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## REVIEW ARTICLE

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### **What are the benefits of antenatal education as a maternal health promotion tool? A systematic review with meta-analysis**

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## **ABSTRACT**

**Introduction:** Antenatal education is a low-cost intervention designed to increase the knowledge of pregnant women on pregnancy and childbirth and reduce fear related to labor pain. However, the impact of antenatal education programs on maternal outcomes is unclear. **Objective:** To investigate whether structured antenatal education programs affect maternal health outcomes. **Methods:** Electronic databases were searched from inception to November 2019, and randomized controlled trials investigating antenatal educational programs for low-risk pregnant women were included. **Results:** A total of 348 studies were identified; nine were included in this review. One study assessed the number of antenatal visits, while three showed that antenatal education programs significantly improved childbirth self-efficacy (outcome expectancy 16.00 [95% CI 9.86-22.15] and efficacy expectancy 20.44 [95% CI=13.62-27.25]). Self-diagnosis on labor was investigated in two studies, and five demonstrated that antenatal education increased the frequency of vaginal delivery (odds ratio 1.28 [95% CI 1.01-1.63]) but not episiotomy (as observed in three studies). **Conclusion:** Structured antenatal education programs may increase childbirth self-efficacy and the frequency of vaginal delivery.

**Keywords:** pregnancy; antenatal education; childbirth; episiotomy.

## INTRODUCTION

Antenatal education is essential in antenatal care to improve maternal skills and confidence and provide a positive childbirth experience. According to the World Health Organization (WHO)<sup>1</sup>, a positive childbirth experience meets or exceeds the expectations of the mother, considering her personal and sociocultural preferences. Thus, the biopsychosocial needs of pregnant women must be considered to provide adequate antenatal care. Also, antenatal education programs improve the confidence of pregnant women, allowing them to demand best practices from healthcare providers<sup>2</sup>.

Antenatal education programs have been officially implemented worldwide due to their various benefits<sup>3</sup>. Although public healthcare systems often provide antenatal education in some developed countries, it is usually a paid service or informally provided by mothers to daughters in most underdeveloped countries<sup>4,5</sup>. Also, several scientific guidelines recommend worldwide access to antenatal education program since it is a low-cost intervention that improves the healthcare assistance and quality for pregnant women<sup>6</sup>.

Childbirth self-efficacy and self-diagnosis on labor are important outcomes related to maternal health in antenatal care. Childbirth self-efficacy refers to the confidence of women in the ability to cope with the stress and labor pain and may affect motivation and attitudes towards vaginal delivery<sup>7</sup>. Also, self-diagnosis on labor is the perception of women on the progress of labor. In this context, antenatal education programs to increase the knowledge of women on pregnancy and childbirth can improve these outcomes.

The influence of antenatal education on maternal health outcomes remains unclear. Structured antenatal education programs with pre-determined themes, number of sessions, and topics to be discussed may positively affect labor and postpartum outcomes. Thus, this review

investigated the benefits of structured antenatal education programs on maternal health outcomes in pregnant women.

## **METHODS**

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was registered on the International Prospective Register of Systematic Reviews (PROSPERO, CRD42020161507). The study included randomized and quasi-randomized controlled trials assessing the effect of structured antenatal education programs on low-risk pregnant women aged 18 years or older.

The research question “what is the effect of antenatal education compared with control or non-structured antenatal education programs on maternal health of pregnant women?” was based on the PICO strategy: the population (P) included pregnant women; intervention (I) was structured antenatal education programs; comparison (C) was no intervention or non-structured antenatal education programs; and outcomes (O) were the number of antenatal care visits to healthcare providers, childbirth self-efficacy, self-diagnosis on labor, type of delivery, and frequency of episiotomy.

### **Types of interventions**

The inclusion criteria comprised studies evaluating outcomes related to the health of adult pregnant women who participated in a structured antenatal educational program. Structured antenatal programs were defined as having pre-determined topics, number of classes and meetings, and other relevant information. Also, antenatal education programs could be in-person meetings (group or individual), lectures, discussions, booklets, e-learning, or M-health-based programs

involving pregnant women alone or with male partners. Only studies evaluating general antenatal education (i.e., without non-specific topics, techniques, or targeted populations) were considered for inclusion (e.g., programs including general anatomical and physiological information about pregnancy or birth).

