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ORIGINAL ARTICLE

Contacting of authors modified crucial outcomes of systematic reviews but was poorly reported, not systematic, and produced conflicting results

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Abstract

Objectives: The objective of the study was to assess the prevalence, the reporting quality, the need, and the consequences of contacting of authors by Cochrane reviewers to obtain additional information for their reviews.

Study Design and Setting: Cross-sectional study and survey on all new Cochrane intervention reviews published between January 1, 2016 and January 31, 2017.

Results: The cross-sectional study found that reviewers had contacted or had tried to contact studies to obtain additional information in 73.4% (234/319) of reviews but reported poorly on the methods, outcomes, and consequences of this procedure. Most eligible studies in the reviews were poorly reported, but few reviewers 21.2% (65/306) reported that they had contacted these studies. The survey showed that risk of bias scores, Grading of Recommendations, Assessment, Development and Evaluation scores, the summary primary or secondary outcomes, and the summary effect size of the primary outcome of the review were changed as a consequence of contacting of authors. Thirty-five of one hundred and thirty (26.9%) reviews scored opposite outcomes for the same question in the cross-sectional study compared with the survey.

Conclusions: Our findings on contacting of authors by Cochrane reviewers showed relevant shortcomings in the current standards and transparency of Cochrane reviews. These shortcomings can compromise the validity and reproducibility of these reviews and affect a wide audience.

Keywords: Author contact; Systematic review; Cochrane; Poor reporting; Bias; Missing data

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Ethical Approval: Not required.

Conflict of interest: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work; no other relationships or activities that could appear to have influenced the submitted work.

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Data sharing: All data sheets of both the cross-sectional study and survey are included in this manuscript as Supplemental Files. The authors will respond rapidly to requests for additional clarifications on their data. Requests can be made to the corresponding author (R.M.R.) at reyndersmail@gmail.com.

Transparency: The lead author (R.M.R.) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned in their published protocol have been explained.

Public and patient involvement statement: This study assesses research methods in Cochrane systematic reviews of interventions. There was no patient and public involvement.

Protocol registration and publication: The protocol of this cross-sectional study and survey has been published in Systematic Reviews with the following reference: Meursinge Reynders R, Ladu L, Di Girolamo N. Contacting of authors by systematic reviewers: protocol for a cross-sectional study and a survey. Syst Rev. 2017 Dec 8; 6(1):249. This open access manuscript can be downloaded at: https://doi.org/10.1186/s13643-017-0643-z.

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1. Introduction

Poor reporting refers to not clearly reporting what researchers did and found in their studies. Poor reporting in eligible primary research studies can seriously compromise the validity of systematic reviews and health care guidelines [1–4]. To address this problem, systematic reviewers often contact authors of poorly reported eligible studies to obtain additional data. In this research study, we assessed the need of contacting of authors, whether these procedures were implemented, how they were reported, whether additional information was obtained through contacting of authors, the consequences of this information for various outcomes of the review, and whether the answers of the surveyed reviewers differed from what was reported in their published articles.

Reporting of trial findings is often biased and incomplete [5–10]. Poor reporting of adverse effects is also common [11–13]. Poor reporting in eligible studies of systematic reviews does not permit reviewers to adequately assess issues such as (1) the quality of the research design, (2) risk of bias, (3) missing data, (4) the true safety of interventions, and (5) conflicts of interest. Poorly reported items can subsequently threaten the validity of the findings and conclusions of systematic reviews and health care guidelines, which contributes to a worldwide waste in research funding [10]. Poor reporting does not permit future researchers to build on the findings of other researchers and does not permit a reliable implementation of research findings to patients [10]. To address poor reporting in published studies, systematic reviewers contact the authors of these publications to obtain additional information [14,15]. Studies have shown that this strategy has helped reviewers to obtain important research data [16–24]. This method has been advocated by the Cochrane Collaboration [15,25] and the item ‘‘contacting of authors’’ has been labeled as ‘‘highly desirable’’ according to the Methodological standards for the conduct of new Cochrane Intervention Reviews [25].

To assess whether this item was implemented, we conducted a two-armed cross-sectional study and a survey in which we posed a series of questions on contacting of authors such as (1) how these procedures were reported, (2) the need of contacting authors, which was represented by the prevalence of ‘‘unclear’’ risk of bias scores as a result of poor reporting in the included studies [26], (3) how contacted authors replied, and (4) the consequences of the obtained information from contacted authors for a series of crucial outcomes of the review such as (a) risk of bias scores, (b) grading the quality of evidence (GRADE) scores [27], (c) the summary primary or secondary outcomes of the review, and (d) the summary effect size of the primary outcome of the review. We also investigated whether the surveyed authors gave the same answer to a simple question on contacting of authors compared with what they had reported in their published articles. We applied our questions to Cochrane reviews because they are considered the reference standard for conducting and reporting in systematic reviews [28]. Our scoping searches produced numerous relevant publications that showed or discussed the importance of contacting authors [14,29–35], but there was little or no overlap with our research questions. These knowledge gaps and the outcomes of our pilot study [36] demonstrated the need for conducting this study. To improve the transparency of our article, we have listed all key terminology in Table 1.

2. Methods

Our research methods were pilot-tested and are reported in our published protocol (Additional File 1) [36]. All methods and the differences between the protocol and the final study are further explained in Additional File 2. There was no patient and public involvement. We adopted the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for reporting the cross-sectional study [37] and completed the STROBE statement checklist of items. We applied the Checklist for Reporting Results of Internet E-Surveys for reporting the survey [38,39].

2.1. Methods for the cross-sectional study

We conducted a two-armed cross-sectional study. The research methods for both arms were identical.

