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REVIEW ARTICLE

Interventions for the prevention of postpartum depression in adolescent mothers: a systematic review

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Abstract

Postpartum depression (PPD) is a major public health problem affecting 10–57% of adolescent mothers which can affect not only adolescent mothers but also their infants. Thus, there is a need for interventions to prevent PPD in adolescent mothers. However, recent systematic reviews have been focused on effective interventions to prevent PPD in adult mothers. These interventions may not necessarily be applicable for adolescent mothers. Therefore, the purpose of this review was to examine the effectiveness of the existing interventions to prevent PPD in adolescent mothers. A systematic search was performed in MEDLINE, CINAHL, and SCOPUS databases between January 2000 and March 2017 with English language and studies involving human subjects. Studies reporting on the outcomes of intervention to prevent PPD particularly in adolescent mothers were selected. Non-comparative studies were excluded. From 2002 identified records, 13 studies were included, reporting on 2236 adolescent pregnant women. The evidence from this systematic review suggests that 6 of 13 studies from both psychological and psychosocial interventions including (1) home-visiting intervention, (2) prenatal antenatal and postnatal educational program, (3) CBT psycho-educational, (4) the REACH program based on interpersonal therapy, and (5) infant massage training is successful in reducing rates of PPD symptoms in adolescent mothers in the intervention group than those mothers in the control group. These interventions might be considered for incorporation in antenatal care interventions for adolescent pregnant women. However, this review did not find evidence identifying the most effective intervention for preventing postpartum depression symptoms in adolescent mothers.

Keywords Adolescent mothers · Intervention · Postpartum depression · Prevention · Systematic review

Introduction

Postpartum depression (PPD) among adolescent mothers is an important public health problem which is defined as "a major depressive disorder with onset during pregnancy or within the first four weeks after delivery" (American Psychiatric Association 2013). Adolescent mothers are at greater risk for developing PPD than adult mothers during the initial parenting period (DeVito 2007; Figueiredo et al. 2006; Kingston et al. 2012; Lanzi et al. 2009) because adolescent mothers encounter many challenges to meeting infant needs and transitioning to the new maternal role (Angley et al. 2015; Lanzi et al. 2009). Several studies have indicated that adolescent mothers have higher prevalence of PPD than adult mothers with incidence rates reported at 14−32% and 7.2−16%, respectively (Figueiredo et al. 2007; Kim et al. 2014; Mollborn and Morningstar 2009; Wahn and Nissen 2008). Therefore, approximately 10−57% of adolescent mothers experience PPD after delivery (Birkeland et al. 2005; Meltzer-Brody et al. 2013; Schmidt et al. 2006; Venkatesh et al. 2014).

PPD is associated with poor maternal and infant outcomes (Hayes and Muller 2004). Adolescent mothers' depression may affect their ability to provide care, parenting, and nurturing for their infants while further affecting the mothers' overall life skills (Morrell 2006). Consequently, PPD is associated with adverse effects on maternal-infant attachment and

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interactions with infants that negatively impact the infants' cognitive, social, and emotional development (Barnet et al. 2008; Righetti-Veltema et al. 2003).

Therefore, findings of high prevalence and adverse outcomes of PPD support the vital need to find effective interventions for preventing PPD in adolescent mothers. Recent systematic reviews have focused on more interventions to prevent and treat PPD in adult than adolescent populations and these systematic reviews have found that many psychosocial and psychological interventions are significant methods for reducing PPD in adult mothers (Dennis 2005; Dennis and Dowswell 2013; Dennis and Hodnett 2007; Goodman and Santangelo 2011; Leis et al. 2009). Unfortunately, none of these systematic reviews has been conducted to examine the effectiveness of preventive interventions for PPD in adolescent mother populations (Lieberman et al. 2014; Yozwiak 2010). In the closest systematic review, Lieberman et al. (2014) performed a systematic review of nine intervention studies to examine and evaluate interventions that prevent and treat perinatal depression in adolescent mothers, especially in low-income and minority groups. However, this systematic review did not focus on PPD in adolescent mothers in general. Rather, the focus was on perinatal depression in high-risk adolescent mothers. Thus, the included interventions may not necessarily be applied to adolescent mothers in general. It is important to find evidence that evaluates the effectiveness of interventions for preventing PPD in adolescent mothers. Therefore, the objectives of the review are to identify, evaluate, and summarize the existing evidence on the effectiveness of interventions for preventing PPD in adolescent mothers.

Methods

A systematic review was conducted by using the PRISMA (Moher et al. 2009) as a guideline. We conducted the search in MEDLINE, CINAHL, and SCOPUS databases from January 2000 to March 2017. Only published articles in the English language and involving human subjects were included. A combination of the following search terms was used: "adolescent pregnancy" OR "adolescent mothers" OR "teenage pregnancy" OR "teenage mothers" AND "postpartum depression" OR "postnatal depression" AND "prevention" AND "intervention".

The inclusion criteria were as follows: (1) studies examining the preventive outcomes for PPD by improving clinical depressive symptoms; (2) adolescent (teenage) pregnant or adolescent mothers aged 10–19 years as a study sample; (3) maternal PPD or depressive symptoms measured as a main or secondary outcome; and (4) studies with randomized controlled trial (RCT) designs or comparison groups. The exclusion criteria were non-comparative studies, qualitative studies, literature reviews, systematic reviews, and meta-analyses.

All titles and abstracts of the selected studies were screened by all reviewers (BS, CW, and NS) based on eligibility criteria. Next, the full texts from the eligible studies were analyzed. Finally, studies reporting on the outcomes of interventions and/or programs for preventing PPD, particularly those conducted in adolescent mothers, were selected.

The quality of the included studies was evaluated by using the quality assessment tool, 'QUALSYST', from the "Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields" (Kmet et al. 2004). The QUALSYST is a validated tool incorporated in both quantitative and qualitative studies assigned on the basis of 14 individual criteria for quantitative studies or 10 individual criteria for qualitative studies. Therefore, the quality of the RCT studies in this review was assessed by using the 14 criteria from QUALSYST. The 14 criteria from QUALSYST included appropriate research questions and study design, sampling strategy, description of allocation concealment and blinding, definition of outcomes and exposures, sample size calculations, description of analytic methods, controls for confounding, and sufficient reporting of results.

