Evidence Based Library and Information Practice

Librarians' Participation in the Systematic Reviews Published by Iranian Researchers and Its Impact on the Quality of Reporting Search Strategy

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Abstract

Objective – The validity of the results from systematic review studies depends largely on the implementation and the reporting of the search strategy. Using an experienced librarian can greatly enhance the quality of results. Thus, the present study aimed to investigate the relationship between the librarian's participation and the quality of reporting search strategy in systematic reviews published by Iranian researchers in medical fields.

Methods – Three databases were searched to identify the systematic review studies conducted by Iranian researchers from 2008 to 2018. A total of 310 studies were selected using systematic random sampling, and the quality of their search strategy reports was reviewed by the Institute of Medicine checklist. A short questionnaire about the librarians' participation in the search strategy of these studies was sent to the corresponding authors of the selected studies. A total of 229 questionnaires was returned. The data obtained from the questionnaire about the librarians' participation in reporting search strategy in systematic review studies and also from the evaluation checklist for reporting search strategy in systematic review studies were analyzed by descriptive and inferential statistics.

Results – The mean value of the evaluation checklist for reporting search strategy in systematic review studies was low. The librarians' participation rate for these studies was 13.6%. No meaningful relationship was found between the librarians' participation and the mean value of the evaluation checklist for reporting search strategy of systematic review studies. However, an investigation of the relationship between each of the items in the evaluation checklist for reporting search strategy in systematic review studies and librarians' participation as the corresponding author or a member of the research team showed a meaningful relationship in five items.

Conclusion – The results showed that the quality of reporting the search strategies in systematic reviews was low and the librarians' participation in designing and reporting the search strategy in systematic reviews was limited. The authors of the systematic review studies, as well as the journals' editors and referees, need to pay more careful attention to reporting the search strategy exactly and comprehensively. Employing librarians in this area can have a major impact on this part of systematic review studies.

Introduction

A systematic review study is a valuable research tool for collecting valid evidence to develop evidence based guidelines, plan decisions, and inform future studies (Patrick et al., 2004). Such studies can offer some important advantages: synthesizing large bodies of data, comparing as well as evaluating the results obtained by prior research, eliminating biased inferences, and finally, drawing more compelling conclusions related to the research questions (Liberati & Taricco, 2010). A systematic and comprehensive search is crucial for any systematic review (Liberati et al., 2009). A weak search strategy may not find all eligible studies. A weak report, in turn, makes it difficult to determine whether the search itself has been inefficient or the report has been poorly presented (Koffel, 2015). Researchers need to present a comprehensive report of their search strategy, as an accurate and complete report of the search strategy can be seen as a criterion for evaluating the quality, validity, and methodology of the report in systematic reviews (Moher & Tsertsvadze, 2006).

To carry out a meticulous and comprehensive search in systematic review studies, the researcher needs to choose relevant terms and appropriate databases as well as obtain the necessary knowledge and skills to conduct a successful search in those databases. Several leading organizations have provided guidelines for conducting a successful literature search and also for reporting the results effectively (Moher, Liberati, Tetzlaff, & Altman, 2009; Stroup et al., 2000). PRISMA, Cochrane Handbook, PRESS, and AMSTAR are examples of the most popular guidelines helping researchers to conduct and report systematic reviews and meta-analyses in a more systematic and standard way. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist provides 27 items and a four-phase flow diagram in this regard (*PRISMA Transparent Reporting of Systematic Reviews and*

Meta-analysis, 2015). The *Cochrane Handbook for Systematic Reviews of Interventions* also provides methodological guidance for the preparation and maintenance of Cochrane Reviews (Higgins et al., 2019). PRESS (Peer Review of Electronic Search Strategies) mostly focuses on improving the quality of the literature search strategy as a key step for systematic review studies (McGowan et al., 2016). AMSTAR (The Assessment of Multiple Systematic Reviews) also provides a checklist containing 11 items guiding authors in conducting high quality systematic reviews (Pieper, Buechter, Jerinic, & Eikermann, 2012).

Among these guidelines, the Institute of Medicine has introduced the IOM guideline, which provides some specialized guidelines for designing and implementing a quality search strategy (Institute of Medicine, 2011). Interestingly, an experienced librarian is recommended in all of these guidelines to design and implement an appropriate search strategy (Centre for Reviews and Dissemination, 2009; Higgins et al., 2019). Librarians not only save time and reduce bias by conducting a comprehensive and accurate search, but they also facilitate the collaboration between the research team members, solve potential technological problems, and help with designing a method for doing systematic review studies (Dayani, 2001). Therefore, employing librarians in the design and reporting of the search strategy in systematic review studies is of special importance. Following the growing interest in conducting systematic review studies, Iranian researchers are increasingly more inclined to research this area. In most universities of medical science in Iran, experienced and trained librarians are willing to work with researchers who intend to conduct systematic review studies. Hence, the present study set out to examine the relationship between librarians' participation and the quality of reporting search strategies in systematic reviews published by Iranian researchers.

