pregnancy (*n* = 905)		
Time period	*n*	%	*n*	%	*n*	%	*p* value[a]
During pregnancy							
Antenatal depression[b]	286	26.4	46	25.8	240	26.5	.926
After delivery							
Postnatal depression[b]	101	9.3	30	16.9	71	7.8	.001

[a]*p* values obtained from chi-square tests.
[b]Depression as indicated by having the score of the Chinese Edinburgh Postnatal Depression Scale (CEPDS) higher than or equal to the cutoff of 10.

the IPV incidents. The mean scores of SF-12 were 50.35 (*SD* = 6.31) for PCS and 52.27 (*SD* = 8.00) for MCS, while that of MSPSS-C was 71.51 (*SD* = 10.69) overall.

Significant differences were observed between the mothers with intended pregnancy and those with unintended pregnancy. When compared to those with intended pregnancy, mothers with unintended pregnancy reported significantly higher level of PND symptoms ($p < .05$), lower degree of father involvement during pregnancy and after childbirth (all $p < .001$), greater likelihood of experiencing IPV ($p < .01$) and fear resulted from IPV ($p < .05$), higher level of postnatal stress, and lower degree of perceived social support from family, friends, and significant others (all $p < .05$).

Table 3 lists the proportion of mothers who reported a CEPDS score higher than the cutoff of 10 in this study. Overall, 26.4% of the mothers could be identified as having antenatal depression and 9.3% as having PND. Significant between-group difference was observed in PND: significantly a greater proportion of mothers with unintended pregnancy could be identified as having PND than their counterparts (16.9% vs. 7.8%, $p < .01$).

Table 4 shows Pearson's correlation of all the variables used in the regression analysis, except those categorical variables. Table 5 shows the summary of the results of the multiphase logistic regression analyses. In Phase 1, none of the demographic characteristics was significantly associated with PND (which was operationalized a CEPDS score over the cutoff of 10). In Phase 2, unintended pregnancy (adjusted odds ratio [a*OR*] = 2.19, 95% confidence interval [CI] = [1.36, 3.55], $p < .01$), IPV during pregnancy

Table 4. Pearson Correlation.

	Antenatal Depression	Postnatal Depression	Age	Education Attainment	Income	Daily Housework	Emotional Support	Check-Ups	Education Classes	Ultrasound	Physical SF-12	Mental SF-12	Anxiety	Stress	MSPSS Overall	MSPSS Family	MSPSS Friends	MSPSS others
Antenatal depression	1																	
Postnatal depression	.021	1																
Age	−.098**	−.034	1															
Education attainment	−.096**	−.020	.125**	1														
Income	−.113**	−.026	.244**	.433**	1													
Daily housework	.035	−.140**	−.014	.105**	.054	1												
Emotional support	−.041	−.230**	.009	.019	.055	.483**	1											
Check–ups	−.004	−.106**	−.008	.005	−.017	.224**	.188**	1										
Education classes	−.014	.026	−.011	.003	−.024	.171**	.138**	.194**	1									
Ultrasound	−.017	−.102**	.033	−.007	.019	.204**	.176**	.383**	.220**	1								
Physical SF–12	−.015	−.274**	−.010	.015	.047	.078*	.154**	.022	−.012	.025	1							
Mental SF–12	−.018	−.724**	.005	.012	−.001	.124**	.157**	.108**	−.024	.044	.093**	1						
Anxiety	−.003	.601**	−.013	−.049	−.036	−.110**	−.174**	−.088**	.083**	−.081**	−.260**	−.496**	1					
Stress	.011	.710**	−.032	−.024	−.032	−.102**	−.161**	−.091**	.055	−.008	−.273**	−.651**	.666**	1				
MSPSS Overall	−.012	−.311**	.022	.033	.039	.207**	.267**	.135**	.084**	.090**	.151**	.340**	−.264**	−.264**	1			
MSPSS Family	−.020	−.356**	.041	.041	.028	.189**	.245**	.106**	.058	.064*	.197**	.358**	−.323**	−.298**	.793**	1		
MSPSS Friends	−.002	−.251**	.011	.029	.041	.184**	.240**	.132**	.081**	.086**	.084**	.300**	−.197**	−.212**	.931**	.555**	1	
MSPSS others	−.010	−.213**	.005	.017	.036	.174**	.221**	.119**	.083**	.088**	.116**	.238**	−.174**	−.185**	.922**	.531**	.914**	1

Note. SF-12 = 12-Item Short-Form Health Survey; MSPSS = Multidimensional Scale of Perceived Social Support.
*$p < .05$. **$p < .01$.