The 14 criteria from QUALSYST were scored on a 3-point scale (0 = no, 1 = partially, and 2 = yes) depending on the degree to which the specific criteria were met. Criteria not applicable to a particular study design were marked "n/a" and excluded from the calculation of the summary scores. A summary score was calculated for each paper by summing the total scores obtained across relevant items and dividing by the total possible score (Kmet et al. 2004). The total possible score was then converted into a percentage. The classification of methodological quality was determined based on the percentage scores as follows: poor quality (score < 50%), fair quality (score = 50–69%), good quality (score = 70–79%), and strong quality (score > 80%) (Lee et al. 2008; Millard et al. 2013), as shown in Table 1.

The data from the included studies were extracted independently by the first reviewer (BS) and checked for accuracy and completeness by the second and third reviewers (CW and NS). Disagreements between reviewers were discussed until a consensus was reached. The following information was extracted from included studies by using a standardized form designed for the purpose: publication (author(s), year of publication, country of origin); sample characteristics (e.g., sample size, age, gestational age (GA)); study design; conceptual framework; intervention; intervention provider; control intervention; outcomes; and findings.

A narrative summary was used to synthesize the findings instead of quantitative meta-analysis. Because these studies were heterogeneous in terms of intervention approach,

Table 1 Methodological quality assessment of included studies assessed with 14-item list

Items															
Authors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Koniak-Griffin et al. 2000 USA	+	+	+	+	+	−	−	+	+	+	−	+	+	+	78
Barnet et al. 2002 USA	+	+	+	+	+	+	−	+	−	+	−	−	+	+	71
Koniak-Griffin et al. 2002 USA	+	±	+	+	+	−	−	+	+	+	−	+	+	+	75
Logsdon et al. 2005 USA	+	+	±	+	±	−	−	+	±	+	−	−	+	+	60
Barlow et al. 2006 USA	+	+	+	+	+	NA	NA	+	±	+	−	±	+	+	83
Barnet et al. 2007 USA	+	±	±	±	±	−	−	+	±	+	−	−	+	+	53
Oswalt et al. 2009 USA	+	+	+	+	±	−	−	+	±	+	+	−	+	+	71
Walkup et al. 2009 USA	+	+	±	+	±	−	−	+	+	+	−	−	+	+	64
Ickovics et al. 2011 USA	+	±	+	+	+	−	−	+	−	+	−	−	+	+	60
Ginsburg et al. 2012 USA	+	±	+	+	±	−	−	+	±	+	−	−	+	+	60
Barlow et al. 2013 USA	+	+	+	±	+	+	NA	+	+	+	−	−	+	+	80
Phipps et al. 2013 USA	+	+	+	+	+	+	−	+	±	+		±	+	+	78
Barlow et al. 2015 USA	+	+	+	+	+	+	−	+	+	+	−	−	+	+	78

NA not applied, + attended criteria, ± criteria partially attended, − criteria not-attended

duration, length of follow-up, and outcome measures (Table 2), the synthesis of the participant and intervention characteristics were described in a narrative way that contained text and tables to provide a descriptive summary and explanation of the intervention findings.

Results

Search results

A total of 2002 records were identified in MEDLINE, CINAHL, and SCOPUS databases. After removing duplicates ($n = 1274$), 728 records were screened for relevance and applicability to PPD in pregnant adolescents or adolescent mothers based on titles and abstracts. After screening the titles and abstracts, 674 records were excluded. The remaining 54 articles were screened for full text and reviewed lists of references. Of these, 13 articles that met the inclusion criteria were included as defined in Fig. 1.

Summary of quality assessment

The results of the quality appraisal assessment with the QUALSYST scoring are presented in Table 1. None of the studies had poor quality. Five studies (Barnet et al. 2007; Ginsburg et al. 2012; Ickovics et al. 2011; Logsdon et al. 2005; Walkup et al. 2009) were evaluated with fair quality scores (score = 50–69%); six studies (Barlow et al. 2015; Barnet et al. 2002; Koniak-Griffin et al. 2000, 2002; Oswalt et al. 2009; Phipps et al. 2013) had good quality (score = 70–79%) and two studies (Barlow et al. 2006, 2013) had strong quality (score > 80%).

Participant characteristics

Table 2 shows the descriptive characteristics of each of the 13 studies. There was wide variability in the participants' ethnicity. Most of the studies were conducted in racial/ethnic minority groups such as American Indians (AI), African-Americans, or Hispanics. Five studies reported that