Literature Review

Given the importance attached to the search strategy in systematic review studies, the number of studies that examine and evaluate the search strategy and its reporting from different aspects is on the rise. Various criteria and standards are used for evaluating the quality of reporting search strategy in systematic review studies. Examples include checklists provided by Cochrane Reviews (Franco, Garrote, Escobar Liquitay, & Vietto, 2018; Koffel, 2015; Opheim, Andersen, Jakobsen, Aasen, & Kvaal, 2019; Page et al., 2016; Yoshii, Plaut, McGraw, Anderson, & Wellik, 2009), PRISMA (Opheim et al., 2019), Peer Review of Electronic Search Strategies (Franco et al., 2018; Rethlefsen, Farrell, Osterhaus Trzasko, & Brigham, 2015), and the IOM standard (Koffel, 2015; Meert, Torabi, & Costella, 2016; Rethlefsen et al., 2015). In several studies, certain instruments were used for evaluating the quality of reporting search strategy in systematic review studies that had been developed based on prior research and the authors' personal experience and knowledge (Koffel & Rethlefsen, 2016; Salvador-Oliván, Marco-Cuenca, & Arquero-Avilés, 2019).

Regarding examining the quality of reporting search strategy, in most studies that evaluated the reporting of the search strategy in systematic review studies, some errors were observed and the design and reporting of the search strategy was weak (Faggion, Huivin, Aranda, Pandis, & Alarcon, 2018; Franco et al., 2018; Koffel & Rethlefsen, 2016; Opheim et al., 2019; Salvador-Oliván et al., 2019; Sampson & McGowan, 2006). According to the criteria used for investigation, the errors made in the reporting of the search strategy included: errors related to missing terms (Faggion et al., 2018; Salvador-Oliván et al., 2019; Sampson & McGowan, 2006), not reporting the time span and the date at which the search was performed (Koffel & Rethlefsen, 2016; Opheim et al., 2019; Yoshii et al., 2009), not reporting the strategy syntax in at least one database (Koffel & Rethlefsen, 2016; Opheim et al., 2019), not using specific search facilities

within databases (Faggion et al., 2018; Salvador-Oliván et al., 2019), not searching in gray literature, not doing manual searching in journals and conferences (Faggion et al., 2018; Franco et al., 2018), and not using the PRISMA flowchart as a graphical representation of the study selection and searching processes during different phases of a systematic review (Opheim et al., 2019). Yoshii et al. (2009) examined the search strategy reports of 65 systematic review studies using seven Cochrane criteria ("databases searched," "name of host database," "date search was run," "years covered by search," "complete search strategy," "one or two sentence summary of the search strategy," and "language restrictions"). According to their study, more than 68% of systematic review studies had used four or fewer criteria (Yoshii et al., 2009).

Few studies have investigated the role of librarians in the design and reporting of the search strategy in systematic review studies. In one scoping review, however, the role of librarians was examined, where roles such as searching, choosing the resources, and training the researchers had received more attention (Spencer & Eldredge, 2018). In their review study, Townsend et al. (2017) identified six competencies for librarians involved in systematic review studies: "Systematic review foundations," "Process management and communication," "Research methodology," "Comprehensive searching," "Data management," and "Reporting" (Townsend et al., 2017). Some studies also examined the role of librarians in the quality of reporting search strategy in systematic review studies, indicating that the librarians did not play a very important role in the design and reporting of search strategy, although their participation could have a positive impact on improving the quality of reporting the search strategy in systematic review studies (Koffel, 2015; Meert et al., 2016; Rethlefsen et al., 2015). Moreover, Rethlefsen et al. (2015) found a high correlation between the level of librarians' participation and search

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1. ("systematic review" OR "systematic-review" OR "systematic reviews" OR "Meta-
analysis" OR "Metaanalysis" OR "Meta-analysis")
2. (Iran [Affiliation] AND university [Affiliation])
3. 1 AND 2 AND ("2008"[Date - Publication]: "2018"[Date - Publication]) AND
systematic[sb]
4. 1 AND 2 AND 3
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Figure 1
Search strategy for PubMed.

reproducibility of strategies reported in systematic review studies.

Aims

Given that few studies have examined librarians' participation in systematic review studies even though it could improve the quality of search strategy reports, the current study aimed:

1. To evaluate the quality of reporting search strategy in systematic reviews published by Iranian researchers.
2. To identify the librarians' participation in reporting search strategy in systematic reviews published by Iranian researchers.
3. To investigate the relationship between librarians' participation and the quality of reporting search strategy in systematic reviews published by Iranian researchers.

Methods

The present study was conducted in two stages using surveys and evaluations. These two stages are briefly explained in this section.

Stage One: Evaluating the Quality of Reporting Search Strategy in Systematic Review Studies Done by Iranian Researchers

To retrieve systematic review studies done by Iranian researchers from 2008 to 2018, three

databases, Web of Science, Scopus, and PubMed, were searched using relevant keywords. The search strategy for the PubMed database is shown in Figure 1. All searches were done in May 2018. The inclusion criteria for these studies were: systematic review studies done by Iranian researchers, the date of publication between 2008 and 2018, and affiliation of the corresponding author with one of the medical universities in Iran. The studies done before 2008 and those considered to be irrelevant or repetitive were deleted.

