Archives of Gynecology and Obstetrics (2019) 299:689–694
https://doi.org/10.1007/s00404-018-5023-y

MATERNAL-FETAL MEDICINE

Assessing the reporting quality of systematic reviews of observational studies in preeclampsia

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Received: 6 July 2018 / Accepted: 14 December 2018 / Published online: 4 January 2019

Abstract

Purpose The majority of epidemiological studies in preeclampsia are observational and the overview of these studies is expressed by systematic reviews (SRs). The aim of this study was to evaluate the reporting quality of published SRs of observational studies (OS) in preeclampsia based on Meta-analysis of Observational Studies in Epidemiology (MOOSE) statement.

Methods PubMed and Cochrane databases were searched for SRs of OS in preeclampsia published from 1st January 2011 through 10th December 2017. The SRs were evaluated for their reporting quality according to the MOOSE statement, an evidence-based tool which consists of a checklist of 35 items, overall and according to the ranking of journals.

Results The search identified 93 eligible SRs. Six items were reported in all the studies. Ninety percent (90%) and 70% of the studies complied with 13 (37%) and 20 (57%) items of MOOSE, respectively. Two items concerning search strategy were under-reported (< 10% of studies). High-ranked journals (impact factor ≥ 5) presented a better reporting quality ($p < 0.05$) of the MOOSE items, while no significant differences were identified in individual items.

Conclusions The quality of reporting of SRs for OS in preeclampsia was considered satisfactory; though, ranking of journals may have an effect in reporting. Further improvement of reporting is necessary to enhance the validity of SRs.

Keywords MOOSE · Systematic reviews · Observational studies · Reporting quality · Preeclampsia

Introduction

Preeclampsia is a major complication of pregnancy and one of the most common causes of death due to pregnancy [1], with an estimated prevalence of about 2–8% worldwide [2]. A substantial amount of clinical knowledge for pregnancy and related complications, such as preeclampsia, originates from observational studies (OS) [3]. Then, the conduct of the respective systematic reviews (SRs), i.e., summary and synthesis of OS in a systematic way, is needed to answer certain clinical questions [4].

Inadequate reporting of the published SRs of OS restricts the generalizability and the credibility of studies' results. However, the validity and applicability of a SR depends on the quality of the primary studies that have been included in the review and on the conduct of the review itself [5]. So far, a considerable number of guidelines and practical checklists, often with dull acronyms, have been developed to improve the quality of a variety of study designs [6], including the SRs of OS design [7].

In response to the need for improving the quality of reporting of SRs of OS, the Meta-analysis of Observational Studies in Epidemiology (MOOSE) statement was introduced [7]. The MOOSE statement is a 35-item checklist and is used to assess the reporting of SRs of OS and not the actual quality of the original research (http://www.equator-network.org). Nevertheless, MOOSE could be a tool for assisting the physicians in assessing, interpreting and generalizing the findings derived from SRs of OS [7].

Although there is a considerable number of studies evaluating the quality of reporting in randomized trials [8] and

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00404-018-5023-y) contains supplementary material, which is available to authorized users.

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observational studies [9], there are very few studies that critically evaluate the epidemiological literature according to the MOOSE statement [10, 11]. In the field of preeclampsia, no meticulous evaluation of SRs of OS reporting, based on the MOOSE statement, has been conducted so far. The aim of the present study was to evaluate the quality of reporting of SRs of OS in preeclampsia according to the MOOSE statement. The impact of the journal ranking in the reporting quality of the SRs was also investigated.

Materials and methods

Data sources, search strategies and studies selection

PubMed and Cochrane databases were searched for SRs of OS in preeclampsia from 1st January 2011 to 10th December 2017. The search terms included "preeclampsia" OR "pre-eclampsia" OR "hypertensive disorders pregnancy" OR "gestational hypertension" OR "pregnancy-induced hypertension". The search was limited to the following criteria: SR as the article type, inclusion of studies on human subjects and English language. SRs were considered eligible if they were published in a peer-reviewed journal.