Table 2 Characteristic of the included studies

Authors/ country	Study design	Sample/sample size	Theoretical framework	Intervention	Intervention provider	Control	Outcomes	Findings
Koniak-Griffin et al. 2000 USA	Prevention: Prospective RCT	Adolescent pregnant with 26 weeks or less gestation Age between 14 and 19 years old,64% Hispanic, 11% African-American, 19% Non-Hispanic white 121 subjects	Public health nursing model	Early intervention program (EIP), which includes 17 home visits, plus 4 preparations for parenting classes	Public health nurse (PHNs)	Traditional public health nursing (TPHN) consisting of 2–3 home visits The TPHN focused on assessment/counseling related to prenatal health care, self-care, childbirth preparation, future educational plans, and well-baby care	Depression at baseline and 6 weeks postpartum by using CES-D	No significant difference in effect on the measurement of internal social competence,which includes self-esteem, sense of mastery, perception of stress, and PPD
Barnet et al. 2002 USA	Prevention: RCT	Adolescent pregnant with 28 weeks or less gestation Age between 12 and 18 years old 98% African-American 148 subjects	Intervention based on human ecology, attachment, and social support theories	A volunteer home visiting intervention, includes weekly 1.5 h home visitsuntil 1 year The intervention emphasizes on child development, nurturing, and parenting The home visitor focused on different characteristics of parenting, health, and education in each visit, and made referrals to early interventions when necessary	A volunteer—a trained home visitor	No home visits	Parenting and mental health outcomes at baseline and15 months postpartum by using MHI-5	Home visiting by trained volunteers group did not \affect depression No differences in mental health outcomes in both groups
Koniak-Griffin et al. 2002 USA	Prevention: RCT	Adolescent pregnant with 26 weeks or less gestation Age between 14 and 19 years old 64% Hispanic, 11% African-American, 19% Non-Hispanic white 102 subjects	Public health nursing model	Early intervention program (intense home visits) which includes 17 home visits, plus 4 preparations for parenting classes	Public health nurse (PHNs)	Traditional public health nursing (TPHN) consisting of 2–3 home-visits The TPHN focused on assessment/counseling related to prenatal health care, self-care, childbirth preparation, future educational plans, and well-baby care	Depression at baseline, 6 weeks, and 6 and 12 months postpartum by using CES-D	No significant difference in depressive symptoms between adolescent mothers in both groups from pregnancy to 1 year after childbirth CES-D scores were significantly decreased in both groups at 1 year postpartum
Logsdon et al. 2005 USA	Prevention: RCT	Adolescent pregnant with 32–36 weeks gestation Mean age 16 56% African-American, 38% White American 128 subjects	Dual coding theory	One-time prenatal social support intervention delivered via pamphlet, video, or video plus pamphlet The intervention was conducted to participants between 32 and 36 weeks of gestation aged	Pamphlet, videotape, or pamphlet plus videotape	Not mentioned	Depressive Symptoms at 6 weeks postpartum by using CES-D	No significant differences in depressive symptoms between both groups at 6 weeks after delivery
Barlow et al. 2006 USA	Prevention: RCT	American Indian adolescent pregnant with 28 weeks or less gestation Age between 12 and 19 years old 41 subjects	Not mentioned	Home-visiting intervention, which includes 25 home visits and 41 lessons until 6 months after delivery Each 1.5-h home visit was provided to adolescents by trained educators delivered with starting between 28 weeks gestation and continued until 6 months after delivery	A para-professional	23−home visits covering 20 breastfeeding lessons	Depression at baseline and 2 and 6 months postpartum by using CES-D	Significantly greater reduced depressive symptoms in the intervention group at both 2 and 6 months after childbirth
Barnet et al. 2007 USA	Prevention: RCT	Adolescent pregnant Mean age 16.9 91% African-American, 9% Unspecified 84 subjects	Not mentioned	Home-visiting program with parenting and adolescent curricula Twice home visiting per week for first year, and once per month for second year	Trained African-American provider from the local community	Usual care at prenatal setting	Outcomes were collected at baseline, 1 and 2 years of follow-up by using AAPI and CES-D School status and repeat pregnancy were	The home-visiting program did not effective to reduce depression, repeat pregnancy, and linkage adolescent mothers with primary care

Table 2 (continued)

Authors/ country	Study design	Sample/sample size	Theoretical framework	Intervention	Intervention provider	Control	Outcomes	Findings
							measured by self-reported	
Oswalt et al. 2009 USA	Prevention: RCT	Adolescent mothers Mean age 16.3 100% African-American 25 subjects	Not mentioned	One-time infant massage training	Not specified	Not mentioned	Maternal-infant physical contact, postnatal depression, and perceptions of infant temperament	The training infant massage to adolescent mothers can improve maternal-infant physical contact, reduce depressive symptoms, and enhance positive mothers' perceptions of infant temperament
Walkup et al. 2009 USA	Prevention: RCT	Adolescent pregnant American Indian Median age 18 65% Navajo, 18% White Mountain Apache or mixed tribal background 167 subjects	Not mentioned	Prenatal antenatal and postnatal educational program—"the Family Spirit" intervention The intervention included prenatal and infant-care, parenting, family planning, preventing substance abuse, and skills of problem-solving and coping 1−h, 25 home visits	Trained American Indian para-professionals	Home visit breastfeeding and nutrition education program 1-h, 23 home visits education program	Outcomes were evaluated at baseline and 2, 6, and 12 months postpartum Primary outcomes: mothers' parenting knowledge and involvement Secondary outcomes: infants' social and emotional behavior, the home environment, and mothers' stress, social support, depression, and substance use	At 6 and 12 months postpartum, the intervention group had more improved parenting knowledge than the control group No significant differences in depressive symptoms, maternal stress, social support, and substance use between the two groups at 6 and 12 months postpartum
Ickovics et al. 2011 USA	Prevention: RCT	Age between 14 and 25 years, with less than 24 weeks gestation, and with no other medical issues 80% African-American, 13% Hispanic, 6% White 1047 subjects	Not mentioned	Prenatal antenatal and postnatal educational program: two interventions in the study, the Centering Pregnancy Plus (CP+) and the Centering Pregnancy (CP) programs The CP+ sessions included the information about self-care activities, antenatal and postpartum care, preparation for childbirth, preventing HIV, mental health, and psycho-social functioning The CP sessions included the same components in the CP+ sessions, except for the prevention of HIV/sexual risk, or psycho-social components, which were emphasized in the CP+ program	Trained prenatal care provider (e.g., midwife, obstetrician)	Standard individual care include the same schedule and number of times as CP+ and CP programs 10–15min each session	Depressive symptoms were assessed at baseline, third trimester pregnancy, and 6 and 12 months postpartum by using CES-D	After intervention, mothers with "high stress" who received the CP+ intervention were a significant decrease in depressive symptoms from baseline to 1 year after delivery
Ginsburg et al. 2012 USA	Prevention: RCT	Adolescent pregnant White Mountain Apache American Indian Mean age 18.15 Baseline depression scores on CES-D > 16 47 subjects	Cognitive behavior therapy (CBT)	Psycho-educational and CBT sessions adapted for Apache adolescents—the "Living in Harmony" intervention. Eight weekly 30–60 min in home sessions Home-sessions were delivered between 29 weeks gestation and continued until 6 months after delivery The home sessions focused on psycho-education, identifying and changing conditions of depression and behaviors,	Trained American Indian para-professionals	Perinatal educational support—the "Educational Support" (ES) intervention Eight weekly education program, 30–60 min The ES content included understanding the reproductive system, stages of pregnancy, nutrition and weight gain, understanding gestational diabetes, preparing for delivery, immunization, American Indian priority diseases, sexually transmitted diseases,	The primary outcome: CES-D and EPDS. The secondary outcomes: changes in mothers' global functioning and social support	After intervention, the rates of depressive symptoms and MDD were similarly reduced in both groups Participants in both groups also showed similar enhancement in global functioning No difference on the measurement of social support in 2 groups

