International Journal of Community Medicine and Public Health
Misra A et al. Int J Community Med Public Health. 2022 Oct;9(10):3849-3862
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20222582

Systematic Review

Risk factors for perinatal mortality in India: a systematic review of observational studies

Aroonima Misra[1], Geetha Menon[2], Anju Pradhan Sinha[3], Shivani Singh[2], M. Vishnu Vardhana Rao[2], Saurabh Sharma[2]*

[1]National Institute of Pathology, [2]National Institute of Medical Statistics, [3]Division of Reproductive, Maternal and Child Health, ICMR, New Delhi, India

Received: 17 August 2022
Accepted: 19 September 2022

***Correspondence:**
Dr. Saurabh Sharma,
E-mail: ssharmadoc@gmail.com

ABSTRACT

Perinatal mortality (PM) is a major public health problem in India and multiple maternal and foetal risk factors have been attributed to high perinatal mortality. This review aimed to systematically summarize the epidemiological literature on maternal and fetal risk factors for PM including those for still birth, intrauterine deaths; early neonatal mortality; early neonatal deaths in India. This systematic review was compliant with preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. We searched for peer-reviewed articles from three electronic bibliographic databases: MEDLINE, Embase, Google Scholar published between 1 January 2000 and 31 March 2019 that reported the risk factors of perinatal mortality in India. Observational studies (cross sectional, case-control and COHORT Studies). Eighteen articles were included in this review. The major risk factors identified for perinatal mortality in India were maternal age, parity, higher birth order and maternal anemia. Complications during pregnancy like ante partum hemorrhage, preeclampsia, obstructed labor, preterm labor and fetal factors like gestational age and low birth weight were documented as risk factors for perinatal deaths. Strengthening national health programs and targeted interventions for both antenatal and institutional care is required to bring down perinatal deaths in India.

Keywords: Perinatal mortality, Early neonatal mortality, Still births, Risk factors, India

INTRODUCTION

PM is defined as the number of fetal deaths past 28 completed weeks of pregnancy plus the number of deaths among live-born children up to 7 completed days of life.[1] Globally, around 2.5 million die annually during the neonatal period, out of which one million die within the first day.[2,3] Additionally, 2.8 million stillbirths occur every year, also counted as PM deaths and the majority of those take place in the low middle-income countries. Perinatal mortality rate (PMR) including still births and early neonatal deaths, is considered as an indicator of the quality of prenatal, intranatal and postnatal care practices.[4] PMR differ considerably across regions and countries, ranging from 40 per 1000 births in Nigeria, Western Africa to 3-5 per 1000 births in the Nordic countries in Northern Europe.[2,5,6]

The risk factors of PM differ from those of under-5 mortality and they are mostly preventable.

Multiple factors have been attributed to PM including lack of quality intranatal care, inadequate ANC services, maternal malnutrition and prevalent endemic infections. Almost half of the stillbirth and early neonatal deaths occur during labour and delivery; with maternal factors

including obstructed labour, pregnancy complications and infections and foetal factors like prematurity, low birth weight, identified as the leading causes for these untimely deaths in LMIC. On the contrary, in high-income countries, antepartum hemorrhage and congenital malformations are the most common causes of stillbirth.[3]

Sustainable developmental goal 3 targets ending preventable new born deaths and reduce neonatal mortality to at least 12 per thousand by the year 2030.[7] On similar lines, National Health Policy (NHP) 2017 of India set a target of 23 deaths per 1000 live births for under-5 mortality and 16 deaths per 1000 livebirths for neonatal mortality by 2025.[8] Under the India Newborn Action Plan, the government has also set a target of fewer than ten neonatal deaths per 1000 livebirths by 2030. India has shown a gradual decline over two decades in childhood mortality and the current neonatal mortality rate is 23 per on thousand live births.[9] As per NFHS 2015 report, PMR in India is still high at 36 per thousand live births which is higher in rural than in urban areas (40 deaths per 1,000 pregnancies versus 26 deaths per 1,000 pregnancies).

Multiple maternal and fetal risk factors have been attributed to high PM in developing countries like India. We could not find any systematic review/meta-analysis in India on identification of maternal and fetal risk factors of perinatal mortality. This study systematically summarized the epidemiological literature on maternal and fetal risk factors for PM including those for still birth, intrauterine deaths; early neonatal mortality; early neonatal deaths in India.

METHODS

This systematic review was compliant with PRISMA guidelines.[10] The PECO (population, exposure, comparison, outcome) for the review was P: all pregnant women, E: a priori defined risk factors, O=perinatal mortality. The review was registered in PROSPERO (International prospective register of systematic reviews) (registration ID: CRD42019124327).

Search strategy

A thorough literature search was conducted on Pubmed, Medline, Embase and Google Scholar for peer-reviewed articles published between 1 January 2000 and 31 March 2019. Search keywords as given in Table 1 were combined using Boolean method to conduct the search.