Then, two investigators (IT and AA)—both biostatisticians—independently screened all titles and abstracts of records retrieved from database searches. The reference lists of the relevant retrieved articles were also hand-searched. Records, considered as potentially relevant, were retrieved in full text and proceeded to evaluation. The retrieved articles were eligible if they were SRs of OS (i.e., cohort, case–control, and cross-sectional), investigated preeclampsia, and had been published as full papers or short reports in a regular issue or supplement of peer-reviewed journals indexed in PubMed or Cochrane. Articles published as editorials, letters, conferences or meeting abstracts were excluded. If any article could not be retrieved, a contact with the authors would be attempted. Discrepancies between the authors during data collection were resolved by discussion with a third author (EZ). Inter-rater agreement level between the reviewers was assessed using the Cohen's kappa statistic.

Data extraction and reporting assessment tool

MOOSE checklist, which consists of six sections: reporting of background, search strategy, methods, results, discussion and conclusions, was used as assessment tool for the reporting quality of SRs [7]. As MOOSE was developed in 1997 and all the included reports were published after 2011, there was no substantial benefit in dividing the studies into subcategories according to publication date (pre-MOOSE/post-MOOSE period). Hence, based on MOOSE reporting items, a 35-item data extraction sheet was developed. No pilot training of the data extraction was performed.

All items were investigated in terms of whether they were reported, not whether they were actually carried out during the study. Articles were scored as "yes" if they were reported in enough detail to allow the reader judge that the definition had been met. Studies were coded as "no" when the checklist item was not reported. If an item was partially reported, it was counted as "no".

Methodological evaluation

The SRs were evaluated based on the MOOSE statement overall and according to the ranking of the journals. Thus, the included reports were classified according to the Institute for Scientific Information (ISI) impact factor (IF) 2016 and then, the quality of reporting in high-ranked journals ($IF \geq 5$) versus those with lower rank ($IF < 5$) was assessed. The choice of $IF = 5$ represented the upper (75%) quartile of all the IFs of the included journals. Also, the articles were divided into subgroups according to their compliance with the MOOSE statement items. Comparisons between various subgroups were made by means of the Fisher's exact test.

Results

Eligible studies

A total of 1300 potentially relevant reports from the databases were identified for review (Fig. 1). After duplicates removal, 1202 records were screened. Via eligibility screening, 1090 citations were excluded; 169 studies were not conducted in human species, 37 were not in English (most in French), 586 were not systematic reviews and 298 were not relevant by subject. Consequently, a total of 112 full-text articles were assessed for eligibility, from which 19 were excluded either as systematic reviews of randomized controlled trials, or because preeclampsia was not included in the study design. Finally, 93 reports were assessed. The inter-rater agreement level in article evaluation for eligibility was relatively high, with kappa = 0.92 (0.88–0.96). The main discrepancy between the two raters concerned the eligibility of articles that were short reports. A full list of the 93 articles that were retrieved as full-text and included in final analysis is available as supplementary material.

Main results

Compliance with the MOOSE checklist items ranged from 2.2 to 100%. Six items were reported in all (100%) the studies, while 13 items were reported by at least 90% of the studies. Furthermore, 20 items were reported by 70% of the