2.1.1. Eligibility criteria for the type of studies

Only new Cochrane intervention reviews were eligible for this cross-sectional study. We excluded updates because they could introduce additional heterogeneity and bias as a result of different methods and standards for contacting studies in the earlier reviews compared with their updates [36]. Reviews that included at least one primary study were eligible. Empty reviews were therefore excluded.

2.1.2. Information sources and search strategy

The Cochrane Database of Systematic Reviews was hand-searched for eligible systematic reviews published in this database between the first of January 2016 and January 31, 2017 [40].

2.1.3. Selection of studies and data extraction

Two calibrated review authors (R.M.R. and L.L.) selected eligible reviews independently in the Cochrane Database of Systematic Reviews and conducted all data extraction procedures. Disagreements on eligibility and data extraction issues were resolved through discussions, and a methodologist (N.D.G.) was consulted in the case of persisting disagreements. References to all the included and excluded studies and the rationale for exclusions were given. Our pilot-tested data collection forms with definitions and criteria for scoring each data item are presented in Additional File 3.

What is new

Key findings of the cross-sectional study

- Reporting by Cochrane reviewers on the methods, results, and consequences of author contact was poor and not systematic.
- The high prevalence of poor reporting in the eligible studies of the reviews indicated a high need for contacting of authors, but few reviewers reported that they contacted these poorly reported studies.
- Poor reporting was the predominant but not the exclusive cause of "unclear" risk of bias scores in the eligible studies of the reviews indicating that they are not synonymous.

Key findings of the survey

- About half of the Cochrane reviewers reported that they did not have valid contact data for all studies that they wanted to contact, representing a barrier to contacting of authors.
- Contacting of authors to obtain additional information caused changes in the following key outcomes of Cochrane reviews, that is, (1) the risk of bias scores, (2) the Grading of Recommendations, Assessment, Development and Evaluation scores, (3) the summary of primary or secondary outcomes of the review, and (4) the summary effect size of the primary outcome of the review.
- Conflicting outcomes between what was reported in the systematic reviews and what was reported in the survey made it unclear where to best place one's trust.

What this adds to what was known?

- Previous studies have addressed various research questions on contacting of authors by systematic reviewers. This study expanded on this issue by producing 28, mostly novel, quantitative outcomes. Our findings demonstrated the importance and complications of contacting of authors for Cochrane reviewers and the poor reporting by these reviewers on the methods, outcomes, and consequences of this procedure.

What is the implication and what should change now?

- Our findings showed relevant shortcomings in the current standards and transparency of Cochrane reviews. These shortcomings can compromise the validity and reproducibility of these reviews and affect a wide audience including patients, clinicians, reviewers, guideline developers, researchers, and research sponsors. A guideline for dealing with these limitations was given.

2.1.4. Data items

We scored only data on the following intervention: Contacting by systematic reviewers of authors of eligible primary studies that are included in the review to obtain additional research data on these primary studies. The definition for contacting of authors to obtain additional information is defined in Table 1 [25]. Outcomes in this study were based on data on contacting and replying of authors of eligible primary studies. Confusion on calculating these outcomes could occur when more than one author were contacted or did reply or when author(s) were contacted or did reply more than once. When calculating our statistics on these outcomes, we used the terms "contacted studies" and "'replying studies" (Table 1). We considered each contacted or replying study as a single data outcome, even when one or more of its authors were contacted or replied or were contacted or replied more than once. A replying study was defined as a study where a response was obtained from the contacted authors.

Higgins et al. [26] divided the definition of "unclear" risk of bias into 3 subgroups (Table 1). In this cross-sectional study, we scored two types of "unclear" risk of bias: (1) those that covered all 3 subgroups of "unclear" risk of bias and (2) those that exclusively referred to the first subgroup, that is, "too few details are available to make a judgment of 'high' or 'low' risk of bias." [26]. For the latter subgroup, we adopted the surrogate "unclear risk of bias as a result of poor reporting" (Table 1).

2.1.5. Power calculation and statistical analysis

According to our protocol, the required sample size was calculated for the prevalence of reviews in which the reviewers reported that they had contacted or had tried to contact studies to obtain additional information. Our power calculations were conducted with the epidemiologic software calculator EpiTools with a 0.95 confidence level (desired precision of estimate 0.05) [41]. We included a final sample size of 319 eligible reviews (January 1, 2016–January 31, 2017), which covered the calculated required sample size of 311 reviews. All outcomes for the cross-sectional study are listed in summary of findings tables. Stata software (Stata Corporation, College Station, Texas, USA), version 15, was used for the statistical analysis [42]. All prevalence statistics were reported with their exact (Clopper–Pearson) 95% confidence intervals.

2.2. Methods for the survey

Our survey methods and questions were pilot-tested and fine-tuned on 2 months of Cochrane reviews and are reported in our published protocol (Additional File 1) [36]. Initial contact with the eligible surveyees in this closed survey was made through emails with a link to our web-based survey (Additional File 4). All survey questions and the

Table 1. Key terminology on contacting of authors to obtain additional information

