Meta-Analysis of the Prevalence of Postpartum Depression Among Women of Advanced Maternal Age in China: Postprint

Authors: Li Long, An Xuemei, Zhang Jie, Huang Linyu, Zhang Xingling

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Abstract

Background: With the rapid development of China' s economy and the shift in fertility perspectives among modern populations, coupled with the full implementation of the "two-child" and "three-child" policies, the number of women of advanced maternal age is increasing annually. Compared with women of appropriate childbearing age, women of advanced maternal age are more likely to experience depressive symptoms due to factors related to themselves, family, and work.

Objective: To systematically evaluate the detection rate of postpartum depression among women of advanced maternal age in China (age $ $35 years at delivery), and to provide relevant evidence for early prevention and intervention.

Methods: A literature search was conducted in CNKI, Wanfang Data Knowledge Service Platform, VIP, Chinese Biomedical Literature Database, PubMed, Cochrane Library, Embase, and Web of Science databases using a combination of subject terms and free terms to identify studies related to the detection rate of postpartum depression among women of advanced maternal age in China. The search timeframe was from database inception to July 2023. Literature screening, data extraction, and quality assessment were performed independently by two researchers. Data analysis was conducted using Stata 16.0 software.

Results: A total of 21 studies were included, with a combined sample size of 5,163 cases. Meta-analysis results showed that the overall detection rate of postpartum depression among women of advanced maternal age in China was 20.0% (95%CI=17.4%~22.6%). Subgroup analysis results indicated that the detection rate was 19.5% (95%CI=13.8%~25.3%) for women aged <40 years and 40.3% (95%CI=11.4%~69.3%) for those aged $ $40 years; 19.7% (95%CI=11.7%~27.7%) for women with education level above high school and 30.7% (95%CI=19.1%~42.3%) for those with high school education or

below; 21.1% (95%CI=14.4%~27.9%) for primiparous women and 16.2% (95%CI=12.9%~19.6%) for multiparous women; 16.4% (95%CI=12.2%~20.6%) for vaginal delivery and 27.8% (95%CI=20.9%~34.8%) for cesarean section; 20.7% (95%CI=15.6%~25.8%) for male newborns and 27.3% (95%CI=20.5%~34.0%) for female newborns; 38.7% (95%CI=22.6%~54.8%) for women with pregnancy complications and 11.7% (95%CI=7.6%~15.8%) for those without complications; 29.5% (95%CI=17.9%~41.1%) for women with adverse pregnancy history and 27.7% (95%CI=16.6%~38.8%) for those without such history; 18.0% (95%CI=16.5%~19.4%) for studies published before 2020 and 19.5% (95%CI=18.0%~21.0%) for those published in 2020 and thereafter; 20.4% (95%CI=18.2%~22.6%) for northern regions and 18.2% (95%CI=17.0%~19.4%) for southern regions; 20.0% (95%CI=18.5%~21.5%) for EPDS score $ $13 and 16.9% (95%CI=15.2%~18.5%) for EPDS score $ $10. Egger' s test (t=1.76, P=0.095) and Begg' s test (Z=1.48, P=0.147) indicated no significant publication bias.

Conclusion: The detection rate of postpartum depression among women of advanced maternal age in China is relatively high (20.0%). Specifically, higher detection rates were observed among women aged $ $40 years, with education level of high school or below, primiparous women, those who underwent cesarean section, those with female newborns, those with pregnancy complications, those with adverse pregnancy history, studies published in 2020 and thereafter, surveys conducted in northern regions, and those with EPDS score $ $13. Attention should be paid to the psychological status of these high-risk groups of women of advanced maternal age, and corresponding prevention and intervention measures should be developed.

