

REVIEW

# Meta-analyses indexed in PsycINFO had a better completeness of reporting when they mention PRISMA

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## Abstract

**Objectives:** To investigate the effect of the explicit mention of PRISMA, a statement designed to help authors report meta-analyses (MAs), on the reporting completeness of MAs.

**Study Design and Setting:** Two investigators evaluated a random sample of 206 MAs indexed in PsycINFO in 2016; 100 explicitly mentioned PRISMA and 106 did not. Two authors independently evaluated the 27 PRISMA items and extracted factors that could potentially be associated with reporting completeness. The data were analyzed descriptively.

**Results:** Among our 206 MAs, perfect adherence to PRISMA was found in less than 4%, of which 87% explicitly followed PRISMA. The following items were encountered significantly more frequently in MAs that explicitly mentioned PRISMA than in those that did not: summary, protocol, information sources, search strategy, study characteristics, results of individual studies, funding, study selection, risk of bias in individual studies, and bias across studies. The journal's impact factor, endorsement of PRISMA by the journal, number of authors, country of author, open access, and design of the included studies were significantly and positively associated with the explicit mention of PRISMA.

**Conclusions:** Even if far from optimal, the explicit mention of PRISMA has a positive influence on the reporting completeness of MAs from PsycINFO. © 2019 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**Keywords:** Meta-analysis; Reporting; Completeness; PRISMA statement; Meta-research

## 1. Introduction

For scientists, searching for current best evidence has become a real challenge given the nearly limitless number of published articles. When a health decision has to be made regarding a problem, scientists need reliable and high-quality systematic reviews (SRs) and meta-analyses (MAs) [1]. However, both MAs and SRs face the same scientific integrity conflicts as empirical studies (e.g.,

methodological bias, conflicts of interest, conclusions influenced by authors' motivation) [2–7]. The risk is therefore to erroneously use the results of biased MAs yet considered to be the best level of evidence to make an important decision [6–9]. To enable readers to assess the robustness of MAs' results, it is essential that they are adequately and transparently reported [9–13]. To meet this need, in 2007, Moher et al. developed the PRISMA (“Preferred Reporting Items for Systematic Reviews and Meta-Analyses”) statement [14]. This statement comprises an evidence-based minimum set of 27 items that are recommended to be used in the reporting of an MA to ensure that the article contains all relevant information [9,14].

In 2017, Page and Moher synthesized all meta-research studies that evaluated the completeness of the reporting of a sample of SRs with the PRISMA statement. They highlighted a lack of transparency in the SRs assessed [9]. Several other studies have examined more specifically, in psychology and associated fields, the completeness of the

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**What is new?****Key findings**

- Perfect adherence to all PRISMA items was found in less than 4% of meta-analyses (MAs) (7 MAs that explicitly mentioned PRISMA and 1 that did not). Most MAs indexed in PsycINFO that mentioned PRISMA use in their article did so imperfectly.
- Of our 206 MAs indexed in PsycINFO, only 20% followed the PRISMA statement with an overall adherence to all items of >90%. Moreover, the explicit mention of PRISMA significantly enhanced the adherence to PRISMA: 34% of MAs with explicit mention of PRISMA had an overall adherence >90% vs. 7.5% of MAs that did not.
- The explicit mention of PRISMA significantly improved the reporting completeness of MAs indexed in PsycINFO. Nearly half of the items (44%) were significantly more frequent in MAs that explicitly used PRISMA than in those that did not.
- Some factors (i.e., journal impact factor, PRISMA-endorsing journal, number of authors, country of the first author, open access, and design of the included studies) were shown to be different between the MAs that did and did not explicitly mention PRISMA.

**What this adds to what was known?**

- This meta-research revealed the positive impact of the mention of PRISMA statement on the reporting completeness of MAs indexed in PsycINFO and highlighted potential factors influencing the mention of PRISMA.