Term	Definitions and descriptions
Poor reporting	Poor reporting refers to not clearly reporting what researchers did and found in their studies.
Contacting of authors to obtain additional information	We adopted the following statement of the MECIR standards [25]. "Contacting study authors to obtain or confirm data makes the review more complete, potentially enhances precision, and reduces the impact of reporting biases. Missing information includes details to inform "Risk of bias" assessments, details of interventions and outcomes, and study results (including breakdowns of results by important subgroups)".
Contacted study	A contacted study was defined as a study whose authors were contacted by reviewers using one or more of the following interventions: emails, sending letters, telephoning, faxing, or visiting investigators of primary research studies. We considered each contacted study as a single data outcome, even when one or more of its authors were contacted or were contacted more than once [36].
Replying study	A replying study was defined as a study where a response was obtained by the reviewers from the contacted authors. We considered each replying study as a single data outcome, even when one or more of its authors replied or replied more than once [36].
Risk of bias scores	Risk of bias scores refer to the judgments of low, high, and unclear risk of bias assigned by reviewers to the various bias domains of a systematic review [26].
Unclear risk of bias	Higgins et al. [26] divided the definition of "unclear" risk of bias in 3 subgroups: "Studies are assessed as unclear risk of bias when (1) too few details are available to make a judgment of "high" or "low" risk; (2) the risk of bias is genuinely unknown despite sufficient information about the conduct; or (3) an entry is not relevant to a study (e.g.,, because the study did not address any of the outcomes in the group of outcomes to which the entry applies)".
Unclear risk of bias as a result of poor reporting	Higgins et al. [26] divided the definition of "unclear" risk of bias into 3 subgroups (see the definitions above). In this manuscript, unclear risk of bias as a result of poor reporting refers to the first subgroup of unclear risk of bias, that is, "too few details are available to make a judgment of "high" or "low" risk of bias." [26].
Summary primary and secondary outcomes of the review	All summary outcomes defined as either "primary" or "secondary" by the authors of a systematic review.
Summary effect size of the primary outcome	The weighted mean for the primary outcome of the effects of the individual studies included in a meta-analysis of a systematic review.
GRADE scores	In this article, GRADE scores refer to the ratings of the quality of a body of evidence in systematic reviews or other syntheses of evidence. These ratings refer to high, moderate, low, or very low quality [27]. We used the term "GRADE scores" in the survey and throughout the article.

Abbreviation: MECIR, Methodological standards for the conduct of new Cochrane Intervention Reviews; GRADE, Grading of Recommendations, Assessment, Development and Evaluation.

criteria for addressing them are also presented in Additional File 4. Each question was presented on a different page in Google Forms [43]. Additional information on our survey methods are reported in Additional File 2.

2.2.1. Target reviews, participants, interventions, and outcomes

For the target reviews, we used the same sample of reviews that were eligible for our cross-sectional study. The corresponding author, that is, the systematic reviewer linked to the contact address of the review, was the target participant (surveyee) of this survey. We only contacted coauthors when the corresponding author responded to our survey and explicitly stated that one of the coauthors of the review would be the appropriate person to complete the survey. The target interventions refer to those described under the heading "Interventions" in the Section 2.1.4 of the cross-sectional study. The target outcomes were the answers of the target participants to the questions of our survey.

2.2.2. Outcomes and statistical analysis

We reported the number of all surveys that were completed and submitted, but in our data analysis, we only included the surveys that answered all questions. Our cutoff point for completing the survey was at 3 months after sending the initial email. Actually, no additional surveys were completed after this cutoff point. Statistical corrections for the nonrepresentative sample were not indicated, because we used a predefined sample of Cochrane reviewers. Our procedures for calculating and reporting outcome measures and the statistical analysis for the survey were identical to those described for the cross-sectional study. The answers to the open-ended survey question were coded independently by 2 operators (R.M.R. and N.D.G.) and when possible were grouped into similar categories.

3. Results

3.1. Results of the search

The search for intervention reviews in the Cochrane Database of Systematic Reviews yielded 846 citations. We excluded 527 reviews because they did not fulfill our eligibility criteria. All 319 included reviews are listed in Additional File 5. The 527 excluded reviews are also reported in this file with the rationale for exclusion. Additional File 6 presents the prevalence of systematic reviews for each individual Cochrane review group for both the cross-sectional study and the survey. To explain the importance of our outcomes, we included Additional File 7, which explains for each single outcome "Was the outcome novel, what was found, why this outcome is important and for who."

3.2. Outcomes of the cross-sectional study

3.2.1. Outcomes on reporting of contacting of authors

Fig. 1 illustrates the first arm of the cross-sectional study and presents the questions on reporting of contacting of authors and explains how the numerators and denominators of the various statistics were constructed. These statistics were presented for the primary and secondary outcomes separately (Tables 2 and 3).

The prevalence of eligible reviews in which the reviewers reported that they had contacted or had tried to contact studies to obtain additional information was 73.4% (234/319). In 72 of 234 reviews (30.8%), the reviewers reported all studies that they had contacted or had tried to contact. In 3 of these 72 reviews, the authors could not be contacted because of a lack of contact information or nonfunctioning