Full Text

Meta-Analysis of the Detection Rate of Postpartum Depression in Advanced Maternal Age in China

Li Long[1], An Xuemei[2]*, Zhang Jie[1], Huang Linyu[1], Zhang Xingling[1]

[1]Nursing College of Chengdu University of Traditional Chinese Medicine, Chengdu 610075, China
[2]Department of Nursing, Affiliated Hospital of Chengdu University of Traditional Chinese Medicine, Chengdu 610032, China

Corresponding author: An Xuemei, Chief superintendent nurse; E-mail: 1051158567@qq.com

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Abstract

Background: With rapid economic development and changing fertility concepts in modern populations, coupled with the full liberalization of the

"two-child" and "three-child" policies, the number of women of advanced maternal age is increasing year by year. Compared with women of appropriate childbearing age, those of advanced maternal age are more likely to experience depressive symptoms due to personal, family, work, and other factors. **Objective:** To systematically evaluate the detection rate of postpartum depression among women of advanced maternal age ($ $35 years at delivery) in China and provide evidence for early prevention and intervention. **Methods:** CNKI, Wanfang, VIP, CBM, PubMed, Cochrane Library, Embase, and Web of Science were searched for articles on the detection rate of postpartum depression in advanced maternal age in China using a combination of subject terms and free terms from database inception to July 2023. Literature screening, data extraction, and quality assessment were conducted independently by two researchers. Stata 16.0 software was used for data analysis. **Results:** A total of 21 studies were included, with a combined sample size of 5,163. Meta-analysis results showed that the overall detection rate of postpartum depression in advanced maternal age in China was 20.0% (95%CI=17.4%-22.6%). Subgroup analysis revealed detection rates of 19.5% (95%CI=13.8%-25.3%) in women aged <40 years and 40.3% (95%CI=11.4%-69.3%) in women aged $ $40 years; 19.7% (95%CI=11.7%-27.7%) in women with high school education or higher versus 30.7% (95%CI=19.1%-42.3%) in those with high school education or lower; 21.1% (95%CI=14.4%-27.9%) in primipara versus 16.2% (95%CI=12.9%-19.6%) in multipara; 16.4% (95%CI=12.2%-20.6%) for natural childbirth versus 27.8% (95%CI=20.9%-34.8%) for cesarean section; 20.7% (95%CI=15.6%-25.8%) for male newborns versus 27.3% (95%CI=20.5%-34.0%) for female newborns; 38.7% (95%CI=22.6%-54.8%) in women with pregnancy complications versus 11.7% (95%CI=7.6%-15.8%) in those without; 29.5% (95%CI=17.9%-41.1%) in women with adverse pregnancy and childbirth history versus 27.7% (95%CI=16.6%-38.8%) in those without; 18.0% (95%CI=16.5%-19.4%) for studies published before 2020 versus 19.5% (95%CI=18.0%-21.0%) for those published in 2020 and after; 20.4% (95%CI=18.2%-22.6%) in northern regions versus 18.2% (95%CI=17.0%-19.4%) in southern regions; and 20.0% (95%CI=18.5%-21.5%) using EPDS score $ $13 versus 16.9% (95%CI=15.2%-18.5%) using EPDS score $ $10. Egger' s test (t=1.76, P=0.095) and Begg' s test (Z=1.48, P=0.147) indicated no significant publication bias. **Conclusion:** The detection rate of postpartum depression is relatively high among women of advanced maternal age in China (20.0%). Higher detection rates were found in women aged $ $40 years, with high school education or lower, primipara, cesarean delivery, female newborns, pregnancy complications, adverse pregnancy and childbirth history, studies published in 2020 and after, northern regions, and EPDS score $ $13. Attention should be paid to the psychological status of these high-risk groups, and corresponding prevention and intervention measures should be formulated.