**What is the implication and what should change now?**

- The reporting completeness of MAs indexed in PsycINFO remains to be improved with more widespread use of PRISMA to facilitate the critical assessment of the validity of the published MAs. In front of these results, we incite researchers to read PRISMA before starting any MAs.

reporting of SRs and MAs [12,13,15–18]. These studies underline unsatisfactory reporting and transparency of SRs and MAs. These authors questioned the transparency of SRs and recommended authors of MAs and SRs in psychology to use guidelines, such as the PRISMA statement,

to improve the completeness of reporting of their studies. However, several MAs that mentioned PRISMA, as suggested by Moher et al., did not report them in a complete and transparent way [8,19]. In psychology or related fields, to the best of our knowledge, it has never been shown whether mentioning the use of PRISMA in the article improves truthfully and objectively the completeness of reporting of MAs and SRs. Therefore, as primary objective, we aimed to investigate the effect of the mention of PRISMA by authors on the completeness of reporting of MAs through a cross-sectional study. Two samples of MAs indexed in the PsycINFO database for the year 2016 were used: one composed of MAs claiming to follow PRISMA and the other composed of MAs ignoring it.

In addition, it has been suggested that the completeness of the reporting of MAs can potentially be impacted by several factors. Indeed, some studies have evaluated the influence of factors such as a journal's impact factor, author's H index, author's experience, number of coauthors and presence of a research protocol on the completeness of reporting [11,15,20,21]. Once again, this has not yet been investigated for studies published in psychology or related fields. Our secondary objective was to measure the association between potential influencing factors (i.e., the characteristics of the scientific journal, articles, and authors) and the mention of PRISMA.

**2. Methods***2.1. Registration and protocol*

The study protocol is available on the Open Science Framework: <https://osf.io/hjybx/>

*2.2. Sample size calculation*

To the best of our knowledge, there are no studies offering a synthetic effect size that could have been used to determine a priori a sample size allowing the detection of a significant difference with regard to our primary objective. We decided to use a minimum sample of 100 MAs in each group: one composed of MAs claiming to follow the PRISMA statement and the other including MAs ignoring it.

*2.3. Screening*

A systematic search of the literature was performed in January 2017 to identify all MAs performed on human subjects, published in English in 2016 and indexed in the electronic database PsycINFO. This database was developed by the American Psychological Association and is specialized in the field of behavioral and social sciences. The electronic search strategy was developed with coauthors and the assistance of a librarian Table 1. Two investigators (V.L. and C.B.) independently reviewed each title and abstract to

**Table 1.** Search strategy

1	meta analysis.md. (15,886)
2	meta analysis/(3,940)
3	meta analys*.mp. (24,573)
4	data pooling*.mp. (50)
5	2 or 3 or 4 (24,599)
6	5 not 1 (10,725)
7	1 or 6 (26,611)
8	limit 7 to (English and human and year = "2016") (2,159)

exclude irrelevant articles and to select only the studies that met the eligibility criteria (full inclusion and exclusion criteria are available in [Table 2](#)). Discrepancies in study selection were resolved by the intervention of a third investigator (V.R.). All article references were indexed in an Excel file and randomly assigned a number. Two blinded researchers (V.L. and S.A., with the intervention of a third researcher in case of disagreement) screened the article. The articles were classified into either the “PRISMA” group or the “no PRISMA” group until each group contained a minimum of 100 MAs. The PRISMA group contained all the MAs that mentioned the PRISMA statement in their article. To reach a minimum of 100 MAs in each group, we elected to randomly select 206 MA articles from all eligible MAs selected at the title and abstract selection step.

**Table 2.** Eligibility criteria

Inclusion criteria	
Meta-analysis	
Articles published in the PsycINFO database	
Published between January 01, 2016 and December 31, 2016	
English	
Exclusion criteria	
Systematic review without meta-analysis	
Metasynthesis	
Qualitative meta-analysis	
Umbrella review	
Meta-analysis of meta-analyses	
Overview, review	
Meta-analysis without systematic review	
Protocol of meta-analysis	
Network meta-analysis	
Activation likelihood estimation meta-analysis (ALE MA)	
Signed differential mapping meta-analysis (SMD MA)	
Voxelwise meta-analysis	
Individual patient data meta-analysis (IPD MA)	
Genetic association study (GWAS), genetic study	
Multilevel meta-analysis	
Update of previous MAs	
Letter, thesis, comment, abstract, chapter, erratum, dissertation or editorial journal	

## 2.4. Assessment of completeness of reporting

Two investigators (V.L. and S.A., with the intervention of a third researcher in case of disagreement) independently extracted all relevant data from the full texts of all selected articles in an Excel file.