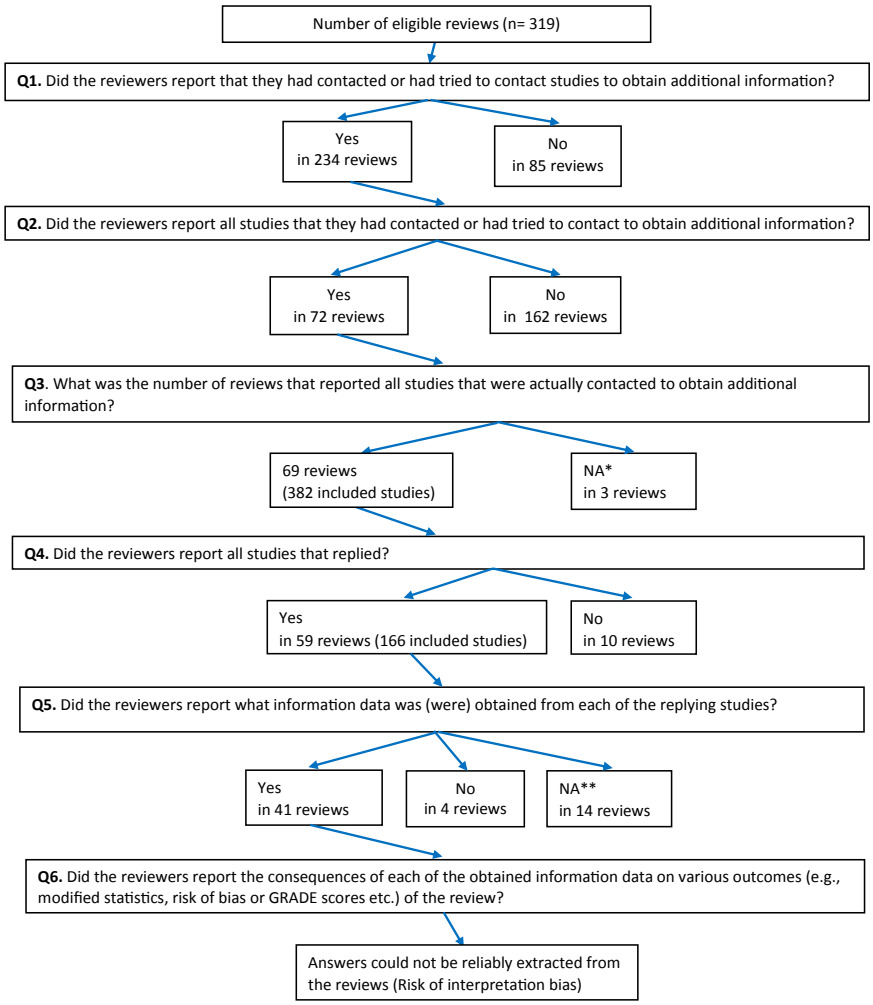

Fig. 1. Reporting on contacting of authors. * Not applicable (NA) was scored for a total of 3 reviews. In these 3 articles, the reviewers reported all studies that they had contacted or had tried to contact, but none of these studies could be contacted because of a lack of contact information or nonfunctioning contact emails and so forth. These 3 reviews were not included in the pertinent prevalence calculations. **Not applicable (NA) was scored for a total of 14 reviews. In these reviews, the reviewers reported that none of the contacted studies replied. The research question, "Did the reviewers report what information data were obtained from each of the replying studies?," could therefore not be addressed for these 14 reviews. These 14 reviews were not included in the pertinent prevalence calculations.

Table 2. Summary of the primary outcomes on reporting of contacting of authors

Description of the primary outcomes	Statistic
Outcome 1: The prevalence of reviews in which the reviewers reported that they had contacted or had tried to contact studies to obtain additional information.	73.4% (234/319) 95% CI: 68.1%–78.1%
Outcome 2:[a] The prevalence of reviews in which the reviewers reported all studies that they had contacted or had tried to contact to obtain additional information.	30.8% (72/234) 95% CI: 24.9%–37.1%
Outcome 3:[b] The prevalence of reviews in which the reviewers reported all studies that were actually contacted to obtain additional information.	29.9% (69/231) 95% CI: 24.0%–36.2%
Outcome 4:[c] The prevalence of reviews in which the reviewers reported all studies that replied.	25.5% (59/231) 95% CI: 20.1%–31.7%
Outcome 5:[d] The prevalence of reviews in which the reviewers reported what information data were obtained from each of the replying studies.	18.9% (41/217) 95% CI: 13.9%–24.8%
Outcome 6: The prevalence of the reviews in which the reviewers reported the consequences of each of the obtained information data on various outcomes (e.g., modified statistics, risk of bias, or GRADE scores, and so forth) of the review.	Outcomes could not be extracted reliably from the reviews

[a] This outcome was calculated for the denominator of 234 reviews, that is, all reviews in which the reviewers report that they had contacted or had tried to contact studies to obtain additional information (Fig. 1).

[b] This outcome was calculated for the numerator 69 (72-3) and the denominator of 231 (234-3) reviews. Three reviews were excluded from the denominator because they were scored as ''not applicable'' for question 3 (Fig. 1).

[c] This outcome was calculated for the numerator of 59 reviews, which refers to the reviews in which the reviewers reported all studies that were contacted as well as all studies that replied (Fig. 1). This outcome was calculated for the denominator of 231 (234-3) reviews. Of the original 234 reviews, 3 were excluded from the denominator because they were scored as ''not applicable'' for question 3 (Fig. 1).

[d] This outcome was calculated for the numerator of 41 reviews, which refers to the reviews in which the reviewers reported all studies that were contacted, all studies that replied, and what information data were obtained from each of the replying studies (Fig. 1). This outcome was calculated for the denominator of 217 (234 reviews minus 3 and minus 14) reviews. Of the original 234 reviews, respectively, 3 and another 14 reviews were excluded from this denominator because they were scored as ''not applicable'' for questions 3 and 5 (Fig. 1).

contact emails (Fig. 1). These 3 studies were not considered in the subsequent prevalence statistics (Table 2). Of the remaining 69 reviews, 59 reported all studies that replied. This implies that in 25.5% (59/231) of the reviews, reviewers reported all studies that were contacted and all studies that replied. The prevalence of reviews in which the reviewers reported (1) all studies that were contacted, (2) all studies that replied, and (3) what information data were obtained from each of the replying studies was 18.9% (41/217) (Fig. 1). Question 6 was not answered because the pertinent date could not be reliably extracted from the eligible reviews by the 2 reviewers (Fig. 1).