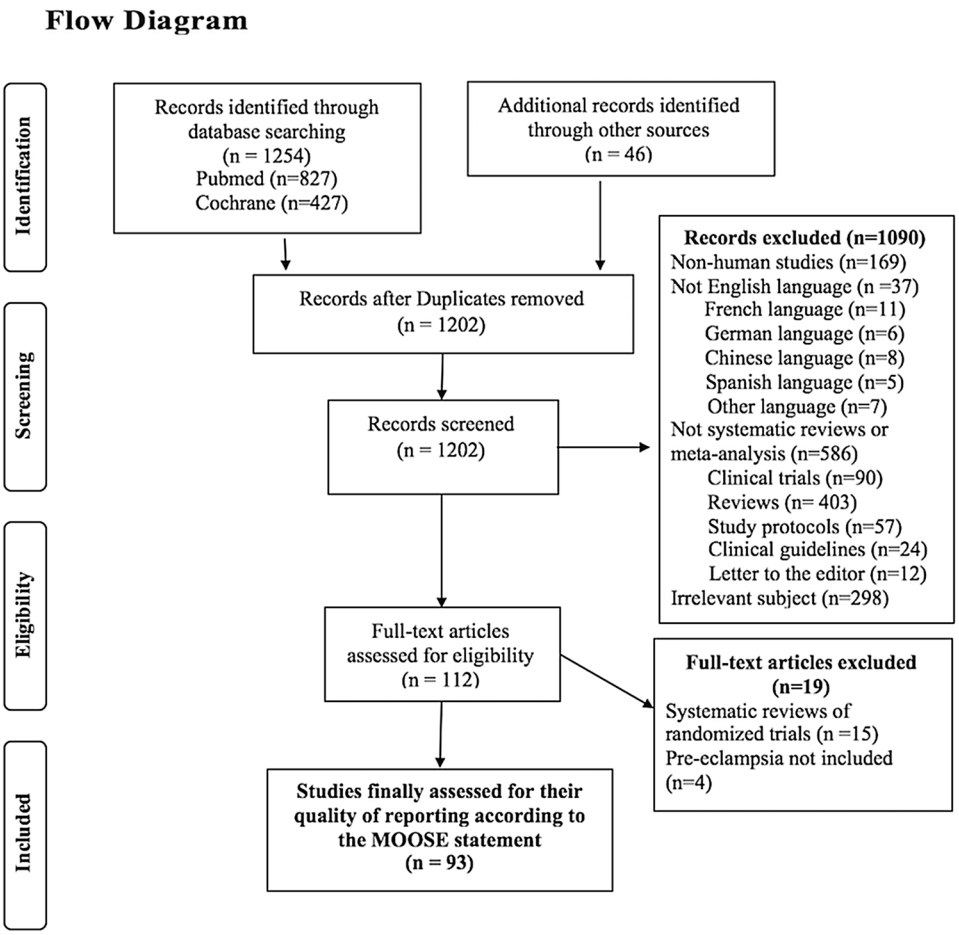

Fig. 1 Flow diagram of the systematic review of observational studies literature search results. Figure adapted from: [14]

studies (Table 1). In contrast, nine MOOSE checklist items were mentioned in less than 50% of the reports, while two of these items [(a) search software used, name and version, including special features used, (b) method of addressing articles published in languages other than English] were included in less than 10% of the reports (Table 2).

Impact of high-ranked journals

The 93 reports were published in 67 different journals, whereas only 15 journals (22.4%) had an impact factor ≥ 5 and were considered as high-ranked. 70 (75.2%) reports were published in low-ranked journals. Thirteen (19.4%) journals endorsed the MOOSE statement; six were considered as high-ranked and seven as low-ranked according to IF. No significant differences were identified in reporting of each MOOSE item between reports published in high- and low-ranked journals (Table 1).

The IF was associated with the different levels of compliance ($p = 0.019$). In high-ranked journals, more than one-third of the reports complied with more than 80% of the MOOSE items, while the percentage of compliance for low-ranked journals was only 11.4% (Table 3).

Discussion

The present study investigated the quality of reporting of SRs of OS in preeclampsia according to the MOOSE statement. The analysis focused both on the reporting of each item in SRs of OS and the effect of journal's ranking. Although the overall reporting quality was relatively high, there were some essential aspects of SRs of OS (especially in the search strategy) that were low-reported, making it difficult for the reader to explicitly assess the validity of a SR of OS. There was no impact of journals' ranking in reporting of each MOOSE item; however, the overall reporting quality of SRs was better in high-ranked journals.