To evaluate the completeness of reporting, all MAs included in this study were assessed with PRISMA. Each individual PRISMA item was answered with a “yes” or “no” response depending on whether the item was fulfilled or not fulfilled, respectively.

## 2.5. General characteristics of MAs and potential factors

As discussed among all the coauthors, we extracted the general characteristics of MAs related to the journal, authors and articles for which we hypothesized that the completeness of reporting of the MAs could be impacted. Journal information included the impact factor, journal recommendation to use PRISMA and the limitation of the number of words to write the article. The author information included the number of authors, continent and country of the first author, H index of the first author, experience with MA of the first author (obtained from a search of Scopus to investigate the number of MA publications the first author had previously coauthored), and affiliation of the first author to a university. The article information included availability in open access, Cochrane study, and design of the studies included in the MA.

## 2.6. Data analysis

We used descriptive statistics to assess the general characteristics of the MAs and for each PRISMA item. We summarized data as frequency and percentage values for categorical items and as median and P25–P75 values for continuous items. None of the quantitative variables followed a normal distribution. Distribution was considered not normal if the data met less than 3 of the 4 following conditions: the mean was close to the median, the Shapiro-Wilk normality test yielded a  $P$ -value  $\leq 0.05$ , the curve of the variables followed the normal (or Gaussian) distribution and the linearity of the QQ-Plots was respected. Using  $\chi^2$  or Mann-Whitney tests, we evaluated whether a significant difference existed between the two groups, PRISMA and no PRISMA, for different characteristics of MAs. The differences were quantified using frequency and percentage values for categorical items and median and P25–P75 values for continuous items. If the application conditions for the  $\chi^2$  test were not respected, we used Fisher’s exact test. A univariate logistic regression was used to test the association between the declaration of the explicit use of PRISMA and the adherence of different PRISMA items. Associations were quantified using the odds ratio with 95% confidence intervals. A  $P$ -value  $<$

0.05 was considered statistically significant for all analyses. All analyses were performed using SAS 9.4 software.

### 3. Results

#### 3.1. Search results

In total, 2,159 records were identified by the search strategy (Fig. 1). After the title and abstract screening, 1,039 articles were excluded. To reach our minimum of 100 articles per group, full-text screening was carried out on 231 randomly selected articles. Our final sample comprised 100 articles for the group using PRISMA and 106 for the group not using PRISMA. The reference list of all MAs included or excluded is available at <https://osf.io/hjybx/>.

The characteristics of the included studies are presented in Appendix 1.

#### 3.2. Completeness of reporting of the MAs

Of our 206 MAs, less than 4% completely adhered to all items of PRISMA (7 MAs that explicitly mentioned

PRISMA and 1 that did not). Moreover, 20% of the MAs had an adherence to PRISMA items >90%, and PRISMA was followed significantly better in MAs that explicitly reported using PRISMA (34%) than in those that did not (7.5%,  $P < 0.0001$ ).

In Fig. 2, we summarize the proportion of MAs that adequately reported each PRISMA item. The items least respected by our two groups (mention of PRISMA and no mention of PRISMA) were declaration of a protocol (24%; 3%), presence of a search strategy (62%; 28%) and assessment of bias in studies in the results section (66%; 25%).