Inclusion and exclusion criteria

Criteria were developed in an iterative process after preliminary searches. Studies that focused on perinatal mortality and reported risk factors associated with perinatal mortality in India published in English between 1 January 2000 and 31st March 2019 were included for the review; analytical observational studies with cross-sectional, COHORT and case-control designs that reported the risk factors for perinatal mortality were included. Studies published in English language were included.

Non-peer reviewed studies, reviews, commentaries, letters to editors and conference presentations were excluded.

Table 1: Search strategy.

S. no.	Search strategy
1.	Perinat* or early neonatal or still birth or intrauterine
2.	Mortality or death
3.	Risk factors or predictors or determinants
4.	India
5.	Addresses [ptyp] or autobiography [ptyp] or bibliography [ptyp] or biography [ptyp] or pubmed books [filter] or case reports [ptyp] or congresses [ptyp] or consensus development conference [ptyp] or directory [ptyp] or duplicate publication [ptyp] or editorial [ptyp] or systematic reviews or meta analysis or festschrift [ptyp] or guideline [ptyp] or *in vitro* [ptyp] or interview [ptyp] or lectures [ptyp] or legal cases [ptyp] or news [ptyp] or newspaper article [ptyp] or personal narratives [ptyp] or portraits [ptyp] or retracted publication[ptyp] or twin study [ptyp] or video-audio media [ptyp]
#1 and #2 and #3 and #4 not #5	

Study selection and data extraction

Title and abstracts were independently screened by two reviewers (SS and SN) as per the eligibility criteria. We used a free online software tool to screen the articles (https://rayyan.qcri.org/welcome).[11] Disagreement between the two reviewers was resolved through consensus after consultation with the y the third reviewer (AA). Data extraction was done for the following variables author, year of publication, study design, participant characteristics, source setting (urban/rural/tribal/ethnic), sample size, outcome measurements, risk factors. Both unadjusted and adjusted odds ratio/risk/hazard ratio were extracted.

Quality assessment

Two independent reviewers (SS and SN) appraised the quality of each study. The Joanna Briggs Institute (JBI) quality appraisal tool for was used.[12] The tool assessed the quality of evidence and the risk of bias based on the following parameters, study characteristics, methodology including sampling design and sample size, confounding factors, measures to control for confounding and appropriate statistical analysis.

