Factor Analysis in Assessing the Research Methodology Quality of Systematic Reviews

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Abstract

Introduction: Many high quality systematic reviews available from medical journals, data bases and other electronic sources differ in quality and provide different answers to the same question. The literature recommended the use of a checklist type approach, which exceeds many of the problems associated with measurements. Aim: This study proposes to identify in a checklist type approach the most commonly used factors (from a methodological point of view) in assessing the quality of systematic reviews, and then mirror the actual stage of medical writing. We want to analyze the factors’ occurrence and / or their development in the text and in the abstract of systematic reviews published in 2011. Methods: The present study randomly selected only free full text systematic reviews found in Pubmed and in Cochrane Database. The most commonly used factors were identified in PRISMA statement and quality measurement tools. Results: The evaluated systematic reviews mentioned or developed several of the factors studied. Only 78% of the papers surveyed have used the correct IMRAD format and 59% of them have mentioned the sample size used. The correspondence between the content of the paper and its abstract is summarized in the proportion of 54.63% and 51.85% for the two sets of factors, and it can lead to scarce appreciation of the article provided that only abstracts are read. Conclusions: Researchers do not properly take into consideration scientific articles and assessment tools used for quality evaluation. They should place more value over methodological factors which help assess systematic review quality, while journals form the only party who can enforce quality standards in medical writing.

Keywords: Review; Systematic; Methodology; Quality; Assessment.

Introduction

Usually used as a way to sum up research evidences, systematic reviews have taken over gradually the narrative reviews and the experts’ comments. Systematic reviews try to bring the same level of rigor in assessing research evidences as the one that should be used in producing those evidences. This type of review should be clear, structured and replicable, if necessary. High quality reviews attempt to: identify all the relevant evidence (published and unpublished), select the studies and reports to be included in the review, evaluate the quality of each study or report, impartially synthetize the results presented in individual studies or reports, interpret the findings and present a balance and impartial summary of the findings, taking into consideration any flaws or errors in the
studied elements.

Many high quality peer-review systematic reviews are available from medical journals, data bases and other electronic sources. However, despite the care with which these reviews are compiled and published, they may differ in quality, and provide different answers to the same question [1].

As science evolves once with the accumulation of new research, new medical interventions, initially considered to be effective and safe, may prove to be ineffective or harmful, or vice-versa [2]. As a result, systematic reports users should be critical and carefully check the quality and methodological essays available [3].

Evaluation of systematic essays regarding the potential sources of error has resulted in numerous studies in which different individual factors were taken as such, for example, a recent methodological research has highlighted the potential importance of publication language and publication bias in systematic reports [4]. West et al. have identified more than 109 measurements, checklists and other guidance documents for conducting risk assessments of bias when carrying out systematic reports [5]. The most often evaluated subject in the whole scientific literature was the use of risk assessment scores for systematic errors in reports [6]. Other authors recommend the use of a checklist type approach, which exceeds many of the problems associated with measurements [6,7]. The abstract is an important aspect in assessing the overall quality of a systematic review. It is recommended that the abstract should be structured and it should be established the extent to which an abstract reflects the information in the article [8].

This study proposes to identify in a checklist type approach the most commonly used factors (from a methodological point of view) in assessing the quality of systematic reviews and, thus, mirror the actual stage of medical writing. We want to analyze the factors’ occurrence and / or their development in the text and in the abstract of systematic reviews published in 2011. The Pubmed database provides 45,656 papers published in 2011, of which only 4,253 are available with free text. Systematic reviews published in the Cochrane Database were chosen because of the renowned rigorous structure and of the free text availability. It offers 1747 essays published in 2011.

**Material and Method**

The most commonly found factors, which show publication’s quality from a methodological point of view, are split into two groups: the researchers’ ability to collect properly and correctly data according to methodology (“Accurate Data Collection”) and data accuracy for medical writing (“Accuracy of Medical Writing Issues”) [4-7].

