Internship Training

at

International Institute of Health Management Research New Delhi

Birth preparedness and complication readiness among pregnant and recently delivered women in India: Systematic review and Meta-analysis.

By

Mr Brajaraj Tripathy

PG/21/025

Under the guidance of

Dr Sidharth Sekhar Mishra

PGDM (Hospital & Health Management)

2021-23

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International Institute of Health Management Research

New Delhi

(Completion of Dissertation from respective organization)

The certificate is awarded to

Mr Brajaraj Tripathy

in recognition of having successfully completed his Internship

at IIHMR, Delhi

and has successfully completed his Project on

Birth preparedness and complication readiness among pregnant and recently delivered women in India: Systematic review and Meta-analysis.

Date- 15th January to 15th April, 2023

International Institute of Health Management Research New Delhi

He comes across as a committed, sincere & diligent person who has

a strong drive & zeal for learning.

We wish him all the best for future endeavours.

Siddharth Sekhar Nishir

Training & Development

Zonal Head-Human Resources

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr Brajaraj Tripathy**, student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at **International Institute of Health Management Research New Delhi** from **15th January to 15th April, 2023.**

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfilment of the course requirements.

I wish him all success in all her future endeavours.

Sidharth Sekhar Mishra

Dr. Sumesh Kumar
Associate Dean, Academic and Student Affairs
IIHMR, New Delhi

Dr. Sidharth Sekhar Mishra
Assisstant Professor
IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"Birth Preparedness and Complication Readiness among Pregnant Women and Recently Delivered Women in India: Systematic Review and Meta-Analysis"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee
for evaluation of dissertation.

Name	Signature
Sidharth Sekhar Mishra	Sidharth Sekhar Mishra
Rupsa Banerjee	

Certificate from Dissertation Advisory Committee

This is to certify that **Mr Brajaraj Tripathy,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. He is submitting this dissertation titled **"BIRTH PREPAREDNESS AND COMPLICATION READINESS AMONG PREGNANT AND RECENTLY DELIVERED WOMEN IN INDIA: SYSTEMATIC REVIEW AND META-ANALYSIS"** in partial fulfilment of the requirements for the award of the **PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Siddharth Sekhar Mishra

Dr Sidharth Sekhar Mishra,
Assistant Professor,
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INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled "**Birth preparedness and complication readiness among pregnant and recently delivered women in India: Systematic review and Meta-analysis**" and submitted by **Mr Brajaraj Tripathy**, Enrollment no. PG/21/025 under the supervision of **Dr Sidharth Sekhar Mishra**, Assistant Professor, IIHMR Delhi for award of **PGDM** (Hospital & Health Management) of the Institute carried out during the period from **15th January to 15th April, 2023** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

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Name of the Student: Mr Brajaraj Tripathy

Name of the Organisation in Which Dissertation Has Been Completed: International Institute of Health Management Research New Delhi

Area of Dissertation: Birth preparedness and complication readiness among pregnant and recently delivered women in India: Systematic review and Meta-analysis

Attendance: 100%

Objectives achieved: All

Deliverables: Excellent Dissertation Report and Presentation.

Strengths: Strong Research Aptitude and Skills, Good Communication and Teamwork Skills.

Suggestions for Improvement: To have faith in own work and to keep learning

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

Siddharth Sekhar Mishra

Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)

Date: 28th June '2023

Place: IIHMR, Delhi

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Name of Guide/Supervisor	Dr. Sidharth Sekhar Mishra		
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Plagiarism detects software used	"TURNITIN"		
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ACKNOWLEDGEMENT

It is an esteemed pleasure to present this research project by thanking each and everyone who helped me in this task. I would like to express my sincere gratitude towards my guide **Dr Sidharth Sekhar Mishra**, Assistant Professor, IIHMR Delhi, who helped me immensely throughout the tenure of my internship. He inspired me greatly to work in this project with his valuable guidance, support, interest, encouragement, involvement and advice.

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Acronyms/Abbreviation-

BPCR- Birth Preparedness and Complication Readiness

GoI- Government of India

JBI- Joanna Briggs Institute

JHPIEGO- Johns Hopkins Program for International Education in Gynaecology and Obstetrics

JSY- Janani Suraksha Yojana

JSSK- Janani Shishu Suraksha Karyakaram

LaQshya- Labour room Quality Improvement Initiative

MMR- Maternal Mortality Ratio

MMR- Maternal Mortality Rate

PMSMA- Pradhan Mantri Surakshit Matritva Abhiyan

PRISMA- Preferred Reporting Items for Systematic Review and Meta-Analysis

SRMA- Systematic review and meta-analysis

WHO-World Health Organization

ABOUT IIHMR DELHI

The International Institute of Health Management Research (IIHMR), New Delhi is allied to the 'Society for Indian Institute of Health Management Research' which was established in October 1984 under the Societies Registration Act-1958. IIHMR-Delhi was setup in 2008 in response to the growing needs of sustainable management and administration solutions critical to the optimal function of healthcare sector both in India and in the Asia-Pacific region.

We are a leading institute of higher learning that promotes and conducts research in health and hospital management; lends technical expertise to policy analysis and formulation; develops effective strategies and facilitates efficient implementation; enhances human and institutional capacity to build a competent and responsive healthcare sector. Our multi-dimensional approach to capacity building is not limited to academic programs but offers management development programs, knowledge and skills-based training courses, seminars/webinars, workshops, and research studies. Our four core activities are…

- Academic courses at masters and doctoral level in health and hospital management to meet the growing need of skilled healthcare professionals.
- Research that has high relevance to health policies and programs at national and global level.
- Continued education through management development programs and executive programs for working professionals to help them upgrade their knowledge and skills in response to the emerging needs of the industry.
- Technical consultation to the national and state-level flagship programs to address the gaps in planning as well as implementation.

International Institute of Health Management Research, New Delhi (IIHMR-Delhi)

Over the years IIHMR-Delhi has emerged as an institute of repute both nationally and globally for producing socially conscious, skilled and vibrant top-class health care management professionals. Our graduates are well-matched for the ever-changing health care sector and evolving social milieu. The institute has progressed as a leader in research, teaching, training, community extension programmes and policy advocacy in the field of health care. IIHMR has carved out a niche for itself through its cutting-edge academic curriculum, infrastructure, accomplished multi-disciplinary faculty and research.

The Institute as an autonomous body of international stature has been developing leaders for several years to shape tomorrow's healthcare by equipping the students in the fields of health, hospital, and health information technology.The Institute's dynamic health care research programmes provide rigorous training in management, health systems, hospital administration, health care financing, economics, and information technology

Commitment to Inclusive Excellence

As an institute, IIHMR-Delhi is committed to creating an environment of higher learning that can serve as the model for the kind of society it strives to build – one of equity, social justice and mutual support. We have also made a concerted effort to promote the ethos and philosophies amongst today's students and nurture them into growing as effective managers, to think both critically and ethically, to learn to cope with ethical dilemmas and apply systems-thinking approaches to serious and complex societal problems. Our internationally renowned faculty lead multidisciplinary health research in multifarious areas such as public health, health services, health economics, hospital management, social determinants of health, mental Health and other topics of global and national interest.

The IIHMR is invited by various governmental and civil society organizations to provide technical support for capacity building and policy research needs that culminates in developing innovative and equitable health care strategies and provide advocacy support for health policy and planning. The institute also responds to the global health threats, natural disasters, conflict and related humanitarian crisis. In addition to the Masters and doctoral level programmes, IIHMR-D also offers several highly specialized and popular Management Development Programmes (MDP) to wide range of health professional in the country and overseas which largely addresses educational needs amongst in-service aspirants.

INTRODUCTION-

The health of pregnant women, from conception to the postnatal period, must be treated as a priority. Each stage of the process should be a positive experience, enabling both mother and baby to realize their full potential for health and happiness.

In 2012, a total of 213 million pregnancies took place, with the majority (89%) occurring in developing nations and a smaller proportion (11%) in the developed world. It highlights the disparities in access to quality health services.(1) Whereas, In India from 2015 to 2019, an estimated 48.5 million pregnancies occurred each year.(2)

Maternal Mortality can be defined as the number of female deaths per annum due to any cause related to or caused by pregnancy, childbirth, or up to 42 days after the termination of the pregnancy, regardless of the length and location of the pregnancy, is recorded.(3)

According to the WHO and a Study by (Say et al. 2014) Suggests, that approximately three-quarters (75%) of maternal fatalities are due to direct obstetric causes that can be attributed to severe haemorrhage, infection typically occurring following childbirth, high blood pressure during gestation (pre-eclampsia and eclampsia), embolism, unsafe abortion and rest (25%) deaths was due to indirect obstetric causes of pregnancy resulting from previously existing disease like cardiovascular diseases, HIV, severe anaemia, diabetes and hepatitis when aggravated by Pregnancy.(4–7)

Although some advances have been made in the past two decades, the number of women who died in 2020 due to pregnancy and childbirth-related causes is still exceedingly high at 287,000, which is not an acceptable figure.(8)

In 2020, virtually 95% of maternal fatalities took place in lower and lower-middle-income countries (LMIC), with most of them being avoidable. Sub-Saharan Africa and Southern Asia were the locations of 87% (253,000) of the estimated global maternal deaths. Between 2000 and 2020, Eastern Europe and Southern Asia experienced the most drastic decrease in the maternal mortality ratio (MMR): a reduction of 70% (from 38 MMR to 11) and 67% (from 408 MMR to 134) respectively.(4)

The Indian Government has made significant progress in reducing MMR from 103 to 97 per lakh live births between 2017-2019 and 2018-2020 respectively, surpassing the goal set by the NHP 2017 for 2020. However, the MMR still needs to be improved further to reach the Sustainable Development Goal of 70 per 100,000 live births by 2030.(9,10)

To reduce the maternal mortality rate (MMR) in India, strategies such as prioritizing maternal and child health (MCH) services, ensuring safe delivery and postpartum periods, providing quality primary health care, promoting health education and reproductive behaviour and rights of safe motherhood should be adopted (11) and as well as the proper management of potential delays.(12,13)

