Original Article

Prevalence of Asymptomatic Bacteriuria (ASB) in Pregnant Women in India: A Systematic Review and Meta-Analysis

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Abstract

Background: Asymptomatic bacteriuria is prevalent during pregnancy. If it goes undetected, it can lead to urinary tract infection with severe maternal and neonatal complications. Until date, India does not have any guidelines to test for ASB during pregnancy. **Objective:** To estimate the pooled prevalence of asymptomatic bacteriuria in pregnant women at national level in India. **Material and Methods:** We searched Medline, Embase, Web of Science, and Google Scholar using search strategy with keyword. Two authors independently assessed the eligibility of study. The checklist of the JBI was used for evaluating the quality of reporting. The extracted data were analyzed, and the results were reported using a random-effects model with 95% confidence interval (CI). Subgroup analysis was conducted for zones of India, parity and trimester. Publication bias is reported as funnel plot. **Result:** Pooled prevalence of asymptomatic bacteriuria among pregnant women in India is 13.5% [CI 11.1; 15.8]. Subgroup analysis based on the various geographic zones of the country the pooled prevalence ranged from 9.2% in central zone to 14.8% in south zone. Distribution of prevalence of ASB as per parity was approximately identical. The prevalence of ASB was found to be high in third (21.8%). **Conclusion:** The prevalence of ASB is found to be high among Indian pregnant women, especially in third trimester. It is therefore recommended for guideline to screen and treat every pregnant woman for ASB to prevent further complications.

Keywords: Asymptomatic, bacteriuria, pregnancy, women

Introduction

Urinary tract infection (UTI) is prevalent among pregnant women. Anatomical, physiological, and hormonal changes in the body during pregnancy facilitate bacterial colonization and ascending infection among pregnant women putting them at higher risk of developing UTIs. It usually occurs in the early pregnancy, with only a quarter of cases in the second and third trimesters. These infections can be either symptomatic or asymptomatic.

"Asymptomatic bacteriuria (ASB) is defined as a condition in which urine culture shows a significant growth of bacteria equal to or more than 10^5 colony-forming units (CFUs)/ml in the absence of any symptoms of acute urinary tract infections."[1] The prevalence of ASB globally is 2-15% of all pregnancies.[2,3]

ASB can lead to symptomatic infection, and if left undiagnosed and/or untreated, this may result in adverse outcomes for both mother and fetus. During pregnancy, the risk of developing pyelonephritis is likely to be 20–30 times higher in women with bacteriuria.[4] Undetected bacteriuria leading to acute pyelonephritis increases hospitalization rates and can lead to severe complications like sepsis and respiratory problems.[5] This can further result in preterm birth, a major contributor to infant morbidity and mortality, thus making ASB a public health problem.[6] Current estimates show that approximately 30% of pregnancies with bacteriuria can develop complications such as preterm delivery and low birthweight infants but with low certainty.[7,8] Other fetal complications associated with ASB include increased perinatal mortality, increased risk of stillbirth, intrauterine growth restriction (IUGR), mental retardation, and development delays.

Treatment of bacteriuria in pregnancy may reduce risk of the complications. Some of the risk factors in pregnant women

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known to be associated with UTI are increasing age, parity, history of UTI in previous pregnancies, diabetes, and immune deficiency. Hence, these high-risk pregnant women should be identified early and should be screened for early detection and diagnosis of ASB. Most of the clinical practice guidelines recommend test-and-treat approach. Screening for ASB is recommended with urine culture between 12 and 16 weeks gestation or during the first prenatal visit.[9-11]

However, there are no specific guidelines in India regarding early screening and detection of ASB. Probable reason for non-existence of these guidelines could be due to failure to understand the magnitude of ASB among pregnant women. Studies on prevalence of ASB among pregnant women are conducted in India but on a small sample size. Furthermore, there is also a wide variation in the reported prevalence. Therefore, there is need to conduct a systematic review for estimating the pooled prevalence of asymptomatic bacteriuria in pregnant women at national level in India to document magnitude of ASB among pregnant women in India.

Methods

Study design, protocol, and registration

This is a systematic review and meta-analysis. The study protocol was registered on PROSPERO, under the registration number PROSPERO 2022 CRD42022322289. This report follows Meta-analyses of Observational Studies in Epidemiology (MOOSE) guidelines.

Search strategy and data sources

We searched Medline (via PubMed), Embase, and Web of Science up to March 2022 using terms such as "prevalence," "Pregnan*," "pregnant women," "bacteriuria," "asymptomatic bacteriuria," and "Urinary tract infection." The complete search strategy is presented in Supplementary File Table 1. The search was limited by Year 2000 onward or English language of publications.

To identify studies not indexed in these databases, we also screened the first hundred results on Google Scholar. We also manually searched the reference list of relevant studies.

Study selection

Study selection was done at four levels.

a) Level 1 is based on study design: Observational studies, e.g., cross-sectional studies, case–control studies, cohort studies, and retrospective studies reporting prevalence or proportion of asymptomatic bacteriuria among pregnant women were included. However, case–control studies with cases as asymptomatic bacteriuria (outcome) and control as no significant bacteriuria were excluded.
b) Level 2: Selected studies were first screened by titles and abstracts using eligibility criteria as follows.

Inclusion criteria for studies

- Study participants are pregnant women residing in India
- ASB is diagnosed with the help of midstream urine culture
- Hospital or community-based setting.

Exclusion criteria

- Study participants are not representative of general population example cohort having specific disease condition
- Participants having symptoms of Urinary tract infection (UTI) during enrolment.

However, in studies if the participants were not initially screened for symptoms of UTI before enrolment, then only asymptomatic case data were extracted.

c) Level 3: Selected studies were further screened by full-text reading using the same strategy as in Level 2.
d) Level 4: Snowballing of literature from included studies.

Two reviewers (MK and DS) independently screened studies from each database. Conflicts were resolved by a third independent reviewer (AM or AG) in discussion with the two reviewers. This review was blinded. All screened, de-duplicated, and retrieved studies were exported to Mendeley and Rayyan (Web-based software).[12] First, we reviewed the title and abstracts of all records identified in our search to select all potentially relevant studies. Then, we assessed the full text of selected studies and included studies meeting the eligibility criteria. Study selection was conducted by two reviewers independently (MK and DS). Disagreements were solved by consensus or arbitrated by a third reviewer (AM).