Table 5. Adjusted Odds Ratios (OR) and 95% Confidence Interval (CI) of Variables Obtained in the Multi-Phase Logistic Regression Using Postnatal Depression (Score Over the Cutoff of 10) as the Dependent Variable (N = 1,083).

	Adjusted OR (95% CI)			
Variable	Model 1	Model 2	Model 3	Model 4
Phase 1				
Depression during pregnancy	1.22 [0.76, 1.94]	1.08 [0.67, 1.76]	1.10 [0.67, 1.79]	1.15 [0.70, 1.89]
Age	0.96 [0.91, 1.01]	0.96 [0.91, 1.01]	0.96 [0.91, 1.01]	0.96 [0.91, 1.01]
Education attainment				
<Junior high school	1.29 [0.56, 2.98]	1.29 [0.55, 3.03]	1.32 [0.55, 3.15]	1.24 [0.50, 3.08]
High school	1.23 [0.75, 2.02]	1.29 [0.78, 2.13]	1.30 [0.78, 2.18]	1.23 [0.72, 2.09]
>College or university	1.00	1.00	1.00	1.00
Employed currently	1.02 [0.58, 1.80]	0.88 [0.49, 1.58]	0.87 [0.47, 1.58]	0.86 [0.46, 1.60]
With chronic health conditions	1.45 [0.73, 2.85]	1.55 [0.77, 3.09]	1.54 [0.76, 3.12]	1.63 [0.80, 3.33]
Marital status				
Married/cohabiting	1.00	1.00	1.00	1.00
Widowed/separated/divorced/ never married	0.87 [0.33, 2.30]	0.85 [0.31, 2.30]	0.88 [0.32, 2.38]	0.94 [0.35, 2.58]
Monthly household income				
<HKD14,999 (~USD1,915)	0.76 [0.36, 1.63]	0.76 [0.35, 1.60]	0.70 [0.32, 1.53]	0.76 [0.34, 1.71]
HKD15,000-HKD39,999 (~USD1,915-USD5,108)	0.61 [0.36, 1.03]	0.65 [0.38, 1.09]	0.63 [0.37, 1.07]	0.60 [0.35, 1.04]
>HKD40,000 (~USD5,108)	1.00	1.00	1.00	1.00
Receiving social security	0.27 [0.04, 2.06]	0.28 [0.04, 2.10]	0.30 [0.04, 2.31]	0.24 [0.03, 1.92]

(continued)

Table 5. (continued)

Variable	Adjusted OR (95% CI)			
	Model 1	Model 2	Model 3	Model 4
Phase 2				
Unintended pregnancy		2.19** [1.36, 3.55]	1.97** [1.18, 3.28]	1.95* [1.15, 3.28]
IPV during pregnancy (any)		1.78* [1.04, 3.03]	1.57 [0.91, 2.71]	1.34 [0.76, 2.36]
Fear		3.10** [1.38, 6.97]	2.88* [1.25, 6.64]	2.19 [0.89, 5.38]
Phase 3				
Father involvement during pregnancy and after childbirth				
Daily housework			0.99 [0.92, 1.07]	1.01 [0.94, 1.09]
Emotional support			0.58** [0.41, 0.83]	0.68* [0.46, 0.99]
Frequency of antenatal check-ups with partner			0.96 [0.90, 1.01]	0.96 [0.91, 1.02]
Frequency of attending parent education classes			1.08 [1.00, 1.18]	1.08 [0.99, 1.18]
Frequency of seeing ultrasound pictures during check-ups with partner			1.00 [0.92, 1.08]	1.01 [0.93, 1.09]
Phase 4				
Social support (overall)				0.95*** [0.93, 0.97]
Nagelkerke R^2	0.020	0.075	0.109	0.167
p value of H&L Test	.670	.910	.505	.860

Note. OR = odds ratio; CI = confidence interval.
*$p < .05$. **$p < .01$. ***$p < .001$.