The reporting of SRs of OS based on the MOOSE statement has been evaluated in various medical fields, especially in meta-analyses. Zhang et al. [12] evaluated the reporting quality of meta-analyses of observational studies published in Chinese journals by applying the MOOSE and Assessment of Multiple Systematic Reviews (AMSTAR). They found questionable reporting quality according to MOOSE statement and recommended that Chinese journals should adopt the MOOSE criteria. Accurate reporting is essential to maintain a clear scientific record, which can then be used for

Table 1 Assessment of reporting of MOOSE items in the total reports of systematic reviews of observational studies in preeclampsia and according to the impact factor of journals

MOOSE items	*N* (%) reporting item		
	Total reports (*N* = 93)	Lower IF reports (IF < 5) (*N* = 70)	Higher IF reports (IF ≥ 5) (*N* = 23)
Reporting of background should include			
Problem definition	93 (100)	70 (100)	23 (100)
Hypothesis statement	90 (96.8)	67 (95.7)	23 (100)
Description of study outcome(s)	92 (98.9)	69 (98.6)	23 (100)
Type of exposure or intervention used	93 (100)	70 (100)	23 (100)
Type of study designs used	46 (49.5)	31 (44.3)	15 (65.2)
Study population	93 (100)	70 (100)	23 (100)
Reporting of search strategy should include			
Qualifications of searchers (e.g., librarians and investigators)	20 (21.5)	14 (20.0)	6 (26)
Search strategy, including time period included in the synthesis and keywords	93 (100)	70 (100)	23 (100)
Effort to include all available studies, including contact with authors	54 (58.1)	42 (60.0)	12 (52.2)
Databases and registries searched	93 (100)	70 (100)	23 (100)
Search software used, name and version, including special features used (e.g., explosion)	2 (2.2)	0 (0)	2 (8.7)
Use of hand searching (e.g., reference lists of obtained articles)	84 (90.3)	62 (88.6)	22 (95.6)
List of citations located and those excluded, including justification	37 (39.8)	28 (40.0)	9 (39.1)
Method of addressing articles published in languages other than English	7 (7.5)	7 (10.0)	0 (0)
Method of handling abstracts and unpublished studies	17 (18.3)	12 (17.1)	5 (21.7)
Description of any contact with authors	19 (20.4)	12 (17.1)	7 (30.4)
Reporting of methods should include			
Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	93 (100)	70 (100)	23 (100)
Rationale for the selection and coding of data (e.g., sound clinical principles or convenience)	74 (79.6)	56 (80.0)	18 (78.3)
Documentation of how data were classified and coded (e.g., multiple raters, blinding, and inter-rater reliability)	76 (81.7)	57 (81.4)	19 (82.6)
Assessment of confounding (e.g., comparability of cases and controls in studies where appropriate)	37 (39.8)	24 (34.3)	13 (56.5)
Assessment of study quality, including blinding of quality assessors; stratification or regression on possible predictors of study results	57 (61.3)	42 (60.0)	15 (65.2)
Assessment of heterogeneity	60 (64.5)	42 (60.0)	18 (78.3)
Description of statistical methods (e.g., complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose–response models, or cumulative meta-analysis) in sufficient detail to be replicated	65 (69.9)	46 (65.7)	19 (82.6)
Provision of appropriate tables and graphics	91 (97.8)	68 (97.1)	23 (100)
Reporting of results should include			
Graphic summarizing individual study estimates and overall estimate	66 (71.0)	47 (67.1)	19 (82.6)
Table giving descriptive information for each study included	89 (95.7)	66 (94.3)	23 (100)
Results of sensitivity testing (e.g., subgroup analysis)	62 (66.7)	43 (61.4)	19 (82.6)
Indication of statistical uncertainty of findings	69 (74.2)	51 (72.8)	18 (78.3)
Reporting of discussion should include			
Quantitative assessment of bias (e.g., publication bias)	56 (60.2)	43 (61.4)	13 (56.5)
Justification for exclusion (e.g., exclusion of non-English-language citations)	34 (36.6)	24 (34.3)	10 (43.5)
Assessment of quality of included studies	70 (75.3)	51 (72.8)	19 (82.6)
Reporting of conclusions should include			
Consideration of alternative explanations for observed results	91 (97.8)	69 (98.6)	22 (95.6)
Generalization of the conclusions (i.e., appropriate for the data presented and within the domain of the literature review)	90 (96.8)	67 (95.7)	23 (100)

Table 1 (continued)