Keywords: Depression, postpartum; Maternal; Advanced age; Detection rate; Meta-analysis; China

Introduction

The International Federation of Gynecology and Obstetrics (FIGO) defines women aged $ $35 years at delivery as advanced maternal age [1]. With China' s rapid economic development and changing fertility concepts, coupled with the full liberalization of the "two-child" and "three-child" policies, the number of women of advanced maternal age is increasing annually [2]. Postpartum depression refers to a series of psychiatric symptoms including low mood, decreased interest, and slowed thinking that occur after delivery, with severe cases potentially leading to suicidal behavior [3]. Postpartum depression typically emerges within 2 weeks postpartum, with symptoms lasting up to 1 year [4]. Compared with women of appropriate childbearing age, those of advanced maternal age face greater health risks and experience more intense psychological stress responses under various pressures, making them more susceptible to negative emotions. Previous data show that the incidence of postpartum depression among women of appropriate childbearing age in China is 14.7%, while the rate among older women can reach as high as 36.9% [5]. Postpartum depression in advanced maternal age not only threatens the mother' s health but also adversely affects family and social relationships [6]. The Obstetrics and Gynecology Branch of the Chinese Medical Association recommends screening for depressive symptoms in perinatal women, making early detection of postpartum depression particularly important [7]. In recent years, numerous studies have examined the detection rate of postpartum depression in advanced maternal age in China, but results vary considerably due to differences in measurement standards, study regions, and populations. Therefore, this study conducted a systematic review and meta-analysis to comprehensively assess the status of postpartum depression among women of advanced maternal age in China, providing a theoretical basis for future research.

Methods

Literature Search Strategy We searched CNKI, Wanfang Data, VIP, CBM, PubMed, Cochrane Library, Embase, and Web of Science for literature on the detection rate of postpartum depression in advanced maternal age in China. The search combined subject terms and free terms from database inception to July 2023. Chinese search terms included "advanced age," "maternal/primipara/multipara/puerpera," and "depression/depressive symptoms." English search terms included "advanced age," "maternal/primipara/multipara/puerpera," "depression/depressive symptoms," and "China/Chinese." Additional relevant search terms were added during the retrieval process. The PubMed search strategy is shown in Table 1 .

Inclusion and Exclusion Criteria **Inclusion criteria:** (1) Study design: cross-sectional studies, case-control studies, and cohort studies; (2) Study population: women aged $ $35 years at delivery; (3) Exposure factors: various factors

associated with depression in advanced maternal age; (4) Outcome measure: detection of depressive symptoms using screening scales. **Exclusion criteria:** (1) Studies where postpartum depression detection rates could not be obtained; (2) Studies with duplicate data; (3) Studies where full text was unavailable; (4) Conference abstracts, reviews, and case reports.

Literature Screening and Data Extraction A total of 1,251 relevant articles were retrieved from databases (CNKI: n=271; Wanfang: n=161; VIP: n=136; CBM: n=392; PubMed: n=240; Cochrane Library: n=1; Embase: n=20; Web of Science: n=30). After removing duplicates, 632 articles remained. Two researchers independently screened the literature according to inclusion and exclusion criteria, first by title and abstract (n=584 excluded), then by full text (n=48 reviewed, n=27 excluded). The final meta-analysis included 21 articles [10-30]. The screening process is illustrated in Figure 1 [Figure 1: see original paper]. Data extraction was performed independently by two researchers using a standardized form, with results cross-checked; disagreements were resolved through discussion or by consulting a third researcher. Extracted data included first author, publication year, study region, survey period, study population, Edinburgh Postnatal Depression Scale (EPDS) cutoff scores, sample size, and detection rate.

Literature Quality Assessment Two researchers selected appropriate quality assessment methods based on study design. Cross-sectional studies were evaluated using the Agency for Healthcare Research and Quality (AHRQ) recommended criteria for bias risk assessment, with a total score of 11 points and studies scoring <4 points considered low quality [8]. Case-control and cohort studies were assessed using the Newcastle-Ottawa Scale (NOS), with a total score of 9 points [9].

Statistical Analysis Extracted detection rates and their 95% confidence intervals (CIs) were compiled in Excel. Meta-analysis was performed using Stata 16.0 software. Heterogeneity was assessed using Q tests and I^2 statistics. When significant heterogeneity was present ($I^2 \geq 50\%$ and $P<0.1$), a random-effects model was used for meta-analysis; otherwise, a fixed-effects model was applied. For substantial heterogeneity, subgroup analyses were conducted based on different characteristics of included studies. Sensitivity analysis was performed by sequentially removing individual studies. Publication bias was assessed using Egger' s test and Begg' s test.