(a*OR* = 1.78, 95% CI = [1.04, 3.03], $p < .05$), and fear (a*OR* = 3.10, 95% CI = [1.38, 6.97], $p < .01$) were significantly associated with PND, while after father involvement was included in Phase 3, only unintended pregnancy (a*OR* = 1.97, 95% CI [1.18, 3.28], $p < .01$), fear (a*OR* = 2.88, 95% CI [1.25, 6.64], $p < .05$), and fathers' emotional support (a*OR* = 0.58, 95% CI = [0.41, 0.83], $p < .01$) were significant factors. Finally, in Phase 4, when social support was added to the regression model, only unintended pregnancy remained as significant risk factor for PND (a*OR* = 1.95, 95% CI = [1.15, 3.28], $p < .05$), while fathers' emotional support (a*OR* = 0.68, 95% CI = [0.46, 0.99], $p < .05$) and social support (a*OR* = 0.95, 95% CI = [0.93, 0.97], $p < .001$) were two significant protective factors for PND. The final model accounted for 16.7% of variance of PND measured 4 weeks postpartum.

Discussion

Main Findings

The findings of this study show that unintended pregnancy was the major risk factor that increased almost twice of the PND risk among mothers after the adjustment of other variables, supporting the link found in previous meta-analysis in literature (Abajobir et al., 2016). Fathers' emotional support and social support from family, friends, and significant others, however, were two protective factors for PND among the Chinese mothers. When father involvement was included, the previously significant effect of IPV and fear resulted from IPV incidents on PND became nonsignificant, implying the possible effect of father involvement on reducing the negative effects of IPV on maternal PND.

This study also reveals reliable estimates on the rates of unintended pregnancy and PND. Approximately 16% of the mothers in Hong Kong reported unintended pregnancy, and this rate falls into the range 9% to 25% found in previous studies in Hong Kong (C. Y. Chan et al., 2013; Koh et al., 2014); although it is not comparable to the rates found in previous Western studies (e.g., 45% in a national survey in the United States; Finer & Zolna, 2016). As for maternal PND, the 9% rate found in this study falls into the lower end of the range of 9% to 22% observed in a Chinese study which used the same cutoff of CEPDS (Leung et al., 2011).

Interpretation

The positive association between unintended pregnancy and PND is supported in this study, providing convergent evidence to the past findings that

PND is more likely to among mothers with unintended pregnancy found both in Western countries and in Asian countries (Abajobir et al., 2016; Abbasi et al., 2013; Ahmad et al., 2018; Brito et al., 2015; Chi, Zhang, Wu, & Wang, 2016). Although some have suggested the possible effects of antenatal depression on this association (Abbasi et al., 2013), the current findings indicate that neither antenatal depression was more likely among mothers with unintended pregnancy, nor antenatal depression could significantly increase the risk of PND at 4 weeks postpartum. Instead, unintended pregnancy was independently linked to PND, even after the adjustment for other factors, providing support to the independent effect of unintended pregnancy among the mixed findings in literature (Abbasi et al., 2013; Brito et al., 2015).

The current findings demonstrate that mothers with unintended pregnancy were more likely to experience IPV during pregnancy, and those experiences might be linked to greater risk of PND. This extends the existing knowledge that unintended pregnancy increases the risk of IPV (Wang et al., 2017) and that IPV increases the risk of PND (Adamu & Adinew, 2018; Ali, Ali, & Azam, 2009; Desmarais, Pritchard, Lowder, & Janssen, 2014), by showing the potential role of IPV in the positive association between unintended pregnancy and PND. Researchers have suggested the possible impact of IPV during pregnancy on the emotional health among mothers. For example, it might increase the risk of negative health behaviors and mood disorders and in turn increase the risk of PND (Walsh et al., 2015). Among the negative impacts aroused by IPV, fear might be one major negative emotion that could be linked to both IPV and depression or PND (Crempien et al., 2011). Indeed, this study demonstrated that fear resulted from IPV played a significant role in increasing the risk of PND, indicating that fear related to IPV might be one underlying factor in explaining PND among mother victims.