Studies evaluating the following themes were excluded: (i) antenatal programs including specific topics (e.g., breastfeeding or weight gain or smoking during pregnancy); (ii) training techniques that could indirectly involve antenatal education (e.g., Mindfulness or hypnosis); or (iii) a specific population (e.g., pregnant teenagers or high-risk pregnancy).

Control groups consisted of pregnant women participating in non-structured antenatal education programs (or those named standards or routine care) or no participation in any antenatal program.

## **Outcome measures**

The following maternal outcomes were considered relevant: number of antenatal care visits, childbirth self-efficacy, self-diagnosis on labor, type of delivery, and frequency of episiotomy.

1) Number of antenatal care visits: although the WHO<sup>8</sup> recommends at least eight antenatal care visits to ensure maternal and fetal health during pregnancy, maintaining this minimum number is challenging in many countries.

2) Childbirth self-efficacy: as described by Bandura<sup>9</sup>, childbirth self-efficacy refers to the level of confidence and ability of women to maintain control during labor and delivery<sup>10-12</sup>. Some studies on childbirth demonstrated the importance of self-efficacy in the ability of women to cope with labor and delivery<sup>13,14</sup>.

3) Self-diagnosis on labor: a good timing for hospital admission may improve childbirth outcomes in low-risk pregnancies. Early admission has been associated with increased rates of labor-related interventions and negative maternal and fetal outcomes<sup>15,16</sup>. Also, the WHO<sup>1</sup> recommends considering active labor when cervical dilation reaches at least six centimeters.

4) Type of delivery: cesarean sections are occasionally performed when women are not in labor<sup>17</sup> and without an appropriate clinical indication, contributing to the increased rates observed worldwide<sup>18</sup>. Factors contributing to high cesarian section rates include women request<sup>19</sup>, convenience to choose weekdays instead of weekend days<sup>20</sup>, reduced availability of obstetricians in the maternity facilities<sup>21</sup>, and increased indexes of maternal education<sup>22</sup>. In contrast, vaginal delivery has become a medicalized event, occasionally with many interventions during labor and delivery. Despite this, most pregnant women initially prefer vaginal delivery but change their option for cesarean section, especially due to fear<sup>23</sup>.

5) Frequency of episiotomy: although recommendations on performing episiotomy only when needed<sup>24</sup>, it remains one of the most controversial issues regarding obstetrics. Thus, episiotomy should be a patient-doctor decision when an emergency context is not involved since it could lead to physical and emotional consequences throughout life<sup>25</sup>.

### **Search methods for identification of studies**

The search was conducted from inception to November 2020 using the following databases: Medline, Lilacs, and Cochrane Library. Keywords for the search were related to the intervention (antenatal education program or childbirth preparation), population (healthy pregnant women), and outcomes (see search strings in the supplementary material).

### **Data collection and analysis**

Two reviewers (MRDZ and CS) independently screened the titles and abstracts and identified studies meeting the inclusion criteria. Full-text studies were assessed for eligibility, and disagreements were resolved through discussion until consensus, recording the reasons for exclusion. The reference lists of primary studies were also selected, and systematic reviews were assessed to identify relevant studies not identified by the electronic search. Articles in English, Portuguese, or Spanish were included, and authors of studies presenting incomplete data were contacted. Two reviewers extracted data from the full-text articles using an Excel form.

Data extraction forms were reviewed, and outcome data from eligible studies were extracted into an Excel file with the following information: number of antenatal visits, childbirth self-efficacy, self-diagnosis on labor, type of delivery, and episiotomy.