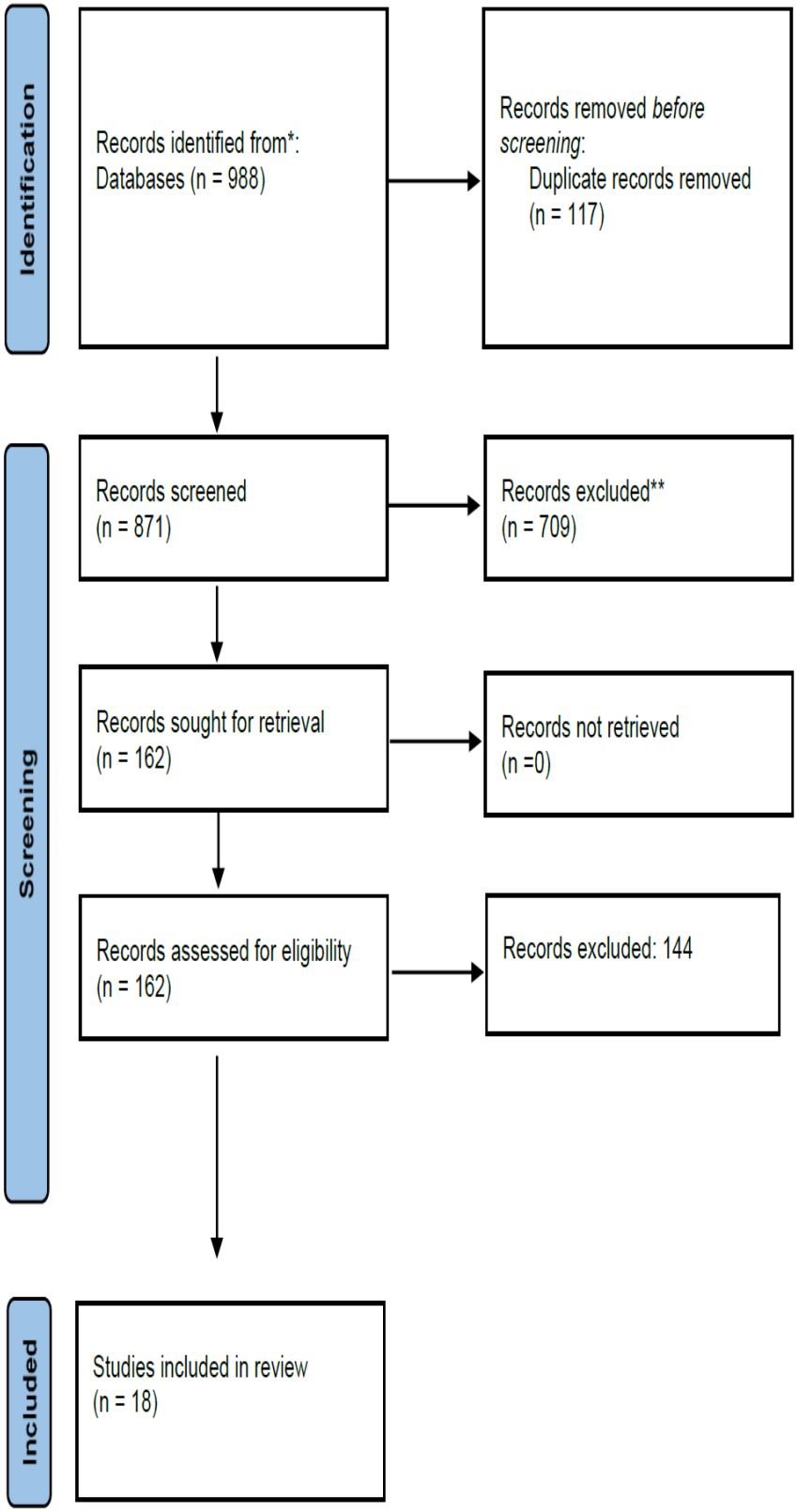

Figure 1: The flowchart for identification of studies via databases using PRISMA 2020 statement (Preferred reporting for systematic reviews and meta-analysis).

Table 2: Characteristics of included articles for systematic review.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural/tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
Neogi et al[13]	Case control study	Mothers of facility based still born babies in the past six months from two districts of Bihar – Gaya and Purnea. For every stillbirth two controls (live births) from the same village born at the same time were chosen .	Rural	Still birth = Baby born dead after 24th week of pregnancy/388	388 cases and 800 controls	Maternal factors Age of the mother >30 years Antenatal factors Birth order (primigravidae) Preterm labour (<37 weeks) Factors during last trimester of pregnancy Bleeding per vagina during pregnancy Oedema (hand or face or legs) Blurring of vision or severe headache during pregnancy High blood pressure during pregnancy Factors related to labour and childbirth Any complication during labour	Adj. OR(95% CI) 4.3 (1.7–10.7) 1.8 (1.3–2.6) 4.5 (3.2–6.5) 2.6 (1.7–3.8) 1.8 (1.3–2.6) 1.9 (1.3–2.8) 2.9 (1.5–5.6) 1.7 (1.2–2.4)	Age of the mother, Occupation of the mother, Birth order, gestation period. active or passive smoking, tobacco chewing, injury or accident during pregnancy, physical violence, Factors during last trimester of pregnancy, Factors related to labour and childbirth, Mode of transport, time to reach and time to attend in the facility

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural /tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
Sinha et al[14]	Prospective COHORT study	Married women of reproductive age living in 12 sqkm area of south Delhi followed up for 3 years Women who became pregnant were followed up to determine the pregnancy outcome Age =25.9+/-5.3 years 84% Hindus 15% literate 31.5% with more than 10 years of education	Urban	Perinatal deaths (28 weeks of gestation to 6 days)/95	20755 married women followed up 9169 pregnancies	Maternal factors Age of the mother	Adj. HR 0.21 (0.004-10.59)	Age, Maternal education, household income, place of delivery, gestation, birth weight
Williams[15]	Cross sectional study	Pregnancy history was obtained from all women in the reproductive age group Information obtained from during 1992-2002	Rural	Still birth - birth of a dead infant that did not cry or move after birth=1978	Number of women =33111 Number of births=80164 births 13,167	Maternal factors Maternal Age more than 35 Multiple births Preceding birth interval < 18 months 18-35 months 60+ months	Adj. OR 1.30 (1.07-1.58) 3.54 (2.92-4.28) 3.10 (2.69-3.57) 1.47 (1.30-1.68) 1.44 (1.19-1.73)	Age, Wealth index, Caste, Maternal education, History of still birth/neonatal death, Birth order, index birth sex, multiple births
Dandona et al[16]	Cross section	Women aged 15-49 years .	Rural and Urban	Still births=foetal	All births R-18388	Maternal factors Maternal age >=	Adj. OR 3.20 (1.52-6.74)	Age, tobacco use, history of stillbirth, miscarriage, diabetes mellitus,