#### 3.3. Association of the explicit mention of PRISMA and reporting completeness

The result of logistic regression that assessed the effect of the explicit mention of PRISMA on the reporting completeness of all PRISMA items is presented in Fig. 3. Twelve of the twenty-seven items of the PRISMA statement were encountered significantly more often in MAs that explicitly mentioned PRISMA than in those that did not. Indeed, the probability of having a structured summary

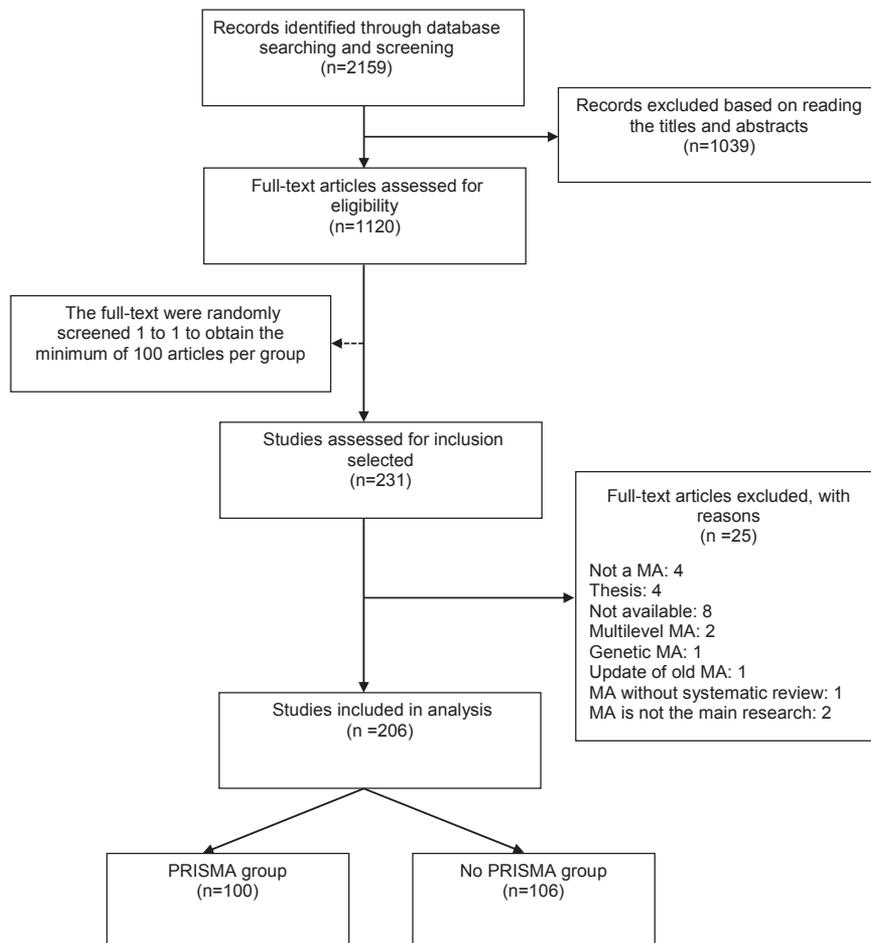


Fig. 1. Flow diagram of study selection.

