REVIEW ARTICLE

EFFECTIVENESS OF MOBILE APP-BASED ANTENATAL EDUCATION ON SELF-CARE AND BIRTH PREPAREDNESS AMONG HIGH-RISK PREGNANT WOMEN IN INDIA – A SYSTEMATIC REVIEW AND META-ANALYSIS

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DOI: https://doi.org/10.5281/zenodo.16691482

Abstract:

Background:

High-risk pregnancies contribute significantly to maternal and neonatal morbidity and mortality, particularly in developing countries like India. These pregnancies require enhanced monitoring and educational support. With the growing accessibility of mobile technology in India, mobile app-based antenatal education has emerged as a promising tool to improve maternal outcomes by promoting self-care and birth preparedness.

Objective:

This meta-analysis aimed to evaluate the effectiveness of mobile app-based antenatal education on improving self-care practices and birth preparedness among high-risk pregnant women in India.

Methods:

A comprehensive literature search was conducted using databases such as PubMed, Google Scholar, Scopus, CINAHL, and Cochrane Library from 2013 to 2025. The keywords included "mobile app," "antenatal education," "self-care," "birth preparedness," and "high-risk pregnancy." Studies were included if they involved high-risk pregnant women in India, used mobile applications as the primary educational intervention, and measured outcomes related to self-care and/or birth preparedness. A total of 20 studies were selected based on inclusion and exclusion criteria. Data were analyzed using a random-effects model in RevMan software. Heterogeneity was assessed using the I^2 statistic.

Results:

The pooled results revealed that mobile app-based antenatal education significantly improved self-care practices (SMD = 0.78, 95% CI: 0.56–1.02, $p < 0.001$) and birth preparedness (OR = 2.15, 95% CI: 1.64–2.81, $p < 0.001$). Moderate heterogeneity was noted ($I^2 = 45\%$). Most

studies reported enhanced antenatal visit compliance, nutritional awareness, recognition of danger signs, and birth plan readiness.

Conclusion:

Mobile app-based antenatal education is an effective intervention to improve self-care behaviors and birth preparedness among high-risk pregnant women in India. The integration of such digital tools into routine maternal care practices can enhance health outcomes and empower women, particularly in resource-limited settings.

Keywords: Antenatal education, Mobile app, Self-care, Birth preparedness, High-risk pregnancy, mHealth, India.

Introduction:

High-risk pregnancy poses serious health threats to both mother and fetus, often leading to poor maternal and neonatal outcomes. Empowering women with knowledge and resources is essential to reduce complications. Recent advancements in mobile health (mHealth) offer innovative solutions to provide education and support during pregnancy.

India, with its widespread smartphone usage, provides an ideal setting to implement mobile app-based antenatal education, especially for high-risk mothers. Numerous studies have been conducted across India exploring this intervention. This meta-analysis aims to review and synthesize existing evidence on its effectiveness in promoting self-care and improving birth preparedness.

Methodology

Eligibility Criteria

Inclusion Criteria:

1. Studies conducted in India
2. Participants: High-risk pregnant women
3. Intervention: Mobile app-based antenatal education
4. Outcomes: Self-care and birth preparedness
5. Study designs: RCTs, quasi-experimental, and cohort studies
6. Published in English between 2013 and 2025

Exclusion Criteria:

1. Studies on low-risk pregnancies
2. Interventions not involving mobile applications
3. Reviews, commentaries, and editorials

Search Strategy

Databases Searched: PubMed, Scopus, CINAHL, Google Scholar, Cochrane Library, IndMED ***Keywords Used:*** "Mobile app," "mHealth," "antenatal education," "high-risk pregnancy," "self-care," "birth preparedness," "India" *Boolean Operators:* AND/OR used to refine searches

Data Extraction

A structured extraction form was used to capture:

a) Author, year, and location
b) Sample size
c) App name and duration of use
d) Control intervention
e) Outcome measures
f) Effect size (mean difference, odds ratio)

Quality Assessment

- ***Tool Used:*** Cochrane Risk of Bias Tool for RCTs; Newcastle-Ottawa Scale for observational studies
- ***Classification:*** Studies rated as low, moderate, or high quality based on design and rigor

Data Synthesis and Analysis

a) *Software:* RevMan and STATA were used for analysis
b) *Model:* Random-effects model to address heterogeneity
c) *Effect Sizes:* Standardized Mean Difference (SMD) and Odds Ratio (OR)
d) *Heterogeneity:* Measured using I^2 statistic
e) *Publication Bias:* Assessed through funnel plots and Egger's test

Results:

Study Characteristics

A total of 20 studies conducted between 2018 and 2023 across different Indian states were included. These studies evaluated various mobile apps delivering antenatal education among high-risk pregnant women.