Data extraction

We extracted relevant information for each study using in a pre-designed form in the Microsoft Excel file. The following data were recorded: first author's surname and year of publication, sample size, total number of ASB, setting, place of study, zone of India, inclusion criteria of participants (age, trimester, gestational age), method use for urine collection, method for diagnosis, and breakdown of ASB if given as per parity and trimester. Data were conducted by two independent reviewers (MK and DS). Disagreements were solved by consensus or arbitrated by a third reviewer (AM).

Risk of bias

The risk of bias was assessed for the individual studies using the Joanna Briggs Institute (JBI) Quality assessment tool[13] for observational studies. Raw proportion of ASB in all included studies was 13.9% considering the prevalence of at least 15% sample size of 200 and more was considered as adequate. Quality was assessed independently by two reviewers (MK and DS) and any disagreement was resolved by third reviewer (SS or AM). However, no studies were excluded depending on the quality of study. Studies rating 7-9 were considered low risk of bias, 5-6 as moderate, and 4 or less as high risk of bias.

Data synthesis and analysis

Data management was done using Microsoft Excel 2013. Data from Excel were exported to R software[14] [Supplementary File Table 2] metafor tool for meta-analysis (pooled prevalence of

ASB with 95% CI). Clinical, methodological, and statistical heterogeneity among studies were assessed. We avoided using any arbitrary threshold for heterogeneity, i.e. I^2 value. The random-effect model (Dersimonian and Laird method) with "dmetafor" function was used for analysis. We assessed and quantified the risk of publication bias with the Funnel plot (trim and fill method). We also found outlier using "dmetar" package in R. We performed a subgroup analysis to explore the influence of study setting (Zone of India), study design, and risk of bias on pooled prevalence of ASB. Outlier analysis was done due to high heterogeneity, and prevalence with predicted interval was noted. The pooled effect size for national prevalence was reported in forest plots. Secondary outcome, i.e. pooled prevalence distributed as per parity and trimester, was reported in prevalence (95% CI) and predicted interval.

Results

Study selection

Our search resulted in 452 unique references. After selection of titles and abstracts, we assessed 64 full texts for eligibility. Finally, we included 51 studies in the review. Figure 1 presents the flowchart of study selection. Supplementary File Table 3 gives an overview of reasons of exclusion. List of exclusion studies is given in Supplementary File Table 4.

Characteristic of studies

Out of fifty-one studies included in meta-analysis, 25 studies (50%) were conducted in South India, 13 (25.4%) in North India, 7 (13.7%) in West, and 5 (9.8%) and 2 (3.9%) studies in east and central India, respectively. Most of studies included all age groups, i.e. women of reproductive age approx. 18–45 years except few studies with upper limit of inclusion criteria ranges 35–40 years. Most of studies included full gestational age or all three trimesters except few studies that were limited till 28 weeks or first and second trimesters [Table 1].

JBI quality score shows that 32 studies (61%) had low risk of bias followed by 15 (28%) with moderate risk and only one study had high risk of bias. None of the study reported response rate. 38 (73%) studies had adequate sample size, i.e. more than 200 [Supplementary File Table 5].

Figure 2 shows pooled prevalence of ASB among pregnant women was 14% [12%, 15%], prediction interval as 0.00; and 0.27 with 96% heterogeneity.

Publication bias can be seen in Figure 3. Outlier analysis shows 21 studies[16,17,22,25,31,32,34,37,39,45-47,49,50,52,56,57,60,62,65,67] ("Jayalaksmi 2008," "Gayathree 2010," "Chandel 2012," "Mekapogu 2013," "Titoria 2014," "Sujatha 2014," "Goyal 2015," "Mukherjee