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural/tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
	al study	Birth outcomes during January to December 2016 was documented		death with gestation period >=7 months Stillbirths R-262 U-13	U-1764	30 years First born child Multiple pregnancies Breech presentation Spontaneous labour Foetal factors Gestation < 7 months Gestation 7-8 months	 5.79 (4.06-8.26) 2.82 (1.49-5.33) 2.70 (1.75-4.18) 1.55 (1.15-2.09) 19.92 (12.41-31.97) 8.41 (5.48-12.92)	hypertension, antenatalcare, multiple foetuses, Gestation period, mothers information, fever/malaria/hypertensionconvulsions/in the last 3 m of pregnancy, Place of delivery, Vaginal delivery, birthweight, breech position, spontaneous labour, foul smelling discharge,
Lakshmi et al[17]	Secondary data analysis (DLHS)	Currently married women aged 15–44 years. Pregnancy outcomes in the past 3 years were obtained	Rural and Urban	Still births (foetal death with gestation period of >=28 weeks) =3112	Number of women respondents = 188917	Maternal factors Maternal age <19 Gravida 3 and above History of previous abortion Anaemia Hypertension Bleeding (bleeding during delivery or pregnancy) Labour complications (prolonged or obstructed labour) Other complications Premature labour	Adj. PR 1.33 (1.22-1.45) 1.34 (1.24-1.45) 21.96 (20.28-23.78) 1.50 (1.37-1.65) 1.4 (1.30-1.51) 2.51 (2.29-2.74) 1.66 (1.54-1.78) 1.59 (1.43-1.77 2.33 (2.15-2.54) 3.30 (2.97-3.67)	Age, education, cooking fuel used, religion, caste, type of house, source of lighting, standard of living index gravida, history of previous abortion, ANC checkup, anemia, hypertension, bleeding, labor complications, premature labor, place of delivery.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural/tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
						Foetal factors Foetal complications (weal movement of the foetus or abnormal position of the foetus)		
Gupta et al[19]	Prospective COHORT study	Women who were between 3 and 7 months' gestation	Urban	Still birth (fetal death with gestation period of >=20 weeks	1167 women	Maternal Factors Age of mother >=30 years Previous Caesarean delivery	Adj HR 2.2 (1.05–4.5) 3.2(1.4-7.3)	age of mother, working status of mother, number of antenatal care visits, number of Tetanus toxoid doses taken, place of delivery, previous stillbirth and previous cesarean section , educational status, socioeconomic score, and parity
Mishra et al[24]	Secondary data analysis (NFHS)	Ever married women aged 40-49 years	Rural and Urban	Still birth (foetal death with gestation period of >=28 weeks)	Number of women=19189 ever married women with complete birth histories	Maternal factors Anaemia Mild	Adj. OR 1.21(CI Not given)	Cooking fuel, Tobacco smoke, Anemia, BMI, Education, Religion, Caster/tribe, Housetype, Separate kitchen, Crowding, Standard of living, residence, region
Bhattacharyya et al[21]	Hospital based cross sectional study	) Pregnant mothers registered and delivered in a rural based hospital	Rural and Urban	stillbirth (fetal death >=28 weeks stillbirths=5257	Total births= 156 101	Maternal factors Age of the mother >=35 yrs Age of the mother <20 yrs Multiple birth Caesarean section Assisted breech Foetal factors Birth weight <2500 gms	Unadj OR 2.31 (1.81-2.95) 6.56 (5.62-7.06) 1.43 (1.31-1.56) 5.24 (4.76-5.76) 1.61 (1.44-1.81) 3.72 (3.52-3.93)	

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural /tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
Kumbhare[26]	Case control study		Rural and Urban	Still birth (fetal death with gestation period of >=28 weeks) Stillbirths= 243	with 486 controls	Maternal factors Antepartum Haemorrhage Hypertension P/H/O SB	Adj OR 11.63 (3.83-35.30) 2.09 (1.20-3.63) 26.13 (3.23-211.29)	Antepartum hemorrhage, Hypertension, IUGR, Maternal age, Oligohydramnios, P/H/O SB, Parity, Postdatism
Jain[27]	Prospective COHORT study	PPregnant women in 24–28 weeks of pregnancy (from Government and Private health facilities	Urban	Still birth and perinatal deaths	15641 pregnant women	Maternal factors GDM Still birth GDM Perinatal deaths	Unadj RR 2.53 (2.0-3.1) 2.48 (2.2-2.9)	
Altijani et al[28]	Cross sectional study	Women aged 15-49 years who were interviewed for about the outcome in the last pregnancy that lasted more than seven completed months	Rural and Urban	Still birth (foetal death with gestation period of >=28 weeks)=8429	886505	Maternal factors Maternal age Twin pregnancy Assisted Vaginal delivery Caesarean section Number of pregnancies Two to four Five or more Complications during pregnancy Anaemia Eclampsia Other hypertensive	Adj. OR 1.76 (1.55-2.00) 1.73 (1.58-1.89 3.45 (3.02-3.93) 1.77 (1.47-2.15 3.06 (2.42-3.86) 4.98 (3.66-5.74) 1.53 (1.27-1.43 1.79 (1.62 to 1.97) 1.22 (1.07-1.38) 2.75 (2.54-2.97) 1.29 (1.11-1.50) 3.45 (3.19-3.74) 2.80 (2.51-3.12) 1.58 (1.40 -	Place of residence, social group, religion, mothers education, occupation, asset index, tobacco use, number of antenatal visits, time of first antenatal care visit, place of delivery, mothers age at index pregnancy, sex of foetus, order of index pregnancy, single or multiple pregnancy, mode of delivery, anaemia, hypertension, eclampsia, antepartum haemorrhage, intra-partum haemorrhage, obstructed labor, breech presentation, abnormal foetal position,