In the category of “Accurate Data Collection” were chosen following criteria: mentioning the medical literature searching (which were the targeted databases), presenting the search strategies used, mentioning sampling methodology, commenting the sample size, indicating the number of patients analyzed statistically in systematic papers, mentioning the data collection method used, specifying the number of reviewers involved in the study, presenting inclusion and exclusion criteria specific for its topic, indicating systematic errors avoidance and assessing the validity of the selected papers. To assess the “Accuracy of Medical Writing Issues” have been pursued: respecting the IMRAD format for writing the systematic review content (observe if the chapters were written mentioning the headings Introduction, Materials and methods, Results, Discussions and Conclusion), properly combining the findings of relevant studies (depending on the presentation of inclusion/exclusion criteria, declaration of articles’ validity and systematic error avoidance) and data supporting the conclusions made by the author (observe if the author’s conclusions are based on the results found).

In order to determine how well systematic reviews’ abstracts reflect the information contained in the text, the display of factors (belonging to the two groups mentioned above) was counted and thus, grading was made.

We intend apply this set of factors on a set of systematic reviews to determine the level of their methodological standpoint. From all the articles available in Pubmed and Cochrane we limited our research and included only systematic reviews published in 2011. We excluded those not meeting the criteria to be considered systematic reviews and those which did not present free full text.
Random selection of reviews was made by picking one or two systematic reviews found on a result pages after applying the strategy “Limits Activated: only items with links to free full text, Systematic Reviews, published in the last 1 year”. Reference to these texts can be found at [16-37].

For statistical analysis of data obtained from systematic reviews’ evaluation included in the study, the programs used are Excel and EpiInfo. Descriptive statistical techniques and statistical tests (Chi-Squared, Fischer) were used. Although the Chi-Squared test showed the existence of statistically significant differences between observed and theoretical distribution for two qualitative variables (example: \( p = 0.002 \)), if one of the contingency table cells was less than 5 we preferred using the Fischer test instead.

Results

15 papers published in Pubmed and 12 systematic reviews published in Cochrane were randomly selected and then analyzed. The evaluated systematic reviews mentioned or developed several of the criteria studied.

Each systematic review stated that there were two assessors for selected articles and disputes were resolved with the help of a third evaluator. All systematic reviews have pointed out where to search the medical literature and which information search strategies were used. All articles mentioned sampling methodology, mentioned data collection method used, applied inclusion criteria specific for its topic and avoided systematic errors. Good quality (validity) of articles included in the all systematic reviews’ research was reported. Analyzing the evaluated studies, 59% of them mentioned the sample size used (95% Confidence Limits for PRESENT 38.8% 77.6%). Figure 1 shows that only 78% of the papers surveyed have used the correct IMRAD format (95% Confidence Limits for YES 57.7%-91.4%).

Figure 1. Distribution of systematic reviews which follow the IMRAD format

Figure 2. Distribution of systematic reviews which present the exclusion criteria
Approximately 70% reviews (95% Confidence Limits for YES 46.0%-83.5%) correctly combine the results of relevant studies, and 96% (95% Confidence Limits for YES 81.0%-99.9%) of them use data to support the author's conclusions. Exclusion criteria are lacking in 19% of cases (95% Confidence Limits for NO 6.3%-38.1%), while 96% of reports have said to avoid systematic errors.

![Figure 3. Patients' distribution in evaluated systematic papers](image)

The number of patients analyzed statistically in systematic papers varies between 200 and 848019.

**Table 1.** Factor distribution according to its occurrence in the evaluated systematic reviews

<table>
<thead>
<tr>
<th>Factors</th>
<th>Number of factors</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present in 100% of evaluated Systematic reviews</td>
<td>6</td>
<td>42.86</td>
</tr>
<tr>
<td>Present in 96% of evaluated Systematic reviews</td>
<td>3</td>
<td>21.4</td>
</tr>
<tr>
<td>Present in 55%-85% of evaluated Systematic reviews</td>
<td>5</td>
<td>35.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 1 shows that only 6 factors from the evaluated groups were found in every systematic review.

The correspondence between the content of the paper and its abstract is summarized in the proportion of 54.63% of “Accuracy of Medical Writing Issues” criteria present in the abstract, while aspects of “Accurate Data Collection” analysis are summarized in the proportion of 51.85%.

Relationships between grouped indicators in “Accurate Data Collection” and analysis of the “Accuracy of Medical Writing Issues” were evaluated.