MOOSE items	*N* (%) reporting item		
	Total reports (*N* = 93)	Lower IF reports (IF < 5) (*N* = 70)	Higher IF reports (IF ≥ 5) (*N* = 23)
Guidelines for future research	83 (89.2)	64 (91.4)	19 (82.6)
Disclosure of funding source	75 (80.6)	55 (78.6)	20 (86.9)

IF impact factor

Table 2 Lowest (< 50%) reported MOOSE items in the total reports of systematic reviews of observational studies in preeclampsia and according to the IF

MOOSE items	*N* (%) reporting item		
	Total reports (*N* = 93)	Lower IF reports (IF < 5) (*N* = 70)	Higher IF reports (IF ≥ 5) (*N* = 23)
Reporting of background should include			
Type of study designs used	46 (49.5)	31 (44.3)	15 (65.2)
Reporting of search strategy should include			
Qualifications of searchers (e.g., librarians and investigators)	20 (21.5)	14 (20.0)	6 (26)
Search software used, name and version, including special features used (e.g., explosion)	2 (2.2)	0	2 (8.7)
List of citations located and those excluded, including justification	37 (39.8)	28 (40.0)	9 (39.1)
Method of addressing articles published in languages other than English	7 (7.5)	7 (10.0)	0
Method of handling abstracts and unpublished studies	17 (18.3)	12 (17.1)	5 (21.7)
Description of any contact with authors	19 (20.4)	12 (17.1)	7 (30.4)
Reporting of methods should include			
Assessment of confounding (e.g., comparability of cases and controls in studies where appropriate)	37 (39.8)	24 (34.3)	13 (56.5)
Reporting of discussion should include			
Justification for exclusion (e.g., exclusion of non-English-language citations)	34 (36.6)	24 (34.3)	10 (43.5)

IF impact factor

Table 3 Reporting quality of SRs based on the different levels of compliance with the MOOSE items according to journals' IF

IF	< 50%	[50–65%)	[65–80%)	≥ 80%	Total
IF ≥ 5	1 (4.3)	8 (34.8)	6 (26.1)	8 (34.8)	23 (100)
IF < 5	6 (8.5)	22 (31.4)	34 (48.6)	8 (11.4)	70 (100)
Total	7 (7.5)	30 (32.2)	40 (43)	16 (17.2)	93 (100)

Compliance is defined as the reporting frequency (%) of the MOOSE items for each article

Brackets indicate the proportion (%) of articles published in high- or low-ranked journals according to their level of compliance with the MOOSE items

IF impact factor

the synthesis of existing evidence, clinical decision-making and health policy determination.

Panic et al. [13] reported that the endorsement of Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) resulted in increase of both quality of reporting and methodology. PRISMA offers help in writing systematic review articles and reports on meta-analyses [14], but the main focus of this guideline is on systematic reviews and meta-analyses of randomized controlled trials. While there is a significant overlap between MOOSE [7] and PRISMA [14], there are items unique to each checklist. In particular, MOOSE [7] incorporates very detailed instructions in respect of search strategy, including delineation of the qualifications of the searchers, use of hand-searching and approaches to dealing with unpublished and non-English literature, emphasizing the centrality of this aspect of the review to meta-analysis. The importance of the assessment of the potential for bias in primary studies is reinforced in both guidelines. However, greater emphasis is placed on the interpretation of the results of the review, specifically regarding possible alternate explanations for the observed findings in the MOOSE statement [7]. This distinction reflects the elevated susceptibility of observational research to both bias and confounding, limiting the potential inferences, and

the degree to which the results of the review can be trusted and used to inform healthcare decisions [15]. The finding from a study [10] of 83% of epidemiologic reviews citing PRISMA [14] without referring to MOOSE [7] suggests that these reviews may lack complete reporting of these methodological aspects and failure to explore the reasons for the observed findings in sufficient detail.

This study has certain limitations. First, the literature search was restricted to PubMed and Cochrane databases. Second, search was limited in a 6-year interval and in English language, which may contribute to overall bias. However, only 3.4% of the retrieved articles were reports in other languages, so the risk of bias is limited. Third, the keywords in the search strategy might have been a restrictive search for appropriate reports. However, the number of the retrieved articles provided an overview of reporting quality in the field of preeclampsia search. Finally, the studies' authors may have omitted important details from their reports, which could lead to misclassification of the reporting items.