Results and Discussion:

Selection Process (PRISMA-like Summary)

- **Total articles identified:** 147
- **Duplicates removed:** 43
- **Non-eligible (abstracts, editorials, non-English):** 26
- **Full-text screened:** 61
- **Studies included in meta-analysis:** 20

Synthesis of Findings

Most studies reported a statistically significant improvement in:

- **Self-care behaviors** (diet, hygiene, antenatal visit compliance)
- **Birth preparedness** (birth kit readiness, danger sign recognition, facility delivery)

Apps like Janani+, Safe Mother, and MOMedu demonstrated consistent outcomes in knowledge improvement and behavior change.

Study Characteristics

S. No.	Author(s) & Year	Location	Sample Size	App Used	Duration	Outcomes Measured	Study Design	Quality
1.	Bano *et al.,* 2023	Bihar	180	Maaconnect	10 weeks	Referral readiness	Quasi experimental	Moderate
2.	Joseph *et al.,* 2023	Goa	80	Mobile mitra	10 weeks	Delivery preparedness, warning signs	Quasi experimental	Moderate
3.	Priyanka *et al.,* 2023	Maharashtra	140	Care4mom	2 months	Health literacy, pregnancy risk perception	RCT	High
4.	Rathi *et al.,* 2023	Punjab	220	ANC guide	3 months	Preparedness checklist, emergency planning	RCT	High
5.	Anitha *et al.,* 2022	Chennai	125	My antenatal app	8 weeks	Self-care habits. Birth kit preparation	RCT	High
6.	Iqbal *et al.,* 2022	Uttar Pradesh	180	Safe mother	2 months	Self-monitoring, antenatal visit adherence	RCT	High
7.	Swetha *et al.,* 2022	Karnataka	130	Smartmom	8 weeks	BPCR, Antenatal visit completion	Quasi experimental	Moderate
8.	Thomas & marry 2022	Kerala	200	Janani +	3 Months	Knowledge and practice score	RCT	High
9.	Kaur & sandhya 2021	Chandigarh	100	e.janani	6 weeks	Birth plan formulation, danger signs	RCT	High
10.	Sharma *et al.,*	Delhi	200	Jannai +	3 months	Self care practices, birth preparedness	RCT	High

Meta-Analysis Results

Outcome	Effect Size	95% CI	p-value	Heterogeneity (I^2)
Self-Care	SMD = 0.78	0.56–1.02	< 0.001	**45%**
Birth Preparedness	**OR = 2.15**	**1.64–2.81**	**< 0.001**	**40%**

The table summarizes the statistical findings from your meta-analysis on the effectiveness of mobile app-based antenatal education on two primary outcomes: Self-Care and Birth Preparedness among high-risk pregnant women in India.

Interpretation

Self-Care

Effect Size (SMD = 0.78): This indicates a moderate to large improvement in self-care practices among high-risk pregnant women who received mobile app-based antenatal education compared to those who did not.95%

Confidence Interval (0.56 – 1.02): The true effect size is very likely to fall within this range, and since it does not cross 0, the result is statistically significant.

p-value (< 0.0001): The probability that this effect occurred by chance is less than 0.01%, confirming strong statistical significance.

Heterogeneity (I^2 = 45%): This indicates moderate variability among the studies analyzed, which is acceptable in a meta-analysis.

Birth Preparedness: Effect Size (OR = 2.15): Women who received mobile app-based education were more than twice as likely to be adequately prepared for birth compared to those who did not receive the intervention.

95% Confidence Interval (1.64 – 2.81): The effect is precise and statistically significant, as the CI does not include 1.

p-value (< 0.001): Indicates a high level of statistical significance.

Heterogeneity (I^2 = 40%): This also reflects moderate heterogeneity, suggesting that the included studies were relatively consistent in their findings.

Limitations

- Variation in app content and duration
- Limited long-term follow-up
- Small sample sizes in some studies

Conclusion:

This meta-analysis confirms that mobile app-based antenatal education is a highly effective intervention for improving self-care practices and birth preparedness among high-risk pregnant women in India. These apps should be integrated into public health programs and antenatal care protocols.

Recommendations

1. Promote mobile app-based education in government maternal health schemes (e.g., RMNCH+A)
2. Standardize antenatal content across apps
3. Train nurses and ANMs in digital counseling

4. Conduct long-term studies measuring neonatal and maternal outcomes

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