Table 3. Summary of the secondary outcomes

Description of the secondary outcomes	Statistic
Outcome 7a:[a] The number of contacted studies per review	Mean: 5.9 (408/69) Median: 2 Mode: 2 Standard deviation: 11.5 Range: 1–87
Outcome 7b:[a] The number of contacted studies per review	Mean: 5.5 (382/69) Median: 2 Mode: 1 Standard deviation: 10.7 Range: 1–81
Outcome 8a:[b] The prevalence of replying studies	43.6% (178/408) 95% CI: 38.8%–48.6%
Outcome 8b:[b] The prevalence of replying studies	43.5% (166/382) 95% CI: 38.4%–48.6%

Abbreviation: Explanation of the statistics.

[a] Outcomes 7a and 7b are calculated for the 69 reviews that reported all studies that were actually contacted to obtain additional information (Fig. 1). For outcome 7a, we used the numerator 408. This number included each contacted study even when a study was split or when the same authors were contacted for more than one study included in the review. For outcome 7b, we used the numerator 382. This number counted a study only once when studies were split or when the same authors were contacted for more than one study included in the review.

[b] Outcomes 8a and 8b were calculated for the 59 reviews in which the reviewers reported all studies that were contacted and all studies that replied (Fig. 1). For outcome 8a, we used the numerator 178 and the denominator 408. These numbers included each contacted or replying study even when a study was split or when the same authors were contacted or replied for more than one study included in the review. For outcome 8b, we used the numerator 166 and the denominator 382. These numbers counted a study only once when studies were split or when the same authors were contacted or did reply for more than one study included in the review.

The secondary outcomes on reporting of contacting of authors were based on subgroups of the overall sample. Table 3 presents these outcomes and explains how the various statistics were constructed. The number of contacted studies per review was 5.5 (382/69) (range: 1–81) for the subgroup of 69 reviews that reported all studies that were actually contacted to obtain additional information (Fig. 1). The prevalence of replying of studies in the 59 reviews in which the reviewers reported all studies that were contacted as well as all studies that replied was 43.5% (166/382).

3.2.2. Outcomes on "unclear" risk of bias as a result of poor reporting

Table 4 presents the prevalence statistics for the second arm of our cross-sectional studies. Additional File 8 illustrates how the various numerators and denominators of these statistics were constructed. The prevalence of eligible studies in the reviews with at least one domain scored as "unclear" risk of bias was 90.8% (3,721/4,099), and most of these scores was the result of poor reporting, that is, 86.3% (3,538/4,099) and 95.1% (3,538/3,721), respectively, for the different subgroups (outcomes 3a and 3b) (Table 4). The reviewers reported in 21.2% (65/306) of the eligible reviews that they had contacted or had tried to contact all studies with at least one "unclear" risk of bias score as a result of poor reporting.

3.3. Outcomes of the survey

3.3.1. Response rates

The response rate to our survey was 40.8% (130/319), and the true response rate was 43.6% (130/298). Only 1 review submitted the survey without answering all questions. This review was excluded from the analysis, resulting in a completeness rate of 99.2% (130/131). The response and completeness rates and raw data of the survey are reported in Additional File 9.

3.3.2. Outcomes for the closed-ended survey questions

Fig. 2 presents the flow diagram of the survey questions and explains how the numerators and denominators of the various prevalence statistics were constructed. A total of 80.0% (104/130) of the surveyed reviews reported that they had contacted or had tried to contact eligible studies to obtain additional information (Table 5). Of these 104 reviews, only 53 (51.0%) had valid contact data for all studies that they wanted to contact. Outcomes 3–6 indicated that contacting of authors to obtain additional information modified crucial outcomes of the review, that is, (1) risk of bias scores, (2) the GRADE scores, (3) the summary primary or secondary outcomes of the review, and (4) the summary effect size of the primary outcome of the review were all modified as a result of these procedures (Table 5).

Table 4. Summary of outcomes on unclear risk of bias scores

Description of outcomes	Statistic
Outcome 1: The number of eligible studies per review.	Mean: 12.9 (4,099/319) Median: 7 Mode: 3 Standard deviation: 18.8 Range: 1–160
Outcome 2: The prevalence of eligible studies in the reviews with at least one domain scored as "unclear" risk of bias.	90.8% (3,721/4,099) 95% CI: 89.9%–91.7%
Outcome 3a: The prevalence of eligible studies in the reviews with at least one domain scored as "unclear" risk of bias as a result of poor reporting.	86.3% (3,538/4,099) 95% CI: 85.2%–87.4%
Outcome 3b:[a] The prevalence of eligible studies in the reviews with at least one domain scored as "unclear" risk of bias as a result of poor reporting.	95.1% (3,538/3,721) 95% CI: 94.3%–95.8%
Outcome 4: The prevalence of reviews in which all eligible studies had at least one domain scored as "unclear" risk of bias.	57.4% (183/319) 95% CI: 51.7%–62.9%
Outcome 5a: The prevalence of reviews in which all eligible studies had at least one domain scored as "unclear" risk of bias as a result of poor reporting.	46.4% (148/319) 95% CI: 40.8%–52.0%
Outcome 5b:[b] The prevalence of reviews in which all eligible studies had at least one domain scored as "unclear" risk of bias as a result of poor reporting.	80.9% (148/183) 95% CI: 74.4%–86.3%
Outcome 6:[c] The prevalence of reviews in which the reviewers reported that they had contacted or had tried to contact all studies with at least one "unclear" risk of bias score as a result of poor reporting.	21.2% (65/306) 95% CI: 16.8%–26.3%

[a] This outcome was calculated for the subgroup in which all eligible studies had at least one domain scored as "unclear" risk of bias.
[b] This outcome was calculated for the subgroup in which all eligible studies in the review had at least one domain scored as "unclear" risk of bias.
[c] This outcome was calculated for the denominator of 306 (319-13) reviews. Of the original 319 reviews, 13 were excluded from this calculation because they were scored as "not applicable" (NA) for question 6. In 6 reviews, NA was scored because none of the included studies had an "unclear" risk of bias score. In 7 reviews, NA was scored because unclear risk of bias in one or more of the included studies was not the result of poor reporting.