To ensure maternal health, it is essential that all women, including adolescents, have access to contraception, safe abortion services, and quality post-abortion care. Furthermore, pregnant women should receive quality care during and after childbirth and should be attended by skilled health professionals. Additionally, measures such as the timely administration of oxytocic, good hygiene, early detection and treatment of infections, and the use of drugs such as magnesium sulphate for pre-eclampsia should be adopted to reduce the risk of maternal mortality.(4)

Thaddeus and Maine (14) have identified three delays associated with receiving care during childbirth: the decision to seek care, identifying and reaching a medical facility, and receiving adequate and appropriate treatment. To address these delays, Johns

Hopkins Program for International Education in Gynaecology and Obstetrics (JHPIEGO) has created the Birth Preparedness and Complication Readiness (BPCR) concept to ensure that expectant mothers are able to access the care they need without unnecessary delays.(15,16)

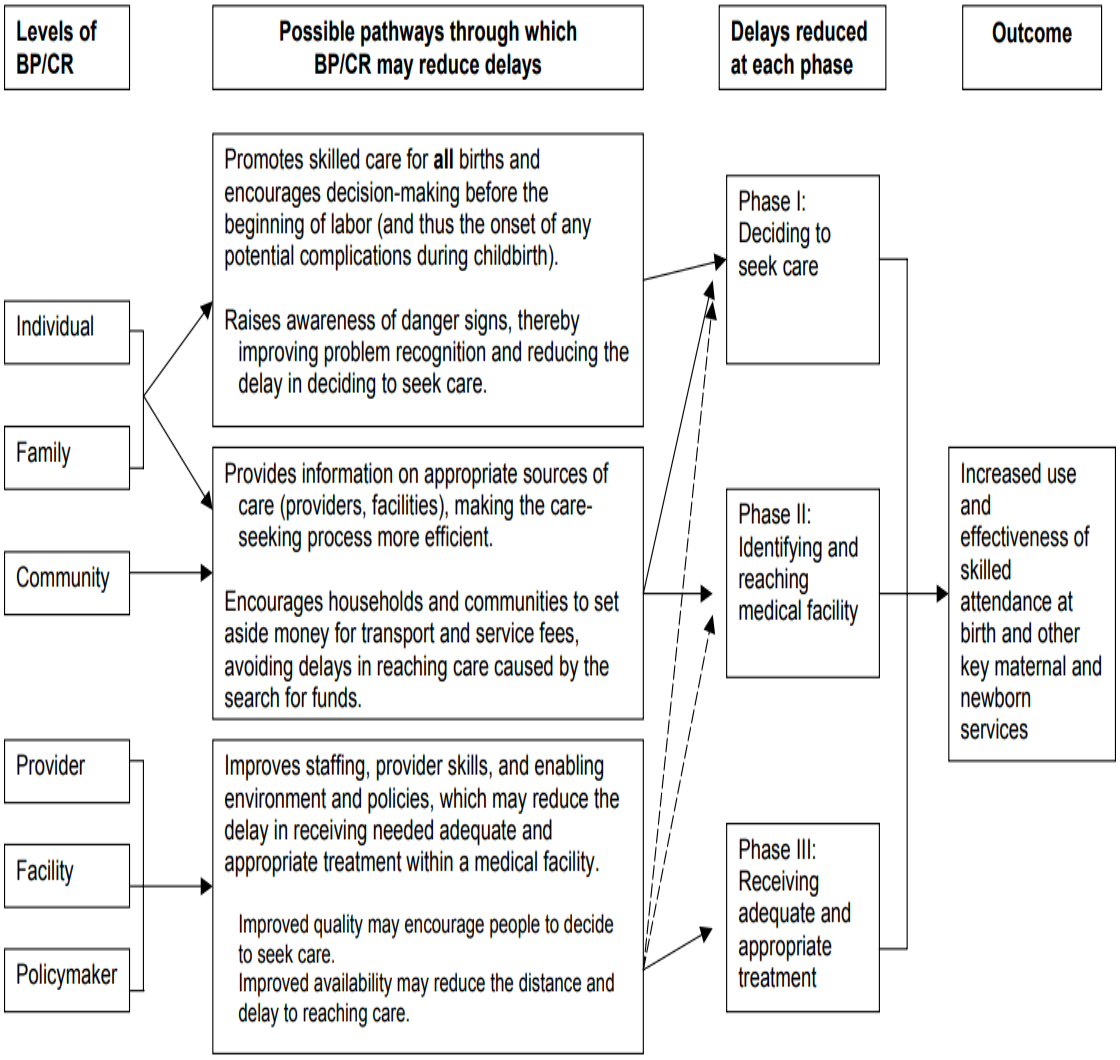

Figure 1:- Conceptual Diagram of How BPCR may increase the use of skilled care

BPCR approach is an effective way to ensure the use of skilled maternal and neonatal services in a timely manner.(17) Having a BPCR plan in place helps to ensure the best possible outcome by being prepared for any unexpected issues that may arise during the birthing process.(18) A study conducted in Ethiopia revealed that the Birth Preparedness and Complication Readiness (BPCR) had a considerable impact on the utilization of skilled care. Furthermore, a meta-analysis of 14 randomized trials demonstrated that, given adequate coverage of the population, BPCR interventions are effective in lowering the maternal and mortality rate in areas with limited resources.(19–21)

BPCR helps to speed up the decision to seek care in two ways. Firstly, BP encourages people to plan to have a trained professional at the time of childbirth. If this plan is put into action, the woman can get the necessary care before any potential issues arise during the birth, thus avoiding the two delays. Secondly, CR raises the awareness of danger signs among families and communities, improving the recognition of the problem and speeding up the decision to seek care.(15,22,23)

The Government of India (GoI) launched several flagship programmes under RMNCH+A some of them are - Janani Suraksha Yojana (JSY), a demand promotion and conditional cash transfer scheme which strives to reduce Maternal and Infant Mortality by encouraging institutional delivery among poor pregnant women. Janani Shishu Suraksha Karyakaram (JSSK) to provide free delivery services, drugs, diagnostics, blood, diet, transport, and treatment for newborns in public healthcare institutions. Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) launched to ensure quality antenatal care and high-risk pregnancy detection on the 9th of every month. LaQshya, a Labour room Quality improvement Initiative, recently introduced to further accelerate the decline in MMR by strengthening key processes related to labour rooms and maternity operation theatres, as well as ensuring Respectful Maternity Care.(24) There is no specific Program in India which focuses specifically on BPCR, but the PMSMA,

consists of one objective, related to BPCR, it states – “appropriate BPCR provided for each pregnant woman, especially those who are identified as having a risk factor or co-morbid condition.”(25)

Rationale-

To date, no systematic review and meta-analysis have been conducted on BPCR in India. This systematic review and meta-analysis (SRMA) will provide a comprehensive overview of the current situation of BPCR in India. This analysis will bring to light the gaps in the existing knowledge base, identify potential areas of improvement, and inform evidence-based strategies to improve BPCR in India.

METHODOLOGY-

Study Registration-

This Systematic Review adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines (26) and the protocol was registered at the International Prospective Register of Systematic Reviews (27) (registration ID: CRD42023396109). **(Annexure 1)**

Search strategy –

Keywords were used to create a search strategy for addressing the research questions. Systematic search was performed by combining every feasible sequence of all the categories of keywords. The Medical Subject Headings (MeSH) terms and truncated keywords were mixed using the relevant Boolean logic operators i.e., AND, OR, and NOT. The authors (BT, TS, AP, DG) pretested the search strategy to ensure appropriateness of the search strategy in retrieving the relevant articles and subsequent modifications.

Based on the inclusion criteria, review was done on the following search engines and other sources. Major databases like; PubMed, Google Scholar, Cochrane Library, and Proquest were used to review published studies. The reference lists of already identified studies were also searched to retrieve additional articles. All published articles up to January 31st, 2023, were included in this review. The search was done using the following search terms using PICO format given in table 1.

Table 1: PICO Format

Population	Pregnant women: "pregnan*"[Title/Abstract] OR "pregnant women"[Title/Abstract] OR "antenatal"[Title/Abstract] OR "anc"[Title/Abstract]
Intervention	-
Comparison	-
Outcome	Birth preparedness: "birth preparedness"[Title/Abstract] OR "preparedness"[Title/Abstract] OR "preparing for birth"[Title/Abstract] OR "emergency preparedness"[Title/Abstract] OR "birth plan"[Title/Abstract]
	Complication Readiness: "danger signs"[Title/Abstract] OR "readiness"[Title/Abstract] OR (("recognisable"[All Fields] OR "recognise"[All Fields] OR "recognised"[All Fields] OR "recognises"[All Fields] OR "recognising"[All Fields] OR "recognize"[All Fields] OR "recognized"[All Fields] OR "recognizes"[All Fields] OR "recognizing"[All Fields]) AND "danger sign"[Title/Abstract]) OR "obstetric complication"[Title/Abstract] OR "pregnancy complication"[Title/Abstract] OR "obstetric danger sign"[Title/Abstract] OR "maternal complications"[Title/Abstract] OR "maternal health"[Title/Abstract] OR "newborn health"[Title/Abstract]

*I and C are not mentioned as only descriptive studies were included in the SRMA.

Study selection and eligibility criteria-

Inclusion criteria

This review included cross- sectional studies conducted at the community or institutional level on BPCR in India among pregnant and recently delivered women in India with BPCR as outcome. All studies in English language irrespective of the time of data collection or publication year were included.

Exclusion criteria

Studies which did not reported the outcome variable as BPCR, didn't specify study population, qualitative studies were excluded.

Selection process-

Studies which met the stated inclusion criteria were retrieved and reviewed by two reviewers independently (TS and BT). The two reviewers independently evaluated the eligibility of the studies obtained from the literature searches for title and abstract screening.

"Rayyan.ai" software, a web-based automated screening tool which uses text mining methods to facilitate semi- automatic screening of records for SRs for title and abstract screening. Records were screened and labelled for either inclusion, exclusion, or "maybe" relevant to the subject of the review, and also highlighted the words for inclusion and exclusion (which significantly assisted manual screening), and both the reviewers choose the reason(s) for excluding a record by turning ON the blinding mode.