### **Assessment of risk of bias**

Two reviewers (MRDZ and CS) independently screened all the selected studies to assess the risk of bias. Disagreements were solved through discussion until consensus, and a third reviewer (BDM) was consulted when needed. For randomized controlled trials, the two reviewers assessed the risk of bias by evaluating each included study for internal validity. Results were included in the Cochrane Software Review Manager version 5.3 (The Nordic Cochrane Centre; Copenhagen, Denmark), which assessed the following bias: generation of random sequence (selection), allocation concealment (selection), blinding of participants and personnel (performance), blinding of outcome assessment (detection), incomplete outcome data (attrition), selective reporting (reporting), and others<sup>26</sup>. Potential risk of bias was categorized as low, unclear, or high for each of the seven domains. An overall decision on the risk of bias was performed

according to the fulfillment of software questionnaires for each study, and the software automatically generated the risk of bias for the included studies (Figure 1).

### **Unit-of-analysis issues**

The generic inverse variance method for meta-analysis calculated the odds ratio (OR) and mean difference as a measure of association (95% confidence interval [CI]), and results were presented as forest plot graphs when suitable.

The  $I^2$  statistic test calculated the heterogeneity between the included studies according to the threshold recommendations of the Cochrane Handbook for Systematic Reviews. The  $I^2$  value between 0% and 40% suggests minor heterogeneity; 30% and 60% moderate heterogeneity; 50% and 90% substantial heterogeneity; and 75% and 100% considerable heterogeneity. According to the handbook, the magnitude and direction of the effects (p value for  $\chi^2$  test, 95% CI for  $I^2$ ) determine the importance of the  $I^2$  statistic. Analyses were performed using the Cochrane Software Review Manager version 5.3 (The Nordic Cochrane Centre; Copenhagen, Denmark). In meta-analyses including a limited number of studies, these heterogeneity tests should be interpreted with caution<sup>27</sup>.

## **RESULTS**

A total of 348 studies were considered eligible for inclusion. After the screening process of titles, 44 studies proceeded to abstract reading; 11 were excluded. Thirty-three studies were fully read, and nine were included<sup>7,28-35</sup> (Figure 2). A total of 2,488 pregnant women were analyzed in the included studies.



All studies were conducted in Oriental hemisphere countries: two in Iran<sup>7,28</sup>, two in Turkey<sup>32,34</sup>, and the others in Hong Kong<sup>29</sup>, Nepal<sup>30</sup>, Denmark<sup>31</sup>, India<sup>33</sup>, and Jordan<sup>35</sup>. The sample size in each study ranged from 72<sup>32</sup> to 1,196<sup>31</sup> pregnant women. For intervention, most studies presented the frequency of antenatal education programs ranging from one<sup>30</sup> to eight<sup>28,32</sup> sessions per week, with 35 minutes<sup>30</sup> to three hours<sup>31</sup> of duration. The meetings involved similar content and general antenatal education topics, such as those established in the inclusion criteria. The methods involved at least one in-person session<sup>30</sup>, and some studies complemented the intervention with other materials, such as booklet<sup>7,29,31</sup>, software<sup>7</sup>, videos<sup>33,35</sup>, pamphlet<sup>35</sup>, and remote assistance from researchers (via phone call or WhatsApp<sup>7,35</sup>). In contrast, other studies focused only on the meetings<sup>28,30-32,34</sup>.

## **Effects of interventions**

### **1) Number of antenatal care visits**

Only one study investigated the effects of a structured antenatal education program on the number of antenatal care visits for low-risk pregnant women<sup>30</sup>. Authors hypothesized that the presence of husbands in antenatal education sessions could improve obstetrics outcomes compared with women attending alone or not receiving antenatal education. Participants of the study were divided into three groups: group I (GI) included pregnant women who attended antenatal education sessions with their husbands; group II (GII) comprised pregnant women who attended antenatal education sessions alone; and group III (GIII) included pregnant women who received no antenatal education. The number of pregnant women who attended more than three antenatal care visits was similar among the three groups (GI: n=85.7, GII: n=80.8, and GIII: n=87.5).