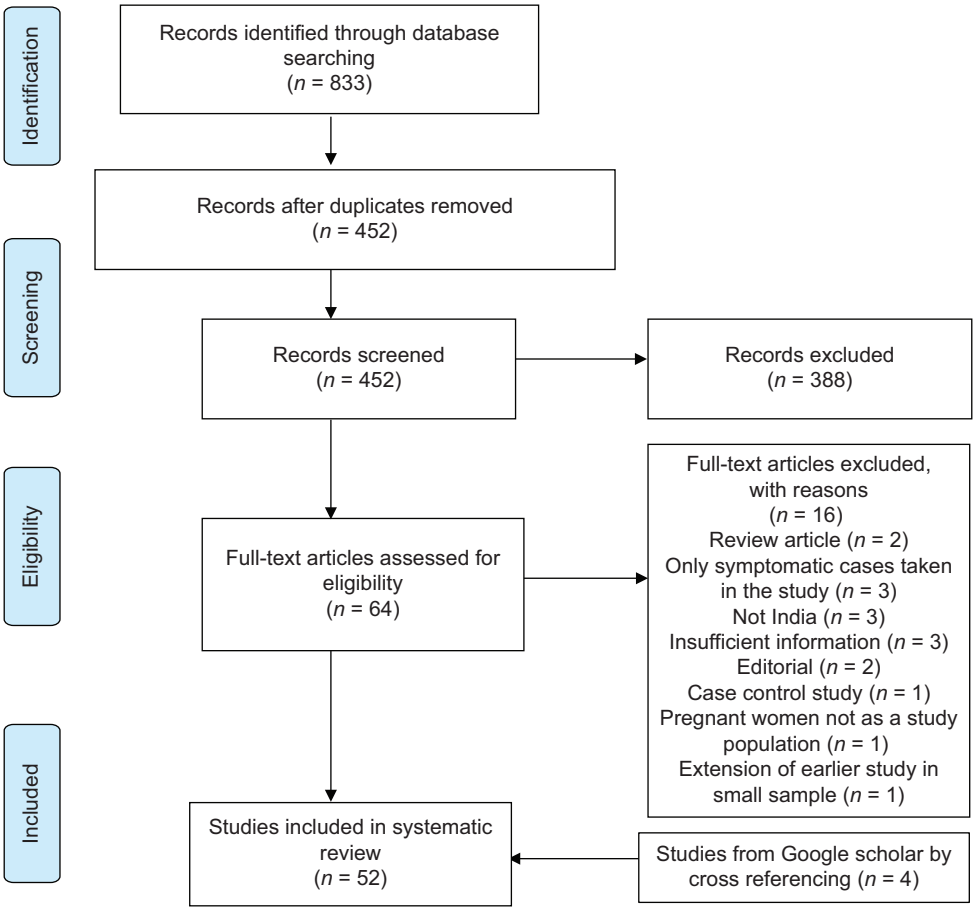

Figure 1: Flowchart of study selection

Table 1: Characteristic of included studies

Study no	Author, year	State	Zone	Age	Gestational age	Trimester
1	Bandyopadhyay *et al*. 2005[45]	Punjab	North	all	all	all
2	Jayalaksmi 2008 [15]	Karnataka	South	all	all	all
3	Gayathree *et al*. 2010 [16]	Karnataka	South	18-45	all	all
4	Girishbabu 2011[46]	Karnataka	South	18-45	all	all
5	Ansari 2011[47]	Andhra Pradesh	South	15-35	all	all
6	Urmila 2012[48]	Uttar Pradesh	North	all	<28 weeks	all
7	Chandel *et al*. 2012[17]	Himachal Pradesh	North	all	all	1st and 2nd
8	Rajshekhar 2013[49]	West Bengal	East	18-41	all	all
9	Karuna *et al*. 2013[50]	Andhra Pradesh	South	all	all	all
10	Mekapogu 2013[18]	Andhra Pradesh	South	all	all	all
11	Lakshmipriya *et al*. 2013[51]	Tamil Nadu	South	18-35	all	2nd
12	Jain *et al*. 2013[52]	Uttar Pradesh	North	all	<20 week, 32-34 weeks	2nd and 3rd
13	Awasthi 2013[53]	Karnataka	South	21-35	above 13 weeks	2nd and 3rd
14	Shankari 2013[54]	Tamil Nadu	South	17-36	12-16 week	1st and 2nd
15	Titoria *et al*. 2014[19]	Delhi	North	all	all	all
16	Sujatha 2014[20]	Uttar Pradesh	North	all	all	all
17	Rajaratnam *et al*. 2014[55]	Karnataka	South	all	all	all
18	Khera *et al*. 2015[56]	Uttar Pradesh	North	all	all	all
19	Goyal *et al*. 2015[21]	Uttar Pradesh	North	all	all	all
20	Shruthi 2015[57]	Karnataka	South	18-36	all	all
21	Ramalingam 2015[36]	Andhra Pradesh	South	ALL	All	all
22	Mukherjee *et al*. 2015[22]	West Bengal	East	all	all	all
23	Byna *et al*. 2015[38]	Andhra Pradesh	South	all	all	all
24	Kasinathan 2016[59]	Pondicherry	South	all	< 28	1st and 2nd
25	Dange 2016[23]	Maharashtra	West	17-39	all	all
26	Chunchaiah *et al*. 2016[40]	Karnataka	South	all	all	all
27	Patel 2016[41]	Madhya Pradesh	Central	all	all	all
28	Verma *et al*. 2016[42]	Rajasthan	West	all	all	all
29	Khanna 2016[43]	Punjab	North	all	all	all
30	Allanki 2017[44]	Telangana	South	18-40	all	all
31	Giri *et al*. 2017[24]	Maharashtra	West	all	all	all
32	Udayagiri *et al*. 2017[25]	Andhra Pradesh	South	all	all	all
33	Bose 2017[26]	Kerala	South	all	12-16 week or first visit	12-16 weeks
34	Maheshwari 2017[65]	Tamil Nadu	South	all	all	all
35	Patnaik *et al*. 2017[28]	Orissa	East	18-40	all	all
36	Kant *et al*. 2017[29]	Haryana	North	all	all	all
37	Jojan 2017[66]	Maharashtra	West	18-41	all	all
38	Shalima *et al*. 2017[30]	Pondicherry	South	all	all	all
39	Waghmare *et al*. 2018[67]	Maharashtra	West	all	all	all
40	Mallikarjun *et al*. 2018[68]	Telangana	South	above 18	all	all
41	Gopchade 2018[69]	Maharashtra	West	all	all	all
42	Rohini *et al*. 2018[31]	Karnataka	South	18-45	all	all
43	Mangalgi 2018[32]	Karnataka	South	all	all	all
44	Pawar 2019[70]	Madhya Pradesh	Central	all	all	all
45	Basundhara 2019[71]	West Bengal	East	all	all	all
46	Goruntla *et al*. 2019[33]	Andhra Pradesh	South	all	all	all
47	Lakshmi 2019[61]	Bihar	East	all	all	all
48	Wagh 2019[35]	Maharashtra	West	all	all	all
49	Kalagara 2020[73]	Telangana	South	all	28 week or less	all
50	Goyal 2020[74]	Punjab	North	18-35	all	all
51	Agarwal *et al*. 2021[27]	Uttar Pradesh	North	above 18	all	all
52	Sonkar 2021[75]	Uttar Pradesh	North	18-45	all	all

2015," "Dange 2016," "Giri 2017," "Udayagiri 2017," "Bose 2017," "Maheshwari 2017," "Patnaik 2017," "Kant 2017," "Shalima 2017," "Rohini 2018," "Mangalgi 2018," "Goruntla 2019," "Lakshmi 2019," "Wagh 2019") as outlier. When these

outliers were removed, percentage of ASB with random-effect model was 12.7% (11.5%, 13.9%), prediction interval (0.074, 0.181), and I^2 63.6% (46.5%, 75.2%).

Table 2 illustrated pooled prevalence of ASB according to parity was 13% (10.116.7%) in multiparous, 15.8% (10-22%) in primiparous, and 14% (8-20%) in nulliparous. The first-trimester prevalence of ASB was 12.7% (6.7-9.3%); in second trimester, it was 13% (10.3-16.7%); and in third, it was 21.8% (16.3-27.3%).

Subgroup analysis according to risk of bias shows prevalence ranging between 12.3% (9.5%; 15.2%) in low risk and 16% (10.8%; 21.1%) in moderate risk of bias studies. As per sample size adequacy, in study with adequate samples, the prevalence was 13% (10.4%; 15.8%) with 96% I^2, while in studies with inadequate sample, the prevalence was 15% (10.4%; 20.3%) with I^2 66.5%. In south (k = 25), west (k = 7), and east (k = 5) zone of India, the prevalence was 14% approximately followed by 10.5% in north (k = 12) and 9% in central India (k = 2). Heterogeneity was high in all the zones [Table 3].