Results

Literature Search Results The literature screening process and results are shown in Figure 1 [Figure 1: see original paper]. After initial retrieval of 1,251 articles and removal of duplicates, 632 articles remained. Following title and

abstract screening, 584 articles were excluded, leaving 48 articles for full-text review. Twenty-seven articles were subsequently excluded: 12 for unavailable detection rates, 8 for being conference abstracts/reviews/case reports, 2 for duplicate data, and 5 for inaccessible full text. Ultimately, 21 articles were included in the meta-analysis.

Characteristics of Included Studies Among the 21 included articles, 20 were in Chinese [10-29] and 1 was in English [30]. All were cross-sectional studies with a total sample size of 5,163. All studies used the EPDS for depression screening, with quality scores ranging from 5 to 8 points. The basic characteristics and bias risk assessment results of included studies are shown in Table 2 .

Meta-Analysis Results Overall Detection Rate of Postpartum Depression in Advanced Maternal Age in China

Significant heterogeneity was observed among included studies (I^2=81.2%, P<0.001), so a random-effects model was used. Meta-analysis results showed that the overall detection rate of postpartum depression in advanced maternal age in China was 20.0% (95%CI=17.4%-22.6%). The forest plot is shown in Figure 2 [Figure 2: see original paper].

Subgroup Analysis

Subgroup analyses were conducted based on age, education level, parity, delivery mode, newborn sex, pregnancy complications, adverse pregnancy history, publication year, study region, and EPDS cutoff scores. All subgroups showed significant heterogeneity (I^2>50%, P<0.001), and random-effects models were applied. The results showed detection rates of 19.5% (95%CI=13.8%-25.3%) for women aged <40 years and 40.3% (95%CI=11.4%-69.3%) for those aged $ $40 years; 19.7% (95%CI=11.7%-27.7%) for women with high school education or higher versus 30.7% (95%CI=19.1%-42.3%) for those with high school education or lower; 21.1% (95%CI=14.4%-27.9%) for primipara versus 16.2% (95%CI=12.9%-19.6%) for multipara; 16.4% (95%CI=12.2%-20.6%) for natural delivery versus 27.8% (95%CI=20.9%-34.8%) for cesarean section; 20.7% (95%CI=15.6%-25.8%) for male newborns versus 27.3% (95%CI=20.5%-34.0%) for female newborns; 38.7% (95%CI=22.6%-54.8%) in women with pregnancy complications versus 11.7% (95%CI=7.6%-15.8%) in those without; 29.5% (95%CI=17.9%-41.1%) in women with adverse pregnancy history versus 27.7% (95%CI=16.6%-38.8%) in those without; 18.0% (95%CI=16.5%-19.4%) for studies published before 2020 versus 19.5% (95%CI=18.0%-21.0%) for those published in 2020 and after; 20.4% (95%CI=18.2%-22.6%) in northern regions versus 18.2% (95%CI=17.0%-19.4%) in southern regions; and 20.0% (95%CI=18.5%-21.5%) using EPDS score $ $13 versus 16.9% (95%CI=15.2%-18.5%) using EPDS score $ $10. Detailed subgroup analysis results are shown in Table 3 .

Sensitivity Analysis and Publication Bias Sensitivity analysis was performed by sequentially removing individual studies. The combined results did not change substantially, indicating that the meta-analysis results were robust. The sensitivity analysis plot is shown in Figure 3 [Figure 3: see original paper]. Publication bias test results showed Egger' s test (t=1.76, P=0.095) and Begg' s test (Z=1.48, P=0.147), both indicating no significant publication bias.

