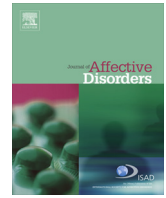




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## Review

# Magnitude and risk factors for postpartum symptoms: A literature review

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## ABSTRACT

**Background:** The prevalence of postpartum depression worldwide varies from 0.5% to 60.8% in the first 12 months postpartum using self-reported questionnaire. This review aims to update the current magnitude of postpartum depression based on self-reported questionnaire and clinical interview and explore its associated factors in developed and developing countries.

**Methods:** A literature search conducted between 2005 and 2014 identified 203 studies, of which 191 used self-reported questionnaire in 42 countries and 21 used structured clinical interview in 15 countries. Nine studies used a combination of self-reported questionnaire and clinical interview.

**Result:** The prevalence of postpartum depression varies from 1.9% to 82.1% in developing countries and from 5.2% to 74.0% in developed countries using self-reported questionnaire. Structured clinical interview shows a much lower prevalence range from 0.1% in Finland to 26.3% in India. Antenatal depression and anxiety, previous psychiatric illness, poor marital relationship, stressful life events, negative attitude towards pregnancy, and lack of social support are significant contributors to postpartum depression.

**Limitation:** All studies are included irrespective of the methodological quality, such as small sample size and their inclusion could affect the generalizability of the results.

**Conclusion:** The current prevalence of postpartum depression is much higher than that previously reported, and similar risk factors are documented. A culturally sensitive cut-off score with adequate psychometric properties of the screening instruments should be available. In future studies, examining the physical, biological, and cultural factors in qualitative studies and in those with adequate methodological qualities is recommended.

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## 1. Background

Depression is a leading cause of disease-related morbidity among women, and its prevalence is twofold greater than that in men (Kessler, 2003). For women of childbearing age, it is second after HIV/AIDS in total disability (WHO, 2001). The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) (APA, 2013) defines postpartum depression as a depressive episode with moderate to severe severity that begins four weeks after delivery. Alternatively, the International Statistical Classification of Disease and Related Health Problems 10th Revision (WHO, 2009) defines it as a mild mental and behavioral disorder that begins six weeks after delivery.

Clinical manifestations of postpartum depression include inability to sleep or sleeping much, mood swings, change in appetite, fear of harming, extreme concern and worry about the baby, sadness or excessive crying, feeling of doubt, guilt and helplessness, difficulty concentrating and remembering, loss of interest in hobbies and usual activities, and recurrent thoughts of death, which may include suicidal ideation (Patel et al., 2012). Many experts in the field consider the extension of postpartum depression onset symptoms to 12 months after delivery (Gaynes et al., 2005).

Postpartum depression is part of the spectrum of mood disturbances affecting postpartum women. The other parts are postpartum blues and postpartum psychosis. Postpartum blues occurs in 50–85% of women following delivery. It peaks around the fourth day and resolves by the tenth day following delivery. Symptoms include brief crying spells, anxiety, sadness, poor sleep, confusion, and irritability. However, suicidal ideation is not present, and no specific treatment is required (Cohen et al., 2010). Postpartum psychosis is rare, with a prevalence of 0.1–0.2%. However, it requires emergency treatment because of risk of infanticide and suicide. Symptoms may include restlessness, agitation, sleep disturbance, paranoia, disorganized thoughts, impulsivity, hallucinations, and delusions. It peaks in the first two weeks after delivery and is common in new mothers aged 35 years and above (Cohen et al., 2010).

The depressive episode during postpartum period has become the focus of clinical attention not only because it affects the patient's social and occupational functioning but also its impact extends to the partner (Bielawska-Batorowicz and Kossakowska-Petrycka, 2006; Roberts et al., 2006), family (Boath et al., 1998) and mother-baby interaction (Murray et al., 1996; McMahon et al., 2006). It is associated with a profoundly poor quality of life (Da Costa et al., 2006), and long-term emotional (Murray et al., 1999; Goodman et al., 2011; Giallo et al., 2014), intellectual (Sharp et al., 1995; Hay et al., 2001) and cognitive (Kurtsjens and Wolker, 2001; Grace et al., 2003) development of the child may be affected.

Extensive studies on postpartum depression have been conducted. In the past 10 years, 16 reviews related to the prevalence of postpartum depression have been identified. Out of which, only seven reviews (Table 1) (Gavin et al., 2005; Halbreich and Karkun, 2006; Klainin and Arthur, 2009; Wong and Fisher, 2009; Vigod et al., 2010; Roomruangwong and Epperson, 2011; Villegas et al., 2011) can be regarded as systematic reviews, whereas the others (Clay and Seehusen, 2004; Leahy-Warren and McCarthy, 2007;

O'Hara, 2009; Ammerman et al., 2010; Miles, 2011; Miller and LaRusso, 2011; Hubner-Liebermann et al., 2012; Patel et al., 2012) are limited in terms of the quantity of evidence and the methodological quality. The latest review by Villegas et al. (2011) reports much higher postpartum depression prevalence in developing countries than in developed countries. However, this review is limited to rural communities, and a comparison with urban communities is made whenever data are available. Other related reviews were conducted in Asian countries (Klainin and Arthur, 2009; Roomruangwong and Epperson, 2011), women with preterm infants (Vigod et al., 2010) and the Chinese population (Wong and Fisher, 2009). Halbreich and Karkun (2006) conducted the largest systematic review involving worldwide studies and reported a prevalence of almost 0–60% using self-report questionnaire.

Two meta-analyses (Beck, 2001; Robertson et al., 2004) have identified the strongest risk factors for postpartum depression, namely, antenatal depression or anxiety, personal and family history of depression, low social support, poor marital relationship, and stressful life events. Nonetheless, these studies are limited to Western populations.

### 1.1. Rationale and objectives

As countries differ in terms of cultural and socio-economic factors, the prevalence of and risk factors for postpartum depression in industrialized countries cannot be generalized worldwide (Halbreich and Karkun, 2006; Klainin and Arthur, 2009). Therefore, an updated systematic review on postpartum depression that considers the possible variations across countries is required. This review aims at summarizing and synthesizing (1) the current magnitude of postpartum depression based on self-reported questionnaire and clinical interview and (2) the associated factors of postpartum depression in developed and developing countries.

## 2. Methods

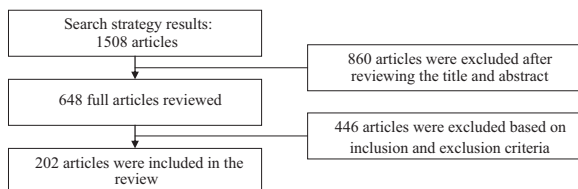
A comprehensive literature search was conducted using the MEDLINE, PSYCHINFO, CINAHL, SCIENCE DIRECT, and PUBMED databases. The following keywords were used: postpartum depression, postnatal depression, depression, postnatal, postpartum, incidence, and prevalence. The literature search was restricted to samples of adult postpartum women, studies written in the English language, and studies published from 2005 to 2014. Studies focusing on postpartum mothers with an established diagnosis of depression and adolescents were excluded. Once the papers were obtained, information on the number of participants, tool used, cut-off score, time of assessment, proportion of postpartum depression, and mean (standard deviation) of postpartum depression score were documented.

## 3. Results

The literature search on the prevalence of postpartum depression identifies 202 individual studies published in the English

**Table 1**  
Details of systematic reviews that determined the magnitude of postpartum depression.

Author (year)	Objectives	Search duration	Number of primary studies (year)	Study selection	Prevalence of postpartum depression
Gavin et al. (2005)	To review the prevalence and incidence of perinatal depression.	January 1980–March 2004	28 studies of which 16 reported the prevalence estimates (1982–2003)	Only studies conducted in developed countries were included.	Combined point prevalence estimates at 2, 3 and 6 months postpartum: 5.7%, 4.7% and 5.6%. Combined period prevalence estimate during first 3 months postpartum: 7.1%. Incidence estimate during the first 3 months after delivery: 6.5%.
Halbreich and Karkun (2006)	To review the prevalence of postpartum depression as measured by questionnaires.	1980–2005	143 studies reported in 40 countries (1982–2005)	Studies of women for the first 12 months postpartum followed up at postnatal clinics and general populations were included.	Ranging between 0.5% and 60.8%. Asian countries: 11.0–60.8% Guyana, Costa Rica, Italy, Chile, South Africa, Korea and Taiwan: 34–57.0%. Ranging between 3.5% and 63.3%
Klainin and Arthur (2009)	To explore risk factors for postpartum depression among women in Asian cultures.	1998–2008	64 studies reported in 17 countries		
Wong and Fisher (2009)	To review the relationship between confinement practices and postpartum depression in Chinese cultures.	1950–June 2007	10 studies, 4 reported the prevalence (2001–2006)	Only studies conducted in Chinese population included.	Ranging between 6.8% and 30.2%
Vigod et al. (2010)	To review the prevalence and risk factors for postpartum depression among women with preterm infants.	Start date of each database used – August 2008	26 studies (1994–2005)	Studies reporting prevalence of postpartum depression or mean depressive symptoms score in mothers of preterm infants were included.	Prevalence in mothers of preterm infants vs. term infants At 8 weeks postpartum: 15.4% vs. 9.4% At 32 weeks postpartum: 10.7% vs. 8.4%
Roomruangwong and Epperson (2011)	To review the prevalence of perinatal depression among Asian countries.	1968–2009	86 studies (1993–2008)	Only studies with samples in general obstetric and prenatal units and population surveys were included.	Ranging between 1% and 73.7%
Villegas et al. (2011)	To review the prevalence of postpartum depression in rural communities in developed and developing countries.	Start date of each database used – early May 2010	17 studies (1994–2010)	Studies with standardized assessment of depression in rural communities within the first year postpartum were included.	Combined prevalence: 27.0%. Combined prevalence in 7 developed countries: 21.5% (ranging between 13.1% and 57.8%). Combined prevalence in 10 developing countries: 31.3% (ranging between 19.8% and 94.0%).