Discussion

This study estimated that the pooled prevalence of asymptomatic bacteriuria among pregnant women in India was 13.5% [CI 11.1; 15.8]. With the removal of outlier studies, the proportion of ASB with random-effect model was 12.7% (11.5;13.9) with heterogeneity I^2 63.6% (46.5%; 75.2%). The lowest prevalence was reported by Kant S *et al*.,[50] which was 1.7 per 100 [CI: 0.9-2.8], and the highest prevalence was reported by Shalima *et al*.[52] was 49.5% [45.4-53.4]. Kant S *et al*.[50] conducted their study in a secondary-level health facility, whereas Shalima e*t al*.[52] conducted the study in a tertiary care hospital prospectively enrolling and screening females for ASB. The high prevalence could be due to referral of high-risk cases to tertiary care hospital. Meta-analysis that involved 15,108 pregnant Iranian women from mainly cross-sectional studies showed overall prevalence of ASB as 13% in Iran and Africa reported the prevalence of 11.1% (95% CI: 7.8, 14.4), which was comparable to the present study.[68,69]

In the present study, publication bias was seen as 21 studies were outliers. This was due to different study settings and recruitment of participants at various stages of pregnancy, age group, parity, and trimester of the participants varied among the studies. Risk of bias was found high only in one study, whereas 34 studies had low risk of bias. Sample size was found adequate in 39 studies (75%) with the prevalence of 13%. On subgroup analysis based on the various geographic zones of the country, the pooled prevalence was found to range from 9.2% in central zone to 14.8% in south zone. Difference in prevalence was also in the meta-analysis conducted by Ghafari M *et al*. in Iran where prevalence was high in north

Table 2: Pooled prevalence of ASB according to parity and trimester

Variable	No. of studies	No. of ASB	Total observations	Percentage (%)	95% CI	I^2 (95% CI)	*P*
Parity							
Multiparous	14	250	2112	13.4	10.1-16.7	76.2% (60.2%; 85.8%)	<0.0001
Primiparous	12	190	1544	15.8	9.9-21.8	94.0% (91.2%; 95.9%)	<0.0001
Nulliparous	9	128	875	14.0	8.2-19.8	87.7% (78.8%; 92.9%)	<0.0001
Trimester							
First Trimester	16	180	1624	12.7	9.2-16.3	79.3% (67.0%; 87.0%)	<0.0001
Second Trimester	17	269	2194	13.5	10.3-16.7	81.4% (71.2%; 88.0%)	<0.0001
Third Trimester	17	268	1554	21.8	16.3-27.3	89.6% (84.9%; 92.8%)	<0.0001

Table 3: Subgroup analysis according to risk of bias, sample size adequacy, and zone of India

	No. of studies	Percentage (RE)* (%)	95% CI	I^2	*P*
Risk of Bias					
High	1	14.0	[000; 31.7]		<0.0001
Moderate	17	16.0	[10.8; 21.1]	81.3%	<0.0001
Low	34	12.3	[9.5; 15.2]	96.6%	<0.0001
Sample size					
Adequate	39	13.0	[10.2; 15.6]	96.6%	<0.0001
Inadequate	13	15.4	[10.4; 20.3]	66.5%	<0.0001
Zone					
South	25	14.8	[11.3; 18.3]	96.3%	<0.0001
North	13	10.5	[5.8; 15.3]	95.7%	<0.0001
West	7	14.5	[7.8; 21.3]	88.5%	<0.0001
East	5	14.2	[6.9; 22.4]	94.0%	<0.0001
Central	2	9.2	[00; 21.3]	0.0%	<0.0001

*Random-effect model

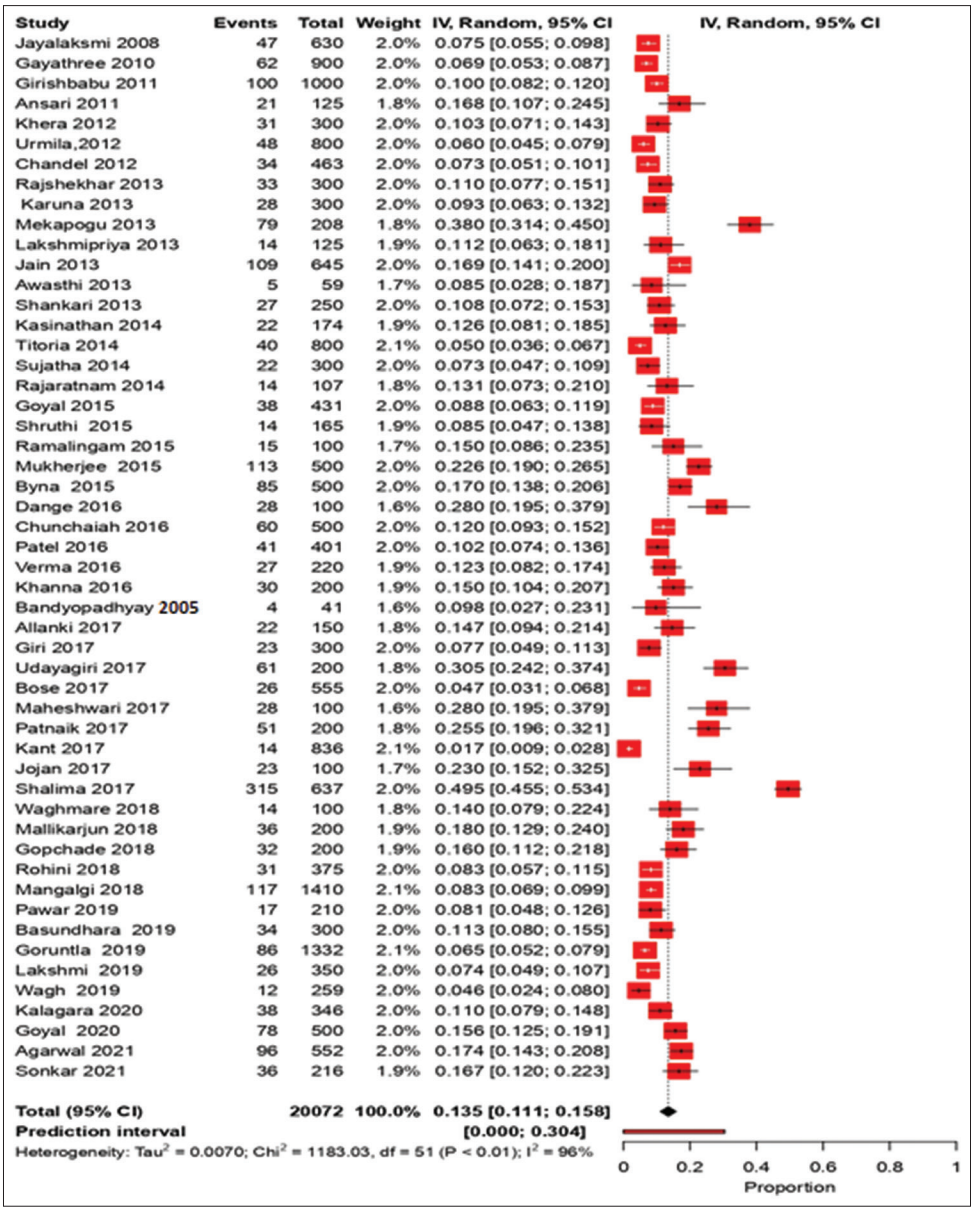

Figure 2: Forest plot of included studies

zone as compared to south zone with high heterogeneity among the studies.[68] Subgroup analyses in study conducted by Awoke N *et al*. revealed variation in the prevalence with highest prevalence 22% in West Africa with heterogeneity index (I^2) of 98.34% ($P < 0.001$) and the lowest prevalence 11% in North Africa.[69] The variation in our study was less as compared to the one conducted in Africa.