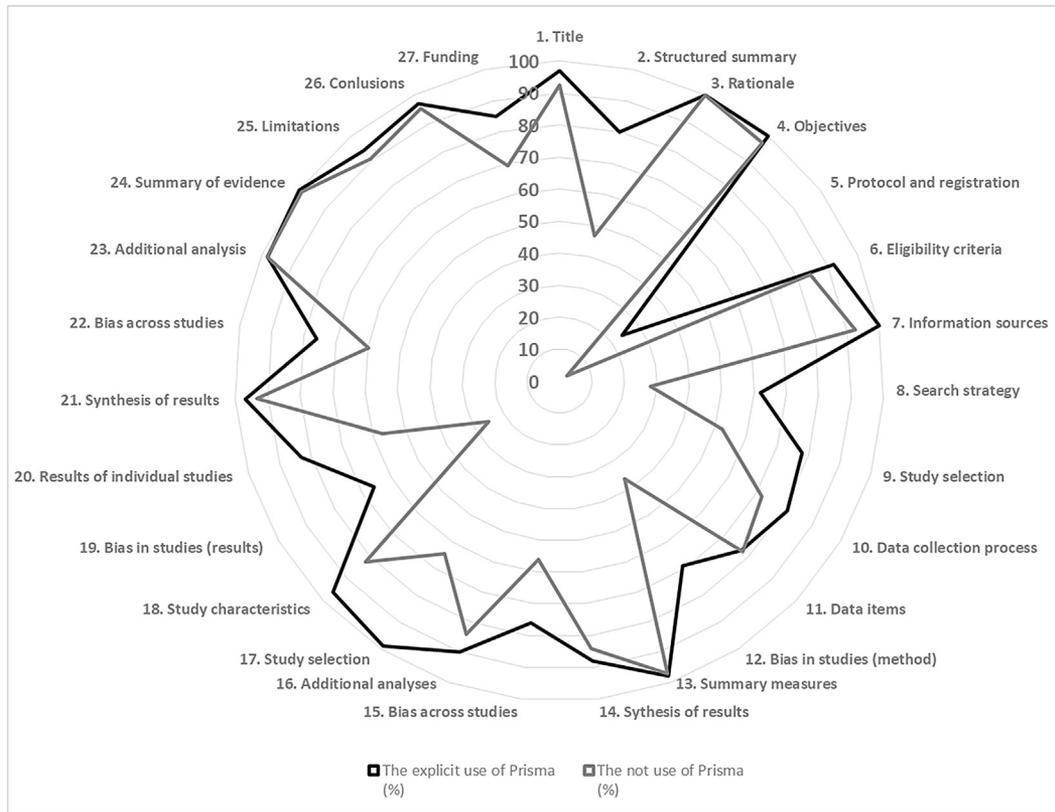


Fig. 2. Proportion of adherence to PRISMA items according to the explicit mention of PRISMA. A higher proportion means that the item is better reported.