Father involvement, in the form of emotional support to the mothers, was found to reduce the risk of maternal PND. It was shown that when fathers' emotional support was included, the previously significant effects of pregnancy IPV and fear on PND became nonsignificant, indicating the potential effectiveness of fathers' support on reducing the negative health consequences related to pregnancy IPV. On one hand, the protective effect of fathers' emotional support may directly reduce the negative emotions and mood problems of mothers, lowering the risk of the onset of PND. On the other hand, father involvement may have indirect effect on PND. It has been suggested that involved fathers may be better prepared for fatherhood (K. L. Chan et al., 2017), which reduces the likelihood of conflicts between the couples due to pregnancy and child care and in turn increases marital satisfaction (Galovan, Holmes, Schramm, & Lee, 2013), an important protective factor for both IPV and maternal PND (Adamu & Adinew, 2018;

Stith, Green, Smith, & Ward, 2008). It is noteworthy that fathers' emotional support remained as a significant protective factor even when more general social support was included in the model, demonstrating that fathers' support could stand out as an independent source of protection against PND among mothers.

Strengths and Limitations

The major strength of this study is the inclusion of father involvement in the associations between unintended pregnancy and maternal PND. Although there has been emerging evidence that father involvement may promote maternal health (K. L. Chan et al., 2017; Gungor & Beji, 2007; Liamputtong & Naksook, 2003), solid empirical evidence from large-scale studies, especially Asian studies, has been scarce. This study provides important evidence supporting the effectiveness of father involvement in reducing the negative consequences of unintended pregnancy on maternal PND.

Another strength of this study is the comprehensive operationalization of father involvement, which has been varying greatly across studies (Gungor & Beji, 2007; Liamputtong & Naksook, 2003). This study examines the concept by including various aspects of father involvement before and after childbirth. Aspects such as instrumental support, emotional support, and the involvement in education classes were all covered. Findings would shed important lights on the operationalization of father involvement in future studies.

Despite the above strengths of this study, there were some methodological limitations. This study only measured PND at about 4 weeks postpartum. Within this time frame, some PND cases might be undetected, since the onset of PND may be beyond the 4 weeks of postpartum (Kettunen, Koistinen, & Hintikka, 2014). Besides, the inclusion of only four out of eight public hospitals might impose limitation on the representativeness of the findings. Without the coverage of all hospitals in the city, the representativeness would not be able to reach the maximum. In addition, this study did not include all potential factors in explaining PND. For example, health of newborns and marital satisfaction might be some examples of the possible factors that could be associated with unintended pregnancy and PND (McPeak et al., 2015; Odinka et al., 2018). Future research may consider including more variables, such as health of other family members and previous history of depression and anxiety of the mothers, in developing the model to explain maternal PND. Another limitation is that the measures of father involvement and PND were based on mother's self-report. Father may have different perception of involvement in terms of instrumental or emotional support (K. L. Chan et al., 2017). Including father's report of

involvement might provide different perspective in understanding the protective effect of father involvement. Self-report on PND using CEPDS is not for the determination of clinical depression. Medical professional's diagnosis would be required to provide more comprehensive assessment of PND, types, and severity of abuses as well.

Conclusion

This study shows that unintended pregnancy increases the risk of maternal PND assessed 4 weeks postpartum. This positive association is robust and remains significant after the adjustment of potential confounding and associated factors. Results also support that IPV and the related fear during pregnancy could be a risk factor of maternal PND, but the strength of these associations would be reduced with increased levels of emotional support provided by fathers. This highlights the importance of promoting father involvement during pregnancy and after childbirth to benefit maternal health and provides insights on the need for concerted efforts from relevant institutions to enable fathers to be available for being involved in pregnancy, childbirth, and child care and, more importantly, to neither accept nor inadvertently create barriers to that involvement.

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