Pooled prevalence also varied based on the parity and trimester of the women included in the studies. The highest prevalence of ASB was found in the primiparous women (15.8%) as compared to nulliparous (14%) and multiparous (13.4%) women in the included studies. Based on each trimester, the pooled prevalence of ASB was found to be high in third (21.8%) trimester as compared to second (13.5%) and first (12.8%) trimesters. As the enrolment of the participants in the study was in different trimesters, the high prevalence in the third trimester could be due to accumulation of the cases that were not screened in the earlier trimesters. Some studies reported high prevalence in third trimester is due to anatomical and physiological changes related to advancing gestational age that leads to stasis of urine, which in turn can cause bacterial multiplication.[38,70,71]

Various studies have contradictory views on the universal screening of the pregnant women for ASB. A prospective cohort study conducted in the Netherlands reported that with an uncomplicated singleton pregnancy, ASB is not associated with preterm birth. They also reported a low absolute risk of pyelonephritis in untreated ASB.[8] Rouse DJ *et al*.[72] concluded when compared with a policy of no screening, screening for and treatment of asymptomatic bacteriuria to prevent

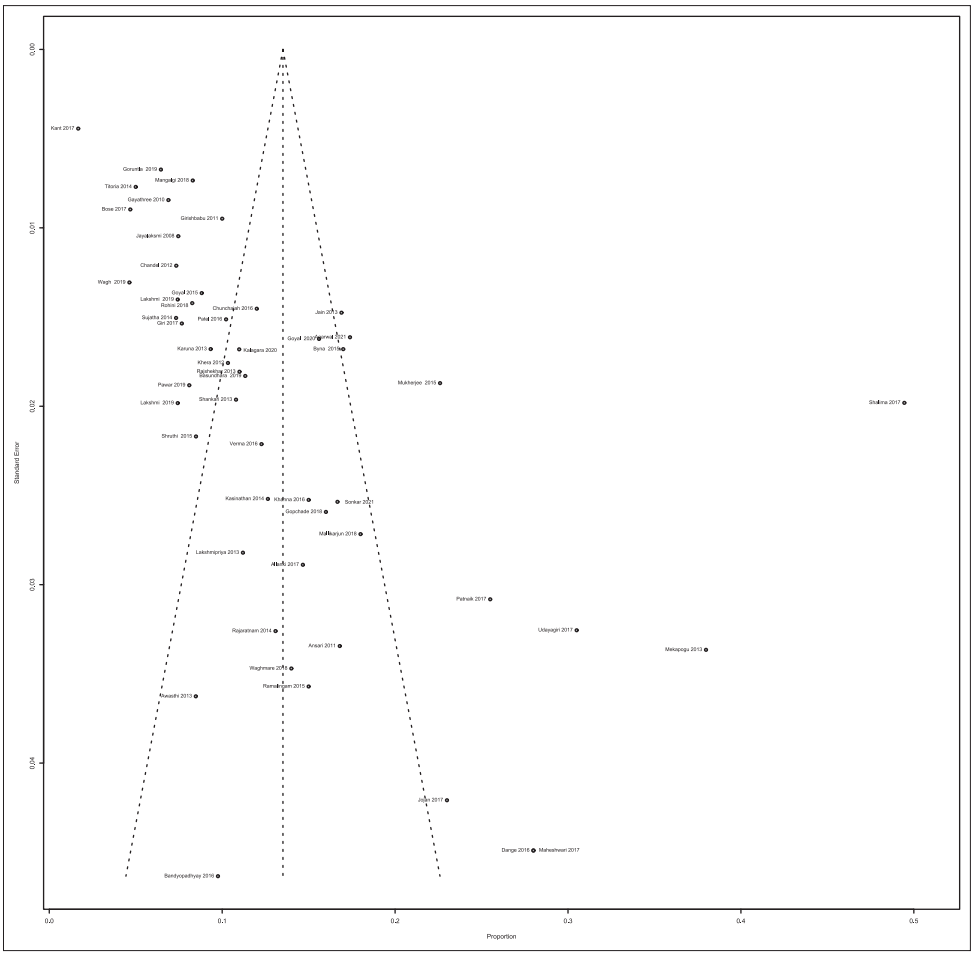

Figure 3: Funnel plot of included studies

pyelonephritis in pregnancy are cost-beneficial whether based on the leukocyte esterase-nitrite dipstick or urine culture. Chicaíza L *et al*.[73] also reported that urine culture in ASB screening avoids the higher number of pyelonephritis and preterm birth cases. They emphasized that the type of screening test depends upon the health system's willingness-to-pay threshold. Moore A *et al*.[10] in their recommendations emphasized that the screening of ASB should depend on the women's preference as some patients are apprehensive of consuming antibiotics during pregnancy but should be done in women who are at increased risk of urinary tract infections in pregnancy like women with diabetes, recurrent urinary tract infections, congenital renal anomalies, and sickle cell diseases. Regarding the appropriate timing of screening, a prospective study reported that the risk of onset of bacteriuria was highest between the ninth and 17th gestational weeks. They also concluded that 16th gestational week was the optimal time for a single screening for bacteriuria based on the number of bacteriuria-free gestational weeks gained by treatment.[74,75]

Conclusion

This meta-analysis was done with pooled prevalence data of ASB from India with population of 20,000 participants. We tried to remove significant heterogeneity among the studies and publication bias by subgroup analysis and removing the outliers, respectively. Considering the high prevalence of ASB as found in meta-analysis, we seek attention of expert panel to frame universal guidelines for screening ASB in pregnancy.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Supplementary File