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural /tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
						disorders Intrapartum haemorrhage Antepartum Haemorrhage Obstructed labour Breech presentation Abnormal foetal presentation	1.77)	
Patel et al[22]	Prospective COHORT study	Pregnant women who had completed 42 days of post partum follow-up	Urban and Rural	Still births =1620	72750 women	Maternal factors Maternal age >29 Parity Nulliparous Anaemia Severe/moderate Anaemia Anaemia and Underweight together Anaemia (<11)-underweight (<18.5)	Adj. OR 1.76 (1.45-2.12) 1.31 (1.18-1.45) 1.43 (1.17-1.75) 1.47 (1.17 to 1.85)	age, education, parity, height, weight and Hb, anaemia,
Saleem et al[23]	Prospective population based observational study	Pregnant women who were followed up till the pregnancy outcome	Urban and Rural	Stillbirth=fetal deaths occurring at ≥ 20 weeks gestation (or for those without gestational age, birth weight of	177009 births	Maternal factors Maternal age >35 Parity Nulliparous Parity >=3	Adj. OR 2.21 (1.96-2.49) 1.26 (1.11-1.43) 1.79 (1.53-2.08)	Maternal age, Education, parity, number of ANC visits, delivery location, number of preterm visits, birthweight

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural/tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
				≥ 500 g) =4415				
Newtonraj et al[20]	Population based case control study	Cases were women (18 45 years) who had stillbirths in the past 3 months from the date of interview and the controls were mothers having live-birth, in the same time frame, residing in the same area as that of case	Urban	Still births (late foetal death with ≥ 28 completed weeks of gestation)=181	181 cases and 181 controls	Maternal factors Age of the mother Mode of delivery Vaginal Labour initiation Induced Gestational age <= 36 weeks Colour of liquor Green	Adj OR 1.1 (1.0-1.2) 8.1 (2.6-26) 2.6 (1.5-4.5) 6.4 (3.7-11) 2.0(1.1-3.8)	Age of mother, No. of household members, mode of delivery, labour initiation, color of liquor, gestational age
Viswanath et al[30]	Population based case control study	Mothers of stillborn (cases) and live births within 7 days from the day of birth of the case and alive on the 7th day	Rural	Perinatal death (either a stillbirth or a late fetal death (>28 weeks gestation	40 cases and 110 controls	Maternal factors Parity >=4 Gestational age at birth (<9 months)	Adj. OR 5.75 1.88-17.54 5.62 (2.12-16.68)	Age of the mother, education, parity, gestational age at birth, total number of antenatal visits, tetanus toxcoid immunization completed, time to reach health facility, place of delivery
Shah[25]	Prospective community-based study	Mothers of still born and live births	Urban and Rural	31 perinatal deaths	731 mothers interviewed	Maternal factors Maternal Age <20 years Parity Primigravida	Unadj RR 4.38 2.34	
Rani et al[29]	Prospective COHO	Pregnant woman with Either period	Urban	Fresh still births at birth - asphyxia-	248 women	Maternal factors Obstructed Labour	Adj OR 23 (1.9-275.8)	Father's occupation, television in household, antenatal care provider having hemoglobin, urine

Continued.

Author (ref) Place	Study design	Participant characteristics	Source setting (urban/rural/tribal/ethnic)	Outcome definition (Number of events/outcome)	Sample size	Risk factors studied	Effect measure (RR/OR/HR) (95% CI)	Adjustment variables
	RT study	of gestation at birth 35 weeks or more or baby weighed at least 2000 g at birth And index pregnancy not Booked in antenatal clinic of the study hospital and Fetus delivered within 24 h of admission to the study Hospital.		specific stillbirth or asphyxia-specific early neonatal death. Asphyxia-specific stillbirth death. Asphyxia-specific early neonatal death				examination during antenatal care, obstructed labour, time of reaching referral centre,
Shah et al[18]	Hospital based case control study	Mothers of stillborn as cases and mothers of live births as controls	Urban and Rural	Perinatal deaths	5353 cases 5362 controls	Maternal factors Preterm delivery (<37 weeks) Twin Pregnancy	Unadj OR 8.32 (7.61-9.08) 2.47 (2.01-3.05)	

Data synthesis

A total of 988 articles were identified of which 127 articles were duplicates. The duplicates were individually screened by the reviewers (SS and SN) and resolved. After applying the selection criteria 18 full text articles were retrieved (Figure1).