Table 2 (continued)

Authors/ country	Study design	Sample/sample size	Theoretical framework	Intervention	Intervention provider	Control	Outcomes	Findings
				skills of problem solving, improving social support, and future planning The mothers attended 3 monthly booster sessions		and review of educational sessions		
Barlow et al., 2013 USA	Prevention: RCT	American Indian adolescent pregnant Mean age 18.1 322 subjects	Not mentioned	The Family Spirit intervention comprise 43 highly structured lessons (three domains: parenting skills across early childhood (0–3 years), preventive maternal drug abuse, and skills for maternal life and positive psychosocial development) plus home visiting The individual home visit included a brief warm-up conversation, conducting the lesson, a question/answer period, and providing summary handouts	Native paraprofessionals	Optimized standard care comprise transportation to suggested prenatal and well-baby clinic visits, providing pamphlets about child care and community resources, and referrals to local services when required	Parent and child emotional and behavioral outcome were collected at baseline and 2, 6, and 12 months postpartum by using self-reports, interviews, CES-D, and observational measures	At 12 months postpartum, the intervention group had better parenting knowledge, enhanced parenting self-efficacy, and higher home safety attitudes when compare with those in the control group At 2, 6, and 12 months after delivery, no significant differences in both groups on reducing depressive symptoms and CES-D mean scores
Phipps et al. 2013 USA	Prevention: RCT	Adolescent pregnant Mean age 16 Approx. 53% Hispanic, 17% Black non-Hispanic, and 16% White non-Hispanic 106 subjects	Interpersonal therapy (IPT)	The REACH Program, based on IPT The REACH program content focused on communication skills to manage relationship and conflicts, expectations about motherhood, stress management, difference between "baby blues" and "depression," development of support system, development of healthy relationships, goal setting, and psycho-social resources for new mothers The REACH program delivered 30–60 min in prenatal period weekly for five consecutive weeks with a single postpartum booster session delivered during hospitalization.	Not specified	The control condition in the control group had no overlapping content with the Project REACH curriculum The control program included: information about maternal health throughout pregnancy and the early postpartum period, fetal development, nutrition, preparationfor labor, and preparation of the home for taking a baby home	Primary outcome: depression at 6 weeks and 3 and 6 months after delivery using the KID-SCID	Lower overall incidence of depression in the intervention group (12.5%) than the control group (25%) with an HR 0.44 (95% CI 0.17–1.15) at 6 months after childbirth
Barlow et al. 2015 USA	Prevention: Prospective RCT	American Indian adolescent mothers Mean age 18.1 322 subjects	Not mentioned	The Family Spirit intervention comprise 43 highly structured lessons (three domains: parenting skills across early childhood (0–3 years), preventive maternal drug abuse, and skills for maternal life and positive psychosocial development) plus home visiting. The individual home visit included: a brief warm-up conversation, conducting the lesson, a question/answer period, and providing summary handouts	Native paraprofessionals	Optimized standard care comprise transportation to suggested prenatal and well-baby clinic visits, providing pamphlets about child care and community resources, and referrals to local services when required	Parent and child emotional and behavioral outcomes were evaluated at 36 months postpartum using self-reports, interviews, CES-D, and observational measures	From pregnancy to 36 months postpartum, the intervention group had significantly better parenting knowledge and parental locus of control, lower depressive symptoms and externalizing problems, and fewer use of marijuana and illegal drugs in the past month

AAPI Adult-Adolescent Parenting Inventory, *CBT* cognitive behavioral therapy, *CES-D* Center for Epidemiological Studies Depression Scale, *EPDS* Edinburgh Postnatal Depression Scale, *IPT-PA* Group interpersonal therapy, *K-SADS* Schedule for Affective Disorders and Schizophrenia for Children, *KID-SCID* Structured Clinical Interview for DSM-IV Childhood Diagnoses, *MDD* major depressive disorder, *MHI-5* Mental Health Inventory-5, *RCT* randomized controlled trial, *REACH program* Relaxation, Encouragement, Appreciation, Communication, Helpfulness program