The generated reports from the two reviewers were retrieved and selected articles will then undergo a full-text screening by (TS and BT). In cases of discrepancies, an agreement was reached by consensus with the advice of third-member arbitrators (AKP

and DG). Justification was given for excluding the studies with proper reason. The search process was presented in the form of a PRISMA flow chart.

Data extraction and data collection-

Two reviewers (TS and BT) independently extracted data using a predefined data extraction Microsoft excel spreadsheet. The sheet included questions on the author's name, publication year, study design, sample size, study area, participants, mean age of participants, response rate and prevalence of BPCR. Additionally, the tool contains information on; percentage of women who saved money for birth and emergency case, women who prepared blood donor, women who identified skilled birth attendant, women who were aware of danger signs during pregnancy, labour, postpartum, and newborn, women who arranged transportation, women who identified place of birth, women who planed health facility delivery, women who knew about financial assistance provided by government in JSY, and women who knew about transportation provided by government in JSSK.

Main Outcome-

The main outcome of this review was to know the BPCR among pregnant and recently delivered women in India.

Measures of effect-

Prevalence of BPCR among pregnant and recently delivered women in India.

Risk of Bias (ROB) Quality Assessment-

All the studies will be assessed for methodological quality, risk of bias to check the validity of the study findings before identifying and finalizing the study for use. Two reviewers (TS and BT) assessed the risk of bias of the included studies independently by using the Joanna Briggs Institute (JBI)(26) critical appraisal checklist, which is devised for studies reporting prevalence data. The JBI methodology checklist consists of 9 questions and is categorized into "Yes", "NO", "Unclear" and "Not applicable".

Overall risk assessment was done by giving each study with a score of 0-9 and categorising them into any of the three categories: - (0-3=HIGH, 4-6=MEDIUM, and 7-9=LOW). After final assessment it was found that Most of the studies have low risk of Bias. Any disagreements over the assessment of the risk of bias and research quality between two reviewers was settled by involving the third reviewer author.

Data synthesis, statistical analysis, and investigation of heterogeneity-

The data was analysed using **CMA (Comprehensive meta-analysis tool) and R studio software**. The analysis was done by **AP, DG, TS, and BT**. We performed a meta-analysis applying fixed and random effects model, considering the assessed heterogeneity between the studies. The pooled estimates were reported by all the studies and the findings were presented using forest plots. Statistical heterogeneity was assessed using a combination of visual inspection of the forest plot along with consideration of the Cochran's Q test, and the I^2 statistic results, in reference to the Cochrane Handbook Criteria. A probability value of $p<0.05$ was taken to indicate statistically significant heterogeneity. When the results fell below 25%, between 25% and 75%, and over 75%, respectively, heterogeneity was deemed low, moderate, and high respectively. When discrepancies between study outcomes go beyond those only due to chance, statistical heterogeneity was present. Funnel plot and Egger's test were

applied to explore the possibility of the publication bias in the studies. Sensitivity analyses was conducted to assess the influence of individual studies on the pooled estimates and to evaluate whether the overall estimates were dominated by one single study.

Subgroup analysis-

As per the data availability, we have done a subgroup analysis for BPCR by delivery status (recently delivered and pregnant women) and geographical region wise (East, West, North, South, and Central). (27)

Definition of BPCR-

BPCR is a strategy to promote the timely use of skilled maternal and neonatal care, especially during childbirth, based on the theory that preparing for childbirth and being ready for complications reduces delays in obtaining this care.(28) BPCR is measured by key elements. The key elements included arrangement for transportation, saving money for delivery, identify skilled birth attendant, identifying place of delivery and identifying blood donor for the case of emergency, knowledge regarding danger signs during pregnancy, labour, postpartum and newborn. All studies that used the above definition of BPCR were included in this review.(15)

RESULTS

Authors have identified records from major databases like PubMed, Cochrane, Proquest (n=1349) records in total and from other sources identified (n=42) records by reference/citation search. After removing (n=378) records before screening, (n=971) articles were finalised to undergo screening, where (n=958) records were removed because of duplication and (n=42) articles from other sources were screened for title and abstract **(Figure 2).**

After title and abstract screening (n=13) articles from major databases and (n=23) from other searches were eligible for full text screening. Lastly (n=36) articles were eligible to be included, which undergone full-text screening and out of which (n=1) article was excluded because of no full text and Finally (n=35) Full text articles were included.

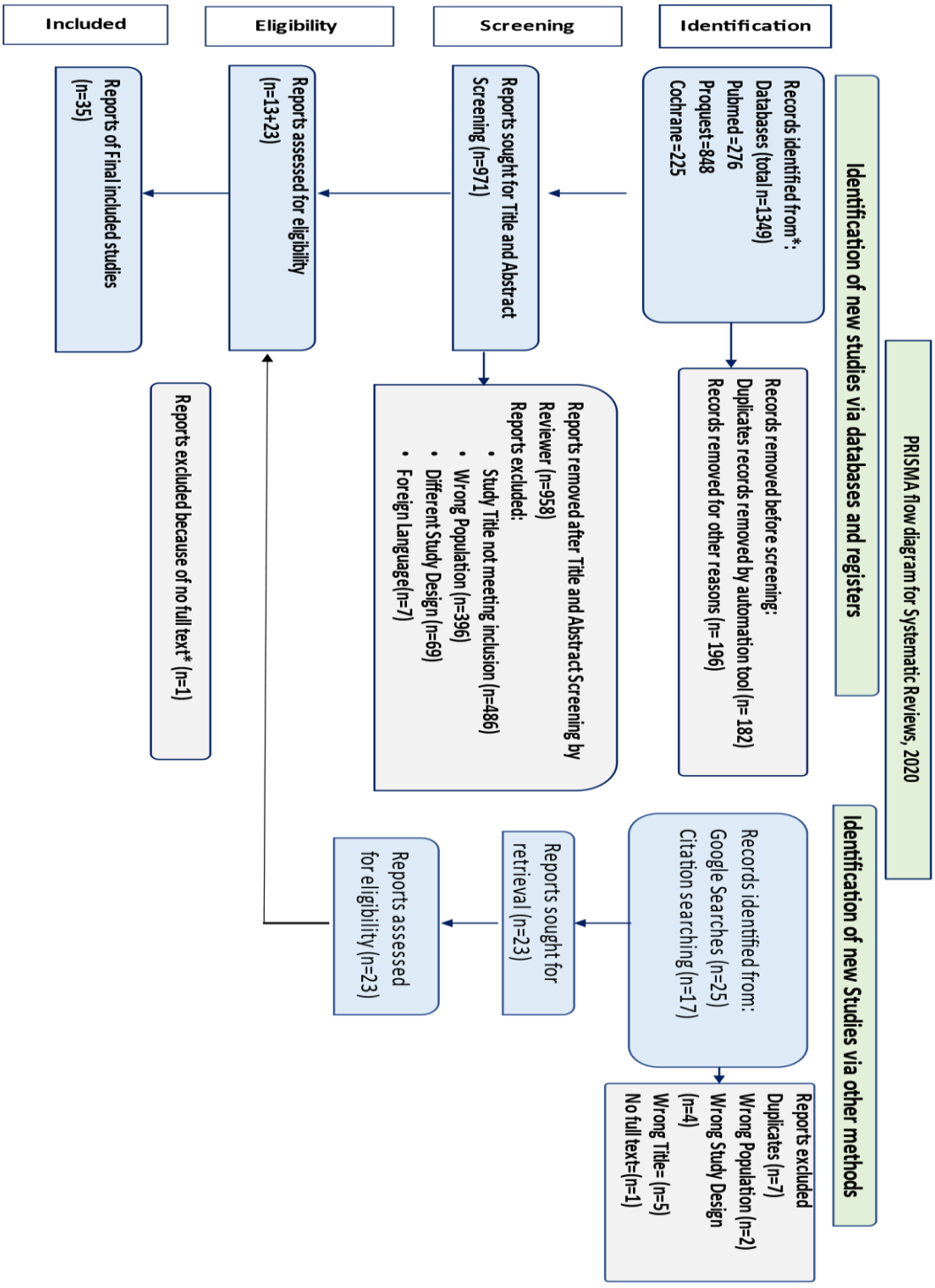

Figure 2:- PRISMA Flow chart summarizing the article selection process

The forest plot **(figure 3)** showed results of meta-analysis of 27 studies that assessed the proportion of pregnant women who are aware of BPCR in different Regions of India. The overall pooled proportion is 0.49 (95% CI: 0.43 to 0.55), which means that on average, about half of the pregnant women are aware of BPCR across. However, there is a high and significant degree of heterogeneity among the studies (I-squared = 94%, tau-squared = 0.3110, $p < 0.01$), which meant that the studies are not consistent and may have different sources of variation. The study with the lowest proportions is Vishwanathan VT (2020) with 0.15 (95% CI: 0.12 to 0.19), while the study with the highest proportion is Akshaya KM with 0.79 (95% CI: 0.72 to 0.84). The CIs of most study overlap with each other and with the overall estimate, which means that there is no significant difference between them in terms of BPCR awareness. However, some study had CIs that do not include the pooled proportion, such as Gurung J (2017), Indira NC (2021), Kushwah SS (2009), and Patil MS (2016), which meant that they were significantly different from the overall estimate and may have some special characteristics or factors that influence their BPCR awareness. The diamond for the random effects model is also slightly to the right of the line of no effect, indicating a positive and statistically significant pooled proportion of BPCR across all studies. The point estimate is 0.50, with a 95% confidence interval of [0.37, 0.63]. This meant that if each study had its own true proportion of BPCR that varied around an overall mean, we would expect it to be between 37% and 63% with 95% probability.