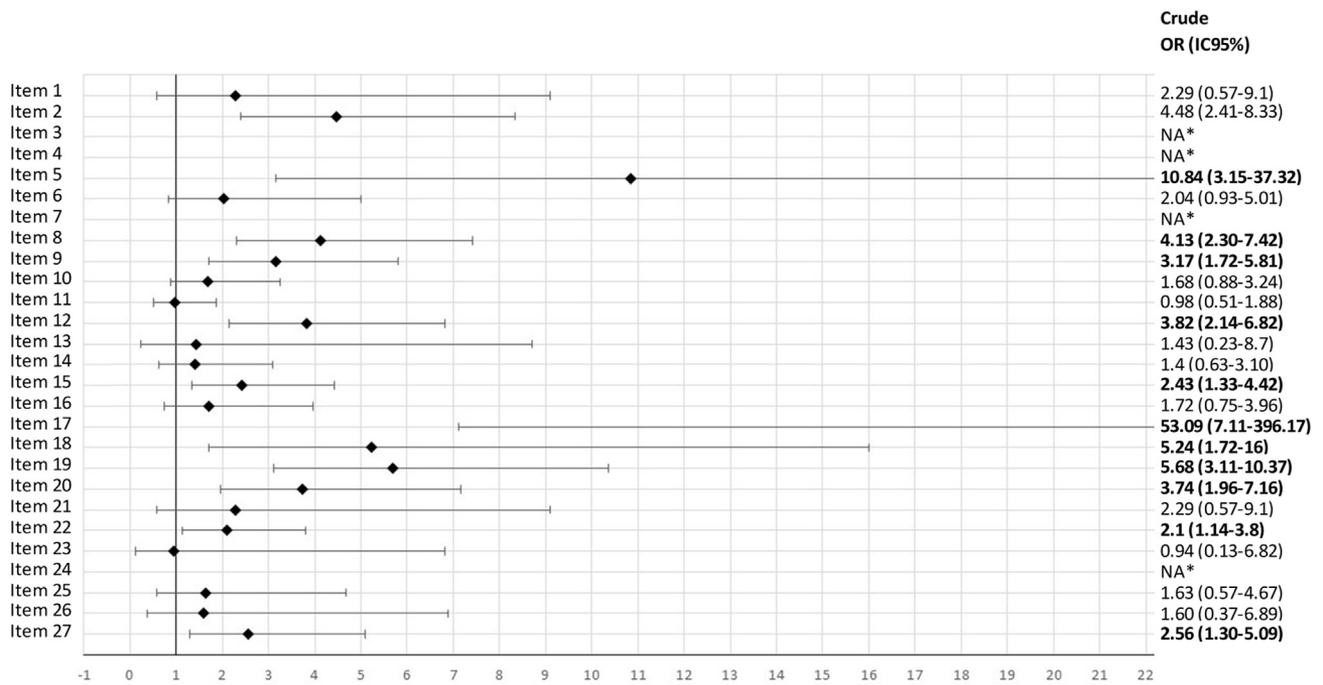


Fig. 3. Impact of the explicit mention of PRISMA on reporting completeness: no explicit mention of PRISMA group vs. explicit mention of PRISMA group. NA\*: calculation of the OR is impossible because the contingency table allowing its calculation contains a zero.

(item2, OR: 4.48; CI 95%: 2.41–8.33); information about the protocol (item5, OR: 10.84; CI 95%: 3.15–37.32); a search strategy (item8, OR: 4.13; CI 95%: 2.30–7.42); the study selection process (item9, OR: 3.17; CI 95%: 1.72–5.81); an assessment of risk of bias in studies in either the methods (item12, OR: 3.82; CI 95%: 2.14–6.82) or the results (item19, OR: 5.68; CI 95%: 3.11–10.37) sections; an evaluation of risk of bias across studies in either the methods (item15, OR: 2.43; CI 95%: 1.33–4.42) or the results (item22, OR: 2.10; CI 95%: 1.14–3.80) sections; presentation of the study selection process (item17, OR: 53.09, CI 95%: 7.11–396.17), study characteristics (item18, OR: 5.24, CI 95%: 1.72–16.00), results of individuals studies (item20: OR: 3.74, CI 95%: 1.96–7.16), and a declaration of funding (item27, OR: 2.56, CI 95%: 1.30–5.09) was significantly higher in MAs with an explicit mention of PRISMA than in those without mentioning PRISMA.

### 3.4. Potential factors influencing the mention of PRISMA

Regarding the journal characteristics, Table 3 shows that the MAs that explicitly mentioned PRISMA were published in journals with a median impact factor of 3.68 (2.74–5.79), compared with 2.66 (2.01–4.36) for the MAs that did not ( $P < 0.001$  between groups). Surprisingly, 21% of the MAs that did not explicitly mention PRISMA were published in journals that recommended the use of PRISMA ( $P = 0.004$ ).

Regarding the author characteristics, the median number of authors in the group with an explicit mention of PRISMA was five and differed significantly from that in the group of MAs that did not, which had a median number of authors of 4 ( $P = 0.011$ ). Most authors of MAs that did not explicitly mention PRISMA were from the United States and China, whereas most authors of MAs that explicitly mentioned PRISMA were from Australia or Canada.

Finally, regarding the article characteristics, the MAs that were available in open access most often explicitly mentioned PRISMA (16% vs. 3.7%;  $P = 0.003$ ). We observed that 39% of the MAs that mentioned PRISMA summarized the results of experimental studies compared with only 20% of the MAs with no explicit mention of PRISMA ( $P < 0.0001$ ).

## 4. Discussion

Incomplete and unusable research contribute to research waste. Transparent and complete reporting in MAs can help readers to assess the strengths and weaknesses of an investigation (e.g., assessments of methods, quality, risk of bias), such that the findings can be used in future research, be replicated or be used to make decisions [10,22,23]. The PRISMA statement helps authors to provide better and

more complete reporting in MAs, allowing readers to have all the information needed to assess the relevance of the results in the MA [23].