## **2) Childbirth self-efficacy**

Three studies evaluated childbirth self-efficacy using the “Childbirth Self-Efficacy Inventory” (CBSEI) developed by Lowe<sup>36</sup>. Of these, two studies used the short version of this instrument developed by Ip et al.<sup>37</sup>. Two domains of the CBSEI-32 (40 and 43) were analyzed using meta-analysis, showing that participation in the antenatal education program improved self-efficacy (outcome expectancy [OE] 16.00 [95% CI 9.86-22.15] and efficacy expectancy [EE] 20.44 [95% CI 13.62-27.25], Figure 3). Abbasi et al.<sup>7</sup> showed higher CBSEI-36 scores in the educational booklet (adjusted mean difference 113.4 [95% CI 100.7-126.1]) and e-learning groups (adjusted mean difference=159.3 [95% CI 146.5-172.0]) than the control group. No heterogeneity was identified in the meta-analysis.

## **3) Self-diagnosis on labor**

Maimburg et al.<sup>31</sup> and Hatamleh et al.<sup>35</sup> analyzed the benefits of antenatal education programs in helping pregnant women (a total of 1,326) to self-diagnose their labor. These studies used different methods to evaluate dilation on hospital admission, hindering the meta-analysis for this outcome. Hatamleh et al.<sup>35</sup> analyzed the mean dilation in centimeters and reported similar dilation at hospital admission in the intervention (IG) and control groups (CG) (IG 3.8 cm, standard deviation (SD) 1.55 cm; CG 3.2 cm, SD 1.61 cm). In contrast, Maimburg et al.<sup>31</sup> analyzed the frequency of pregnant women with more than three centimeters of dilation at hospital admission, observing a higher number of women from the antenatal education group than those from the control group (IG 280; CG 185,  $p < 0.005$ ).

#### **4) Type of delivery**

Five of the included studies<sup>28,31,33-35</sup> evaluated the influence of antenatal education programs on the type of delivery. A total of 1,753 pregnant women were analyzed. These results (Figure 4) showed that antenatal education programs were essential to favor vaginal delivery (OR 1.28 [95% CI 1.01-1.63]). The  $I^2$  statistic test found moderate heterogeneity.

#### **5) Frequency of episiotomy**

Three included studies<sup>28,31,34</sup> investigated the influence of antenatal education programs on the frequency of episiotomy. A total of 1,483 deliveries were analyzed, and results showed that antenatal education programs increased the frequency of episiotomy (Figure 5). However, after excluding the Citak Bilgin et al.<sup>34</sup> study due to its lower methodological quality than the others, antenatal education programs did not influence the frequency of episiotomy (OR 1.32 [95% CI 0.93-1.86]). No heterogeneity was identified in the meta-analysis.

## **DISCUSSION**

This systematic review with meta-analysis investigated whether the available randomized or quasi-randomized studies showed the influence of an antenatal education program on maternal health and labor-related outcomes. Our results corroborated an earlier report<sup>38</sup> suggesting the lack of evidence on the most effective format of antenatal education. Cultural and geographical needs should be considered when designing antenatal education programs for each country or region. Based on the present results, structured and bidirectional (or active) antenatal education programs involving anatomical and physiological information on pregnancy and childbirth may decrease the cesarean section rate in low-risk pregnancies.

This review evaluated the number of antenatal care visits to healthcare providers as an outcome. The National Collaborating Centre For Women's and Children's Health<sup>39</sup> recommended that nulliparous women should receive ten antenatal care visits; slightly higher than those recommended by the WHO<sup>8</sup>. This data was only presented by one of the included studies<sup>30</sup>, and antenatal education programs did not affect pregnant women attending the program alone or with their husbands. This study was conducted in Nepal and defined adequate antenatal care as attending at least four visits. In this context, whether antenatal education programs could improve the bond of pregnant women with healthcare providers and increase adherence to antenatal care visits remains unclear.

Admission to hospital facilities without active labor is common worldwide, even in developed countries. For instance, a study in the United Kingdom demonstrated that 30% of pregnant women admitted to hospitals were not in labor<sup>40</sup>. Pregnant women may be insecure on when to refer to a hospital, and early admission may become an issue since it was related to increased labor interventions and impaired maternal and fetal outcomes<sup>41</sup>. Of the two studies analyzing the relationship between antenatal education programs and hospital admission, one found no relationship<sup>35</sup>, and the other<sup>31</sup> found that pregnant women who received antenatal education were admitted to the hospital with greater dilatation than those in the control group.