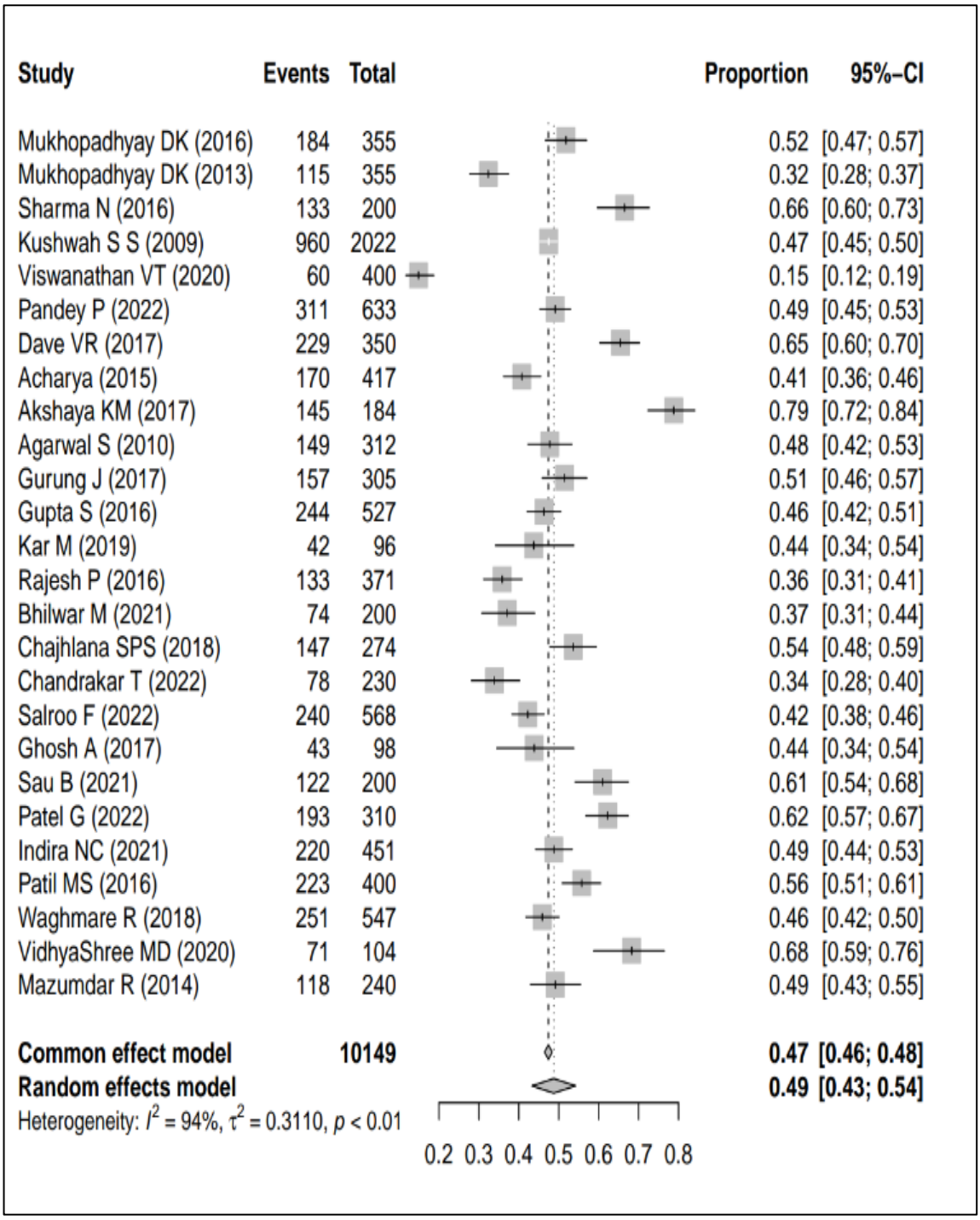

Figure 3:- Forest Plot Depicting Overall BPCR status in India

Forest Plot **(Figure 4)** depicted weight of each study which was analyzed through random and common effect model. We considered Random effect Model for assessing the studies as it assumed that there were different true effects for each study and the difference among the study is due to chance and real variation therefore it gives balanced weight to all studies.

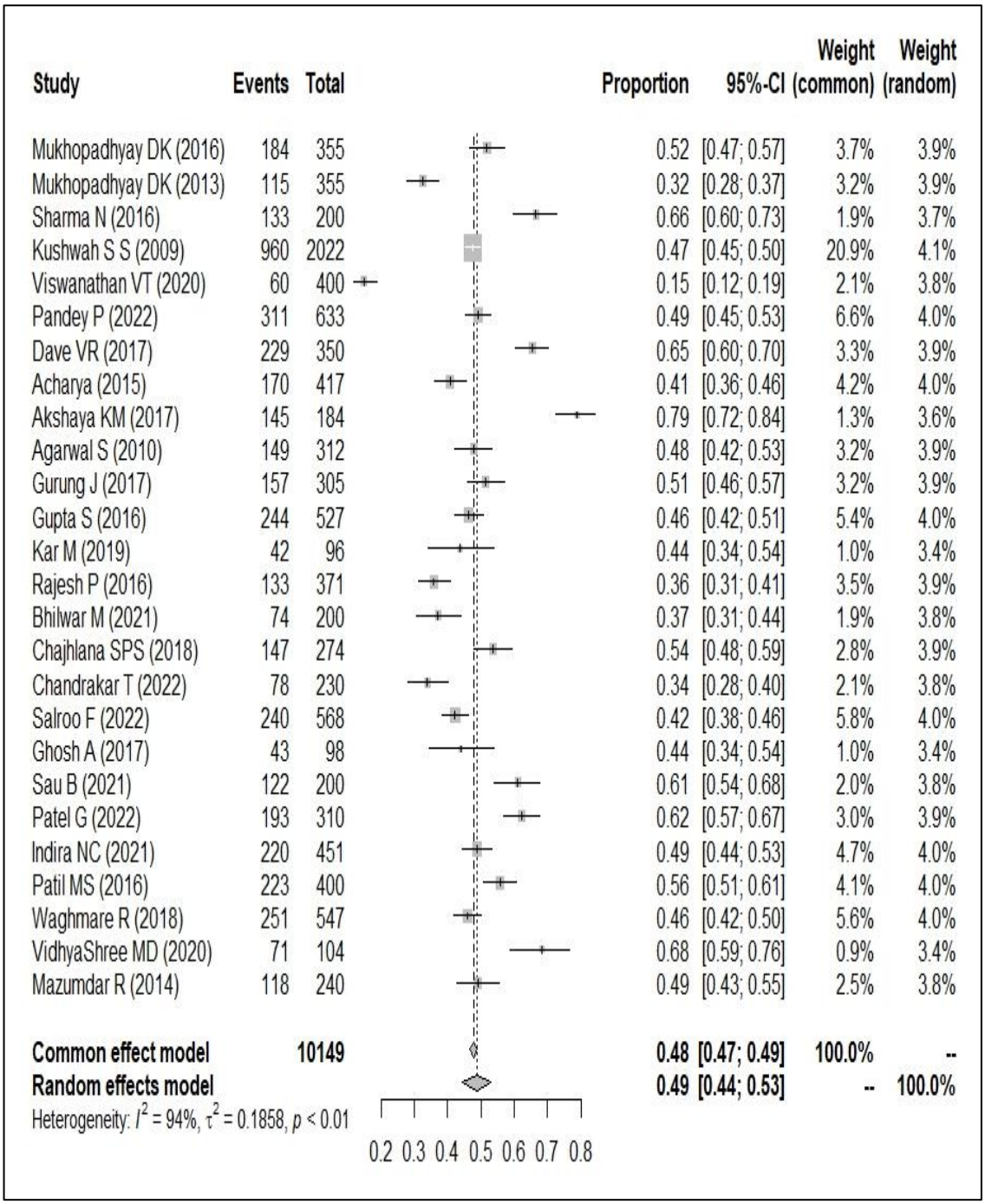

Figure-4 Forest plot Depicting (Weight of Studies).

In a study by Kushwah SS (2009) has a total sample size of 2022 so, its weight in Common Effect model was 20.9% which is very high from other studies, whereas in random effect model the same study has a weight of 4.1% which shows the equal balance of weights among all studies.

Subgroup analysis taking delivery status into account was performed. The overall pooled proportion of knowledge of BPCR in RDW was 0.54 (95% CI: 0.46 to 0.62) and in PW was 0.50 (95% CI:0.45 to 0.55) with high heterogeneity (I^2= 91%, Tau Square= 0.1221 and with a p- value < 0.01 which is statistically significant. As the CIs among the subgroups overlap there was no statistical significance observed. Same happened when the subgroup analysis was done region wise. The overall pooled proportion of knowledge of BPCR in East region is 0.47 (95% CI: 0.38 to 0.56), North region is 0.47 (95% CI: 0.36 to 0.57), Central region is 0.46 (95% CI: 0.43 to 0.49), West region is 0.48 (95% CI: 0.26 to 0.70), South region is 0.56 (95% CI: 0.45 to 0.67). **(Figure 5 and 6)**