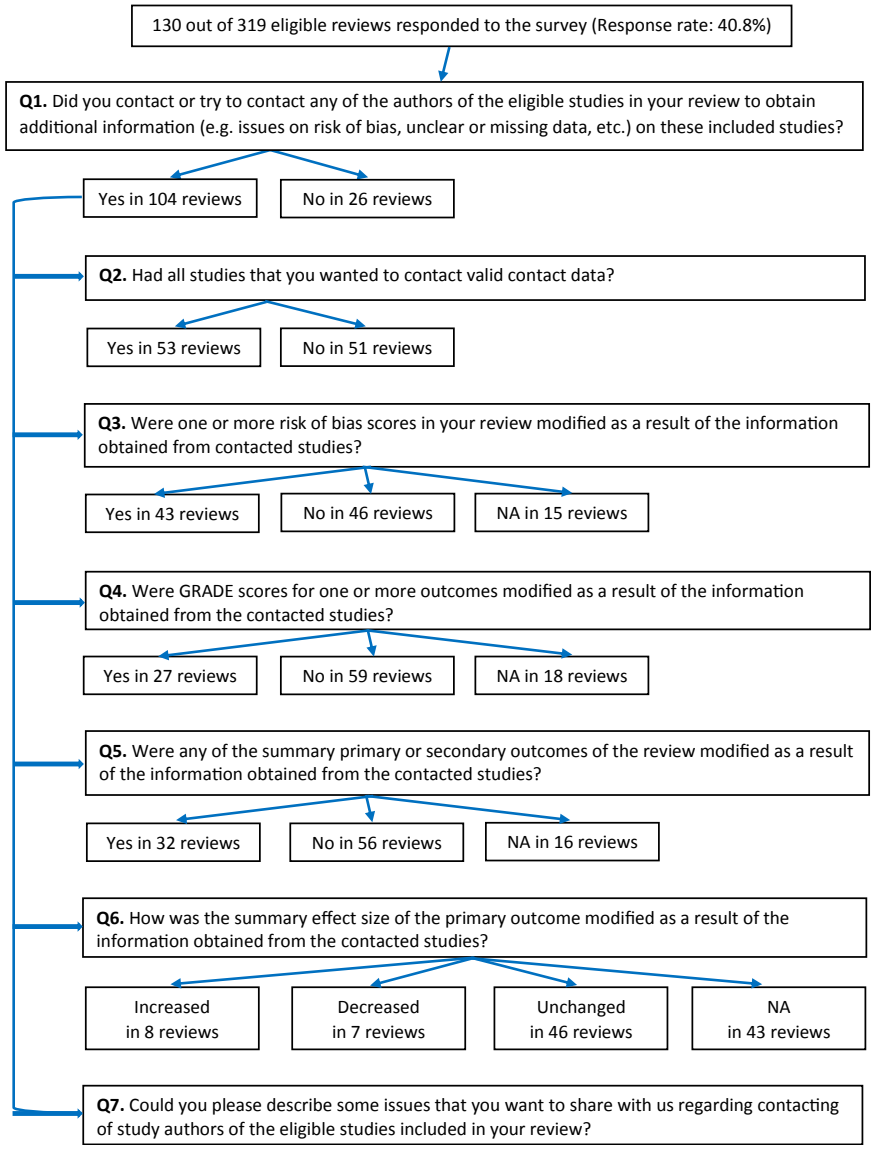

Fig. 2. Research questions of the survey.

3.3.3. Outcomes for the open-ended survey question

Of the surveyed Cochrane reviewers that reported that they had contacted or had tried to contact eligible studies to obtain additional information, 52.9% (55/104) wanted to share some issues regarding these procedures (Table 5). These 55 surveyees reported a total of 82 issues, which were coded and categorized (Additional File 9). The key message shared by the review authors was that a lack of contact data and not replying (in particular in the older studies) were predominant barriers to obtaining information from contacted studies.

3.3.4. Differences in outcomes between the cross-sectional study and the survey

We asked one simple question in both the cross-sectional study and survey: "Did you contact or try to contact any of the authors of the eligible studies in your review to obtain additional information (e.g., issues on risk of bias, unclear or missing data, and so forth) on these included studies?" In 26.9% (35/130) of the surveys, an opposite outcome was scored for this question compared with what was reported in the published review.

4. Discussion

4.1. Principal findings of the study and comparison with other studies

The principal findings of this research study and how they compare with other studies are reported in the following. In Additional File 7, we reported for each single