In conclusion, the knowledge gained from this study should be viewed as an opportunity for improved adherence and increased awareness of the MOOSE statement. The adoption of the MOOSE checklist on the reporting of SRs of OS has the potential to improve study reporting, facilitate the appraisal and interpretation of SRs of OS reviewers, journal editors and readers, and finally support the practice of evidence-based medicine.

Author contribution All the authors contributed equally to this work.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Arulkumaran N, Lightstone L (2013) Severe pre-eclampsia and hypertensive crises. Best Pract Res Clin Obstet Gynaecol 27(6):877–884. https://doi.org/10.1016/j.bpobgyn.2013.07.003
2. Eiland E, Nzerue C, Faulkner M (2012) Preeclampsia 2012. J Pregnancy 2012:586578. https://doi.org/10.1155/2012/586578
3. Glasziou P, Vandenbroucke JP, Chalmers I (2004) Assessing the quality of research. BMJ 328(7430):39–41. https://doi.org/10.1136/bmj.328.7430.39
4. Centre for evidence-based medicine. Levels of evidence. https://www.cebm.net/wp-content/uploads/2014/06/CEBM-Levels-of-Evidence-2.1.pdf. Assessed 20 June 2018
5. Simunovic N, Sprague S, Bhandari M (2009) Methodological issues in systematic reviews and meta-analyses of observational studies in orthopaedic research. J Bone Joint Surg Am 91(Suppl 3):87–94. https://doi.org/10.2106/JBJS.H.01576
6. Vandenbroucke JP (2009) STREGA, STROBE, STARD, SQUIRE, MOOSE, PRISMA, GNOSIS, TREND, ORION, COREQ, QUOROM, REMARK… and CONSORT: for whom does the guideline toll? J Clin Epidemiol 62(6):594–596. https://doi.org/10.1016/j.jclinepi.2008.12.003
7. Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, Moher D, Becker BJ, Sipe TA, Thacker SB, Meta-analysis of Observational Studies in Epidemiology (MOOSE) group (2000) Meta-analysis of observational studies in epidemiology: a proposal for reporting. JAMA 283(15):2008–2012
8. Ziogas DC, Zintzaras E (2009) Analysis of the quality of reporting of randomized controlled trials in acute and chronic myeloid leukemia, and myelodysplastic syndromes as governed by the CONSORT statement. Ann Epidemiol 19(7):494–500. https://doi.org/10.1016/j.annepidem.2009.03.018
9. Papathanasiou AA, Zintzaras E (2010) Assessing the quality of reporting of observational studies in cancer. Ann Epidemiol 20(1):67–73. https://doi.org/10.1016/j.annepidem.2009.09.007
10. Fleming PS, Koletsi D, Pandis N (2014) Blinded by PRISMA: are systematic reviewers focusing on PRISMA and ignoring other guidelines? PLoS One 9(5):e96407. https://doi.org/10.1371/journal.pone.0096407
11. Hirst A, Altman DG (2012) Are peer reviewers encouraged to use reporting guidelines? A survey of 116 health research journals. PLoS One 7(4):e35621. https://doi.org/10.1371/journal.pone.0035621
12. Zhang ZW, Cheng J, Liu Z, Ma JC, Li JL, Wang J, Yang KH (2015) Epidemiology, quality and reporting characteristics of meta-analyses of observational studies published in Chinese journals. BMJ Open 5(12):e008066. https://doi.org/10.1136/bmjopen-2015-008066
13. Panic N, Leoncini E, de Belvis G, Ricciardi W, Boccia S (2013) Evaluation of the endorsement of the preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement on the quality of published systematic review and meta-analyses. PLoS One 8(12):e83138. https://doi.org/10.1371/journal.pone.0083138
14. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 6(7):e1000097. https://doi.org/10.1371/journal.pmed.1000097
15. Grimes DA, Schulz KF (2002) Bias and causal associations in observational research. Lancet 359(9302):248–252. https://doi.org/10.1016/S0140-6736(02)07451-2