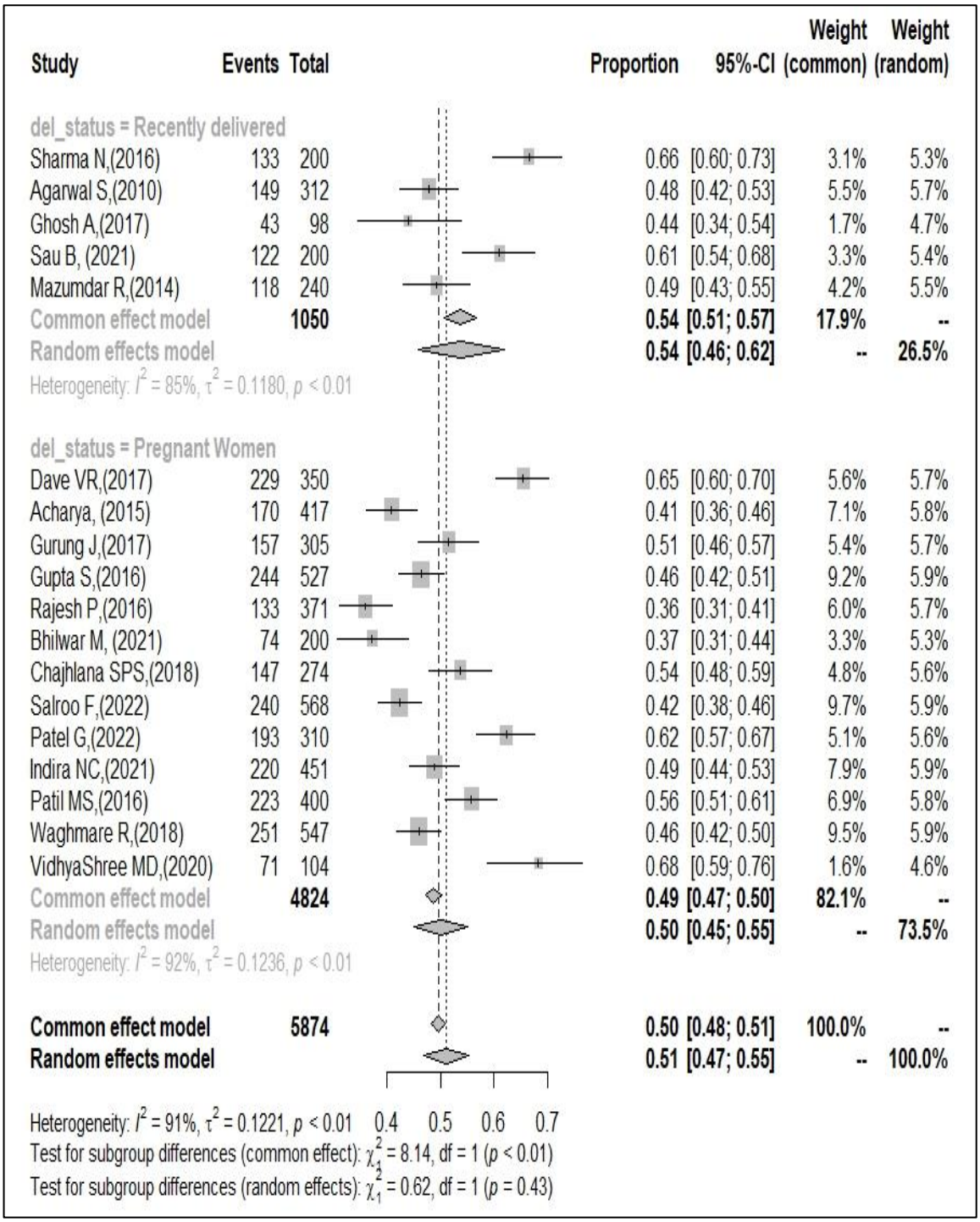

Figure 5: - Forest plot Depicting subgroup analysis – Delivery Status wise

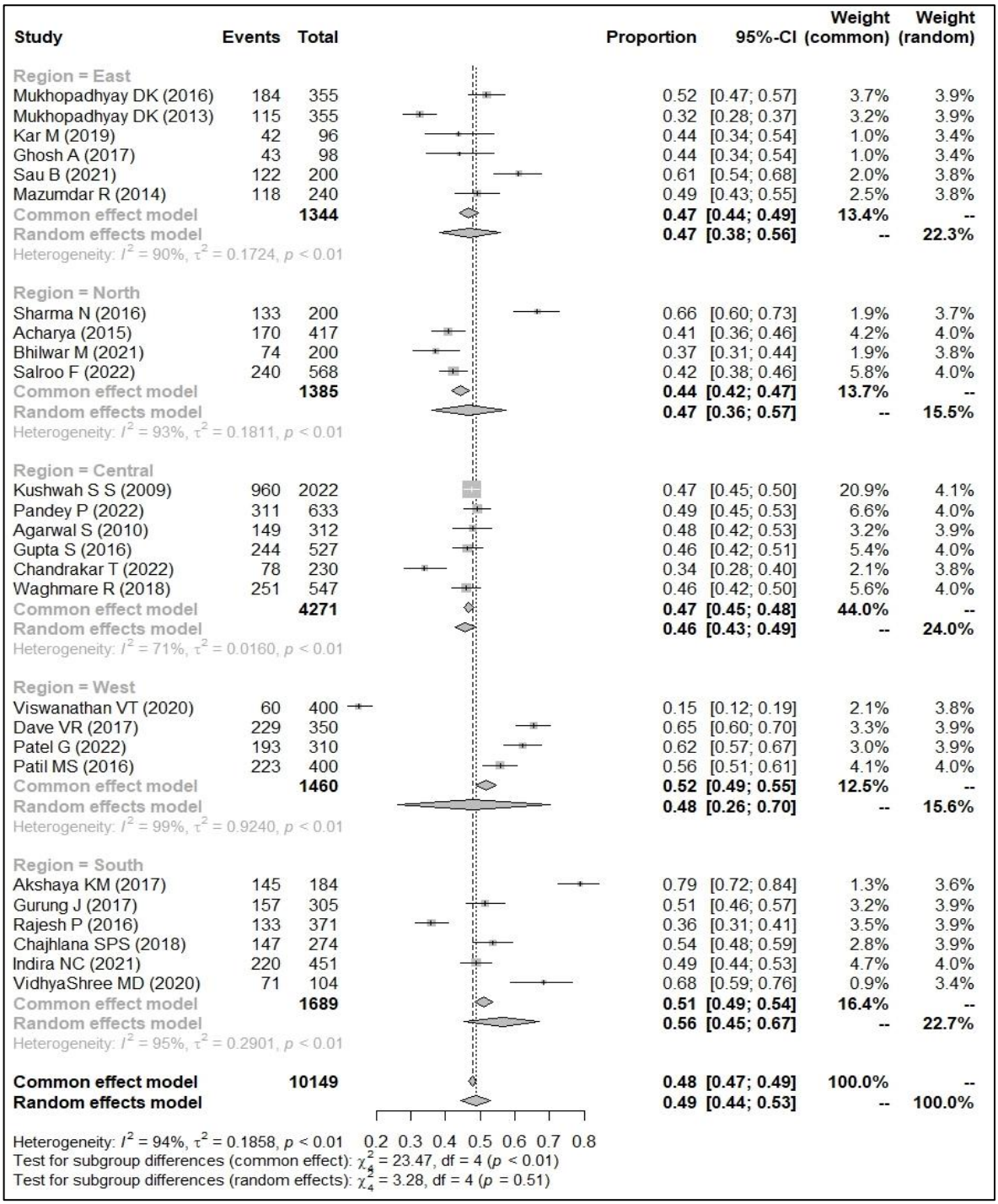

Figure 6:- Forest plot Depicting Sub group analysis – Region wise

Prevalence of Components of BP and CR

From the 35 Studies that were finalized, all of them were divided their BPCR indicators into two main heads i.e, Knowledge regarding BP and Knowledge regarding CR **(Table 1).**

Several Components of danger signs during pregnancy among them 13 studies have reported at least one danger sign of pregnancy and the lowest prevalence was found (9.3%) to be in studies reporting three or more danger signs of postpartum. Knowledge regarding danger signs during pregnancy were reported by 10 studies with a prevalence of 34.9%, i^2=97.4 and p value=0.00 and similarly, prevalence among other components like Knowledge regarding danger signs during labor, postpartum, and in neonate was found to be 11.6%, 12.2% and 18.8% and the i^2 was 98%, 91.1% and 95.3%, which depicts high heterogeneity.

Similarly, components of BP were also assessed by different studies among which 14 studies reports that the prevalence of women who identified a place of delivery was 59.4% and 13 studies report that prevalence of women who got financial assistance by JSY scheme was 55.5%.

BP component which was found similar in most of the studies was women who have identified transport and saved money for their delivery and the prevalence of both the components was found to be 46% and the i^2 was 98.8, with a p-value of 0.00.

The highest prevalence 86.7% was seen in women who attended their 1st antenatal visit with a skilled person during 1st trimester and the least prevalence 10.1% was seen in women who identified blood donor.

	Components	Events	Samplesize	Prevalence	I2	TauSq	P value	number of studies	LL	UL
Knowledge regarding Danger signs	Knowledge regarding danger signs during pregnancy	754	2325	**34.9%**	97.4	0.95	0.00	10	0.22	0.50
	Knowledge regarding danger signs during labor	237	1553	11.6%	98.0	1.69	0.00	5	0.04	0.29
	Knowledge regarding danger signs during postpartum	267	1687	12.2%	91.1	0.32	0.00	6	0.08	0.19
	Knowledge regarding danger signs in neonate	195	1189	18.8%	95.3	0.57	0.00	4	0.10	0.33
	3or more ds of newborn care	430	1512	12.3%	97.6	0.88	0.00	4	0.05	0.27
	3or more ds of Postpartum	169	1512	**9.3%**	94.2	0.66	0.00	4	0.04	0.20
	3or more ds of labor n childbirth	322	1512	15.7%	92.7	0.30	0.00	4	0.09	0.26
	3or more ds of preg	423	1512	22.0%	93.6	0.26	0.00	4	0.14	0.33
	1ds of newborn	837	2770	28.8%	98.5	1.31	0.00	8	0.15	0.47
	1ds of postpartum	567	1863	30.4%	97.6	1.41	0.00	6	0.14	0.54
	1ds of labor	649	2367	30.0%	97.7	1.04	0.00	6	0.16	0.50
	1DS of Pregnancy	1559	4339	**38.7%**	98.7	1.59	0.00	13	0.24	0.56
Knowledge regarding Birth preparedness	place of delivery	2192	5964	59.4%	99.1	2.50	0.00	14	0.39	0.77
	transportjsskjsy	1895	5286	50.6%	99.0	1.32	0.00	11	0.34	0.67
	Financial assistance jsy	3276	5566	55.5%	98.7	1.06	0.00	13	0.41	0.69
	skilledbirthattendant for deLI	6183	8345	83.3%	98.6	1.86	0.00	22	0.73	0.90
	identify blood donor	1008	7842	**10.1%**	98.0	1.45	0.00	19	0.06	0.16
	identify transport	6396	14232	46.0%	98.8	1.28	0.00	34	0.37	0.56
	Saved Money	5839	13774	46.0%	98.8	1.28	0.00	33	0.40	0.56
	Four ormore ANCs	2205	4910	51.5%	98.8	1.27	0.00	13	0.36	0.66
	1st antenatal visit with a skilled person during 1st trimester	1958	2283	**86.7%**	96.1	0.71	0.00	7	0.77	0.93
	registrationwithin12weeks	2028	3511	63.6%	99.0	1.37	0.00	8	0.44	0.80

Table 2:-Prevalence of components of BP and CR

PUBLICATION BIAS:

To detect publication bias we constructed funnel plot in which most of the studies were lying in the middle of the plot which showed that there is no major variance among the studies. **(Figure 8)** To statistically prove that there was no major variance we used Egger's Test, which states that if the p- value < 0.05, it indicates evidence of publication bias, and in our study, we found out that the p value is 0.59 (p > 0.05**). (Figure 9)**

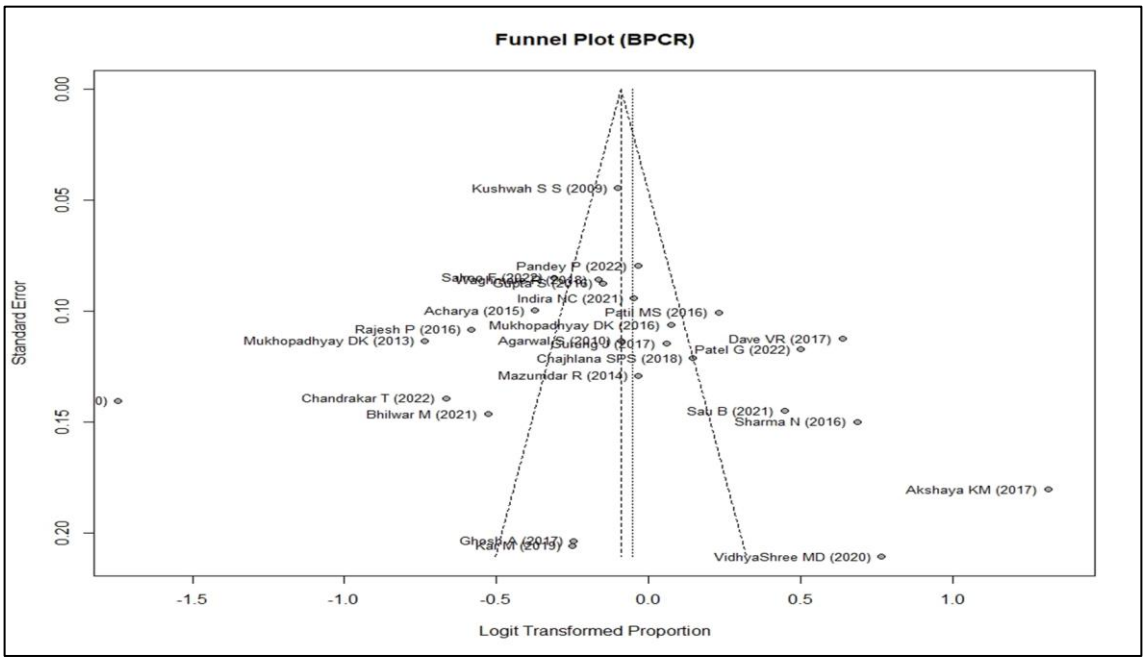

Figure 7:- Funnel Plot

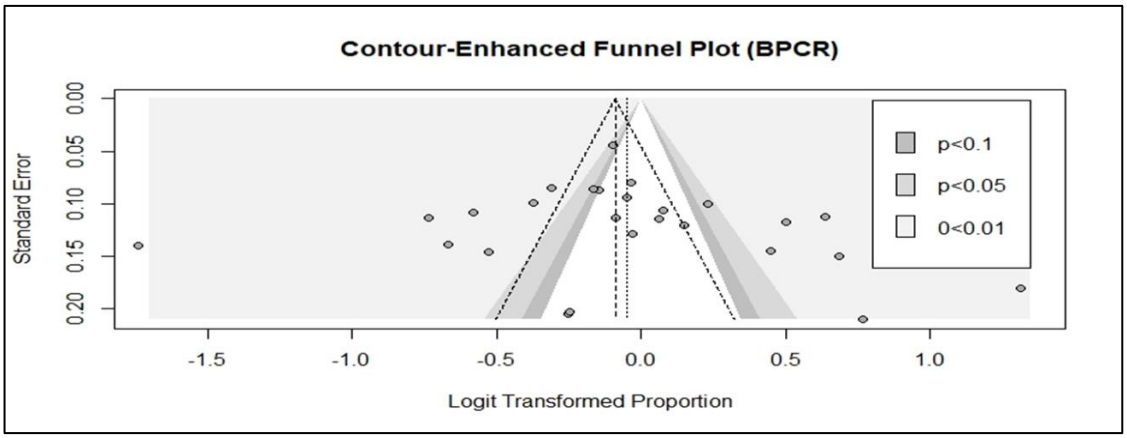

Figure 8:- Funnel Plot after Performing Eggers Test.

Graph depicting: Quality Assessment

The author's estimated ROB which was found to be low for 28 studies, unclear for 7 studies, and high for 0 studies. Detailed information regarding the results of the quality assessment of the selected studies is provided in **Figure 10.**

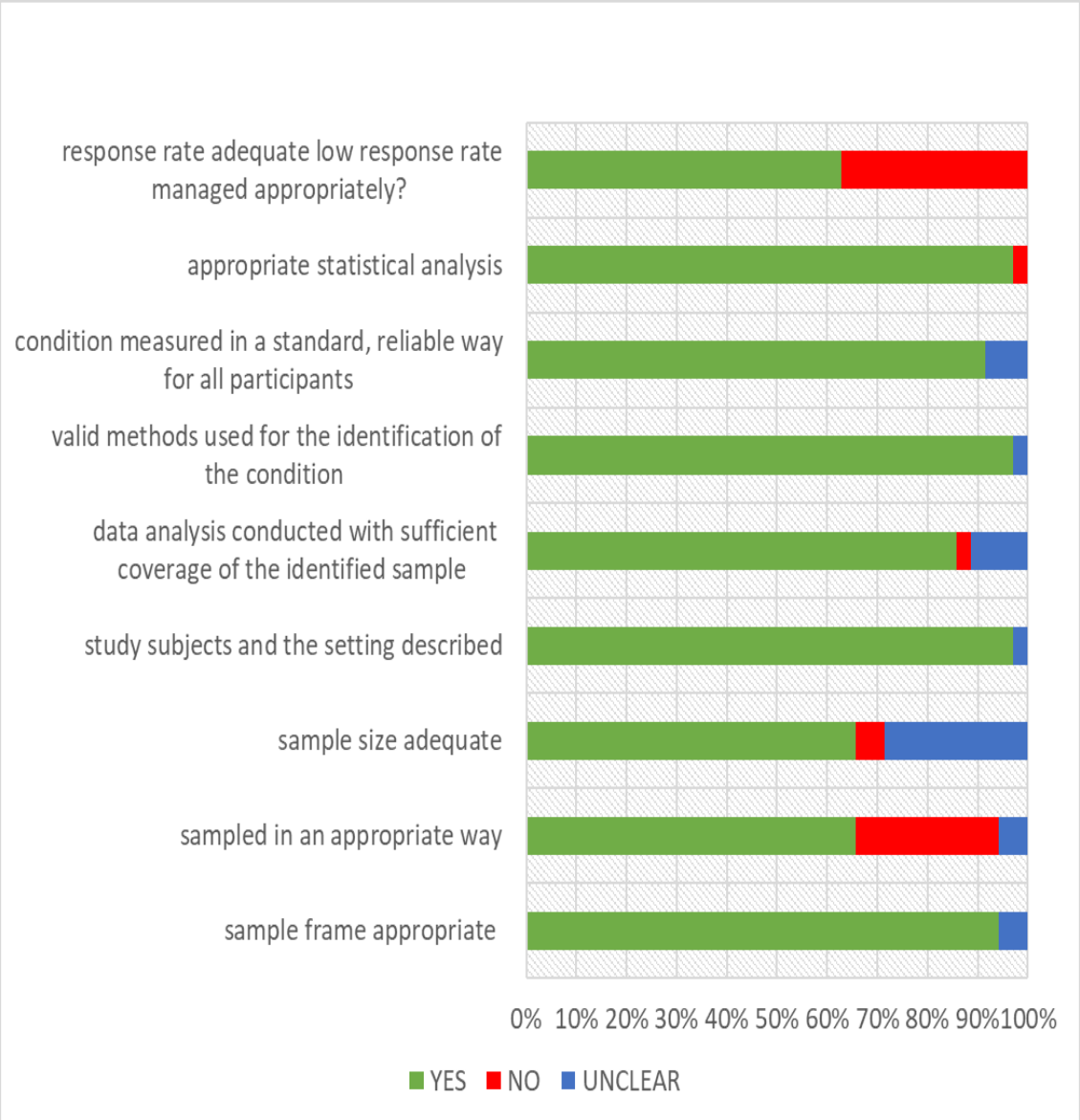

Figure 10:- Stacked bar chart depicting ROB.

DISCUSSION

The overall BPCR score of 49% in our study indicates that there is still a gap in the utilization of BPCR services among pregnant women in India. This score is slightly higher than the 44.9% reported by Girma et al. (2013)(29) in a similar study in Ethiopia. The variation in the BPCR scores may be attributed to the differences in the socio-demographic characteristics, health system factors, and cultural practices of the study populations. Compared to other studies in Nigeria, Ethiopia, and India by Akinwaare et al. (2015)(30), Gedefa et al. (2017)(31), and Nimavat et al. (2018)(32), our study had a moderate BPCR score of 49%, which ranged from 30.6% to 58.7% in these studies. Therefore, there is a need to improve the awareness and utilization of BPCR services among pregnant women in our setting, as well as to address the barriers and facilitators that influence their decision-making and behavior regarding BPCR.

The prevalence of women who saved money for their delivery was found to be 46% in our study, which is an important indicator of BPCR. This prevalence is higher than the 38.7% reported by Berhe et al. (2016)(33) in a study in Ethiopia, but lower than the 63.4% reported by Akinwaare et al. (2015)(30) in a study in Nigeria, the 59.6% reported by Nimavat et al. (2018)(32) in a study in India, and the 83.3% reported by Moran et al. (2018)(34) in a study in Burkina Faso. The differences in the prevalence of saving money for delivery may reflect the variations in the economic status, access to financial services, and social norms of the study populations. Saving money for delivery can help women to overcome the financial barriers to access skilled care during pregnancy and childbirth, and to cope with any unforeseen complications that may arise. Therefore, there is a need to promote and facilitate saving money for delivery among pregnant women in our setting, as well as to provide them with adequate information and counselling on the benefits and options of saving money for delivery.