RESULTS

Study characteristics and findings

The study characteristics of the included articles are described in the Table 2. Out of the 18 retrieved articles 6 were case control studies, 5 COHORT studies, 4 cross sectional studies and the remaining 3 were secondary data analysis based on national level health surveys. The total sample size of the studies ranged from 128 to 5353 considering the outcome variable as perinatal deaths or still births. Still birth was the key outcome variable in 12 studies while 6 studies reported on perinatal deaths. The definition of still birth and perinatal death used in these studies also varied. Two studies have considered still birth as fetal death with gestation period of ≥20 weeks while one study has used 24 weeks as the cut off for defining still birth. Only one study focused on the type of still birth, fresh and macerated. Three studies were conducted in the rural population while five were done in the urban population.

Maternal factors

Antenatal

Maternal age was found to be one of the risk factors for perinatal mortality.[13-20] Maternal age less than 20 years was identified as a risk factor by four studies.[17,19,21] Increasing maternal age had also been identified as a risk factor, however the maternal age cut off varied from >30 years to >35 years in the included studies. Birth order had been documented as a risk factor in the included studies with primigravida having the highest risk. A case control study by Neogi et al had shown that the primigravida were 1.8 times (OR 1.8 (1.3-2.6) at higher risk of still birth.[13] Similar findings had been documented in the COHORT study by Patel et al OR- 1.31 (1.18-1.45) and Saleem et al OR-1.26 (1.11-1.43).[22,23] Birth order of more than three was also reported as a risk factor for perinatal mortality. A cross sectional study by William et al had identified previous birth interval of less than 18 months as a predictor of still birth with an three times increased risk; OR 3.10 (2.69-3.57).[15]

Maternal anemia had been documented as a risk factor for perinatal mortality in four studies.[13,17,22,24] However the severity of anemia had not been independently analyzed in these studies. Two case control studies by Neogi et al OR 4.5 (3.2-6.5) and Shah et al OR 8.32 (7.61-9.08), have documented an association between preterm labor and perinatal mortality.[13,25] Past history of abortion was documented as a risk factor for still birth by Kumbhare et al and Lakshmi et al OR-21.96 (20.28-23.78).[17,26]

A prospective COHORT study by Jain et al studied gestational diabetes mellitus as a risk factor for perinatal deaths and concluded that mothers with GDM were at 2.5 times higher risk of still birth RR 2.53 (2.0-3.1).[27] A case control study by Bhattacharya et al found that twin pregnancy was associated with perinatal death; OR-1.43 (1.31-1.56) and similar findings were reported by Shah et al; OR-2.47 (2.01-3.05).[21,25]

Intranatal

Complications during the last trimester of pregnancy and delivery like pregnancy induced hypertension, preeclampsia and eclampsia obstructed labor, intrapartum hemorrhage, breech presentation have been documented as risk factors for perinatal mortality.[13,16,17,26,28,29]

Fetal factors

Low birth weight was identified as a risk factor for perinatal death, specifically early neonatal mortality by Bhattacharya et al; OR-3.72 (3.52-3.93) 21. Gestational age less than seven months; OR-19.92 (12.41-31.97) and gestational age between seven to eight months; OR-8.41 (5.48-12.92) was identified as a risk factor for still birth in a cross sectional study conducted in Bihar by Dandona et al.[16] A population based case control study by Vishwanath et al identified gestational age less than 9 months; OR-5.62 (2.12-16.68) as a predictor for perinatal deaths.[30] For all the conditions the summary estimate could not be calculated because of the varying age groups and varying case definitions of the outcomes.

DISCUSSION

The study findings revealed that the most important clinical factors for perinatal mortality in India include maternal anemia, age at parity, birth order of more than three, complications during pregnancy including preeclampsia, obstructed labor and intrapartum hemorrhage in particular and fetal factors primarily low birth weight and preterm birth.

Maternal anemia has been identified to be associated with perinatal mortality in India. Studies conducted in low and middle income countries have shown poor perinatal outcome in anemic pregnant mothers.[31] The burden of nutritional anemia is one of the highest in India and efforts are being made to combat iron deficiency anemia by launching National Iron Plus Initiative, a comprehensive strategy which addresses anemia in all age groups. Perinatal mortality showed a U-shaped curve when it was plotted against parity depicting that babies born after the third child are at high risk.[32] In the Indian context, a number of factors are interlinked to birth order including early age at marriage, birth spacing and maternal undernutrition. India's family planning

programme followed a cafeteria approach with a basket of choices where the eligible couples are free to choose contraceptive method of choice. However, the unmet need for family planning in India was still 13 percent.[33] There was a need to focus on priority areas like unmet need for both limiting family size and spacing birth in India. Complications during the third trimester and during child birth like pregnancy induced hypertension, preeclampsia and eclampsia, obstructed labor, intrapartum hemorrhage, have been documented as risk factors for perinatal mortality.[34] India had time and again implemented various health programs which was primarily targeted towards reducing stillbirths and early neonatal deaths. The Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA), labour room and quality improvement initiative (LaQshya), Dakshata program an initiative for improving quality of intra and immediate postpartum care were some initiatives which focus on management of complications during labor and reduction of still births.[35]