This study provides a global overview of the completeness of reporting of MAs indexed in the PsycINFO database and asks the following question: “Does the explicit mention of PRISMA truly improve the completeness of reporting of MAs?” We found that the explicit mention of PRISMA enhances the completeness of reporting of MAs, but room for improvement remains. This observation has been made in several studies on systematic reviews and MAs in biomedical science [7,8,10,11,19–21,24–28] and psychology [12,13,15–18]. However, to the best of our knowledge, this is the first study to assess the impact of the explicit mention of PRISMA on the completeness of reporting of MAs. The explicit mention of PRISMA appears to have a positive and significant influence on almost half of the items of completeness of reporting according to PRISMA. Interestingly, adherence to the different items was heterogeneous and ranged between 3% and 100% in our study. These results were similar to those of two studies that showed an adherence to items of between 6% and 88% in systematic reviews that used PRISMA [26] and between 21 and 90% in MAs published after 2010 [9].

Despite the positive influence of the mention of PRISMA on the completeness of reporting, some items are very rarely reported. In the explicit use of PRISMA group, less than a quarter of the studies (24%) completed a research protocol, and less than half reported the search strategy (44%) or the assessment of bias in the individual studies (45%). The same deficiencies were also observed in other studies [9,26]. These particular variables are more important than the others due to their implications for the methodology of an MA and the consequences they may have on the relevance of the MA.

Several authors formulated hypotheses to explain why the completeness of reporting is poor, such as the limited knowledge of statistics to accurately describe the analyses, the drafting conditions imposed by journals (limitation of the number of words or additional charges for tables. See in Supplementary File 2), the recommendation of using the PRISMA statement by scientific journals, and the fact that some items are easier to write than others [9,10]. Furthermore, factors other than the authors can be involved in the completeness of reporting. For example, editors and reviewers are key elements in the process of publishing an article that should be clear, complete, transparent, and as free as possible from bias [10].

Some factors appear to be associated with the explicit mention of PRISMA in MAs. Surprisingly, 21% of MAs that do not explicitly use PRISMA are published in journals that recommend the use of PRISMA. The impact of PRISMA endorsement by the journal on completeness of reporting is not clear. In some studies, no clear relation of the completeness of PRISMA and a journal’s endorsement of

**Table 3.** Characteristics of MAs and potential factors influencing the explicit mention of PRISMA

Characteristics	MAs that used PRISMA			MAs that did not use PRISMA			P-value
	n	Frequency (%)	Median (P25–P75)	n	Frequency (%)	Median (P25–P75)	
<b>Journal</b>							
Impact factor	98		3.68 (2.74–5.79)	102		2.66 (2.01–4.36)	<0.0001
PRISMA-endorsing journal	100			107			0.004
Yes		39 (39)			22 (20.6)		
Limitation of words	100			107			0.433
Yes		66 (66)			65 (60.8)		
<b>Authors</b>							
Number of authors	100		5 (3–6)	107		4 (3–6)	0.011
Continent of first author	100			107			0.058
Africa		1 (1)			0 (0)		
America		25 (25)			40 (37.4)		
Asia		16 (16)			25 (23.3)		
Europe		42 (42)			28 (26.2)		
Oceania		16 (16)			14 (13.1)		
Country of first author	100			107			0.017
USA		16 (16)			34 (31.8)		
Australia		14 (14)			12 (11.2)		
China		6 (6)			16 (14.9)		
England		11 (11)			11 (10.3)		
Netherlands		7 (7)			8 (7.5)		
Canada		8 (8)			5 (4.7)		
Germany		8 (8)			3 (2.8)		
Others		30 (30)			18 (16.8)		
H index of first author	100		5 (3–12.5)	105		5 (2–11)	0.760
Experience in MAs of first author	100		2 (1–7)	107		2 (1–5)	0.299
Affiliation of first author	100			107			0.881
University		91 (91)			98 (91.6)		
Nonuniversity		9 (9)			9 (8.4)		
<b>Article</b>							
Open access	100			107			0.003
Yes		16 (16)			4 (3.7)		
MAs Cochrane	100			107			0.431 <sup>a</sup>
Yes		1 (1)			0 (0)		
Design of included studies	100			107			<0.0001
Experimental		39 (39)			21 (19.6)		
Observational		44 (44)			53 (49.6)		
All types		12 (12)			7 (6.5)		
Not specified		5 (5)			26 (24.3)		

<sup>a</sup> Fisher's exact test.

reporting guidelines is observable [22,29], whereas other studies show a difference in total adherence to PRISMA between journals endorsing PRISMA and other journals [7,19,20]. In addition, the explicit mention of PRISMA could be associated with the impact factor of the journal. Consistent with our results, another recent study in the surgery field found that the impact factor was positively associated with the completeness of PRISMA [20]. However, two previous studies did not demonstrate any association between the impact factor and adherence to PRISMA [7,11].