**Fig. 1.** Flow diagram of search.

language from 2005 to 2014 (Fig. 1). Studies undertaken within the 10-year period are included because they are more likely to reflect the current state of knowledge on postpartum depression. Tables 2 and 3 show 191 individual studies using self-reported questionnaire in 42 countries of which 137 studies are from 24 developed countries and 54 studies (three populations were cited by two different studies) are from 19 developing countries. The majority of the studies were conducted prospectively ( $n=92$ ; 48.2%), followed by cross-sectionally ( $n=71$ ; 37.2%), with a sample size ranging from 10 to 21,560. The time frame reported for measuring postpartum depression varied from zero month to

one year. Majority of studies (154, 80.6%) used the time frame of four weeks onwards.

Table 4 shows 21 studies that used structured clinical interview from 15 countries, of which 16 studies are from 11 developed countries and 5 studies are from 4 developing countries. Most studies were conducted prospectively ( $n=14$ ; 66.7%), followed by cross-sectionally ( $n=6$ ; 28.6%), with a sample sizes ranging from 70 to 511,422. Nine studies used a combination of self-reported instruments and clinical interviews. Studies ( $n=22$ ) involving subgroups of populations with special characteristics that are likely to differ from general populations (Gavin et al., 2005; O'Hara, 2009) are not included in the analysis and reported separately in this review.

### 3.1. Magnitude of postpartum depression

In the current review, the prevalence of postpartum depression by self-reported questionnaire in developed countries varies from 1.9% to 82.1%, with the lowest reported in Germany and the highest in the United States (Table 2). In developing countries,

**Table 2**  
Magnitude of postpartum depression in developed countries by self-report questionnaire.

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
<b>Australia</b>						
Willinck and Cotton (2004)	358	EPDS	≥ 13	6–8 weeks	7.0	
Boyce and Hickey (2005)	425	EPDS	≥ 12	6 weeks	8.9	
				12 weeks	8.9	
				18 weeks	10.1	
				24 weeks	8.6	
Miller et al. (2006)	325	EPDS	≥ 9	6 weeks -6 months	25.0	
Bilszta et al. (2008)	908	EPDS	≥ 13	6–8 weeks	6.6	
	1058				8.5	
Leigh and Milgrom (2008)	161	EPDS	≥ 12.5	10–12 weeks	11.2	
Brooks et al. (2009)	3853	EPDS	≥ 13	First year	6.0	
Clark et al. (2009)	116	BDI	mild =4–7 mod=8–15 severe ≥ 16	6 weeks	mild =23.8 mod=8.9 severe=2	3.29 (2.88)
				6 months	mild =23 mod =11.5 severe=0.9	3.23 (3.21)
				12 months	mild =23.3 mod =10.3 severe=0	2.8 (2.75)
Yelland et al. (2010)	4366	DASS-21	≥ 10	6 months	17.4	
Eastwood et al. (2012)	15,389	EPDS	≥ 10 ≥ 13	2-3 weeks	16.9 7.7	5.48
<b>Austria</b>						
Klier et al. (2008)	105	EPDS	≥ 11	6 months	13.5	
				18 months	17.3	
<b>Canada</b>						
Dennis and Ross (2006)	425	EPDS	≥ 10	8 weeks	14.1	
Da Costa et al. (2006)	78	EPDS	≥ 12	4–38 weeks	63.0	13.82 (3.88)
Dennis and Letourneau (2007)	498	EPDS	≥ 13	8 weeks	8.0	5.5 (4.5)
Dennis et al. (2009)	315	EPDS	≥ 13	12 weeks	7.0	8.89 (5.24)
Dritsa et al. (2009)	88	EPDS	≥ 10	4–38 weeks	–	13.86 (3.88) 13.57 (3.90)
Lanes et al. (2011)	6421	EPDS	≥ 13	5–14 months	8.7	
Sword et al. (2011)	2560	EPDS	≥ 12	6 weeks	7.6	
Bowen et al. (2012)	649	EPDS	≥ 12	4 weeks	8.1	
Malta et al. (2012)	972	EPDS	≥ 10	4 months	10.0	
McDonald et al. (2012)	1578	EPDS	≥ 10	4 months	13.0	
Dennis and Vigod (2013)	497	EPDS	≥ 10	8 weeks	20.7	
Vigod et al. (2013)	6126	EPDS	≥ 13	N/A	7.47	5.27
<b>Chile</b>						
Quelopana et al. (2011)	163	PDSS	≥ 60	2 weeks	25.0	
<b>Denmark</b>						
Ajslev et al. (2010)	21,121	SCL-90	N/A	6 months		0.59
<b>France</b>						
de Tyche et al. (2008)	181	EPDS	≥ 12 8–11	4–8 weeks	9.4 22.1	
Gaillard et al. (2014)	264	EPDS	≥ 12	6–8 weeks	16.7	
<b>Germany</b>						
Ballestrem et al. (2005)	772	EPDS	≥ 9.5	6–8 weeks	17.0	
	132			9–12 weeks	3.6	
Moehler et al. (2006)	101	EPDS	≥ 9	2 weeks	–	
				6 weeks	–	
				4 months	–	
				14 months	–	
Reck et al. (2008)	1024	EPDS & PHQ-9	≥ 10	3 months	4.6	
Goecke et al. (2012)	157	EPDS	≥ 9	3 weeks	25.5	6.12 (3.61)
				6 months	10.1	4.95 (2.96)
				18 months	12.2	4.37 (3.61)
	159					
	132		≥ 12	3 weeks	7.6	
				6 months	1.9	
	159			18 months	5.6	
	132					
<b>Greece</b>						
Chatzi et al. (2011)	529	EPDS	≥ 13	8–10 weeks	14.0	
Koutra et al. (2014)	438	EPDS	≥ 13	8 weeks	13.0	6.48(4.90)
<b>Hong Kong</b>						
Leung et al. (2005)	269	EPDS	≥ 13	6 weeks	19.8	
Lau and Chan (2007)	1200	EPDS	≥ 9	2–5 days	34.4	
Lee et al. (2007)	244	EPDS	≥ 10	6 weeks	24.2	
Tiwari et al. (2008)	3036	EPDS	≥ 10	1 week	69.9	
<b>Ireland</b>						
Leahy-Warren et al. (2012)	410	EPDS	≥ 11	6 weeks	13.2	7.2 ( 4.4)

Table 2 (continued)