Table 1: Detailed Search strategy

S.no.	PubMed	Embase	Web of Science
#1	(((((((Pregnancy) OR (pregnant)) OR ("pregnant women")) OR ("pregnant woman")) OR (pregnancy[MeSH Terms])) OR (gestation[MeSH Terms])) OR (gestation)) OR ("pregnant female*"))	Pregnancy [embase]/lim OR pregnant[embase]/lim OR "pregnant women": ab,ti OR "pregnant woman": ab,ti OR gestation [embase]/lim OR "pregnant female*"[embase]/lim	TS=(Pregnancy OR pregnant OR "pregnant women" OR "pregnant woman" OR gestation OR "pregnant female*") OR TI=(Pregnancy OR pregnant OR "pregnant women" OR "pregnant woman" OR gestation OR "pregnant female*")
#2	(bacteriuria) OR (bacteriuria[MeSH Terms])) OR ("asymptomatic bacteriuria")) OR ("bacteria in urine") OR "Bacteriuria"[Mesh])	'asymptomatic bacteriuria'/de OR [embase]/lim 'asymptomatic'/de OR [embase]/lim asymptomatic*:ab,ti OR [embase]/lim asymptomatic*:ab,ti OR [embase]/lim bacteriuri*:ab,ti	TS=(bacteriuria OR "asymptomatic bacteriuria" OR "bacteria in urine") OR TI=(bacteriuria OR "asymptomatic bacteriuria" OR "bacteria in urine")
#3	("pregnancy complication*") OR ("pregnancy infection*") OR "Pregnancy Complications"[Mesh])) OR ("risk factor*")) OR ("pregnancy associated risk factor*")) OR (anemi*)) OR (gestational hypertensi*)) OR ("Anemia"[Mesh])) OR ("Hypertension, Pregnancy-Induced"[Mesh])) OR ("preterm birth*")) OR ("perinatal mortality")) OR ("maternal mortality")) OR ("maternal death")) OR ("low birth weight")) OR ("pre eclampsia")) OR ("Pre-Eclampsia"[Mesh])) OR ("Perinatal Mortality"[Mesh] OR "Perinatal Death"[Mesh])) OR ("Maternal Mortality"[Mesh])) OR (pyelonephritis)) OR (dysuria)) OR ("Pyelonephritis"[Mesh]) OR "Dysuria"[Mesh])	"pregnancy complication*"[embase]/lim OR "pregnancy infection*"[embase]/lim OR "risk factor*"[embase]/lim OR "pregnancy associated risk factor*" [embase]/lim OR anemi* [embase]/lim OR gestational hypertensi* [embase]/lim OR "preterm birth*"[embase]/lim OR "perinatal mortality"[embase]/lim OR "maternal mortality"[embase]/lim OR "maternal death"[embase]/lim OR "low birth weight"[embase]/lim OR "pre eclampsia"[embase]/lim OR pyelonephritis[embase]/lim OR (dysuria))	TS= ("pregnancy complication*" OR "pregnancy infection*" OR "risk factor*" OR "pregnancy associated risk factor*"OR anemi* OR gestational hypertensi* OR "preterm birth*" OR "perinatal mortality" OR "maternal mortality" OR "maternal death" OR "low birth weight" OR "pre eclampsia" OR pyelonephritis OR dysuria)
#4	#1 AND #2 AND #3	#1 AND #2 AND #3	#1 AND #2 AND #3
Total	1365	1158	486
Filters lang: English Year:2000-March 2022 Region: India	441	379	13

Table 2: R commands

```
setwd(&quot;C:/Users/acer/Desktop&quot;)
dat=read.csv(&quot;data.csv&quot;, header=T, sep=&quot;,&quot;)
glimpse(data)
View(data)
data &lt;- read.csv(&quot;C:/Users/acer/Desktop/data.csv&quot;)
View(data)
dat=read.csv()
install.packages(c(&quot;metafor&quot;, &quot;meta&quot;))
library(metafor)
library(meta)
escalc(xi=case, ni=total, data=dat, measure=&quot;PR&quot;)
escalc(xi=cases, ni=total, data=dat, measure=&quot;PLO&quot;)
escalc(xi=case, ni=total, data=dat, measure=&quot;PR&quot;/&quot;PLO&quot;/&quot;PFT&quot;)
escalc(xi=cases, ni=total, data=dat, measure=&quot;PFT&quot;)
escalc(xi=case, ni=total, data=dat, measure=&quot;PLO&quot;)
pes=rma(yi, vi, data=ies, method=&quot;REML&quot;)
pes.logit=rma(yi, vi, data=ies, method=&quot;DL&quot;/&quot;REML&quot;)
ies=&gt; escalc(xi=case, ni=total, data=dat, measure=&quot;PLO&quot;)
ies= escalc(xi=case, ni=total, data=dat, measure=&quot;PLO&quot;)
pes=rma(yi, vi, data=ies, method=&quot;REML&quot;)
print(pes)
pes.logit=rma(yi, vi, data=ies.logit, method=&quot;DL&quot;, level=95)
pes.logit=rma(yi, vi, data=ies, method=&quot;DL&quot;, level=95)
print(pes.logit)
confint(pes)
confint(pes,digit=2)
pes.summary=metaprop(case, total, authoryear, data=dat, sm=&quot;PRAW&quot;)
forest(pes.summary)
forest(pes.summary,xlim=c(0,4),pscale=1000,
rightcols=FALSE,
leftcols=c(&quot;studlab&quot;, &quot;event&quot;, &quot;n&quot;, &quot;effect&quot;, &quot;ci&quot;),
leftlabs=c(&quot;Study&quot;, &quot;Cases&quot;, &quot;Total&quot;, &quot;Proportion&quot;, &quot;95% C.I.&quot;),
xlab=&quot;Prevalence of CC&quot;, smlab=&quot;&quot;,
weight.study=&quot;random&quot;, squaresize=0.5, col.square=&quot;navy&quot;,
col.square.lines=&quot;navy&quot;,
col.diamond=&quot;maroon&quot;, col.diamond.lines=&quot;maroon&quot;,pooled.totals=FALSE,
comb.fixed=FALSE,
fs.hetstat=10,
print.tau2=TRUE,
print.Q=TRUE,
print.pval.Q=TRUE,
print.I2=TRUE,
digits=2)
precision=sqrt(ies$vi)
forest(pes.summary,xlim=c(0,4),pscale=1000,
+ rightcols=FALSE,
+ leftcols=c(&quot;studlab&quot;, &quot;event&quot;, &quot;n&quot;, &quot;effect&quot;, &quot;ci&quot;),
+ leftlabs=c(&quot;Study&quot;, &quot;Cases&quot;, &quot;Total&quot;, &quot;Prevalence&quot;, &quot;95% C.I.&quot;),
+ xlab=&quot;Prevalence of CC&quot;, smlab=&quot;&quot;,
+ weight.study=&quot;random&quot;, squaresize=0.5, col.square=&quot;navy&quot;,
+ col.square.lines=&quot;navy&quot;,
+ col.diamond=&quot;maroon&quot;, col.diamond.lines=&quot;maroon&quot;,pooled.totals=FALSE,
+ comb.fixed=FALSE,
+ fs.hetstat=10,
```

Contd...