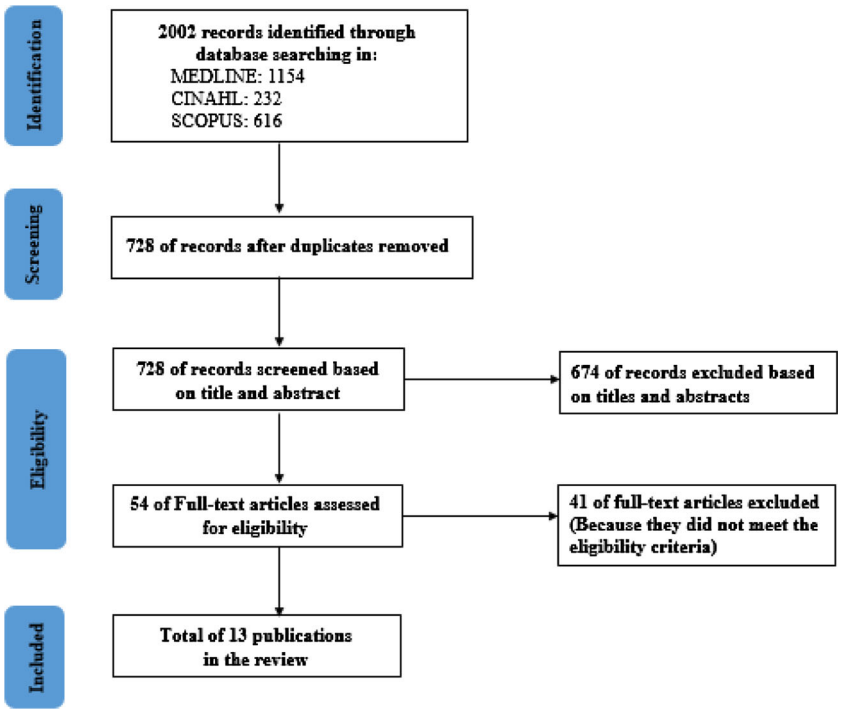

Fig. 1 Flow diagram of the searches and the selection process

100% of the participants were American Indian (Barlow et al. 2006, 2013, 2015; Ginsburg et al. 2012; Walkup et al. 2009); eight studies reported that 11 to 100% of the participants were African-American (Barnet et al. 2002, 2007; Ickovics et al. 2011; Koniak-Griffin et al. 2000, 2002; Logsdon et al. 2005; Oswalt et al. 2009; Phipps et al. 2013); four studies reported that 13 to 64% of their participants were Hispanic (Ickovics et al. 2011; Koniak-Griffin et al. 2000, 2002; Phipps et al. 2013). However, five studies reported that 6–38% of the participants were Caucasian (Ickovics et al. 2011; Koniak-Griffin et al. 2000, 2002; Logsdon et al. 2005; Phipps et al. 2013).

Overall, the adolescent women ranged in age from 12 to 19 years. Most of the studies reported that the mean age of adolescents ranged between 16 and 18 years, and gestational age at enrollment ranged between 26 and 28 weeks or less. Most of the participants in the studies were first-time mothers, living with parents, and unemployed.

Intervention characteristics

The interventions found differences among the participant's characteristics (e.g., race/ethnicity, country of study, gestational age range); sample sizes; conceptual framework; intervention content; type of intervention provider; intervention duration and frequency; outcome measurements; and follow-up times.

All of the studies (13 studies) were designed as randomized controlled trials (RCT) and conducted in the USA. The interventions were divided into two major groups including psychosocial and psychological intervention groups. The backgrounds of the individuals who provided interventions were varied by professional training. For example, two of the studies were provided by Native American Indian paraprofessionals. Another two of the studies were provided by trained American Indian paraprofessionals. Only two of the studies were provided by public health nurses (PHNs).

Based on the definitions utilized for prevention by Cuijpers et al. (2008), the preventive interventions were defined as seeking to diminish the raised symptoms of depression among teenage mothers who had no clinical signs, or to prevent new onset of symptoms of depression or major depressive disorder (MDD). Based on the meaning, 13 interventions were preventive because all of the pregnant adolescents were absent of clinical depression symptoms before enrolling in the studies.

Psychosocial interventions

The interventions of the studies were categorized into specific types of psychosocial interventions based on Cochrane Database of Systematic Reviews by Dennis and Dowswell (2013) and included the following five interventions: (1) home visits (Barlow et al. 2006, 2013, 2015; Barnet et al. 2002, 2007); (2) prenatal antenatal/postnatal educational programs (Ickovics et al. 2011; Walkup et al. 2009); (3) social support interventions (Logsdon et al. 2005); (4) early intervention programs (EIP) (Koniak-Griffin et al. 2000, 2002); and (5) infant massage training (Oswalt et al. 2009).

Home visits

A home-visiting intervention of Barnet et al. (2002) comprised the rearing of parent and development/improvement of adolescent curriculum. The intervention emphasized child development, nurturing, and parenting. A trained home visitor provided weekly 1.5-h home visits to the intervention group until 1 year after delivery. The home visits focused on the different characteristics of parenting, health, and education observed at each visit, and referrals were made to early interventions when necessary. The control group did not receive home visits from the provider. The results indicate that the home visiting group did not exhibit depressive symptoms and no differences were observed in mental health problems in either group.

A community-based home visiting program developed by Barnet et al. (2007) evaluated the effectiveness of the program on adolescent mother's outcomes. The participants in the intervention group received parenting curriculum, promotion of contraceptive use, linking with primary care, and encouragement in school continuation, while the control group received usual care only in a prenatal setting. The results show that the home visiting intervention was not effective in reducing depressive symptoms, repeat pregnancies and the linkage of adolescent mothers with primary care.

Barlow et al. (2006) assessed the effectiveness of a home-visiting intervention delivered by a paraprofessional to encourage knowledge about child rearing, skills, and maternal involvement in American Indian pregnant adolescents. The intervention group received 25 home visits comprising 41 lessons on antenatal care, preparation for childbirth, breastfeeding, nutrition, parenting, home safety for infants, vaccinations, child raising, family planning, preventing sexually transmitted disease, and setting of maternal achievement of personal and family development. The participants in the control group received 23 home visits covering 20 breastfeeding lessons developed by John Hopkins Center for American Indian Health participating communities in 1996–1997. The duration of home visits for providing the intervention to the participants was 1 to 1.5 h per visit. The results show a greater reduction in the depressive symptoms in the experimental group at 2 and 6 months postpartum.

Barlow et al. (2013, 2015) examined the effectiveness of the Family Spirit intervention to enhance parenting outcomes of American Indian adolescent mothers and child emotional and behavioral function. The Family Spirit intervention consisted of 43 highly structured lessons and home visits. The intervention was delivered by native paraprofessionals from the prenatal through the early child periods. The content of the Family Spirit intervention consisted of the following three domains: parenting skills across early childhood (0–3 years), maternal drug abuse prevention, and maternal life skills and positive psychosocial development. The individual home visits included a brief warm-up conversation, conducting the lesson, a question/answer period, and provision of summary handouts. Each 1-h home visit occurred weekly through the end of pregnancy, biweekly until 4 months after delivery; monthly between 4 and 12 months after delivery, and bi-monthly between 12 and 36 months after delivery. The control group received the optimized standard care comprising transportation to suggested prenatal and well-baby clinic visits, provision of pamphlets about child care, and community resources and referrals to local services when required. In order to avoid contamination of the control conditions, the family health liaisons who administered the optimized standard care were not trained in the Family Spirit intervention. At 2, 6, and 12 months postpartum, the results showed non-significant differences in depressive symptoms and mean scores for the Center for Epidemiologic Studies Depression Scale (CES-D) between the two groups. In the follow-up period at 36 months postpartum, the results showed that knowledge of parenting skills and parental locus of control were significantly better in the home-visiting group than the control group. Furthermore, fewer depressive symptoms were found with less marijuana and illegal drug use in the experimental group.