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
<b>Israel</b>						
Bloch et al. (2005)	210	EPDS	≥ 10	2–4 days	33.0	6.9 (5.6)
Eilat-Tsanani et al. (2006)	574	EPDS	≥ 13	2 months	9.9	
<b>Italy</b>						
Oppo et al. (2009)	600	EPDS	≥ 13	1–6 months	6.7	
Barbadoro et al. (2012)	5812	Self-reported			2.8	
<b>Japan</b>						
Miyake et al. (2006)	865	EPDS	≥ 9	2–9 months	14.0	
Sekizuka et al. (2006)	54	PDS	≥ 40	3–5 days	9.3	
Ueda et al. (2006)	70	EPDS	≥ 9	First year	27.0	
Murakami et al. (2008)	865	EPDS	≥ 9	2–9 months	14.0	
Sato et al. (2008)	1348	HADS	≥ 8	3–4 months	19.0	
				9–10 months	24.0	
Choi et al. (2010)	413	ZSDS	≥ 50	3–12 months	14.5	41.05 (7.98)
Ohoka et al. (2014)	388	EPDS	≥ 9	1 month	10.3	
<b>Korea</b>						
Kim et al. (2008)	239	EPDS	≥ 9.5	6 weeks	12.6	
Bang (2011)	137	EPDS	-	1 month	22.6	
<b>Netherlands</b>						
Verkerk et al. (2005)	277	EPDS	≥ 12	3 months	10.8	
				6 months	8.7	
				12 months	7.2	
				2 months	8.0	
Blom et al. (2010)	4941	EPDS	≥ 12			
<b>Norway</b>						
Dorheim et al. (2009)	2791	EPDS	≥ 10	7 weeks	16.5	5.3 (4.5)
Glavin et al. (2009)	310	EPDS	≥ 9	6 weeks	14.0	4.73 (3.6)
			≥ 10		10.1	
			≥ 11		7.5	
			≥ 12		5.8	
Glavin et al. (2010)	2247	EPDS	≥ 10	6 weeks	14.5	
				3 months	10.4	
				6 months	8.8	
				12 months	5.9	
Haga et al. (2012)	737	EPDS	≥ 10	6 weeks	15.1	5.82 (4.02)
				3 months	11.6	4.77 (4.20)
				6 months	14.2	4.74 (4.32)
Kozinszky et al. (2011)	1619	LQ	≥ 12	6–10 weeks	17.4	
Ravn et al. (2012)	44	CES-D	≥ 16	1 months	27.3	10.9 (6.7)
				6 months	4.8	
				12 months	15.8	
	43					
	41					
Markhus et al. (2013)	43	EPDS	≥ 10	3 months	6.9	3.5 (3.2)
<b>Portugal</b>						
Maia et al. (2012)	386	BDI-II		3 months		4.99 (5.142)
Figueiredo and Costa (2009)	91	EPDS	≥ 10	3 months	26.7	
Figueiredo and Conde (2011)	260	EPDS	≥ 10	0 month	17.6	
				3 months	11.1	
Figueiredo et al. (2013)	145	EPDS	≥ 10	0 month		5.69 (4.78)
				3 months		4.78 (4.21)
<b>Singapore</b>						
Chee et al. (2005)	278	EPDS	≥ 7	6 weeks	6.8	
<b>Spain</b>						
Escriba-Aguir and Artazcoz (2011)	769	EPDS	≥ 11	3 months	9.3	
				12 months	4.4	
<b>Sweden</b>						
Rubertsson et al. (2005)	2430	EPDS	≥ 12	2 months	11.1	6.0
				12 months	13.7	6.5
Syven et al. (2013)	1838	EPDS	≥ 12	5 days	11.1	
				6 weeks	11.1	
				6 months	9.5	
Agnafors et al. (2013)	1812					
	1554					
	1707	EPDS	≥ 10	3 months	12.0	
	893				10.4	
<b>Taiwan</b>						
Chien et al. (2006)	202	CES-D	≥ 15	4–6 weeks	30.2	
Wang and Chen (2006)	83	BDI-II	≥ 10	6 weeks	39.8	
Chen et al. (2007)	122	EPDS	≥ 12	First 2 years	42.6	10.99 (5.37)
				29.5% – 1m		
				15.6% – 3m		
				27% – 6m		
				18% – 12m		
				5.7% – 18m		

Table 2 (continued)

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
Heh et al. (2008)	400	EPDS	≥ 10	4.1% – 24m 4 weeks	23.0	16.5 (2.6) 16.3 (3.2)
Huang and Mathers (2006)	101	EPDS	≥ 13	6 months	19.0	
Hung (2007)	526	ZSDS	N/A	1 week 3 weeks 5 weeks		47.16 (9.43) 49.40 (10.10) 48.97 (10.49)
Huang and Mathers (2008)	106	EPDS	≥ 13	6 months	25.5	
Lee et al. (2011)	60		Mild: 14–19 Mod: 20–28 Sev: 29–63	5–8 weeks	16.7 6.7 1.7	
Chen et al. (2012)	226	EPDS	≥ 10	1 month	24.1	6.67
	203			6 months	12.3	4.02
Chien et al. (2012)	190	EPDS	≥ 10	First year	8.4	3.09 (4.26)
	190				41.1	8.45 (5.27)
	190		≥ 13		5.8	
	190				24.2	
(Cheng et al. (2013)	238	CES-D	≥ 16	First year	35.3	14.78 (10.65)
<b>United Arab Emirates</b>						
Green et al. (2006)	86	EPDS	≥ 13	3 months	22.0	
	56			6 months	12.5	
Hamdan and Tamim (2011)	137	EPDS	≥ 10	2 months	16.8	5.9 (4.9)
Bener et al. (2012)	1659	DASS-21	≥ 10	0–6 months	18.6	
<b>United Kingdom</b>						
Ramchandani et al. (2005)	11,833	EPDS	≥ 12	8 weeks	10.0	
Huang and Mathers (2006)	50	EPDS	≥ 13	3 months	18.0	
Morrell et al. (2009)	914	EPDS	≥ 12	6 weeks	16.3	6.8 (5.0)
	1745				17.7	6.6 (4.8)
	914			6 months	16.4	6.4 (5.2)
O'Higgins et al. (2013)	2048	EPDS	≥ 13	1 month	13.9	
Iles et al. (2014)	212	EPDS		6 weeks 3 months		7.14 (4.87) 5.30 (4.74)
<b>United States</b>						
Baker et al. (2005)	151	PDSS	N/A	6 weeks	23.2	
Birkeland et al. (2005)	149	EPDS	≥ 13	2–12 months	29.0	
Pridham et al. (2005)	18	CES-D	≥ 16	1 month	42.0	16.5 (10.28)
				4 months	26.0	13.12 (8.57)
				8 months	21.0	13.14 (7.63)
				12 months	26.0	11.50 (5.20)
Boyd et al. (2006)	72	BDI-II	≥ 14	3 months	33.3	
Goyal et al. (2006)	58	PDSS	> 80	2 weeks-2 months	24.0	65.7 (24.88)
Mosack and Shore (2006)	98	EPDS	≥ 12	6 months	14.3	
Paulson et al. (2006)	5089	CES-D	≥ 15	9 months	14.0	4.58 (4.96)
Rich-Edwards et al. (2006)	1278	EPDS	> 12	6 months	8.0	
Rychnovsky and Beck (2006)	109	PDSS	≥ 80	0 week 2 weeks 6 weeks	9.2 13.8 11.0	
Dietz et al. (2007)	4398	N/A	N/A	N/A	10.4	
Segre et al. (2007)	4332	IDD		4.6 months	12.0	
Baker and Oswald (2008)	154	PDSS	≥ 60	6 weeks	22.5	31.13 (36.4)
Eisenach et al. (2008)	1228	EPDS	≥ 13	8 weeks	11.2	
Herring et al. (2008)	850	EPDS	≥ 13	6 months	4.0	4.8 (4.5)
McGrath et al. (2008)	114	EPDS	≥ 12	2 months 6 months	15.0 11.0	
Dagher et al. (2009)	638	EPDS	≥ 13	11 weeks	4.7	4.19 (3.95)
Doering Runquist et al. (2009)	43	EPDS	≥ 13	1 month 3 months 6 months	35.0 23.0 15.0	9.4 (6.06) 7.6 (5.99) 5.8 (5.38)
Gjerdingen et al. (2009)	436	PHQ-2	N/A	0–1 month	3.4	
	438	PHQ-9			3.4	
Horowitz et al. (2009)	5169	EPDS	≥ 10	4 weeks	13.0	
Howell et al. (2009)	563	PHQ-2	N/A	2 weeks 6 months	24.0 10.0	
Hunker et al. (2009)	123	EPDS	≥ 9	2 weeks	21%	
Price and Proctor (2009)	37	PHQ-9			24.3	
Le et al. (2009)	142	PDSS	≥ 80	First year	23.0	
	150				12.0	
Goyal et al. (2010)	198	CES-D	≥ 16	3 months	39.9	
Murphy et al. (2010)	97	EPDS	≥ 9	4–6 weeks	12.0	
Silverman and Loudon (2010)	439	EPDS	≥ 9 ≥ 12	6 weeks	21.4 12.3	5.4 (5.9)



Table 2 (continued)

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
Gjerdingen et al. (2011)	506	PHQ-9	≥ 10	0–1 month	12.5	
	464			2 months	7.1	
	459			4 months	7.0	
	455			6 months	5.0	
	472			9 months	10.2	
Mott et al. (2011)	147	EPDS	≥ 13	First year	7.5	6.5 (4.9)
	147				8.8	5.4 (4.5)
Watkins et al. (2011)	2586	EPDS	≥ 13	2 months	8.6	
Dagher and Shenassa (2012)	526	EPDS	N/A	8 weeks	6.5	
Kim et al. (2012)	324	EPDS	≥ 10	7 days	17.0	
				≥ 12		11.1
Lucero et al. (2012)	96	PDSS	≥ 60	Overall	54.2	69
	48			2–12 weeks	52.1	
	23			13–24 weeks	60.9	
	10			25–36 weeks	50	
	15			37–48 weeks	46.7	
Gress-Smith et al. (2012)	132	CES-D	≥ 16	5 months	33.0	
				9 months	38.0	
Howell et al. (2012)	250	EPDS	≥ 13	2 days	8.0	
	251				10.0	
Abbasi et al. (2013)	2972	EPDS	≥ 12	1 month	5.1	
Cheng et al. (2013)	151	CES-D	≥ 16	First year	24.5	11.07 (9.08)
Demissie et al. (2013)	652	EPDS	≥ 13	3 months	7.0	
Easterbrooks et al. (2013)	707	CES-D	≥ 16	1 year	38.0	
Hahn-Holbrook et al. (2013)	200	EPDS	≥ 10	3 months	20.0	
Horowitz et al. (2013)	66	EPDS		6 weeks		12.15 (4.7)
	68				12.53 (4.8)	
	66			PDSS	93.26 (22.1)	
	68				93.62 (24.1)	
Manian et al. (2013)	953	BDI-II	Low: 1–7 Mid: 8–12 High: > 12	4–16 weeks	42.7	10.87 (8.37)
					25.9	
					31.4	
Mercier et al. (2013)	688	EPDS	≥ 13	3 months	7.3	
	550			12 months	6.0	
Park et al. (2013)	25	EPDS	≥ 13	2–14 weeks	12.0	
				2 weeks		6.4 (3.2)
				6 weeks		4.6 (3.5)
				10 weeks		3.5 (3.0)
				14 weeks		3.6 (2.7)
Paul et al. (2013)	1049	EPDS	≥ 12	2 weeks	5.5	4.9 (3.7)
	985			2 months	2.6	
	936			6 months	2.9	
				4–6 weeks	50.0	14.58 (6.37)
Drake et al. (2014)	18	EPDS	≥ 13	2–3 months	5.6	8.0 (4.76)
Gaffney et al. (2014)	1447	EPDS	≥ 10	2 months	24.1	
Gjerdingen et al. (2014)	700	PHQ-2	≥ 3	0–18 months	82.1	
Howell et al. (2014)	270	EPDS	≥ 10	2 days	14.0	5.0 (4.0)
	270				11.0	4.0 (4.0)
	251			3 weeks	5.6	
	249				6.0	
	232			3 months	6.5	
	238			6 months	4.6	
				1 month	28.8	8.9 (6.1)
Kuo et al. (2014)	101	EPDS	≥ 13	6 months	20.8	7.6 (5.4)