Antenatal education programs could also reduce the anxiety of pregnant women by decreasing their sensation of negative feelings and sense of unsafety. Information about physiological changes and signs of a pregnant body helps pregnant women to increase their confidence that "everything is developing as it should". In this context, the sense of control over physiological responses through attitudes and actions (e.g., pain relief) reduces the emotional tension, increasing the childbirth self-efficacy<sup>42</sup>.

After analyzing three studies<sup>7,29,32</sup> and assessing two<sup>29,32</sup> of them using meta-analysis, we suggested that structured antenatal education programs could significantly enhance the childbirth self-efficacy of pregnant women. Therefore, antenatal education programs are essential to improve public health.

General, bidirectional, and structured antenatal education programs may increase the frequency of vaginal delivery. This finding corroborated Chen et al.<sup>38</sup>, who suggested that workshops for pregnant women alone or with their partners reduce the frequency of cesarean sections and increase vaginal delivery.

The frequency of episiotomy was assessed in three studies<sup>28,31,34</sup> and suggested that women who received antenatal education had an increased chance of receiving episiotomy. This relationship may be difficult to understand; however, the increased frequency of vaginal delivery in pregnant women who received antenatal education may have indirectly affected the frequency of episiotomy. In this context, this topic is important and should be included in all antenatal education programs.

The participation of male partners in the reproductive health of women has been increasingly recognized<sup>43</sup>. However, only two studies<sup>30,32</sup> in this review involved male partners through innovative methods in antenatal education programs. Mullany et al.<sup>30</sup> had one male and female professional delivering the antenatal education to the couple and observed that pregnant women accompanied by male partners were more likely to attend postpartum visits than those alone. Although Serçekus et al.<sup>32</sup> presented no results regarding the visits, they included the "father-infant interactions" topic in the meetings, which was not addressed in any of the included studies.

Besides considering topics, the entire antenatal education program must be designed according to the needs of pregnant women to ensure adherence. Also, governments must strengthen

antenatal education programs as a public health policy since it is a tool for health promotion that can contribute to healthy maternal behaviors, reducing the risk of adverse maternal and fetal outcomes<sup>44</sup>. These actions involve resistance from governments, probably due to the financial aspect. For example, although Denmark is one of the countries with the best health service worldwide, antenatal care and education have been phased out to reduce costs<sup>31</sup>. This fact motivated Maimburg et al.<sup>31</sup> (included in this review) to develop one of the largest clinical trials on the topic.

As a strength of this review, only studies providing a detailed description of the antenatal education program were included. Some methods (e.g., Lamaze and Mindfulness) are very specific and may not be easily replicated in public health settings. Therefore, antenatal education programs (as a public health policy) should be more general and not rely on specialized health professionals. This approach was successfully implemented by Maimburg et al.<sup>31</sup> in a study with a health instructor who completed a three-day preparation course. Also, the approach can include social health activists or community agents, which could be a low-cost strategy to improve maternal health in the public health system.

This review also presented some limitations, such as the small number of studies included in the meta-analysis, which could interfere with the results<sup>45</sup> especially when analyzing only two studies, as occurred in the self-efficacy outcome. However, analyzing few studies is a common practice<sup>46,47</sup> and may encourage further research on a specific topic.

## **Conclusion**

This systematic review suggested that structured antenatal education programs have strong evidence to be recommended and benefit maternal health since they improve childbirth self-

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efficacy and the probability of vaginal delivery in low-risk pregnant women. Antenatal education programs may be a powerful and low-cost tool for promoting health by involving a multidisciplinary team to improve maternal outcomes. However, we observed a lack of randomized clinical trials investigating whether antenatal education programs can increase the frequency of antenatal care visits and improve self-diagnosis on labor.