Antenatal/postnatal educational programs

The intervention in a study by Walkup et al. (2009) examined the effectiveness of an intervention entitled "a paraprofessional-delivered home-visiting" in reservation-based American Indian adolescent mothers on knowledge and involvement in parenting and maternal–infant outcomes. The intervention group received paraprofessional-delivered home-visiting interventions consisting of the 25-visit "Family Spirit" intervention addressing prenatal and infant care together with maternal life skills. The control conditions in the study included a 23-visit breastfeeding/nutrition education intervention. The interventions in both groups began during pregnancy and continued to 6 months postpartum. The results showed non-significant differences in depressive symptoms, maternal stress, social support, and substance use between the two groups at 6 and 12 months postpartum. However, also at 6 and 12 months postpartum, the intervention group had greater parenting knowledge gains compared to the control group (13.5 ($p < .0001$) and 13.9 ($p < .0001$), respectively).

Ickovics et al. (2011) developed two programs comprising the "Centering Pregnancy Plus (CP+)" and the "Centering Pregnancy (CP)" programs. The first program, CP+, was designed to reduce negative birth outcomes, decrease sexual risks, and improve psychosocial outcomes (decreased stress, social conflict, and depression) within a model of group prenatal care with 8–12 women. Trained healthcare providers

(e.g., midwives, obstetricians) were assigned to provide the CP+ program to the participants during prenatal care in 10 structured sessions for approximately 2 h per session. Each 2-h group prenatal care session included physical assessment, education/skills building, and support via facilitated discussion. The second program, the CP program, had the same components as the CP+ sessions, except for content on the prevention of HIV, reduction of sexual risks, and psychosocial function which was emphasized in the CP+ program. While the participants in the control group received standard individual care on the same schedule and for the same number of times as their appointments with healthcare providers as in the CP+ and CP programs at approximately 10–15 min per session. The results showed the participants with "high stress" who received the CP+ program to have significantly diminished depression from baseline to 12 months after delivery.

Social support interventions

Logsdon et al. (2005) evaluated the effectiveness of a social support intervention to prevent PPD. The one-time prenatal social support intervention consisted of three interventions including a booklet, a videotape, or a combination of the booklet and the videotape. The details of the intervention were based on literature that explained the desired social support by adolescent mothers during the postpartum period. The social support intervention in the study consisted of the following six topics: (1) recognizing the need for support (Do you need help?); (2) identifying the type of support needed (What kind of support do you need?); (3) determining the desired source of help (Who do you want to help you?); (4) methods for requesting help (How do you ask for help?); (5) reciprocation (How do you return the favor?); and (6) summary. However, the details of the controlled conditions in the control group were not described in the study. The results showed non-significant differences in depressive symptoms between both groups at 6 weeks after delivery.

Early intervention programs

Early intervention programs (EIP) refer to a comprehensive nursing care program which is a combination of the "Preparation for Motherhood" classes, maternal-fetal interactive activities and pre/postnatal home visits by PHNs for counseling, social support and facilitation of mother-infant interactions (Koniak-Griffin et al. 1999). Koniak-Griffin et al. (2000, 2002) studied two interventions by using EIP as interventions in an experimental group and application of traditional public health nursing care (TPHN) in the control group. The EIP was created to encourage teen mothers to organize their lives and tailored to have positive outcomes on the antenatal health behavior outcomes of teen mothers, infant and maternal health, and social competence with educational achievement of adolescent mothers. The EIP program included 17 home visits with 1.5 to 2 h per visit plus four preparations for parenting classes. During the postpartum home visit, PHNs provided general information about child care, postpartum recovery, maternal and infant nutrition, home safety, and family planning. The control condition provided for the control group was the TPHN consisting of two to three home visits. The TPHN focused on assessment and counseling related to prenatal health care, self-care, childbirth preparation, future educational plans, and well-baby care. Throughout the study, the PHNs made regular telephone contacts to the participants in both groups to prevent attrition and to arrange and confirm home visits. The results showed a non-significant difference in the effects on the measurement of internal social competence that include self-esteem, sense of mastery, perception of stress, and PPD. At the 1-year follow-up, the results also showed non-significant differences in depressive symptoms between the mothers in both groups from pregnancy to 1 year after childbirth. However, the results also noted that CES-D scores had significantly decreased in both groups at 1 year post-delivery.

Infant massage training

An infant massage program was conducted by Oswalt et al. (2009) to evaluate the effects of trained infant massage on the attitudes and perceptions of adolescent mothers toward their infants. The program served as a parent training program for high school students and focused on educational and vocational concerns for adolescent mothers. Moreover, the program also increased knowledge about child development and improved attitudes and perceptions about the parenting of adolescent mothers. However, the researchers did not describe the details of the infant massage program provided to the intervention group. Moreover, the description of controlled conditions in the control group was not mentioned in the study. The results showed that training adolescent mothers in infant massage was able to improve maternal-infant physical contact and decrease depressive symptoms in addition to enhancing mothers' positive perceptions of infant temperament.

Psychological interventions

The interventions of the studies were categorized into specific types of psychological interventions including the following two interventions: (1) psycho-educational and cognitive behavioral therapy (CBT) (Ginsburg et al. 2012) and (2) group interpersonal therapy (IPT) (Phipps et al. 2013).

Psycho-educational and cognitive behavioral therapy

Ginsburg et al. (2012) developed the "Living in Harmony" (LIH) intervention based on CBT curricula. The goal of LIH intervention was to decrease prenatal depressive symptoms and prevent the onset of major depressive disorder (MDD) in American Indians (AI) adolescent mothers. The content of LIH intervention was the main cognitive and behavioral skills taught included psycho-education, identifying and modifying depressive cognitions and behaviors, problem-solving skills, enhancing social support, and planning for the future. The LIH intervention included eight weekly lessons in a CBT-based program, 30–60 min in-home (or in-office) sessions and included three monthly booster sessions. Each session of the intervention was focused on teaching new skills and providing the opportunity to practice these skills both within sessions and at home (i.e., during daily life activities). The controlled condition in the study is the Educational-Support Intervention (ES), which focused on pregnancy and parenting education. The ES intervention comprised eight weekly lessons in an education program with 30–60 min in-home or in-office sessions and three booster sessions. The ES content included understanding about the reproductive system, stages of pregnancy, nutrition and weight gain, gestational diabetes, preparing for delivery, immunization, American Indian priority diseases, and sexually transmitted diseases with a review of educational sessions. Both interventions were delivered by AI paraprofessionals during pregnancy (initiated prior to 29-week gestation).