Table 2: Contd...

```
+ print.tau2=TRUE,
+ print.Q=TRUE,
+ print.pval.Q=TRUE,
+ print.I2=TRUE,
+ digits=2,sortvar=precision)
forest(pes.summary,sortvar=precision,xlim=c(0,4),pscale=1000,
+ rightcols=FALSE,
+ leftcols=c(&quot;studlab&quot;, &quot;event&quot;, &quot;n&quot;, &quot;effect&quot;, &quot;ci&quot;),
+ leftlabs=c(&quot;Study&quot;, &quot;Cases&quot;, &quot;Total&quot;, &quot;Prevalence&quot;, &quot;95% C.I.&quot;),
+ xlab=&quot;Prevalence of CC&quot;, smlab=&quot;&quot;,
+ weight.study=&quot;random&quot;, squaresize=0.5, col.square=&quot;navy&quot;,
+ col.square.lines=&quot;navy&quot;,
+ col.diamond=&quot;maroon&quot;, col.diamond.lines=&quot;maroon&quot;,pooled.totals=FALSE,
+ comb.fixed=FALSE,
+ fs.hetstat=10,
+ print.tau2=TRUE,
+ print.Q=TRUE,
+ print.pval.Q=TRUE,
+ print.I2=TRUE,
+ digits=2)
forest(pes.summary,sortvar=precision,xlim=c(0,4),
pscale=1000,
rightcols=FALSE,
leftcols=c(&quot;studlab&quot;, &quot;event&quot;, &quot;n&quot;, &quot;effect&quot;, &quot;ci&quot;),
leftlabs=c(&quot;Study&quot;, &quot;Cases&quot;, &quot;Total&quot;, &quot;Prevalence&quot;, &quot;95% C.I.&quot;),
xlab=&quot;Prevalence of CC&quot;, smlab=&quot;&quot;,
weight.study=&quot;random&quot;, squaresize=0.5, col.square=&quot;navy&quot;,
col.square.lines=&quot;navy&quot;,
col.diamond=&quot;maroon&quot;, col.diamond.lines=&quot;maroon&quot;,pooled.totals=FALSE,
comb.fixed=FALSE,
fs.hetstat=10,
print.tau2=TRUE,
print.Q=TRUE,
print.pval.Q=TRUE,
print.I2=TRUE,
digits=2)
inf=influence(pes.logit)
print(inf); plot(inf)
subgroup from https://bookdown.org/MathiasHarrer/Doing_Meta_Analysis_in_R/mixed.html
library(dmetar)
install.packages(dmetar)
install(dmetar)
install.packages(&quot;devtools&quot;)
devtools::install_github(&quot;MathiasHarrer/dmetar&quot;)
sgame &lt;- subgroup.analysis.mixed.effects(x = pes.summary,
subgroups = data$size)
library(dmetar)
sgame &lt;- subgroup.analysis.mixed.effects(x = pes.summary,subgroups = data$size)
subgroups = data$size)
sgame &lt;- subgroup.analysis.mixed.effects(x = pes.summary,subgroups = data$size)
print(sgame)
forest(sgame)
funnel(pes.summary,xlab = &quot;g&quot;,studlab = TRUE)
&gt; eggers.test(x = pes.summary
Outlier
install.packages(&quot;devtools&quot;)}devtools::install_github(&quot;MathiasHarrer/dmetar&quot;)library(dmetar)
install.packages(&quot;devtools&quot;)
install_github(&quot;MathiasHarrer/dmetar&quot;)
install.packages(&quot;dmetar&quot;)
out&lt;-find.outliers(pes.summary)
out
View(out)
```

Table 3: Reasons for exclusion of studies

Reason for exclusion	Number of studies
Review article	*n*=2
Only symptomatic cases taken in the study	*n*=3
Country other than India	*n*=3 (Nepal=2, Pakistan=1)
Full text not available	*n*=2
Editorial	*n*=2
Case control study (16week and 32 week of gestation)	*n*=1
Prevalence of ASB cannot be computed with given information in the article	*n*=1
Pregnant women not as a study population (only diabetic patient included)	*n*=1
Extension of earlier study in small sample	*n*=1
Total	*n*=16