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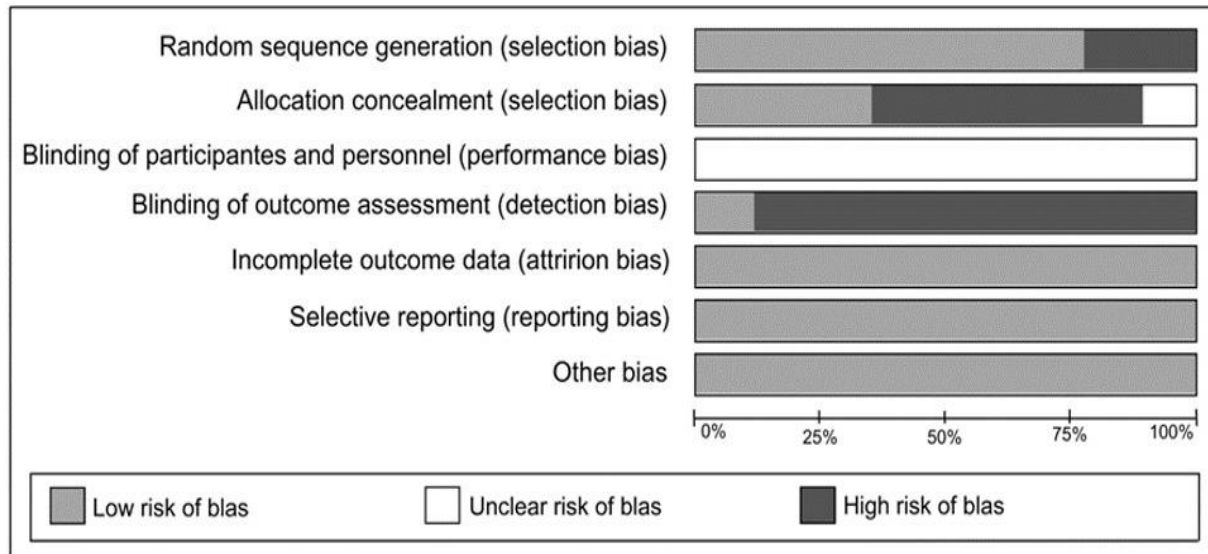
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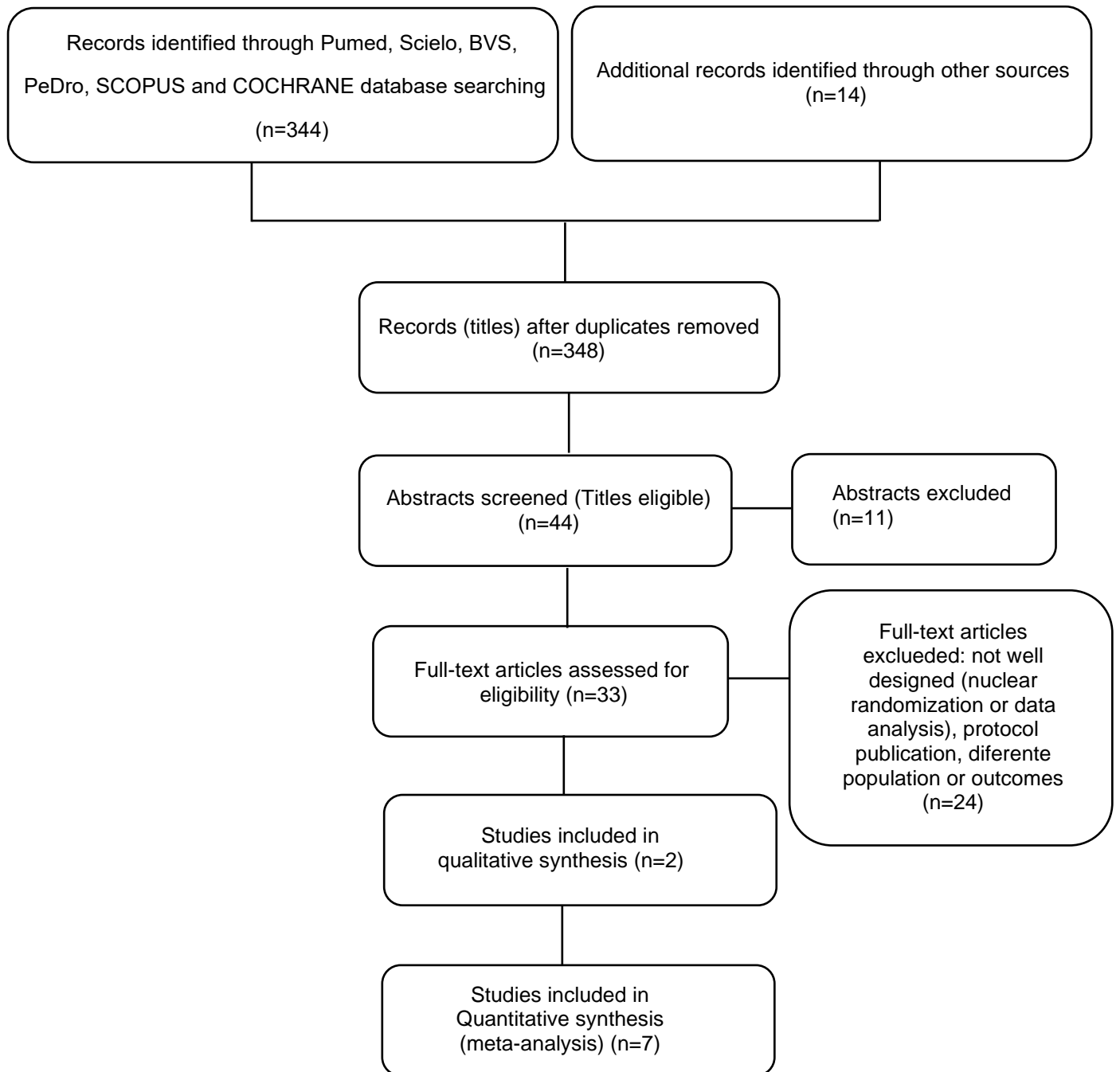
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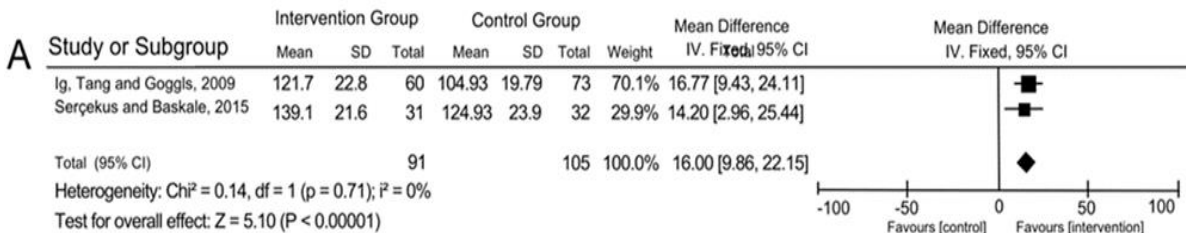
**Figure 1:** Risk of the included studies.