The prevalence of women who have knowledge of key danger signs of pregnancy was 34.9% in our study, which is a low level of awareness that can compromise the timely recognition and management of pregnancy complications. This prevalence is higher than the 26.3% reported by Berhe et al. (2016)(33) in a study in Ethiopia, but lower than the 52% reported by Akinwaare et al(30). (2015) in a study in Nigeria, the 83.3% reported by Moran et al. (2018)(34) in a study in burkina faso, and the 42% reported by Mukhopadhayay et al. (2016)(28) in a study in India. The differences in the prevalence of knowledge of key danger signs of pregnancy may be related to the variations in the educational level, exposure to mass media, and quality of antenatal care services of the study populations. Knowledge of key danger signs of pregnancy is essential for pregnant women to seek prompt and appropriate care when they experience any signs of potential complications, and to prevent maternal and neonatal morbidity and mortality. Therefore, there is a need to improve the knowledge of key danger signs of pregnancy among pregnant women in our setting, as well as to provide them with effective health education and counseling on the identification and management of key danger signs of pregnancy.

The prevalence of women who have arranged transport for their delivery was 46% in our study, which is a moderate level of preparedness that can facilitate the access to skilled care during childbirth. This prevalence is similar to the 46.1% reported by Moran et al. (2018)(34) in a study in Burkina Faso, but varies from the other studies in Ethiopia, Nigeria, and India by Berhe et al. (2016), Akinwaare et al. (2015), Nimavat et al. (2018), and Mukhopadhyay et al. (2016),(28,30,32,33) which reported prevalences ranging from 20.59% to 58.6%. The differences in the prevalence of arranging transport for delivery may depend on the availability, affordability, and acceptability of transport services in the study settings. Arranging transport for delivery can help women to overcome the geographical and financial barriers to reach a health facility in time, and

to avoid delays and complications during delivery. Therefore, there is a need to encourage and support pregnant women in our setting to arrange transport for their delivery, as well as to improve the transport system and infrastructure in our area.

The prevalence of women who have identified a place of birth for their delivery was 59.4% in our study, which is a relatively high level of preparedness that can influence the choice and utilization of skilled care during childbirth. This prevalence is slightly higher than the 54.85% reported by Berhe et al. (2016)(33) in a study in Ethiopia, which had a similar study design and population. The similarity in the prevalence of identifying a place of birth for delivery may reflect the common socio-cultural and health system factors that affect the decision-making and behavior of pregnant women in both settings. Identifying a place of birth for delivery can help women to plan ahead and to select a health facility that meets their needs and preferences, and to avoid uncertainty and confusion during delivery. Therefore, there is a need to maintain and enhance the prevalence of identifying a place of birth for delivery among pregnant women in our setting, as well as to provide them with adequate information and counseling on the benefits and options of identifying a place of birth for delivery.

The prevalence of women who have arranged a blood donor for their delivery was 10.1% in our study, which is a very low level of preparedness that can increase the risk of maternal and neonatal mortality due to hemorrhage. This prevalence is similar to the 8.18% reported by Berhe et al. (2016)(33) in a study in Ethiopia, and the 9.9% reported by Mukhopadhyay et al. (2016)(28) in a study in India, but higher than the 2.7% reported by Nimavat et al. (2018)(32) in another study in India. The similarity in the prevalence of arranging a blood donor for delivery may indicate the common challenges and barriers that pregnant women face in accessing and obtaining blood transfusion services in these settings. Arranging a blood donor for delivery can help women to cope with any potential complications that may require blood transfusion, and to save lives

during delivery. Therefore, there is a need to improve the prevalence of arranging a blood donor for delivery among pregnant women in our setting, as well as to improve the availability, accessibility, and quality of blood transfusion services in our area.

LIMITATION-

The Meta- analysis did not address the factors affecting for the low Utilization of BPCR, therefore Researchers should Conduct further studies in this Area**.**

CONCLUSION-

Our study highlights the low prevalence of BPCR in India and the factors associated with it. Our findings underscore the need for targeted interventions to improve BPCR and suggest that there is a need to improve the awareness and utilization of BPCR services among pregnant women in India, as well as to address the factors that influence their decision-making and behavior regarding BPCR. India's health system is already overburdened by adverse health outcomes. Therefore, scaling up cost-effective interventions like BPCR that have a positive overall effect is necessary. Our study suggests that birth preparedness and complication readiness (BPCR) is such an intervention that should be given utmost importance to reduce maternal morbidity and mortality and to achieve the Sustainable Development Goals.

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ANNEXURE

NIHR | National Institute for Health Research

PROSPERO
International prospective register of systematic reviews

Birth preparedness and complication readiness among pregnant women in India: Systematic review and Meta-analysis

To enable PROSPERO to focus on COVID-19 submissions, this registration record has undergone basic automated checks for eligibility and is published exactly as submitted. PROSPERO has never provided peer review, and usual checking by the PROSPERO team does not endorse content. Therefore, automatically published records should be treated as any other PROSPERO registration. Further detail is provided here.

Citation

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Review question

Does Birth preparedness and complication readiness interventions have good birth outcome in India?

As a Mandate For SRMA this was registered on PROSPERO - Registration No. is – CRD42023396109

Keywords

Title: Birth preparedness and complication readiness among pregnant women in India: systematic review and Meta-analysis	
Inclusion Criteria	Cross-sectional studies
Population	**Pregnant women**: "pregnan*"[Title/Abstract] OR "pregnant women"[Title/Abstract] OR "antenatal"[Title/Abstract] OR "anc"[Title/Abstract]
Intervention	-
Comparison	-
Outcome	**Birth preparedness**: "birth preparedness"[Title/Abstract] OR "preparedness"[Title/Abstract] OR "preparing for birth"[Title/Abstract] OR "emergency preparedness"[Title/Abstract] OR "birth plan"[Title/Abstract]
	Complication Readiness: "danger signs"[Title/Abstract] OR "readiness"[Title/Abstract] OR (("recognisable"[All Fields] OR "recognise"[All Fields] OR "recognised"[All Fields] OR "recognises"[All Fields] OR "recognising"[All Fields] OR "recognize"[All Fields] OR "recognized"[All Fields] OR "recognizes"[All Fields] OR "recognizing"[All Fields]) AND "danger sign"[Title/Abstract]) OR "obstetric complication"[Title/Abstract] OR "pregnancy complication"[Title/Abstract] OR "obstetric danger sign"[Title/Abstract] OR "maternal complications"[Title/Abstract] OR "maternal health"[Title/Abstract] OR "newborn health"[Title/Abstract]

Title

Database	No	Search Query	Results
PUBMED (Data as on 06-02-2023)			
	#1	"pregnan*"[Title/Abstract] OR "pregnant women"[Title/Abstract] OR "antenatal"[Title/Abstract] OR "anc"[Title/Abstract]	**620,091**
	#2	"birth preparedness"[Title/Abstract] OR "preparedness"[Title/Abstract] OR "preparing for birth"[Title/Abstract] OR "emergency preparedness"[Title/Abstract] OR "birth plan"[Title/Abstract]	**20,978**
	#3	"danger signs"[Title/Abstract] OR "readiness"[Title/Abstract] OR (("recognisable"[All Fields] OR "recognise"[All Fields] OR "recognised"[All Fields] OR "recognises"[All Fields] OR "recognising"[All Fields] OR "recognize"[All Fields] OR "recognized"[All Fields] OR "recognizes"[All Fields] OR "recognizing"[All Fields]) AND "danger sign"[Title/Abstract]) OR "obstetric complication"[Title/Abstract] OR "pregnancy complication"[Title/Abstract] OR "obstetric danger sign"[Title/Abstract] OR "maternal complications"[Title/Abstract] OR "maternal health"[Title/Abstract] OR "newborn health"[Title/Abstract]	**39,433**
	#4	#1 AND #2 AND #3	**276**