At 4, 12, and 24 weeks post intervention, however, the results showed that the rates of depressive symptoms and MDD were similarly reduced in both groups. Moreover, the participants in both groups also showed similar improvements in global functioning. No changes in either group were found on the measure of social support.

Group interpersonal therapy

Phipps et al. (2013) estimated the effects of an interpersonally oriented program to decrease the risk of PPD in first-time adolescent mothers. The intervention in the study, the REACH program, was adapted from an interpersonal therapy-based preventive intervention. The content of the REACH program focused on the development of effective communication skills to manage relationships and reduce conflicts before and after childbirth, expectations about motherhood, stress management, difference between "baby blues" and "depression," development of a support system, development of healthy relationships, goal setting, and psychosocial resources for new mothers. The program was delivered to the participants by multimedia (video snippets), interactive (role-playing) components, and homework with feedback. The controlled condition in the control group was no overlapping content with the REACH program curriculum. The control program included information about maternal health throughout pregnancy and the early postpartum period, fetal development, nutrition, preparation for labor, and preparation of the home for taking a baby home. The REACH program and control program sessions were delivered to the participants in both groups during pregnancy over the course of five 1-h prenatal sessions together with an individual booster session during the postpartum period. Each session lasted approximately 30–60 min, depending on the discussion. The results showed that the participants in the REACH group had lower total rates of depression (12.5%) than the non-experimental group (25%) at 6 months after childbirth. The results also showed that prenatal IPT intervention is likely to reduce the risk of PPD in adolescent mothers.

Duration of the intervention

The duration of the sessions in each intervention was fairly different. The time for providing the intervention on each occasion ranged from 1 to 2 h in the home visit intervention and 30 min to 2 h in the educational intervention. In the home visit interventions, most studies used approximately 1 h per visit (Barlow et al. 2013, 2015; Walkup et al. 2009) and approximately 1 to 1.5 h for providing the intervention per visit (Barlow et al. 2006; Barnet et al. 2002). The maximum duration of the home visit intervention was 1.5 to 2 h per visit (Koniak-Griffin et al. 2000, 2002).

In the prenatal educational session, most researchers used approximately 30 to 60 min to provide prenatal educational per session (Ginsburg et al., 2012; Phipps et al., 2013). In another study, Ickovics et al. (2011) delivered the CP+ and the CP interventions to the participants with approximately 2 h per session. However, three studies did not describe the duration of each intervention/session (Barnet et al. 2007; Logsdon et al. 2005; Oswalt et al. 2009)

Time points of assessment

Generally, most participant outcomes were evaluated at different time points such as baseline, immediately after the intervention and follow-up ranging from 6 weeks after the intervention to 36 months postpartum.

Effectiveness of interventions

A narrative synthesis is provided for preventing PPD outcomes. The effectiveness of the interventions in preventing PPD was identified by lower depression scores or lower incidence of PPD compared to the controlled conditions. Based on the measurement of the outcomes, the following six studies and four studies were effective in preventing PPD symptoms

in adolescent mothers and improving maternal/infant outcomes, respectively.

Prevent/reduce postpartum depressive symptoms in adolescent mothers

In six studies, five of seven interventions reported the effectiveness of preventive PPD interventions which found the adolescent mothers in the intervention group to have lower PPD symptoms or lower incidence of PPD than the control group (as shown in Table 2). Effective outcomes were yielded by the following intervention types: (1) home visiting interventions (Barlow et al. 2006, 2015), (2) prenatal antenatal and postnatal educational programs (Ickovics et al. 2011); (3) psycho-educational and CBT (Ginsburg et al. 2012); (4) the REACH program based on IPT (Phipps et al. 2013); and (5) infant massage training (Oswalt et al. 2009).

In another seven studies, however, four interventions reported no significant differences in the prevention of PPD symptoms between the intervention and control groups as follows: (1) two home-visiting interventions based on the EIP program (Koniak-Griffin et al. 2000, 2002); (2) a volunteer model home visiting program (Barnet et al. 2002), a home visiting program with adolescent parenting curricula (Barnet et al. 2007), and the Family Spirit home visiting intervention (Barlow et al. 2013); (3) prenatal and infant-care parenting programs (Walkup et al. 2009); and (4) an improvement social support intervention (Logsdon et al. 2005). Interestingly, two of the interventions that included home visits and antenatal/postnatal educational interventions reported both significant and non-significant differences in the prevention of PPD in adolescent mothers.

Increased parenting and infant outcomes

In four studies, the following three of seven interventions were effective in increasing parenting outcomes: (1) home visiting (Barlow et al. 2013, 2015), (2) infant massage training (Oswalt et al. 2009), and (3) prenatal and infant-care parenting programs (Walkup et al. 2009). In the experimental group, adolescent mothers had higher scores of parenting knowledge, enhanced self-efficacy of parenting skill, and parental locus of control than the control groups, as in the results from the Family Spirit home visiting intervention and prenatal and infant care parenting intervention.

Only one of the interventions reported the effectiveness of the intervention in improving infant outcomes. The infants in the experimental group also showed more positive interactions, greater growth development, fewer medical complications, and normal levels of biochemistry. At 12 months after childbirth, the infants in the experimental group had improved mental and motor scores than the infants in the control group.

Discussion

To the best of our knowledge, this study is the first systematic review providing effective outcomes of preventive interventions for PPD in adolescent mothers by using an assessment system to evaluate the quality appraisal of the RCT intervention. Thirteen studies of psychological and psychosocial interventions for the prevention of PPD symptoms in adolescent mothers were reviewed. Seven interventions reported in 13 studies were included in the review. Six studies were found to have significant effectiveness in preventing PPD, while seven studies did not. Of these six preventive studies, three psychosocial intervention types and two psychological intervention types were successful in preventing PPD among adolescent mothers by having lower depression score or lower incidence of PPD compared to the controlled conditions. The three psychosocial intervention types included home-visiting (Barlow et al. 2006, 2015), prenatal antenatal and postnatal educational programs (Ickovics et al. 2011), and infant massage training (Oswalt et al. 2009). The two psychological intervention types included psycho-educational and CBT (Ginsburg et al. 2012) and the REACH program based on IPT (Phipps et al. 2013). However, home visits and antenatal/postnatal educational interventions are two of seven interventions finding both significant and non-significant success in reducing the rates of PPD when compared to the controlled conditions.