Surprisingly, our results did not show any influence of the mention of PRISMA according to the experience with MAs of the researchers. However, according to the study of Fanelli et al. [30], an early-career researcher is more likely to be involved in questionable research practices. The same study found that US studies are also more involved in questionable research practices than other countries, and our analyses showed at the descriptive level that MAs with an American as the first author use PRISMA less often than other MAs. Finally, Fanelli et al. found that

higher numbers of scientists working in collaboration are correlated with a lower likelihood of being involved in questionable research practices [30]. In the same way, another study showed that a collaboration with a minimum of five authors is positively associated with the completeness of PRISMA [11]. This observation is consistent with our results that showed that the number of coauthors is more important in the group that explicitly mention PRISMA. Furthermore, we highlighted that MAs available in open access mention PRISMA more often.

The strength of this study is that two authors independently and in duplicate performed the study selection and data extraction on all MAs included to minimize the risk of errors. Furthermore, this study was the subject of a research protocol available on the Open Science Framework platform with transparent and complete research details. In addition, the search strategy that we developed allowed us to identify MAs even if this term was not mentioned in the title and therefore to limit the risk of missing some MAs that did not label themselves as such (e.g., “research synthesis”, “systematic review”) in the title or abstract. On the other hand, this article also has some limitations that should be considered. First, only a random sample of studies indexed in PsycINFO, published in 2016 and in English, was included. Therefore, we cannot generalize our findings to MAs published in other years, in other languages or in other databases. We believe that additional searches in other databases (e.g., Campbell Collaboration, Web of Science/Social Science Edition) could be relevant, even if some overlap potentially exists between databases. We arbitrarily chose the PsycINFO database to cover published articles in the field of behavioral and social sciences according to the description of the content in PsycINFO. However, we acknowledge that, even if our sample is moderately heterogeneous in terms of topics investigated and even if PsycINFO appears to be a comprehensive source, it is likely that it does not completely cover this wide area of research. Moreover, regarding the year of publication, MAs published several years ago likely differ in regard to their methodologies. Science methodology has improved over the years, and new guidelines and new tools are available for research. It should be acknowledged that PRISMA is currently being revised (<https://osf.io/2v7mk/>), and, as another perspective, it could be interesting to evaluate the completeness of reporting of MAs over several years to compare the evolution before/after PRISMA (2009) and the new tool currently being updated. Second, we cannot generalize the results of completeness of reporting to the conduct quality; the evaluation of completeness of reporting depends on descriptions by the authors and may not be an accurate reflection of what actually occurred during the review process. Finally, it is possible that some authors may have mentioned PRISMA but did not explicitly declare the use of the statement in their article. Some articles may thus have been misclassified. However, we made the assumption that using PRISMA gave an added

value to the MA and that if the authors used PRISMA, it would be declared.

## 5. Conclusion

Even if far from optimal, the explicit use of PRISMA has a positive influence on the reporting completeness of MAs. In front of these significant results, we strongly encourage researchers to read PRISMA before starting any MAs. Because MAs are lauded for their rigorous methodological approach, full and transparent reporting from MA authors is necessary to enhance the credibility, validity, and robustness of the evidence from published MAs. Generalizing the use of the PRISMA statement may improve the transparency of MAs.

## CRedit authorship contribution statement

**Victoria Leclercq:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing - original draft, Writing - review & editing. **Charlotte Beaudart:** Conceptualization, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Sara Ajamieh:** Investigation, Resources. **Véronique Rabenda:** Investigation, Resources. **Ezio Tirelli:** Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Olivier Bruyère:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

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## Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclinepi.2019.06.014>.

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