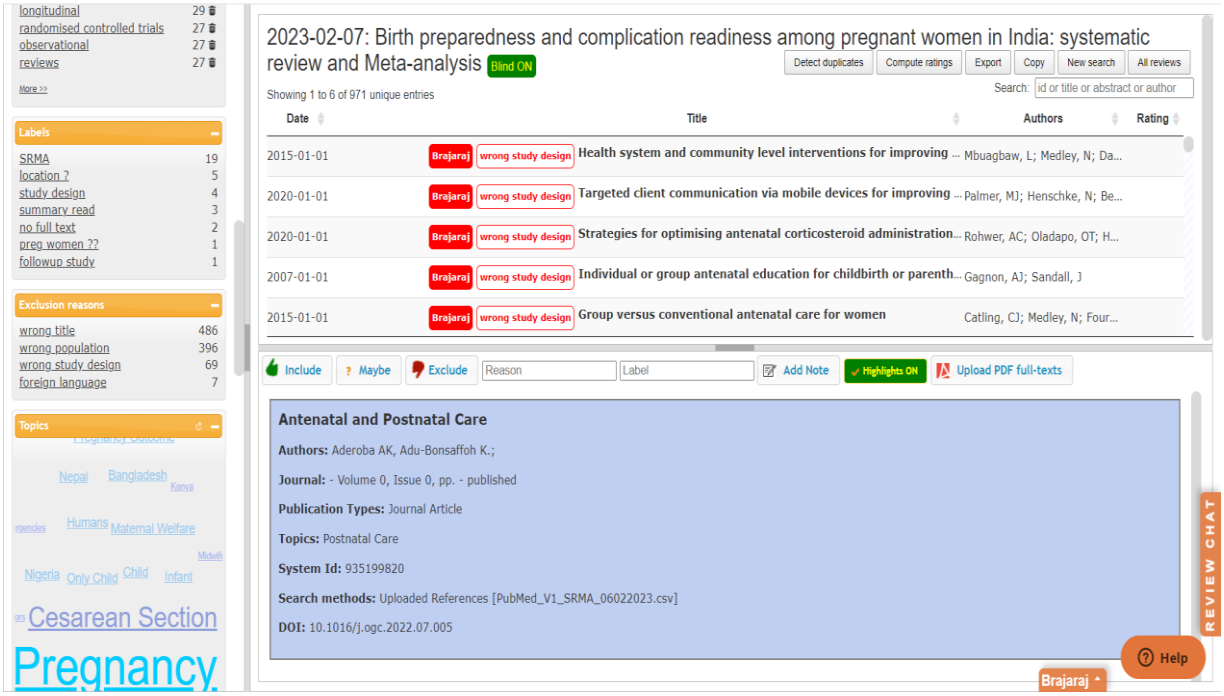
Title

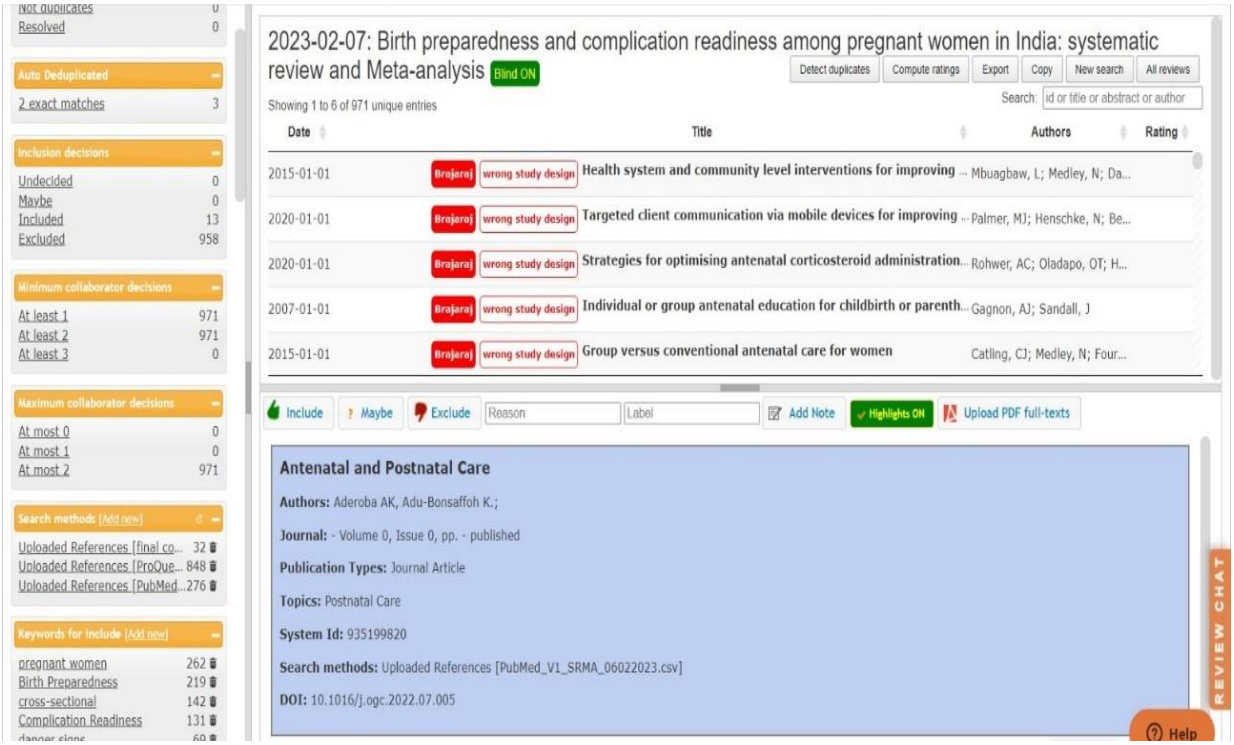
Database	No	Search Query	Results
PROQUEST (Data as on 06-02-2023			
	#1	noft(pregnan*) OR noft(pregnant women) OR noft(antenatal) OR noft(anc)	**124,342**
	#2	noft(birth preparedness) OR noft(preparedness) OR noft(preparing for birth) OR noft(emergency preparedness) OR noft(birth plan)	**29,912**
	#3	noft(complication readiness) OR noft(readiness) OR noft(recognising danger signs) OR noft(danger sign) OR noft(obstetric complication) OR noft(pregnancy complication) OR noft(obstetric danger sign) OR noft(maternal complications) OR noft(maternal health) OR noft(newborn health)	**95,890**
	#4	#1 AND #2 AND #3 (noft(pregnan*) OR noft(pregnant women) OR noft(antenatal) OR noft(anc)) AND (noft(birth preparedness) OR noft(preparedness) OR noft(preparing for birth) OR noft(emergency preparedness) OR noft(birth plan)) AND (noft(complication readiness) OR noft(readiness) OR noft(recognising danger signs) OR noft(danger sign) OR noft(obstetric complication) OR noft(pregnancy complication) OR noft(obstetric danger sign) OR noft(maternal complications) OR noft(maternal health) OR noft(newborn health))	**848**

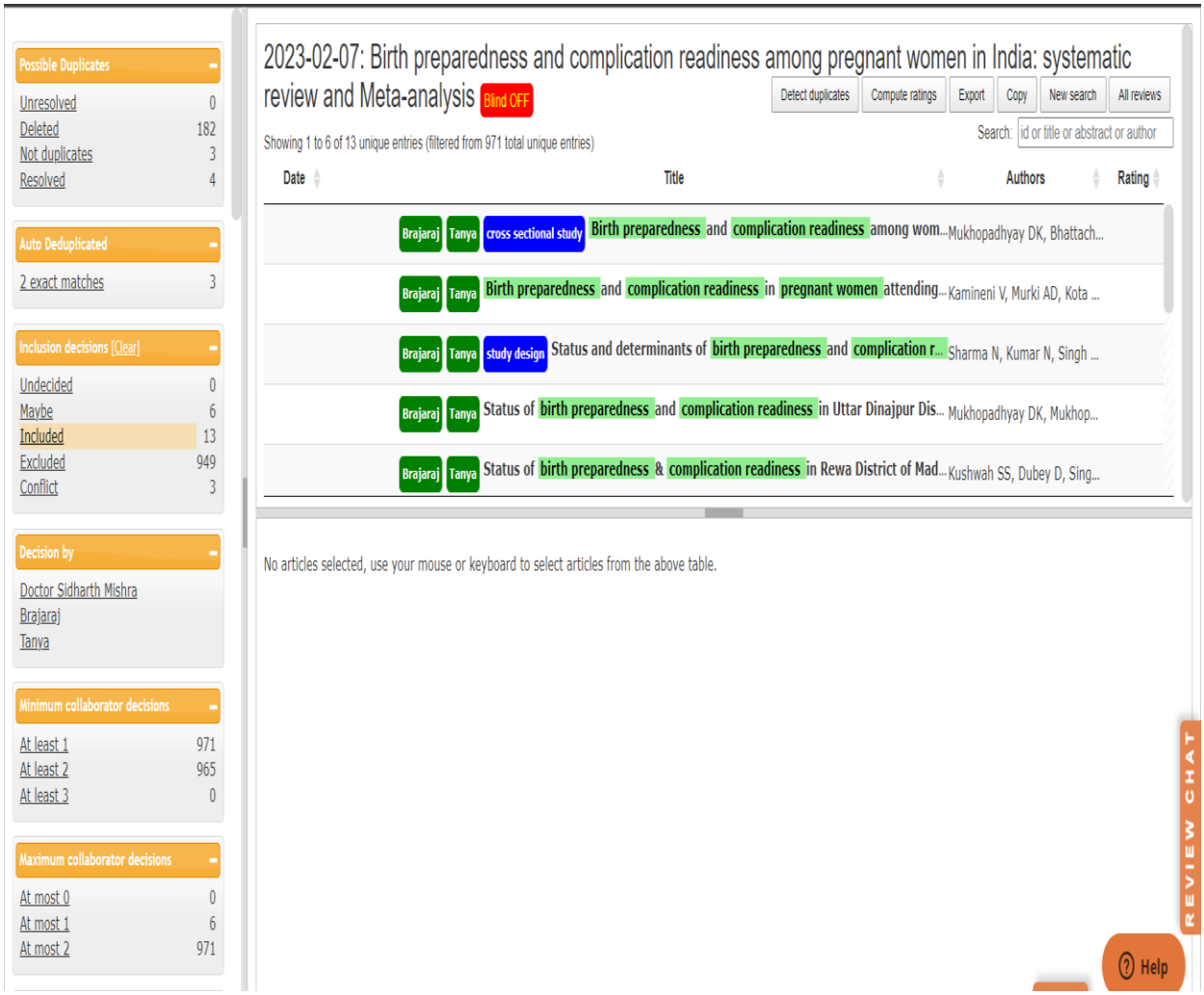
Title

Database	No	Search Query	Results
Cochrane (Data as on 06-02-2023			
	#1	(pregnan*):ti,ab OR (pregnant women):ti,ab OR (antenatal):ti,ab OR (anc):ti,ab	**68406**
	#2	(birth preparedness):ti,ab OR (preparedness):ti,ab OR (preparing for birth):ti,ab OR (emergency preparedness):ti,ab OR (birth plan):ti,ab	**1639**
	#3	(complication readiness):ti,ab OR (readiness):ti,ab OR (recognising danger signs):ti,ab OR (danger sign):ti,ab OR (obstetric complication):ti,ab OR (pregnancy complication):ti,ab OR (obstetric danger sign):ti,ab OR (maternal complications):ti,ab OR (maternal health):ti,ab OR (newborn health):ti,ab	**14641**
	#4	#1 AND #2 AND #3	**225** (193 - TRIALS, COCHRANE REVIEWS - **32**)

Title and Abstract Screening using RAYAAN.AI Software



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		Yes	No	Unclear	Not applicable
1.	Was the sample frame appropriate to address the target population?	☐	☐	☐	☐
2.	Were study participants sampled in an appropriate way?	☐	☐	☐	☐
3.	Was the sample size adequate?	☐	☐	☐	☐
4.	Were the study subjects and the setting described in detail?	☐	☐	☐	☐
5.	Was the data analysis conducted with sufficient coverage of the identified sample?	☐	☐	☐	☐
6.	Were valid methods used for the identification of the condition?	☐	☐	☐	☐
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