Table 4: List of excluded studies

Reason for exclusion	Article Name	Year	Author
Symptomatic cases included in the study population	1. Can the Griess Nitrite test and a Urinary Pus Cell Count of ≥5 cells per micro liter of urine in pregnant women be used for the screening or the early detection of urinary tract infections in rural India?	2012	Thakre *et al*
	2. Poverty and community-acquired antimicrobial resistance with extended-spectrum β-lactamase–producing organisms, Hyderabad, India	2018	Alsan, M. *et al*
	3. Prevalence of urinary tract infections and its etiological agents among pregnant women in Malabar region of Kerala	2015	Fasalu Rahiman, O.M., Balasubramanian, T., Kumar, P., Ashif, C.M., Shejina, M.
Review	4. Asymptomatic bacteriuria in pregnancy	2015	Deepjyoti Kalita ; Sangita Deka
	5. Unmet need of antenatal screening for asymptomatic bacteriuria: A risk factor for adverse outcomes of pregnancy	2019	Manish Gehani *et al*
Full text not available	7. Usefulness of dipstick reagent strip for screening of asymptomatic bacteriuria during pregnancy in low resource country	2012	V. Jain *et al*
	8. Symptomatic and asymptomatic urinary tract infection by Escherichia coli among pregnant women attending outpatient clinic of obstetrics and gynecology	2011	H. Anandkumar
Editorial	10. The 2019 USPSTF Report on Screening for Asymptomatic Bacteriuria-Lessons from History	2019	Kalpana Gupta, Barbara W Trautner
	11. Hygiene practices and sexual activity associated with urinary tract infection in rural pregnant women of Nagpur, India	2015	Thakre, S.S. *et al*
Prevalence not given	12. Incidence of SHV-1 and CTX-M-15 extended spectrum of β-lactamases producing gram-negative bacterial isolates from antenatal women with asymptomatic bacteriuria	2018	Kalaivani, R. *et al*
Not India	13. Pregnancy-associated asymptomatic bacteriuria and drug resistance (Nepal)	2015	Khan, S. *et al*
	14. Asymptomatic bacteriuria among pregnant women visiting Nepal Medical College Teaching Hospital, Kathmandu, Nepal	2011	R Marahatta *et al*
	15. Asymptomatic Bacteriuria (ASB) in diabetic patients: Treat or not to treat: A prospective, observational study conducted at a tertiary care hospital (Pakistan)	2021	Abubakar Tauseef *et al*
Pregnant women not as a study population (only diabetic patient included)	16. Prevalence, clinical profile and follow up of asymptomatic bacteriuria in patients with type 2 diabetes-prospective case control study in Srinagar, India	2021	Bashir A Laway
Extended study is available	Urinary Tract Infection During Pregnancy: Prevalence, Associated Risk Factors and Treatment Outcome Based on Antimicrobial Sensitivity Pattern	2019	Lakshmi, Pragya; Srivastava, Ranjan Kumar; Bharadwaj, Alok
Case control with cases as ASB	A comparative study of the prevalence of asymptomatic bacteriuria (ASB) among elderly diabetics and non-diabetics with their antibiotic resistant pattern	2018	Shadma Yaqoob, Vaibhav Shukla, Mastan Singh, Priyanka Shukla, Fareya Haider

Table 5: JBI Quality score of studies

Author, Year	Was the sample frame appropriate to address the target population?	Were study participants sampled in an appropriate way?	Was the sample size adequate?	Were the study subjects and the setting described in detail?	Was the data analysis conducted with sufficient coverage of the identified sample	Were valid methods used for the identification of the condition?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	JBI Quality score
Bandyopadhyay 2005[45]	0	U	0	1	1	1	1	1	U	5
Jayalaksmi 2008[15]	U	U	1	0	1	1	1	1	U	5
Gayathree 2010[16]	1	U	1	1	1	1	1	1	U	7
Girishbabu 2011[46]	1	U	1	1	1	1	1	1	U	7
Ansari 2011[47]	1	U	0	1	1	1	1	1	U	6
Khera 2012[48]	1	U	1	1	1	1	U	1	U	6
Urmila 2012[49]	1	1	1	1	1	1	1	1	U	8
Chandel 2012[17]	1	U	1	1	1	1	1	1	U	7
Rajshekhar 2013[50]	1	U	1	1	1	1	1	1	U	7
Karuna 2013[51]	1	U	1	1	1	1	1	1	U	7
Mekapogu 2013[18]	1	U	1	0	1	1	1	1	U	6
Lakshmipriya 2013[52]	1	U	0	1	1	1	1	1	U	6
Jain 2013[53]	1	U	1	1	1	1	1	1	U	7
Awasthi 2013[54]	1	U	0	1	1	1	1	1	U	6
Shankari 2013[55]	1	U	1	1	1	1	1	1	U	7
Kasinathan 2014[56]	1	U	0	1	1	1	1	1	U	6
Titoria 2014[19]	1	1	1	1	1	1	1	1	U	8
Sujatha 2014[20]	1	U	1	1	1	1	1	1	U	7
Rajaratnam 2014[57]	1	U	0	1	1	1	1	1	U	6
Goyal 2015[21]	1	1	1	1	1	1	1	1	U	8
Shruthi 2015[58]	1	1	0	1	1	1	1	1	U	7
Ramalingam 2015[59]	1	U	0	1	1	1	1	1	U	6
Mukherjee 2015[22]	1	U	1	1	1	1	1	1	U	7
Byna 2015[38]	1	U	1	1	1	1	1	1	U	7
Dange 2016[23]	1	U	1	1	1	1	1	1	U	7
Chunchaiah 2016[60]	1	U	1	1	1	1	1	1	U	7
Patel 2016[61]	1	U	1	1	1	1	1	1	U	7
Verma 2016[62]	1	U	1	1	1	1	1	1	U	7
Khanna 2016[63]	1	U	1	1	1	1	1	1	U	7
Allanki 2017[64]	1	U	0	1	1	1	1	1	U	6
Giri 2017[24]	1	U	1	1	1	1	1	1	U	7
Udayagiri 2017[25]	1	U	1	1	1	1	1	1	U	7
Bose 2017[26]	1	0	1	1	1	1	1	1	U	7
Maheshwari 2017[65]	1	U	0	1	1	1	1	1	U	6
Patnaik 2017[28]	1	U	1	1	1	1	1	1	U	7

Contd...

Table 5: Contd...

Author, Year	Was the sample frame appropriate to address the target population?	Were study participants sampled in an appropriate way?	Was the sample size adequate?	Were the study subjects and the setting described in detail?	Was the data analysis conducted with sufficient coverage of the identified sample	Were valid methods used for the identification of the condition?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	JBI Quality score
Kant 2017[29]	1	1	1	1	1	1	1	1	U	8
Jojan 2017[66]	1	U	0	0	1	1	1	1	U	5
Shalima 2017[30]	1	1	1	1	1	1	1	1	U	8
Waghmare 2018[67]	0	U	0	0	1	1	1	1	U	4
Mallikarjun 2018[68]	1	U	0	1	1	1	1	1	U	6
Gopchade 2018[69]	1	U	1	1	1	1	1	1	U	7
Rohini 2018[31]	1	U	1	1	1	1	1	1	U	7
Mangalgi 2018[32]	1	U	1	1	1	1	1	1	U	7
Pawar 2019[70]	1	U	1	1	1	1	1	1	U	7
Basundhara 2019[71]	1	U	1	0	1	1	1	1	U	6
Goruntla 2019[33]	1	1	1	1	1	1	1	1	U	8
Lakshmi 2019[72]	1	U	1	1	1	1	1	1	U	7
Wagh 2019[35]	1	U	1	1	1	1	1	1	U	7
Kalagara 2020[73]	1	U	1	1	1	1	1	1	U	7
Goyal 2020[74]	1	U	1	1	0	1	1	0	U	5
Agarwal 2021[27]	1	U	1	1	1	1	1	1	U	7
Sonkar 2021[75]	1	1	1	1	1	1	1	1	U	8

1 – Yes, 0 – No, U – Uncertain