It is anticipated that these interventions may reduce the risk of developing PPD via several mechanisms. For example, the study of Oswalt et al. (2009) showed that the training of infant massage for adolescent mothers can enhance maternal-infant physical contact and decrease depressive symptoms. Field et al. (1996) found that infant massage and relaxation therapy also decreased depression in adolescent mothers. This suggests that the mothers who attended the class on infant massage substantially enhanced mother-infant bonding. Consequently, attendance in the class may also provide the improvements of postpartum maternal mood such as PPD (Onozawa et al. 2001). Another study by Phipps et al. (2013) showed that prenatal IPT interventions have the likely effect of minimizing the risk for developing PPD in adolescent mothers at 6 months postpartum. In addition, Werner et al. (2015) who summarized the results of the seven RCT interventions to evaluate IPT for preventing PPD, found that four studies showed reduced risk for developing PPD. Therefore, the IPT intervention may be accepted to prevent PPD, because the IPT intervention is commonly concerned with social functioning and symptom functioning which is assumed to have biological and psychological precipitants. The intervention also specifically focuses on social interactions and can improve social support, which is a strong factor in preventing PPD (Dennis and Dowswell 2013).

The present systematic review affirms the advantages of both psychological and psychosocial interventions in

preventing PPD symptoms in adolescent mothers. Although the attributes of psychological and psychosocial interventions are different in general, this review found the studies of psychological and psychosocial interventions included in the review to have some normal characteristics. Most of the interventions were conducted in pregnant adolescent women with interventions provided by relevant health professionals such as public health nurses (PHNs), midwives, obstetricians, paraprofessionals, and volunteers. The objectives were as follows: (1) reduce the risk for PPD in adolescent mothers, (2) improve adolescent mothers' parenting and infant outcomes, and (3) promote knowledge and skills in parenting and child care. Therefore, the findings of this review support the implementation of these psychological and psychosocial interventions during the antenatal period. They also indicate that relevant health professionals can be trained to implement these interventions for pregnant adolescent women. However, the most effective provider for delivering these interventions and the most effective intervention for preventing PPD symptoms in adolescent mothers remain unclear.

Interestingly, the majority of the participants in the studies were focused on high-risk groups, especially racial/ethnic minority populations in the USA such as African-Americans, American Indians, and Hispanics. The findings and description of the effective interventions can be replicated and implemented in pregnant adolescents or adolescent mothers, particularly those in high-risk groups, and racial/ethnic minority groups in high income countries to reduce PPD symptoms. However, the findings of these interventions may be not generalized to various populations in different cultures and countries, particularly in low- and middle-income countries. Because the effective interventions for preventing PPD in this review require trained healthcare providers and provide several one-on-one home visits (10 and 25 visits) in the participants' homes (Barlow et al. 2006, 2015; Ickovics et al. 2011), it might be suggested that these interventions require high research costs and take a long time to conduct for the participants.

Regarding quality ratings, the study qualities were evaluated by using the 14-item QUALSYST (Kmet et al. 2004). Most of the studies (eight studies) reported a summary score of more than 70 points, which is classified as good quality. Items 6, 7, 11, and 12 included the blinding of investigators, blinding of subjects, estimates of reported variance for the main results, and control of confounding factors, respectively. These were the items that mostly lacked reporting. It is indicated, therefore, that there is a requirement for more methodologically rigorous study in this field. Therefore, more attention is recommended in creating any generalized interpretations of the significant findings.

Although both psychosocial and psychological interventions in this review were found to have significant effectiveness in preventing PPD, some limitations of the review are noted. The limitations of the review are difficult to compare and draw conclusions on the effectiveness of the interventions in each study, because this review comprises the differences in the studies such as participant and intervention characteristics, intervention providers, outcomes and measurements used. Therefore, this review did not find evidence to support identification of the most effective intervention for preventing PPD symptoms in adolescent mothers. Furthermore, the cost-effectiveness of the interventions in the review was not evaluated. Because the purposes of all studies in the review were not analyzed, the cost-effectiveness of the intervention compared to usual care. Therefore, unit costs or healthcare service costs were not reported in the measured outcomes.

Another limitation is that the findings of this review may not be relevant to non-western countries, because the review was restricted to articles published in English. All studies conducted in western countries, especially in the USA, were included. In the last limitation, the effective interventions in this review may be not generalized and implemented in the general population, especially in less developed and developing countries. Therefore, studies to examine the effectiveness of preventive interventions for PPD in high-risk pregnant adolescent women in various eastern cultures (in less developed, developing, and developed countries) and western cultures (in other developed countries) are recommended for further studies. Importantly, researchers should also be encouraged to focus on home visits and antenatal/postnatal educational interventions to prevent PPD in adolescent mothers, because these interventions reported both significant and non-significant effects on the prevention of PPD.

Conclusion

The evidence from the systematic review recommends that both psychological and psychosocial interventions include the following (1) home visiting, (2) antenatal/postnatal educational programs, (3) CBT psycho-educational, (4) the REACH program based on IPT, and (5) infant massage training are successful in preventing postpartum depressive symptoms among adolescent mothers compared to the controlled conditions. Interestingly, two psychosocial intervention types including home visits and antenatal/postnatal educational interventions reported both significant and non-significant effectiveness in decreasing PPD in adolescent mothers. These effective interventions might be considered for provision to pregnant adolescent women as antenatal care interventions together with usual prenatal care. However, this review did not any find evidence to support identification of the most effective intervention for preventing PPD symptoms in adolescent mothers.

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Compliance with ethical standards

Ethical approval The article does not contain any studies with human participants performed by any of the authors.

Conflict of interest The authors declare that they have no competing interests.

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