EPDS=Edinburgh Postnatal Depression Scale, BDI=Beck Depression Inventory, DASS-21=Depression Anxiety Stress Scales-21, PDS=Postpartum Depression Scale, PDSS=Postpartum Depression Screening Scale, SCL-90=Symptom Distress Checklist, PHQ-9=9-item Patient Health Questionnaire (Primary Care Evaluation of Mental Disorders, PRIME-MD), PHQ-2=2-item Patient Health Questionnaire (Primary Care Evaluation of Mental Disorders, PRIME-MD), HADS=Hospital Anxiety and Depression Scale, ZSDS=Zung Self-rating Depression Scale, LQ=Leverton questionnaire, CES-D=Center for Epidemiologic Studies-Depression Scale, IDD=Inventory to Diagnose Depression, N/A=Information not available.

the prevalence varies from 5.2% to 74.0%, with the lowest prevalence reported in Pakistan and the highest in Turkey (Table 3).

Table 5 shows the summary of postpartum depression prevalence based on the Edinburgh Postnatal Depression Scale (EPDS) in developed and developing countries. In developed countries, the prevalence of postpartum depression based on EPDS ranges from 5.5% to 34.4% in less than four weeks, 2.6–35.0% in four to

eight weeks, 2.9–25.5% in six months, and 6.0–29.0% in 12 months. The use of other assessment tools reveals a similar range except for the Center of Epidemiologic Study-Depression (CES-D), which shows a prevalence of 42.0% in less than four weeks and 50.0% in four to eight weeks. However, these figures are limited because of the small sample size. CES-D is also reported to have a much higher prevalence at 38.0% in the first year postpartum.

**Table 3**  
Magnitude of postpartum depression in developing countries by self-report questionnaire.

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
<b>Bangladesh</b>						
Black et al. (2007)	221	CES-D	> 16	12 months	52.0	
Gausia et al. (2009)	346	EPDS	≥ 10	6–8 weeks	22.0	
Edhborg et al. (2011)	674	EPDS	≥ 10	2–3 months	10.7	5.7 (3.2)
<b>Brazil</b>						
Moraes et al. (2006)	410	HRSD	≥ 18	30–45 days	19.1	10.6 (8.4)
Pinheiro et al. (2006)	386	BDI	≥ 10	6–12 weeks	26.3	
Cantilino et al. (2007)	120	PDSS	102	2–25 weeks	12.5	
Lobato et al. (2011)	811	EPDS	≥ 12	0–5 months	24.3	
Bottino et al. (2012)						
Faisal-Cury et al. (2012)	701	SRQ-20	≥ 8	12 months	27.9	
Zubaran and Foresti (2013)	89	PDSS		2–12 weeks		70.96 (25.38)
		EPDS				8.21 (5.50)
<b>Burkina Faso</b>						
Filippi et al. (2007)	1014	K10 scale	≥ 14	3 months	9.6	
				6 months	6.6	
				12 months	6.7	
<b>China</b>						
Xie et al. (2007)	300	EPDS	≥ 13	6 weeks	17.3	
Gao et al. (2009)	130	EPDS	≥ 13	6–8 weeks	13.8	8.44 (3.88)
Gao et al. (2010)	126	EPDS	≥ 13	6–8 weeks	14.3	
Xie et al. (2011)	534	EPDS	≥ 13	2 weeks	19.3	
<b>Georgia</b>						
Stowe et al. (2005)	209	EPDS		0–6 weeks		19.0 (4.7)
				> 6 weeks		17.9 (4.9)
<b>Hungary</b>						
Csatornai et al. (2007)	1656	LQ	≥ 10	0–6 weeks	15.0	
<b>India</b>						
Nagpal et al. (2008)	172	EPDS	≥ 10	> 28 weeks	59.4	
			≥ 13		36.6	
Savarimuthu et al. (2010)	137	EPDS		2–10 weeks		5.98 (6.71)
<b>Indonesia</b>						
Andajani-Sutjahjo et al. (2007)	274	EPDS	≥ 12	6 weeks	6.6	5.0 (4.5)
	97			6 months	8.2	5.8 (4.9)
<b>Iran</b>						
Iranfar et al. (2005)	129	BDI	> 10	10 days	32.5	
Montazeri et al. (2007)	100	EPDS	≥ 13	6–8 weeks	22.0	
				12–14 weeks	18.0	
Kheirabadi et al. (2009)	6627	BDI-II	Mild: 10–16 Mod: 17–29 Sev: 30–63	2–12 months	Mild: 20.0 Mod: 18.3 Sev: 18.9	
Kheirabadi and Maracy (2010)	1291	EPDS	> 13	6–8 weeks	26.3	
Goshtasebi et al. (2013)	281	EPDS	≥ 13	4–6 weeks	5.5	
<b>Iraq</b>						
Ahmed et al. (2012)	1000	EPDS	N/A	6–8 weeks	28.4	
<b>Jamaica</b>						
Wissart et al. (2005)	73	ZSDS	≥ 50	6 weeks	34.3	
<b>Malaysia</b>						
Azidah et al. (2005)	377	EPDS	≥ 12	1 week	22.8	
Azidah et al. (2006)				4–6 weeks	20.7	
<b>Morocco</b>						
Agoub et al. (2005)	144	EPDS	≥ 12	2–3 weeks	20.1	7.05 (5.5)
Alami et al. (2006)	100	EPDS	≥ 12	0–36 weeks	21.0	6.08 (4.5)
<b>Nepal</b>						
Ho-Yen et al. (2006)	426	EPDS	≥ 13	5–10 weeks	4.9	
Ho-Yen et al. (2007)		SRQ-20	> 10		3.1	
<b>Nigeria</b>						
Adewuya and Afolabi (2005)	632	ZSDS	N/A	1 week	19.9	
	630			4 weeks	10.3	
	600			8 weeks	15.3	
	547			12 weeks	14.6	
	512			24 weeks	10.1	
	480			36 weeks	8.1	
Abiodun (2006)	360	EPDS	≥ 9	6 weeks	18.6	
Adewuya (2006)	478	EPDS	≥ 13	5 days	20.9	5.88 (5.82)
				4 weeks		3.97 (3.55)
				8 weeks		4.18 (4.02)
<b>Pakistan</b>						
Husain et al. (2006)	149	EPDS	≥ 12	12 weeks	36.0	
Ali et al. (2009)	420	AKUADS	≥ 19	First year	28.8	
				1 month	5.2	
				2 months	5.2	
				6 months	10.1	



Table 3 (continued)