Table 5. Summary of the outcomes of the closed-ended survey questions

Description of the outcomes	Statistic
Outcome 1: The prevalence of reviews in which the reviewers reported that they had contacted or had tried to contact eligible studies to obtain additional information on these included studies.	80.0% (104/130) 95% CI: 72.1%–86.5%
Outcome 2: The prevalence of reviews in which all studies that the reviewers wanted to contact had valid contact data.	51.0% (53/104) 95% CI: 41.0%–60.9%
Outcome 3: The prevalence of reviews in which one or more risk of bias scores were modified as a result of the information obtained from contacted studies.	48.3% (43/89)[a] 95% CI: 37.6%–59.2%
Outcome 4: The prevalence of reviews in which the GRADE scores [27] for one or more outcomes were modified as a result of the information obtained from the contacted studies.	31.4% (27/86)[a] 95% CI: 21.8%–42.3%
Outcome 5: The prevalence of reviews in which any of the summary primary or secondary outcomes of the review were modified as a result of the information obtained from the contacted studies.	36.4% (32/88)[a] 95% CI: 26.4%–47.3%
Outcome 6a: The prevalence of reviews in which the summary effect size of the primary outcome was modified as a result of the information obtained from the contacted studies.	24.6% (15/61)[a] 95% CI: 14.5%–37.3%
Outcome 6b: The prevalence of reviews in which the summary effect size of the primary outcome increased as a result of the information obtained from the contacted studies.	13.1% (8/61)[a] 95% CI: 5.8%–24.2%
Outcome 6c: The prevalence of reviews in which the summary effect size of the primary outcome decreased as a result of the information obtained from the contacted studies.	11.5% (7/61)[a] 95% CI: 4.7%–22.2%
Outcome 7: The prevalence of reviews in which the reviewer wanted to share some issues regarding contacting of study authors of the eligible studies included in the review.	52.9% (55/104) 95% CI: 42.9%–62.8%

[a] Studies that answered this question with ''not applicable'' were not included in the denominator.

outcome, ''was the outcome novel, what was found, why this outcome is important and for who.''

4.1.1. High prevalence of contacting of authors by reviewers

A high prevalence of Cochrane reviews that had contacted or had tried to contact authors was identified in both our cross-sectional study and survey, 73.4% (234/319) and 80.0% (104/130), respectively (Tables 2 and 5). This finding confirmed the importance of this research procedure for systematic reviewers. Our prevalence statistics were slightly higher than those scored in earlier studies on smaller sample sizes [30,44].

4.1.2. Poor reporting on contacting of authors by reviewers

Our cross-sectional study showed that reporting by Cochrane reviewers on procedures for contacting authors and their outcomes was poor (Table 2). These limitations could introduce bias, imprecision, and reproducibility issues into the review. Outcomes on the consequences of information data obtained from contacted authors could not be reliably extracted from the reviews because of a high risk of interpretation bias.

4.1.3. Unclear risk of bias is not synonymous with poor reporting

High scores of ''unclear'' risk of bias scores were identified in a large epidemiological study by Dechartres et al. [6] on 2,092 randomized controlled trials in 2001 systematic reviews. These authors used the outcome ''unclear'' risk of bias as a synonym for poor reporting. However, our cross-sectional study showed that 90.8% (3,721/4,099) of eligible studies in the reviews had at least one domain scored as ''unclear'' risk of bias and 86.3% (3,538/4,099) as ''unclear'' risk of bias as a result of poor reporting (Table 4). This finding showed that ''unclear'' risk of bias cannot be used as a synonym for poor reporting. This is congruent with the definition of ''unclear'' risk of bias by Higgins et al. (Table 1) [26].

4.1.4. Poor reporting in eligible studies of systematic reviews and the need to contact authors

The high prevalence of poor reporting among the eligible studies also quantified the need for contacting of authors to obtain additional information. Only 21.2% (65/306) of Cochrane reviewers reported that they had contacted or had tried to contact all studies with at least one ''unclear'' risk of bias score as a result of poor reporting (Table 4). This issue is important when considering the validity of findings of systematic reviews.

4.1.5. The consequences of contacting authors for the outcomes of the review

Our survey identified changes in key outcomes of reviews as a consequence of contacting of authors, that is, changes in (1) the risk of bias scores, (2) the GRADE scores, (3) the summary primary or secondary outcomes, and (4) the summary effect size of the primary outcome (Table 4). These findings showed the importance of contacting of authors for these key outcomes of systematic reviews. Lensen and Farquhar [45] in a case substudy confirmed changes of the risk of bias assessments as a result of contacting of authors.

Table 6. Summary of findings on contacting of authors of an hypothetical eligible study

Questions	Answer
Was contacting of authors of the eligible study necessary to obtain additional information data (e.g., issues on risk of bias, unclear or missing data, and so forth)?	Answer: Yes/No
Did the eligible study have valid contact data?	Answer: Yes/No/NA NA: When the previous question was addressed with a ''No.''
Did you contact one or more authors of the eligible study?	Answer: Yes/No/NA No: Present the rationale. NA: When previous question(s) was/were addressed with a ''No.''
Did the authors of the eligible study reply?	Answer: Yes/No/NA NA: When previous question(s) was/were addressed with a ''No.''
Did you obtain all the information requested from the eligible study?	Answer: Yes/No/NA No: Present the rationale. NA: When previous question(s) was/were addressed with a ''No.''
What information was and was not obtained from the eligible study?	Answer: Describe what information was obtained. Describe what information was not obtained. NA: When previous question(s) was/were addressed with a ''No.''
How was the obtained information used?	Answer: Describe how each type of obtained information data were used, for example, for imputing statistics, the risk of bias assessment, the meta-analysis, and so forth. NA: When previous question(s) was/were addressed with a ''No.''.
What were the consequences of the obtained information for the systematic review?	Answer: Describe the consequences of each type of obtained information data for the systematic review, for example, it modified statistics, increased or decreased risk of bias or GRADE scores, and so forth). Report also when the obtained information did not have consequences for the review. NA: When previous question(s) was/were addressed with a ''No.''
Was a draft of the systematic review sent to the original investigators before the publication of the systematic review?[a]	Answer: Yes/No/NA No: Present the rationale. NA: When previous question(s) was/were addressed with a ''No.''.
Did the contacted author approve the correctness and accuracy of the use of the obtained information in the systematic review?	Answer: Yes/No/NA No: Present the rationale. NA: When previous question(s) was/were addressed with a ''No.''