Discussion

This meta-analysis included 21 studies related to the detection rate of postpartum depression in advanced maternal age in China, covering 20 different regions. The results showed an overall detection rate of 20.0% for postpartum depression in this population. Previous meta-analyses have reported lower rates: Tao et al. [31] reported a prevalence of 10.7% for postpartum depression in China (17 studies), Liu et al. [32] reported a detection rate of 15.0% (24 studies), and LIU et al. [33] reported global prevalence rates of 12.0% in developed countries and 15.0% in developing countries (33 studies). These comparisons indicate that the detection rate of postpartum depression is notably higher among women of advanced maternal age in China.

The puerperium is a critical transitional period after delivery, and postpartum depression is the most common psychological problem among perinatal women [34]. Postpartum depression often presents insidiously, with symptoms such as hostility, neglect, reduced tolerance, and unresponsiveness to infant needs [35]. Additionally, maternal postpartum depression is a significant predictor of paternal postpartum depression [36]. Women of advanced maternal age must cope with delivery trauma, role transitions, and family pressures, and their adaptive capacity may decline with age, increasing their vulnerability to postpartum depression [37].

Subgroup analysis revealed several important findings. Women aged $ $40 years (often termed "very advanced maternal age") had a higher detection rate (40.3%) than those aged <40 years (19.5%). Research indicates that very advanced maternal age is associated with higher rates of delivery-related diseases and poorer infant health outcomes [38-39], which may negatively impact maternal psychological well-being. Women with high school education or lower had a higher detection rate (30.7%) than those with higher education (19.7%), consistent with findings from Li et al. [40]. Better-educated women have broader access to perinatal health knowledge and are more likely to seek professional help for postpartum discomfort, while less-educated women may experience greater fear of childbirth and lack family understanding, increasing their depression risk [41]. Primipara had a higher detection rate (21.1%) than multipara (16.2%), consistent with DO et al. [42]. Primipara lack experience in childbirth and newborn care, making role adaptation more difficult and negative emotions more pronounced [43]. Cesarean delivery was associated with a higher detection rate

(27.8%) than natural delivery (16.4%), consistent with Yuan et al. [44]. Postoperative incision pain may require analgesic medication, which can prolong functional recovery [45] and increase depression risk. Women with female newborns had a higher detection rate (27.3%) than those with male newborns (20.7%), consistent with LIU et al. [46]. Traditional preferences for male infants may make it more difficult for mothers of female infants to accept their child' s gender, increasing depression risk [47]. Women with pregnancy complications had a higher detection rate (38.7%) than those without (11.7%), consistent with Gao et al. [48]. Advanced maternal age increases the risk of complications such as gestational diabetes, hypertension, and placenta previa, which can lead to adverse pregnancy outcomes, prolonged recovery, and significant psychological impact [49]. Women with adverse pregnancy history had a higher detection rate (29.5%) than those without (27.7%), consistent with Wang et al. [50]. Women with previous histories of preterm birth, miscarriage, or dystocia may experience greater anxiety about current pregnancy outcomes, increasing psychological stress and depression risk [51]. Detection rates also varied by publication year, region, and EPDS cutoff scores, with higher rates in studies published after 2020 (possibly reflecting greater modern psychological stress), in northern regions (likely due to differences in climate, culture, and diet), and when using EPDS score $ $13 (though this may reflect the smaller number of studies using EPDS $ $10).

This study has several limitations. First, all included studies were cross-sectional, which are susceptible to various biases and may lack accuracy in measurement and reporting. Second, significant heterogeneity remained despite subgroup and sensitivity analyses, possibly due to other unmeasured differences among included studies. Third, sample sizes in individual studies were relatively small; larger-scale, multi-regional studies are needed to strengthen these findings. Despite these limitations, postpartum depression screening is increasingly recognized as important. Healthcare providers should pay close attention to the mental health of women of advanced maternal age, particularly those with identified risk factors, to enable early detection of depressive tendencies.

Author Contributions

Li Long was responsible for study conception and design, data extraction, and manuscript writing. Zhang Jie performed data analysis and literature quality assessment. Huang Linyu and Zhang Xingling conducted literature quality assessment. An Xuemei was responsible for manuscript revision and quality control, and oversaw the entire project.

Conflict of Interest

The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.