Author (year)	n	Instrument	Cut-off score	Postpartum assessment	Depressed	
					(%)	Mean (SD)
<b>Thailand</b>				12 months	13.1	
Limlomwongse and Liabsuetrakul (2006)	525	EPDS	≥ 10	6–8 weeks	16.8	
<b>Turkey</b>						
Alkar and Gencoz (2005)	151	EPDS	≥ 13	Initial days	50.7	12.96 (5.52)
Aydin et al. (2005)	728	EPDS	≥ 10		74.0	
	174		≥ 13	First year	34.6	11.3 (0.2)
	61			1 month	37.8	10.7 (5.7)
	51			2 months	50.8	12.7 (6.4)
	37			3 months	30.6	10.6 (5.9)
	59			4 months	34.3	11.2 (6.1)
	57			5 months	31.6	9.6 (6.6)
	46			6 months	38.2	11.9 (6.2)
	46			7 months	50.0	13.0 (6.0)
	41			8 months	31.8	10.6 (5.2)
	42			9 months	43.6	11.8 (6.4)
	51			10 months	42.5	11.3 (6.9)
	63			11 months	41.2	11.8 (5.5)
Inandi et al. (2005)	1350	EPDS	≥ 13	12 months	50.8	12.4 (5.7)
Ayvaz et al. (2006)	152	EPDS	≥ 13	First year	31.1	9.8 (5.7)
	132			6–8 weeks	29.6	
Gulseren et al. (2006)	125	EPDS	N/A	6 months	11.4	
				5–8 weeks	16.8	
				10–14 weeks	14.4	
				20–26 weeks	9.6	
Sabuncuoglu and Berkem (2006)	80	EPDS	≥ 11	2–18 months	30.0	
Tezel and Gozum (2006)	567	EPDS	≥ 11	1 week	12.9	
Dindar and Erdogan (2007)	679	EPDS	≥ 12	2 months	30.5	
				8 months	36.2	
				10 months	32.8	
				12 months	31.3	
Orhon et al. (2007)	103	EPDS	≥ 12	1 month	27.2	
Akman et al. (2008)	60	EPDS	≥ 13	1 month	13.6	
Ege et al. (2008)	364	EPDS	≥ 13	First year	33.2	11.1 (4.1)
				6–24 weeks	29.9	10.7
				25–48 weeks	39.2	11.7
Kara et al. (2008)	163	BDI	≥ 17	1–3 months	17.0	
Kirpinar et al. (2010)	479	EPDS	≥ 13	1 week	17.7	
				6 weeks	14.0	
Yagmur and Ulukoca (2010)	785	EPDS	≥ 13	First year	21.0	8.36 (5.6)
				26.6% – 2m		
				16.2% – 4m		
				35.0% – 6m		
				22.2% – 12m		
Goker et al. (2012)	318	EPDS	≥ 13	6 weeks	31.4	9.4 (6.17)
Ozdemir et al. (2014)	912	ZSDS	≥ 60	1 week	18.0	50.1(0.3)
				1 month	9.8	45.8(0.3)
<b>Mexico</b>						
Flores-Quijano et al. (2008)	163	EPDS	≥ 13	2–12 weeks	24.5	

CES-D=Center for Epidemiologic Studies-Depression Scale, EPDS=Edinburgh Postnatal Depression Scale, HRSD=Hamilton Rating Scale for Depression, BDI=Beck Depression Inventory, PDSS=Postpartum Depression Screening Scale, SRQ-20=Self-Reporting Questionnaire, K10=Kessler Psychological Distress Scale, LQ=Leverson Questionnaire, ZSDS=Zung Self-rating Depression Scale, AKUADS=Aga Khan University Anxiety and Depression Scale, N/A=Information not available.

By contrast, the prevalence of postpartum depression based on EPDS in developing countries is higher than that in developed countries, ranging from 12.9% to 50.7% in less than four weeks, 4.9–50.8% in four to eight weeks, 8.2–38.2% in six months and 21.0–33.2% in the first year postpartum. The use of other assessment tools reveals a similar range except for K10 at 6.7%, CES-D at 52.0% and Beck Depression Inventory (BDI) at 57.2% in the first year postpartum.

Most of the studies identify depressive symptoms through self-report depression screening instruments and some clinical interviews. The prevalence of a major depressive episode varies from 0.1% in Finland to 26.3% in India using ICD-10. The prevalence of a minor depressive episode ranges from 2.5% in Singapore to 10.0% in Japan using the Structured Clinical Interview for DSM-IV (SCID-IV) (Table 4).

Aside from expressing the magnitude of postpartum depression in terms of prevalence, some studies express postpartum

depression as a numerical outcome. The mean scores give an approximate level of depressive symptomatology in the overall general population. For the 47 studies in developed countries, the mean (SD) ranges from 3.09 (4.26) to 16.5 (2.6) for EPDS scores, 4.58 (4.96) to 16.5 (10.28) for CES-D scores, 31.13 (36.4) to 93.62 (24.1) for Postpartum Depression Screening Scale (PDSS) scores, 2.8 (2.75) to 4.99 (5.142) for BDI scores and 41.05 (7.98) to 49.40 (10.10) for Zung Self-rating Depression Scale (ZSDS) scores. For the 17 studies in developing countries, the mean (SD) ranges from 3.97 (3.55) to 19.0 (4.7) for EPDS scores, 45.8 (0.3) to 50.1 (0.3) for ZSDS scores, 70.96 (25.38) for PDSS scores and 10.6 (8.4) for Hamilton Rating Scale for Depression (HRSD) scores.

The subgroups of populations documented to experience postpartum depression are immigrants, mothers of ill newborn and neonatal intensive care unit infants, epilepsy patients, military wives, women with low socio-economic status, women with preterm birth, and

**Table 4**  
Magnitude of postpartum depression in developed and developing countries by clinical interview.

Author (year)	n	Instrument	Type of depression	Postpartum assessment	Depressed (%)
<b>Developed Countries</b>					
<b>Australia</b>					
McMahon et al. (2006)	127	CIDI	Major	4 months	62.0
<b>Canada</b>					
Walker et al. (2013)	1452	DSM-IV-TR	Major	First year	8.4
<b>Finland</b>					
Raisanen et al. (2013)	511,422	ICD-10	Major	0–6 weeks	0.1
<b>France</b>					
Gaillard et al. (2014)	264	DIGS	Major	6–8 weeks	16.7
<b>Germany</b>					
Ballestrem et al. (2005)	772	HAMD	Major	9–12 weeks	3.6
<b>Israel</b>					
Bloch et al. (2005)	210	SCID-IV	Major / Minor	6–8 weeks	19.0
<b>Japan</b>					
Kitamura et al. (2006)	280	SCID-III-R	Major	0–3 months	5.0
Ueda et al. (2006)	70	SCID-IV	Major Minor	12 months	17.1 10.0
Ikeda and Kamibeppu (2013)	76	MINI	Major /Minor	1 month	21.0
<b>Portugal</b>					
Maia et al. (2012)	386	DSM-IV ICD-10	Major	3 months	11.7 16.6
Bos et al. (2013)	244 251	DSM-IV ICD-10 DIGS	Major	0–3 months	8.6 17.1
<b>Singapore</b>					
Chee et al. (2005)	278	SCID-IV	Major Minor	6 weeks	4.3 2.5
<b>United Arab Emirates</b>					
Hamdan and Tamim (2011)	137	MINI		2 months	10.2
<b>United States</b>					
Gjerdengen et al. (2009)	506	SCID	Major	0–1 month	8.9
Giannandrea et al. (2013)	192	SCID-IV	Major Major /Minor	First year	37.0 56.0
Manian et al. (2013)	505	SCID-IV	Major Minor	3–5 months	14.9 6.3
<b>Developing Countries</b>					
<b>India</b>					
Savarimuthu et al. (2010)	137	ICD-10	Major	2–10 weeks	26.3
<b>Morocco</b>					
Agoub et al. (2005)	144	MINI		2–3 weeks 6 weeks 6 months 9 months	18.7 6.9 11.8 4.6
Alami et al. (2006)	100	MINI		2–3 weeks 12 weeks 24 weeks 36 weeks	16.8 14.0 12.0 6.0
<b>Thailand</b>					
Liabsuetrakul et al. (2007)	400	SCID-IV	Major Minor	6–8 weeks	1.0 9.0
<b>Uganda</b>					
Nakku et al. (2006)	544	MINI	Major	6 weeks	6.1

CIDI=Composite International Diagnostic Interview, DSM-IV-TR=Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision, HAMD=Hamilton interview (based on DSM-IV), SCID =Structured Clinical Interview for DSM-IV or DSM-III-R, MINI=Mini International Neuropsychiatric Interview, DIGS=Diagnostic Interview for Genetic Studies (based on DSM-IV), ICD=International Classification of Diseases

women who experienced a natural disaster. Immigrants have high postpartum depression prevalence of 0.5–65.0% in Western and non-Western countries (Pearlstein et al., 2009; Le et al., 2010; Chien et al., 2012; Hung et al., 2012; Lucero et al., 2012). Postpartum depression was reported to be 7–70% in mothers of ill newborn (de Alencar et al., 2009; Lefkowitz et al., 2010; Gold et al., 2013; Guo et al., 2013), 13% in mothers of preterm infants (Korja et al., 2008) and 23.5% in mothers of infantile colic infants (Akman et al., 2006). Among military women, 13% and 11% of mothers have positive screening for postpartum depression at two weeks and six weeks, respectively (Rychnovsky and Beck, 2006). About half of military wives (Schachman and Lindsey, 2013), one-fourth of epilepsy patients (Galanti et al., 2009) and 9.0% of

women with intimate partner violence (Beydoun et al., 2012) have postpartum depression.

Low-income women are particularly at high risk of postpartum depression. A striking prevalence of postpartum depression of 33% to almost 40% was observed among low-income mothers between three months and nine months after delivery (Gress-Smith et al., 2012; Ortiz Collado et al., 2014). However, the prevalence is low at 17.0% at seven days postpartum (Kim et al., 2012). Disaster is usually a cause of psychopathology. However, studies do not report a higher proportion (13–29%) of postpartum depression than that for the general population following a natural disaster (Harville et al., 2009; Qu et al., 2012; Demirchyan et al., 2014).