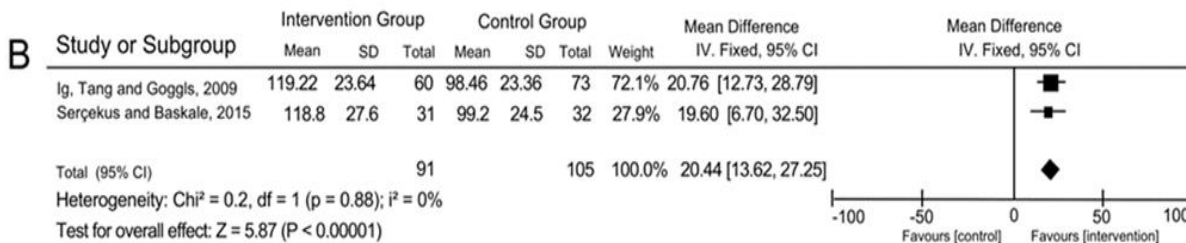
**Figure 2:** Flowchart for identification and selection of articles for the systematic review

**Figure 3:** Forest plot of comparison: pregnant women who participated in antenatal education program compared to those who did not participate. Outcome: self-efficacy on childbirth. a) OE-16 and b) EE-16.



*Caption*

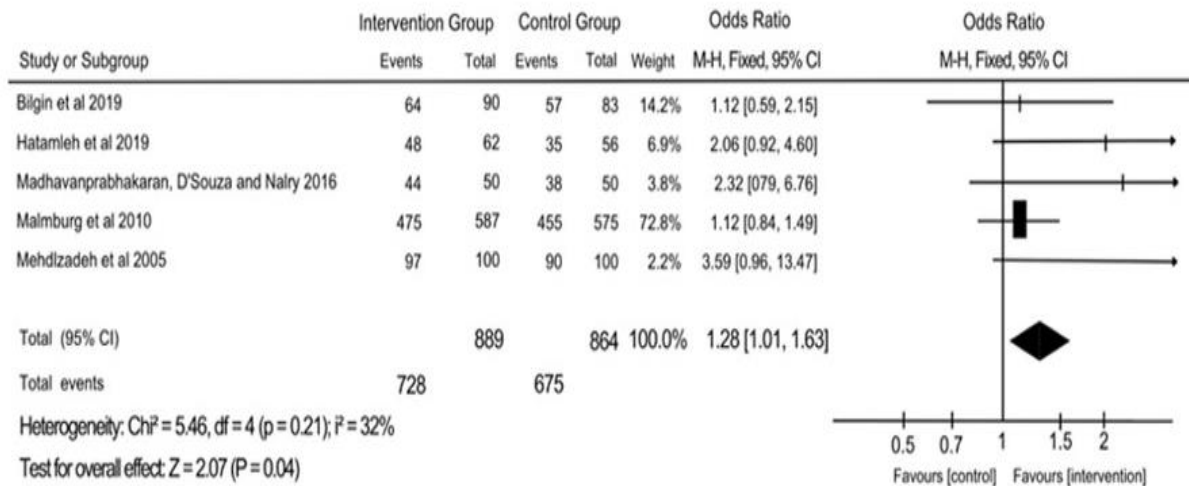
Forest plot of comparison: 1 New Comparison, outcome: 1.5 OE-16



*Caption*

Forest plot of comparison: 1 New Comparison, outcome: 1.6 EE-16

**Figure 4:** Forest plot of comparison: pregnant women who participated in antenatal education program compared to those who did not participate. Outcome: frequency of vaginal delivered.



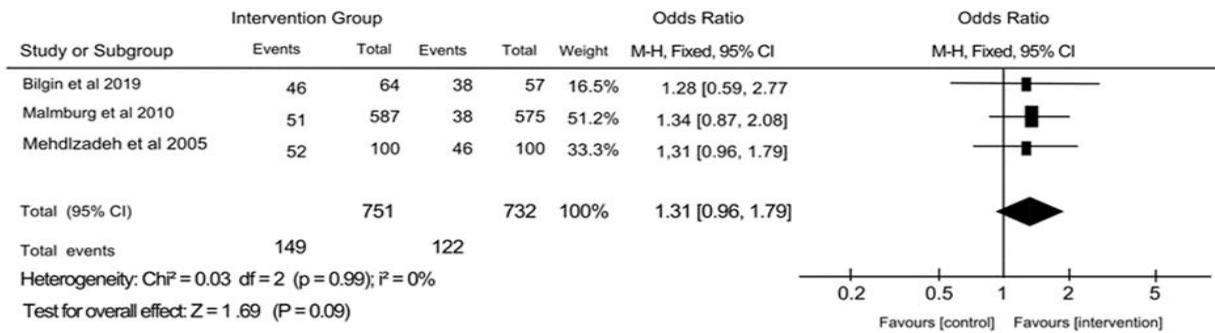
*Caption*

Forest plot of comparison: 1 New Comparison, outcome: 1.3 Vaginal Delivery



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**Figure 5:** Forest plot of comparison: pregnant women who participated in antenatal education program compared to those who did not participate. Outcome: frequency of episiotomy.



**Caption**

Forest plot of comparison: 1 New Comparison, outcome: 1.3 Vaginal Delivery