Abbreviation: NA: Not applicable.

[a] Clarke et al. [52] recommend that a draft of the systematic review is sent to the original investigator to double-check the correctness and accuracy of the use of the obtained information in the systematic review.

4.1.6. Barriers to obtain additional data from authors

Our survey showed that about half (51.0%) of the reviews had valid contact data for all the studies that the reviewers wanted to contact. This barrier to obtain additional data was also reported in the open-ended question of the survey and applied predominantly to the older studies (Additional File 9). Similar findings were reported in other articles on this topic [35,46]. Not replying of authors to reviewers is another barrier to obtaining additional data. A low replying prevalence (around 43%) was scored in our cross-sectional study (Table 2) as well as in earlier research studies [30,46].

4.1.7. Opposite outcomes between the cross-sectional study and survey

A high prevalence of opposite outcomes, that is, 26.9% (35/130), was scored for the same simple closed-ended question in the survey compared with what was reported in the published review. We chose this question on having contacted authors or not because recall issues are not expected on this important research procedure. Conflicting outcomes between information obtained from contacted authors and what was reported in the review were also identified in two small studies [30,44] and one pilot study [45]. Our findings are worrisome because it remains unclear whether to place trust in what is reported in the review or in the information obtained from contacted authors [45]. This lack of trust was confirmed in a survey by Schroll et al. [31]. They showed that around 20% of the Cochrane reviewers refrained from searching unpublished data because they expected these data to be unreliable.

4.2. Strengths and weaknesses

The strengths of this article include the following: (1) it focused on a narrow-spectrum target intervention, that is, contacting of authors to obtain additional information, (2) all research questions were pilot-tested, (3) a peer-reviewed protocol was published a priori, (4) a power

calculation with a high level of confidence (0.95), and high precision (0.05) was applied, (5) only Cochrane reviews were included, which represents the highest quality for such reviews [28], (6) all research procedures were conducted by 2 operators independently, (7) all methods and all raw data were reported in Additional Files, which permitted full transparency, and (8) explanatory tables were created that presented for each single outcome, "was the outcome novel, what was found, why this outcome is important, and for who" (Additional File 7).

Weaknesses of this article include the following: (1) the external validity of the findings of this study is influenced by having included only Cochrane reviews. However, these reviews are considered the reference standard [28] for conducting systematic reviews. We therefore expect that our findings underestimate the true magnitude of these outcomes, (2) over-representation of certain review groups in our sample could have skewed outcomes (Additional File 6), (3) specific review characteristics such as the inclusion of nonrandomized studies in the reviews could have influenced outcomes, (4) the low response rate to our survey notwithstanding our numerous strategies to boost this rate, and (5) the responding surveyees are possibly more likely to contact authors than reviewers who did not complete the survey.

4.3. Implications and future research

4.3.1. Dealing with poor reporting on contacting of authors of eligible studies

The Cochrane Handbook [15], the PRISMA Statement [47,48], and the PRISMA-P Statement [49,50] have included some suggestions on methods for contacting authors, but little has been published on this topic [35]. Developing guidance on such methods could be an important initial strategy to address poor reporting on contacting of authors. Including a table in systematic reviews that clearly summarizes such contacting procedures, their findings, and consequences could guide end users of reviews and help future reviewers to reproduce or update a review. We have developed a prototype for such a table, which is based on the findings in this research study but requires further testing for its validity (Table 6). Strategies for obtaining better response rates and a higher quantity and quality of data from contacted authors should be further explored. Such strategies refer to precise and clear questions to authors [15], creating a reference standard for contacting protocols, financial incentives [51], double checking between the original investigator and the reviewer on the correctness and accuracy of the use of the obtained information in the systematic review [52], exploring social media, listing the names of nonresponding authors in the published reviews and involving directors of the research institutes of the pertinent authors when replying of authors is unsuccessful, and so forth.

4.3.2. Problems associated with the research procedures for contacting of authors of eligible studies

However, contacting of authors also implies applying a new research method "post hoc" to an already published study. This introduces a series of problems that could skew the outcomes of systematic reviews. Such issues refer to the following: (1) the reviewer's subjective decision to either contact authors or not [31]. Cochrane has defined this procedure as "highly desirable" and not as "mandatory" [15,25,53]; (2) the lack of validated research protocols on methods for contacting authors and for dealing with the obtained information; (3) resource dependency, because contacting of authors is time-consuming and therefore costly [31,35]; (4) contacting of authors slows down the research process [35]; (5) older studies often have no valid contact data, which was reported in our survey and in a Cochrane review by Young and Hopewell [35]. This could introduce bias by skewing the outcomes of a review toward those of the more recent studies; (6) poor communication and language barriers between reviewers and authors; (7) not replying of contacted authors [30,46]; (8) data sharing issues [54–60]; (9) the quality and quantity and the trustworthiness of the information obtained from the contacted authors [44,45]; (10) reviewers are more tempted to contact authors when reviews include a smaller number of studies [30] or possibly when multiple included studies are published by the same authors. These issues are important for all end users of systematic reviews and for future reviewers who want to contact authors to obtain additional information on their research study.

5. Conclusions

This cross-sectional study and survey produced 28 quantitative outcomes that showed the importance and complications of contacting of authors for Cochrane reviewers as well as the poor reporting by these reviewers on the methods, outcomes, and consequences of this procedure. Our findings showed relevant shortcomings in the current standards and transparency of Cochrane reviews. These shortcomings can compromise the validity and reproducibility of these reviews and affect a wide audience including patients, clinicians, reviewers, guideline developers, researchers, and research sponsors. A guideline for dealing with these limitations was given.

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Supplementary data

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