**Table 5**  
Summary of postpartum depression.

Countries	< 4 weeks (%)	4–8 weeks (%)	6 months (%)	First year (%)
<b>Developed Countries</b>				
EPDS ( <i>n</i> =98)	5.5–34.4	2.6–35.0	0.9–25.5	6.0–29.0
CES-D ( <i>n</i> =6)	42.0	30.2–50.0		26.0–38.0
PDSS ( <i>n</i> =6)	23.0–25.0	11.0–23.2		
PHQ-9 ( <i>n</i> =6)	3.4–12.5	7.1	5.0	
BDI ( <i>n</i> =5)		34.7–39.8	35.4	33.6
PHQ-2 ( <i>n</i> =3)	3.4–24.0		10.0	
DASS-21 ( <i>n</i> =2)			17.4–18.6	
ZSDS ( <i>n</i> =1)	s			14.5
PDS ( <i>n</i> =1)	9.3			
<b>Developing Countries</b>				
EPDS ( <i>n</i> =39)	12.9–50.7	4.9–50.8	8.2–38.2	21.0–33.2
BDI ( <i>n</i> =4)	32.5	17.0–26.3		57.2
ZSDS ( <i>n</i> =3)	18.0	9.8–34.3		
SRQ-20 ( <i>n</i> =2)		3.1		27.9
CES-D ( <i>n</i> =1)				52.0
HRSD ( <i>n</i> =1)		19.1		
K10 ( <i>n</i> =1)			6.6	6.7
AKUADS ( <i>n</i> =1)		5.2	10.1	28.8
LQ ( <i>n</i> =1)		15.0		

AKUADS=Aga Khan University Anxiety and Depression Scale, BDI=Beck Depression Inventory, CES-D=Center for Epidemiologic Studies-Depression Scale, DASS-21=Depression Anxiety Stress Scales-21, EPDS=Edinburgh Postnatal Depression Scale, HRSD=Hamilton Rating Scale for Depression, K10=Kessler Psychological Distress Scale, LQ=Leverson Questionnaire, PDS=Postpartum Depression Scale, PDSS=Postpartum Depression Screening Scale, PHQ-2=2-item Patient Health Questionnaire (Primary Care Evaluation of Mental Disorders, PRIME-MD), PHQ-9=9-item Patient Health Questionnaire (Primary Care Evaluation of Mental Disorders, PRIME-MD), SRQ-20=Self-Reporting Questionnaire, ZSDS=Zung Self-rating Depression Scale.

### 3.2. Measurement of postpartum depression

Various self-reported instruments are used to determine postpartum depression worldwide (Tables 2 and 3). In this review, EPDS is the most frequently used (*n*=136; 71.6%), followed by BDI (*n*=9; 4.1%), PDSS (*n*=8; 3.6%), and CES-D. A variety of cut-off scores for the EPDS (9–13), BDI-II (10–17), PDSS (60–102), and CES-D (15–16) were observed. Several clinical interviews are used to diagnose postpartum depression. In this review, Structured Clinical Interview for Diagnostic (SCID) and Statistical Manual of Mental Disorders are the most commonly used (*n*=7; 35.0%), followed by the Mini International Neuropsychiatric Interview (MINI) (*n*=5; 25.0%). Eight studies use a combination of self-reported instruments and clinical interviews.

### 3.3. Risk factors of postpartum depression

The etiology of postpartum depression remains unclear (Patel et al., 2012) but several risk factors have been identified. In this review, the risk factors are categorized into physical and biological, psychological, obstetric and pediatric, socio-demographic, and cultural groups as outlined by Klainin and Arthur (2009).

#### 3.3.1. Physical and biological factors

Several physical and biological factors are related to postpartum depression in developed countries, such as poor physical health (Eilat-Tsanani et al., 2006; Sword et al., 2011; Eastwood et al., 2012; Cheng et al., 2013; Gaillard et al., 2014), negative body image (Green et al., 2006) and body weight (Green et al., 2006). Similarly, poor physical health (Nakku et al., 2006; Andajani-Sutjahjo et al., 2007; Barbadoro et al., 2012) was reported in developing countries. Body mass index of less than 20 kg/m<sup>2</sup> was shown to increase the risk of postpartum depression among

Nepalese women (Ho-Yen et al., 2007). History of medical conditions (Aydin et al., 2005) and premenstrual symptoms (Aydin et al., 2005; Limlomwongse and Liabsuetrakul, 2006; Kara et al., 2008) were also reported.

#### 3.3.2. Psychological factors

Antenatal depression and anxiety, previous psychiatric illness, poor marital relationship, and stressful life events are important predisposing factors of postpartum depression in both developed and developing countries. Significant risk factors in developed countries are antenatal depression (Leung et al., 2005; Kitamura et al., 2006; Rich-Edwards et al., 2006; Lee et al., 2007; Bilszta et al., 2008; Leigh and Milgrom, 2008; Davey et al., 2011; Escriba-Aguir and Artazcoz, 2011; Hamdan and Tamim, 2011; Lanes et al., 2011; Gaillard et al., 2014), antenatal anxiety (Lee et al., 2007; McGrath et al., 2008), previous psychiatric illness (Bloch et al., 2005; Chee et al., 2005; Eilat-Tsanani et al., 2006; Mosack and Shore, 2006; Rich-Edwards et al., 2006; Baker and Oswald, 2008; Bilszta et al., 2008; Leigh and Milgrom, 2008; Davey et al., 2011; Abbasi et al., 2013; Raisanen et al., 2013), poor marital relationship (Escriba-Aguir and Artazcoz, 2011), stressful life events (Boyce and Hickey, 2005; Rubertsson et al., 2005; Escriba-Aguir and Artazcoz, 2011), child care stress (Leung et al., 2005) and negative attitude towards pregnancy (Kitamura et al., 2006). The psychological factors for postpartum depression documented only in developed countries are poor mental health (Sword et al., 2011), poor quality of life (de Tychev et al., 2008), history of premenstrual dysphoric disorders (Bloch et al., 2005), intention of returning to work (Kozinszky et al., 2011) and perceived stress (Wang and Chen, 2006). The associations between postpartum depression and sexual, physical and psychological abuse (Tiwari et al., 2008; Silverman and Loudon, 2010) were significantly reported in developed countries.

Similarly, in developing countries, antenatal depression (Azidah et al., 2005; Gulseren et al., 2006; Ho-Yen et al., 2007), antenatal anxiety (Ayvaz et al., 2006; Husain et al., 2006; Liabsuetrakul et al., 2007; Kirpinar et al., 2010), previous psychiatric illness (Aydin et al., 2005; Inandi et al., 2005; Ayvaz et al., 2006; Dindar and Erdogan, 2007; Ho-Yen et al., 2007; Ege et al., 2008; Kara et al., 2008; Gausia et al., 2009; Kheirabadi and Maracy, 2010; Kirpinar et al., 2010; Ahmed et al., 2012; Goker et al., 2012; Demirchyan et al., 2014), poor marital relationship (Agoub et al., 2005; Alkar and Gencoz, 2005; Alami et al., 2006; Gulseren et al., 2006; Dindar and Erdogan, 2007; Kirpinar et al., 2010; Yagmur and Ulukoca, 2010), stressful life events (Agoub et al., 2005; Aydin et al., 2005; Alami et al., 2006; Husain et al., 2006; Nakku et al., 2006; Ho-Yen et al., 2007; Demirchyan et al., 2014), child care stress (Aydin et al., 2005) and negative attitude towards pregnancy (Limlomwongse and Liabsuetrakul, 2006; Ali et al., 2009; Kheirabadi et al., 2009) were reported to be significant risk factors for postpartum depression. However, mixed findings for family history of psychiatric illness (Ayvaz et al., 2006; Ahmed et al., 2012) were found in Iraq and Turkey. On the contrary, no association was found between postpartum depression and physical abuse (Savarimuthu et al., 2010).

#### 3.3.3. Obstetric and pediatric factors

The obstetric and pediatric risk factors for postpartum depression are inconclusive. In developed countries, unplanned pregnancy (Chee et al., 2005; Eilat-Tsanani et al., 2006; Ege et al., 2008; Kozinszky et al., 2011; Goker et al., 2012; Gaillard et al., 2014) and mode of delivery (Green et al., 2006; Eisenach et al., 2008; Kim et al., 2008; Davey et al., 2011; Lee et al., 2011; Goker et al., 2012; Koutra et al., 2014; Raisanen et al., 2013; Gaillard et al., 2014) showed mixed findings. Koutra et al. (2014) showed a statistically significantly high level of mean postpartum depression score among mothers who underwent cesarean section, consistent with Lee et al. (2011).