India had shown a modest decline in LBW rates in the past decade from 20.4% to 16.4%.[36] However, LBW and preterm births are still a major public health challenge in India. As mentioned above maternal nutrition is directly linked to birth weight and various initiatives have been taken by GOI in this direction including integrated child development scheme (ICDS) which focuses on supplementary nutrition, counselling on diet rest and breastfeeding. Further in 2018, National Nutrition Mission also known as POSHAN Abhiyaan was launched to give impetus for reducing maternal and child malnutrition.[37]

Limitations

The definition of still birth and perinatal death was not consistent in the studies which might lead to selection bias. Secondly the risk factor definition also varied in the studies. The cutoff for maternal age, birth order, preterm births also differed in the included studies. Some of the studies were hospital based while the others are population based which might lead to a bias while interpreting the results of this review. A metanalysis to report the pooled estimate of each risk factor was not done due to varying age groups and varying case definitions of the outcomes.

CONCLUSION

This systematic review found that maternal age, parity, higher birth order and maternal anemia were major risk factors of perinatal mortality in India. Complications during pregnancy like antepartum hemorrhage, preeclampsia, obstructed labor, preterm labor were also documented as risk factors similar to those by other published studies. Fetal factors like gestational age and low birth weight were documented as risk factors for perinatal deaths. Furthermore, there is also a need to standardize the definitions used both for still birth and the risk factors for better interpretation of the results and improvement in the external validity of the studies and also pooled analysis of all their results especially in countries where large scale multicentric nationalized survey results and studies are unavailable. The results of this review will help in informing policy and further streamlining future thrust areas of research and assists policy makers in planning, developing and implementing public health interventions which provide adequate antenatal and obstetric care services. This will ultimately lead to improvement in maternal health and reducing perinatal mortality at both the individual and community levels.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. WHO. Neonatal and Perinatal Mortality; Country, Regional and Global Estimates, 2006. Available at: https://apps.who.int/iris/handle/10665/4. Accessed on 02 August 2022.
2. DeLange TE, Budde MP, Heard AR, Tucker G, Kennare R, Dekker GA. Avoidable risk factors in perinatal deaths: a perinatal audit in South Australia. Australian and New Zealand J Obstetr Gynaecol. 2008;48(1):50-7.
3. Partridge S, Balayla J, Holcroft CA, Abenhaim HA. Inadequate prenatal care utilization and risks of infant mortality and poor birth outcome: a retrospective analysis of 28,729,765 US deliveries over 8 years. Am J Perinatol. 2012;29(10):787-94.
4. Ghimire PR, Agho KE, Akombi BJ. Perinatal mortality in South Asia: systematic review of observational studies. Int J Environment Res Public Health. 2018;15(7):1428.
5. Logavlen VV, Mikkelsen MS, Zachariassen G. Improved survival of very preterm born infants from 2000 to 2013 in Denmark. Dan Med J. 2019 Dec 1;66(12):31791481.
6. Zonneveld R, Holband N, Bertolini A, Bardi F, Lissone N, Dijk PH, Plötz FB, Juliana A. Improved referral and survival of newborns after scaling up of intensive care in Suriname. BMC Pediatr. 2017;17(1):1-8.
7. United Nations. Fact sheet: Sustainable development goals 3. Department of Economic and Social Affairs. Available at: https://sdgs.un.org/goals/goal3. Accessed on 1 August 2022.
8. Ministry of Health and Family Welfare. Government of India. National Health Policy – 2017. New Delhi: MoHFW; 2017.
9. Office of the Registrar General and Census Commissioner of India. Sample Registration System New Delhi: Vital Statistics Division, Office of the Registrar General of India, 2020. Available at: https://censusindia.gov.in/census.website/data/SRSSTAT. Accessed on 02 August 2022.