**Table 2.** Relationship between “Correct Combining the Proper Results of Relevant Studies” and “Sample Size Specification”

<table>
<thead>
<tr>
<th>Combining correctly the proper results of relevant studies</th>
<th>YES</th>
<th>NO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifies the size of samples</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>NO</td>
<td>11</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>9</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>

Using statistical Fisher test p-value = 0.002 was found for the relationship between “Sample Size Specification” and “Combining Correctly the Proper Results of Relevant Studies”.

**Table 3.** Relationship between the “Combining Correctly the Proper Results Of Relevant Studies” and “Reference to the Exclusion Criteria”

<table>
<thead>
<tr>
<th>Combining correctly the proper results of relevant studies</th>
<th>YES</th>
<th>NO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifies the exclusion criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>18</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>NO</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>9</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>
According to Table 3, Fisher statistical test was used to assess the relationship between the presentation of the Reference To The Exclusion Criteria and Correct Combining The Proper Results Of Relevant Studies, and \( p = 0.001 \).

Table 4. Relationship between “Data Supports the Author’s Conclusions” and “Avoidance of Systematic Errors in the Study”

<table>
<thead>
<tr>
<th>Data supports the author's conclusions</th>
<th>YES</th>
<th>NO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance of systematic errors in the study</td>
<td>YES</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>NO</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>26</td>
<td>1</td>
<td>27</td>
</tr>
</tbody>
</table>

The link between “Avoidance of Systematic Errors in the Study” and “Data Supports of the Author’s Conclusions” has been evaluated with the help of Fisher’s exact test, \( p \) is equal to 0.037.

Discussion

Following the conducted analysis, it was observed that not all indicators, considered suitable to achieve quality assessment and writing a systematic review, have been described or were at least mentioned.

Although the IMRAD format is very popular in writing research articles and has a clear structure to present items of research [9], it was not correctly applied in the text or has not been used, denoting researchers lack of information on the methodological accuracy in medical writing and, last but not least, shows no rigor imposed by journals where such reports were published.

Although all authors presented the search strategies and databases they have used to identify articles for use in developing systematic essays, only some of them informed on the exclusion criteria and the sample size studied. For 41% of systematic papers the number of patients analyzed statistically has to be looked for in tables and graphics.

Avoiding systematic errors is an issue that helps determining the validity of an article, but 4% of surveyed papers do not specify if this was taken into account.

A partial presentation in the abstract of issues that help determining the quality and rigor of research can mislead readers. It was noted that only half of the indicators presented in the content of the reports are listed in abstracts, which does not appropriately reflect the quality of research itself. This can lead to underestimation of the quality of the essay if it is not entirely read by researchers and clinicians. The development of richly detailed abstracts is highly recommended for establishing the quality level essential for reviews. Another recommendation is aimed at the readers to run through the entire systematic review text if the abstract is close to the expected quality.

There is a statistically significant relation between mentioning the sample size and the correct combination of relevant studies (Fisher: \( p <0.05 \)).

There is a statistically significant connection between the presentation of the exclusion criteria and the correct combination of relevant studies (Fisher: \( p <0.05 \)).

There is a statistically significant connection between the study’s avoiding systematic errors and the author’s conclusions supported by data (Fisher: \( p <0.05 \)).

Conclusions

Although many scientific articles and assessment tools suggested different sets of indicators, measurements and checklists for evaluating the systematic review’s quality and proved their efficiency, researchers do not take them into consideration. Only 42.86% of the most commonly used criteria in quality assessment were present in the text of all reviews. The correspondence between the content of the paper and its abstract is summarized in the proportion of 54.63% and 51.85% for the two sets of factors, and it can lead to scarce appreciation of the article provided that...
only abstracts are read. Researcher should place more value over methodological factors which help
assess article quality, while journals form the only party who can enforce quality standards in
medical writing. Sample size and exclusion criteria are related to the presentation of the correctly
combined results of relevant studies. Another relation was established between errors evasion in
systematic reviews and the author’s conclusions supported by data.

Conflict of Interest

The authors declare that they have no conflict of interest.

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