Cohort studies shows that mode of delivery is not associated with postpartum depression (Kim et al., 2008; Gaillard et al., 2014) and that the severity of acute pain response to childbirth predicts postpartum depression (Eisenach et al., 2008). However, Gaillard et al. (2014) did not report similar finding. Other factors, such as lack or non-initiation of breastfeeding (Chien et al., 2006; Green et al., 2006; Mosack and Shore, 2006; Lau and Chan, 2007; Baker and Oswalt, 2008; Davey et al., 2011; Sword et al., 2011; Watkins et al., 2011; Figueiredo et al., 2013; Hahn-Holbrook et al., 2013), parity (Green et al., 2006; Glavin et al., 2009; Hamdan and Tamim, 2011; Kozinszky et al., 2011; Sword et al., 2011; Raisanen et al., 2013; Gaillard et al., 2014) and sex of baby (Boyce and Hickey, 2005; de Tychev et al., 2008; Kim et al., 2008; Koutra et al., 2014) showed mixed findings. Women whose infants had medical illnesses (Green et al., 2006; Ueda et al., 2006; Kim et al., 2008; Raisanen et al., 2013), are born prematurely (Raisanen et al., 2013) and are temperamentally difficult (McGrath et al., 2008; Eastwood et al., 2012) are likely to experience postpartum depression. Abbasi et al. (2013) and Christensen et al. (2011) did not find any relationship between unintended pregnancy and postpartum depression.

In developing countries, contradictory findings related to obstetric and pediatric factors were reported only for mode of delivery (Alami et al., 2006; Yagmur and Ulukoca, 2010; Ahmed et al., 2012; Barbadoro et al., 2012), parity (Abiodun, 2006; Alami et al., 2006; Ayvaz et al., 2006; Csator dai et al., 2007; Ho-Yen et al., 2007; Xie et al., 2007; Yagmur and Ulukoca, 2010; Goker et al., 2012; Ozdemir et al., 2014) and sex of baby (Ayvaz et al., 2006; Moraes et al., 2006; Nakku et al., 2006; Dindar and Erdogan, 2007; Xie et al., 2007; Ali et al., 2009; Yagmur and Ulukoca, 2010; Xie et al., 2011). The preference to the sex of the baby changes according to culture. For example, a significant increase in postpartum depression in the case of a female baby was found in China but mixed findings were found in Turkey. Women with unplanned pregnancy (Inandi et al., 2005; Nakku et al., 2006; Ege et al., 2008; Yagmur and Ulukoca, 2010), unintended pregnancy (Iranfar et al., 2005; Csator dai et al., 2007), previous history of loss of a baby (Gausia et al., 2009; Yagmur and Ulukoca, 2010), suffering from problems during pregnancy (Agoub et al., 2005; Inandi et al., 2005) or have low hemoglobin level during delivery (Goshtasebi et al., 2013) are likely to experience postpartum depression. Following delivery, women whose infants had medical illnesses (Agoub et al., 2005; Aydin et al., 2005; Abiodun, 2006; Alami et al., 2006; Nakku et al., 2006; Yagmur and Ulukoca, 2010; Demirchyan et al., 2014), who lack of childcare knowledge (Ege et al., 2008) and who lack or fail to initiate breastfeeding (Ali et al., 2009; Zubaran and Foresti, 2013) are at risk of developing postpartum depression.

### 3.3.4. Socio-demographic factors

Research evidence on the relationship between demographic characteristics and postpartum depression is conflicting. In developed countries, younger maternal age (Boyce and Hickey, 2005; Kozinszky et al., 2011; Quelopana et al., 2011; Sword et al., 2011) were reported to be a risk factor for postpartum depression, but Glavin et al. (2009) found the reverse. A large study involving 1897 women found that those aged less than 25 years are five times more likely to have postpartum depression at six weeks post-delivery (Sword et al., 2011). However, many studies found no association between postpartum depression and maternal age (Green et al., 2006). In developing countries, a similar phenomenon was observed. Few studies found younger maternal age as a risk factor (Nakku et al., 2006; Gausia et al., 2009; Bottino et al., 2012), one found the reverse (Kheirabadi et al., 2009) and many found no association (Alami et al., 2006; Moraes et al., 2006; Ali et al., 2009; Kheirabadi and Maracy, 2010; Yagmur and Ulukoca, 2010; Goker et al., 2012; Ozdemir et al., 2014).

Studies suggest that low socio-economic status contributes to the development of postpartum depression (Goyal et al., 2010). Its determinants of low education level (Chien et al., 2006), low income (Segre et al., 2007; Kim et al., 2008; Kozinszky et al., 2011; Eastwood et al., 2012) and unemployment (Rubertsson et al., 2005) are related to postpartum depression. Other studies have reported no such influence in developed countries (Boyce and Hickey, 2005; Green et al., 2006; Kim et al., 2008; Leigh and Milgrom, 2008; Hamdan and Tamim, 2011; Goker et al., 2012; Deng et al., 2014). In developing countries, low socio-economic status is a risk factor for postpartum depression (Inandi et al., 2005; Ahmed et al., 2012; Ozdemir et al., 2014). Low education level (Ege et al., 2008; Kheirabadi et al., 2009; Yagmur and Ulukoca, 2010; Goker et al., 2012; Ozdemir et al., 2014), low income (Inandi et al., 2005; Moraes et al., 2006; Andajani-Sutjahjo et al., 2007; Dindar and Erdogan, 2007) and unemployment (Kheirabadi et al., 2009) are associated with postpartum depression. Other studies reported opposite findings (Alami et al., 2006; Ayvaz et al., 2006; Moraes et al., 2006; Ali et al., 2009; Goker et al., 2012).

Although the risk factors for postpartum depression are considered multifactorial, studies have consistently identified the significant role of social support. Studies in both developed (Boyce and Hickey, 2005; Chee et al., 2005; Green et al., 2006; Hunker et al., 2009; Escriba-Aguir and Artazcoz, 2011; Kozinszky et al., 2011; Lanes et al., 2011; Lee et al., 2011; Quelopana et al., 2011; Sword et al., 2011; Eastwood et al., 2012) and developing (Aydin et al., 2005; Chee et al., 2005; Inandi et al., 2005; Husain et al., 2006; Wang and Chen, 2006; Dindar and Erdogan, 2007; Liabsuetrakul et al., 2007; Ege et al., 2008; Gausia et al., 2009; Yagmur and Ulukoca, 2010) countries show that the lack of social support is an independent predictor of postpartum depression. Other less studied factors significantly related to postpartum depression in developed countries are migration status (Eilat-Tsanani et al., 2006; Gaillard et al., 2014) and domestic violence (McGrath et al., 2008; Dennis and Vigod, 2013). In developing countries, having an unemployed or uneducated husband (Aydin et al., 2005; Ege et al., 2008; Yagmur and Ulukoca, 2010), domestic violence (Husain et al., 2006; Ali et al., 2009; Ahmed et al., 2012), dissatisfaction with living conditions (Xie et al., 2007; Demirchyan et al., 2014) and polygamous marriage (Ho-Yen et al., 2007) are noted as additional risk factors for postpartum depression.

### 3.3.5. Cultural factors

Postpartum confinement period is associated with the less likelihood of experiencing postpartum depression among Taiwanese women (Chien et al., 2006). The traditional practice of confinement, referred to as doing-the-month, confines women to the home for one month after delivery. These women are given assistance in doing household tasks, eat only certain foods and perform rituals, such as avoiding wind and exercise and not washing their hair. On the contrary, confinement experience is a significant risk factor for postnatal depression and is not welcomed by Singaporean women (Chee et al., 2005).

An arranged marriage is one of the social customs embedded in Asian Indian families. It is a marriage between a man and a woman who are introduced by their parents on the basis of caste, education, family background and mutual family suitability. No significant difference was reported on the level of postpartum depressive symptomatology among immigrant Asian Indian in Northern California (Goyal et al., 2006).

## 4. Discussion

The primary goals of this review are to provide an updated description on the magnitude of postpartum depression and the related contributory factors. Based on the literature review, the



prevalence of postpartum depression varies from 1.9% to 82.1% in developed countries and from 5.2% to 74.0% in developing countries using self-reported questionnaire. The prevalence of a major depressive episode as diagnosed by clinical interviews is low, ranging from 0.1% in Finland to 26.3% in India. The prevalence of postpartum depression is determined by using either self-reported questionnaires or structured clinical interviews or both. Self-reported questionnaires are used to screen the clinically significant depressive symptoms and the structured clinical interviews are used to determine the diagnosis of major or minor depressive disorders. The prevalence of a major depressive episode as determined by structured clinical interviews is much lower.

EPDS is the most widely used measure of postpartum depression symptoms (Gaynes et al., 2005) and it does not directly correspond to the DSM-IV-TR criteria. It excludes somatic depressive symptoms (appetite change and fatigue), psychomotor agitation/retardation, and diminished concentration (Cox et al., 1987). It has two atypical symptoms from the postpartum depression literature, namely, anxiety and loss of control (Condon and Corkindale, 1997). A cut-off score of  $\geq 13$  indicates the likelihood of a major depressive disorder (Cox et al., 1987). However, EPDS developers have recommended the culturally sensitive cut-off points of 9–10 to 13–14 for different populations. Therefore, the cut-off scores vary in different cultures. Their sensitivity or specificity were determined by researchers (Halbreich and Karkun, 2006).

BDI-II is based on clinical observations of behaviors associated with depression, and it retains the somatic items in accordance with the DSM-IV-TR criteria related to loss of energy and sleep disturbances (Beck and Gable, 2001). It incorporates one atypical symptom from the postpartum depression literature, namely, irritability. A cut-off score of  $\geq 20$  indicates a major depressive disorder (Gaynes et al., 2005).