10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372.
11. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan-a web and mobile app for systematic reviews. Systematic Rev. 2016;5(1):1-0.
12. Joanna Briggs Institute. Critical appraisal tools. Available at: https://jbi.global/critical-appraisal-tools. Accessed on 01 August 2022.
13. Neogi SB, Sharma J, Negandhi P, Chauhan M, Reddy S, Sethy G. Risk factors for stillbirths: How much can a responsive health system prevent? BMC Preg Childbirth. 2018;18(1).
14. Sinha S, Aggarwal AR, Osmond C, Fall CHD, Bhargava SK, Sachdev HS. Maternal age at childbirth and perinatal and under-five mortality in a prospective birth cohort from Delhi. Indian Pediatrics. 2016;53(10):871-7.
15. Williams EK, Hossain MB, Sharma RK, Kumar V, Pandey CM, Baqui AH. Birth interval and risk of stillbirth or neonatal death: Findings from rural North India. J Tropic Pediatr. 2008;54(5):321-7.
16. Dandona R, Kumar GA, Akbar M, Bhattacharya D, Nanda P, Dandona L. Deferred and referred deliveries contribute to stillbirths in the Indian state of Bihar: Results from a population-based survey of all births. BMC Med. 2019;17(1):1-17.
17. Lakshmi PVM, Virdi NK, Sharma A. Household air pollution and stillbirths in India: Analysis of the DLHS-II National Survey. Environment Res. 2013;121:17-22.
18. Shah MS, Khalique N, Khan Z, Ahmad A, Ansari MA. Perinatal mortality: an analysis of the causes and determinants of deaths. Ind J Public Health Res Develop. 2015;6(1).
19. Gupta PC, Subramoney S. Smokeless tobacco use and risk of stillbirth: a COHORT study in Mumbai, India. Epidemiology. 2006;17(1):47-51.
20. Newtonraj A, Kaur M, Gupta M, Kumar R. Level, causes, and risk factors of stillbirth: A population-based case control study from Chandigarh, India. BMC Preg Childbirth. 2017;17(1):1-9.
21. Bhattacharyya R, Pal A. Stillbirths in a referral medical college hospital, West Bengal, India: a ten-year review. J Obstetr Gynaecol Res. 2012;38(1):266-71.
22. Patel A, Prakash AA, Das PK, Gupta S, Pusdekar YV, Hibberd PL. Maternal anemia and underweight as determinants of pregnancy outcomes: COHORT study in eastern rural Maharashtra, India. BMJ Open. 2018;8(8):21623.
23. Saleem S, Tikmani SS, McClure EM. Trends and determinants of stillbirth in developing countries: results from the global network's population-based birth registry. Reproduct Health. 2018;15(1):23-30.
24. Mishra V, Retherford RD, Smith KR. Cooking smoke and tobacco smoke as risk factors for stillbirth. Int J Environment Health Res. 2005;15(6):397-410.
25. Shah D, Shroff S, Ganla K. Factors affecting perinatal mortality in India. Int J Gynecol Obstetr. 2000;71(3):209-10.
26. Kumbhare SA, Maitra NK. Aetiological classification of stillbirths: a case control study. J Obstetr Gynecol India. 2016;66(6):420-5.
27. Jain R, Davey S, Davey A, Raghav S, Singh J. Can the management of blood sugar levels in gestational diabetes mellitus cases be an indicator of maternal and fetal outcomes? The results of a prospective cohort study from India. J Fam Commun Med. 2016;23(2):94.
28. Altijani N, Carson C, Choudhury SS. Stillbirth among women in nine states in India: Rate and risk factors in study of 886,505 women from the annual health survey. BMJ Open. 2018;8(11):22583.
29. Rani S, Chawla D, Huria A, Jain S. Risk factors for perinatal mortality due to asphyxia among emergency obstetric referrals in a tertiary hospital. Indian Pediatrics. 2012;49(3):191-4.
30. Viswanath K, Ps R, Chakraborty A, Prasad JH, Minz S GK. A community based case control study on determinants of perinatal mortality in a tribal population of southern India. Rural Remote Health. 2015;15.
31. Ali AA, Rayis DA, Abdallah TM, Elbashir MI, Adam I. Severe anaemia is associated with a higher risk for preeclampsia and poor perinatal outcomes in Kassala hospital, eastern Sudan. BMC Res Notes. 2011;4(1):1-5.
32. Bakketeig LS, Hoffman HJ. Perinatal mortality by birth order within cohorts based on sibship size. Br Med J. 1979;2(6192):693.
33. Indian Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-4), 2015-16: India, 2017. Available at: http://rchiips.org/nfhs/NFHS-4Reports/I. Accessed on 02 August 2022.
34. Cooper P. The challenge of reducing neonatal mortality in low- and middle income countries. Pediatrics. 2014;133(1):4.
35. Murki S, Upadhyaya S. Reducing perinatal deaths: a distant dream but on the right path! Indian Pediatrics. 2020;57(11):1004-5.
36. Khan N, Mozumdar A, Kaur S. Determinants of low birth weight in India: An investigation from the National Family Health Survey. Am J Human Biol. 2020;32(3):23355.
37. POSHAN Abhiyaan. Ministry of Women and Child Development, Government of India. Available at: https://icds-wcd.nic.in/nnm/home.htm. Accessed on 01 August 2022.

Cite this article as: Misra A, Menon G, Sinha AP, Singh S, Rao MVV, Sharma S. Risk factors for perinatal mortality in India: a systematic review of observational studies. Int J Community Med Public Health 2022;9:3849-62.