CES-D is designed for depression screening in the home among the general population (Radloff, 1977). The items are not based on the DSM-IV-TR criteria of fatigue and self-harm ideas. It incorporates one atypical symptom from the postpartum depression literature, namely, loneliness/isolation. A cut-off score of  $\geq 16$  indicates a major depressive disorder (Gaynes et al., 2005).

PDSS is based on a substantive theoretical approach to postpartum depression derived from qualitative research, in which PPD is conceptualized as a construct distinct from a major depressive disorder (Beck and Gable, 2000). PDSS incorporates the motherhood context into its items. Most of the symptoms are unique to postpartum depression literature, such as anxiety, irritability, loneliness, loss of self, and loss of control. It does not address some of the DSM-IV-TR criteria for major depressive disorder, including psychomotor agitation/retardation or fatigue. A cut-off score of  $\geq 80$  indicates a major depressive disorder (Beck and Gable, 2000).

The instruments used for assessing postpartum depression are initially intended for clinical (BDI-II), general (CES-D), or postpartum (EPDS, PDSS) populations and for measuring symptoms in the past seven days (CES-D, EPDS) or the past two weeks (BDI-II, PDSS). The number of items in self-reported instruments varies from 10 (EPDS) to 20 (CES-D), 21 (BDI-II) and 35 (PDSS). The scoring system for EPDS, BDI-II, and CES-D is presented on a four-point scale and that for PDSS is presented on a five-point scale. The instruments seem to be similar in their approach to screening for postpartum depression except for PDSS, which has 14 to 15 more items than the other instruments. PDSS (0.96), EPDS (0.88), BDI-II (0.85) and CES-D (0.82, 0.92, and 0.79) demonstrate high internal consistency reliability for a major depressive disorder in postpartum women. The criterion validity of EPDS, BDI-II and PDSS is validated using SCID. CES-D is validated using Schedule for Affective Disorders and Schizophrenia, and it has a moderate correlation (0.59–0.70) with the DSM-IV-TR criteria for a major depressive disorder in the postpartum context (King, 2012).

Halbreich and Karkun (2006) reported a postpartum depression prevalence of 0–60% in 143 studies in 40 countries. The findings in the current review reveal a much higher prevalence of postpartum depression in both developed and developing countries. The wide range of postpartum depression prevalence can be attributed to several reasons. First, different instruments are used for assessing postpartum depression. As shown in this review, the use of the two-item Patient Health Questionnaire (PHQ-2) documents a tremendously high prevalence of postpartum depression in developed countries at up to 82.1%. Without using this instrument, the prevalence decreases to 69.9%, which is slightly higher than that reported previously. Moreover, CES-D classifies more postpartum women as being depressed than EPDS, as supported by other studies (Mosack and Shore, 2006; Villegas et al., 2011).

Second, the prevalence of self-reported postpartum depression is higher than that of interview-based studies (Halbreich and Karkun, 2006). Women may overestimate or underestimate their responses to a self-report questionnaire depending on their beliefs, perception, culture and stigma of mental health in their communities (Dankner et al., 2000). Although interviews are more reliable, self-reported measures are easier and less costly and do not require trained interviewers. These characteristics explain their greater popularity, particularly in studies with large samples (Vliegen et al., 2014). Furthermore, women's experience of depressive symptoms from the questionnaire should not be used to diagnose clinical depression in which clinical interviews are more recommended (Affonsoa et al., 2000).

Third, the instruments used in assessing the prevalence of postpartum depression have variable cut-off scores. Differences in cut-off scores yield varying sensitivities and specificities in each observed population and with each cut-off score used (Georgiopoulos et al., 2005). For example, EPDS with a cut-off score of  $\geq 10$  classifies 74.0% of women as depressed and that with a cut-off score of  $\geq 13$  classifies 50.7% (Alkar and Gencoz, 2005) of women as depressed. Instruments not specifically developed for assessing postpartum depression may reflect fatigue, bodily dissatisfaction and loss of libido with high scores, although they are common conditions during the postpartum period. The circumstances are different for EPDS and PDSS, which were specifically developed for use during this period. According to King (2012), EPDS has a relatively higher sensitivity (55–81% vs. 45–60%) and lower specificity (88–99% vs. 91–100%) than BDI and CES-D. Similarly, PDSS has a relatively higher sensitivity (71–94%) and lower specificity (72–78%) in detecting major depression than other measures.

Fourth, many studies do not show sufficient evidence of psychometric properties of the translated instruments conducted in their sample, leading to dubious results. Fifth, prevalence also depends on how the postpartum period is defined. The prevalence of postpartum depression in developed countries until eight weeks postpartum is 35% and it decreases by one-third to 25% in six months. The prevalence is double in developing countries until eight weeks postpartum. Similarly, it decreases by one-third to 38% in six months. The influence on the timing of the assessment was reported in another review (Vigod et al., 2010).

Most studies have reported the prevalence of postpartum depression, but only a few have done so on the postpartum depression score (Birkeland et al., 2005; Adewuya, 2006; Da Costa et al., 2006; Chen et al., 2007; Baker and Oswalt, 2008; Dritsa et al., 2009; Yagmur and Ulukoca, 2010). Limlomwongse and Liabsuetrakul (2006) considered the decrease in EPDS score by 4 or more as large, 2 to 3 as medium and 0 to 1 as negligible or small and the increase in EPDS score by 1 as medium and 2 or more as large in prospective studies. Score changes are unfortunately limited in EPDS and information on other postpartum depression screening instruments is unavailable.

Most of the population subgroups studied does not show outstandingly high prevalence of postpartum depression. However, immigrants have relatively high postpartum depression prevalence

in Western and non-Western countries; this finding may be due to the challenges associated with migration status, racial and cultural differences (Pearlstein et al., 2009; Le et al., 2010; Chien et al., 2012; Hung et al., 2012; Lucero et al., 2012). Women from a low socio-economic status are also at particularly high risk of postpartum depression.

Our review demonstrates that psychological factors of antenatal depression and anxiety, previous psychiatric illness, poor marital relationship, stressful life events and negative attitude toward pregnancy are significant contributors to postpartum depression in both developed and developing countries. The obstetric and pediatric risk factors for postpartum depression in developed countries are inconclusive. In developing countries, problems during pregnancy, previous loss of a baby, unplanned pregnancy, unintended or unwanted pregnancy and pediatric illness are significant risk factors. Regarding socio-demographic factors, low socio-economic factors, domestic violence and most importantly lack of social support are important predisposing factors of postpartum depression, especially in developing countries. The association between postpartum depression and abuse was significant in developed countries but not in developing countries. However, a systematic review found positive association between maternal abuse and postpartum depressive symptoms (Alvarez-Segura et al., 2014).

Other studies have classified the risk factors of postpartum depression into three categories: strong-moderate, moderate, and small effect sizes. Antenatal depression, antenatal anxiety, and previous depressive illness have the strongest effect size in postpartum depression (Robertson et al., 2004; Ryan et al., 2005; Milgrom et al., 2008; Oppo et al., 2009); life stress and lack of social support have a strong-moderate effect size (Milgrom et al., 2008; Oppo et al., 2009); psychological factors and marital dissatisfaction have a moderate effect size and obstetric factors and socio-economic status have a small effect size (Robertson et al., 2004). Using the Postpartum Depression Predictors Inventory-Revised (PDPI-R), Oppo et al. (2009) found that the distribution of risk factors for postpartum depression at different times of assessment is slightly different. History of depression and antenatal depression are associated with a three- and fourfold increase in having postpartum depression at six months postpartum. Antenatal anxiety during the first trimester of pregnancy does not predict postpartum depression but is significant during the last phase of pregnancy. During this period, history depression, antenatal anxiety, lack of social support and socio-economic status predict the occurrence of postpartum depression.

#### 4.1. Limitation

The limitations in this review should be addressed. First, the review is confined to studies published in English, and thus generalizability of the findings is limited. Second, qualitative studies exploring the reasons for the predisposing factors for postpartum depression are not included. However, their inclusion could compromise the accuracy of the findings because of their differently applied methodology. Finally, all studies are included irrespective of the methodological quality, such as, varying time periods for collecting data on depressive symptoms and small sample size and their inclusion could affect the generalizability of the results.

#### 4.2. Conclusion

The prevalence of postpartum depression using self-reported questionnaire varies from 1.9% to 82.1% in developed countries and from 5.2% to 74.0% in developing countries, much higher than that previously documented. Structured clinical interview shows a

lower prevalence, ranging from 0.1% in Finland to 26.3% in India. Antenatal depression and anxiety, previous psychiatric illness, poor marital relationship, stressful life events, negative attitude toward pregnancy and lack of social support are significant contributors to postpartum depression. The prevalent postpartum depression in some countries and the identified risk factors may assist healthcare providers in screening and managing postpartum depression. A culturally sensitive cut-off score with adequate psychometric properties of the screening instruments should be available. Physical and biological factors as well as cultural factors show inconclusive result. Therefore, future studies with strong methodologies should explore and confirm the findings. Complementary qualitative studies are strongly recommended to explain the results of the quantitative findings on the risk factors.

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