After searching the three databases, a total of 4,963 studies published by Iranian researchers was retrieved. As a result of a preliminary review, 1,930 studies were found to be duplicated, 1,320 studies were not systematic reviews, 52 were recorded as Systematic Review Protocol, and those with no full-text availability were removed. Eventually, 1,652 studies were finalized for further analysis. To calculate the size of the sample, the Cochrane formula was used. In this formula, *P* and *Q* (the probability of success and failure) equaled 0.5. The value of $Z_{\alpha/2}$ in the error level of 0.05 was 1.96 and the error of *d* equaled 0.05. The value of N was equal to the population size, 1,652. According to this formula, the sample size was estimated to be 310. These studies were selected based on systematic random sampling. First, all 1,652 studies were fed to Excel. Unique but consecutive numbers were allocated to each study. Of all the numbers, 310 numbers that
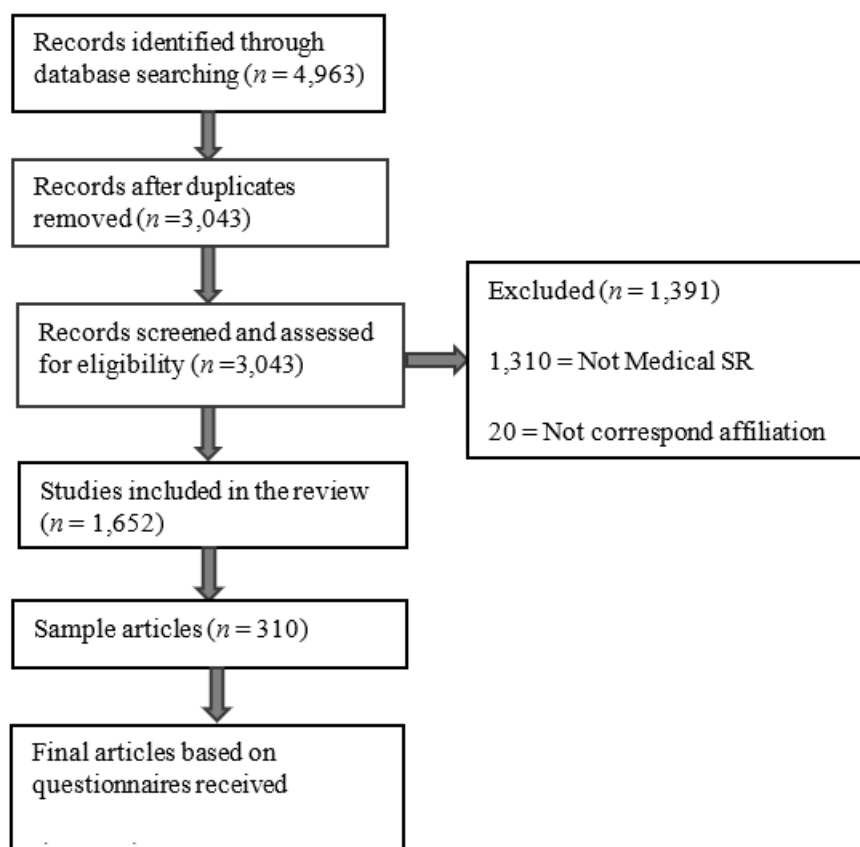
Figure 2
Flow chart of study selection.

belonged to 310 systematic review studies were systematically selected at regular intervals of 5. The 310 systematic review studies were chosen as the sample for examining the librarian's participation in these studies and its effect on the quality of reporting search strategy in systematic review studies. The questionnaires were sent to the corresponding authors of the 310 sample articles to identify the librarians' participation in conducting, designing, and reporting the search strategy in the systematic review studies. The flowchart in Figure 2 provides the details.

To evaluate the reporting of search strategy in systematic review studies, a standard checklist has been designed by the Institute of Medicine (IOM) as a guideline for conducting high-quality systematic review studies (Institute of Medicine, 2011). The IOM checklist includes 15 standards that provide exact and accurate guidelines for the implementation and reporting of a strong search strategy. These 15 IOM standards, along with their descriptions, are presented in Table 1.

To collect descriptive data, including the study title, publication year, journal name, and the organizational affiliation of the author, the researchers reviewed the full text of the studies. In cases where the full text of the article was not available, an email was sent to the corresponding authors explaining the purpose of the study and asking them to provide the full text of the study if possible. The data needed for examining the quality of reporting search strategy in systematic review studies were transferred to Excel 2013. To avoid any bias and enhance the accuracy of all stages in selecting

Table 1
15 IOM Standards and Their Descriptions

Item	Description
3-1-1	"Work with a librarian or other information specialist trained in performing systematic reviews to plan the search strategy"
3-1-2	"Design the search strategy to address each key research question"
3-1-4	"Search bibliographic databases"
3-1-5	"Search citation indexes"
3.1.6	"Search literature cited by eligible studies"
3-1-7	"Update the search at intervals appropriate to the pace of generation of new information for the research question being addressed"
3-1-8	"Search subject-specific databases if other databases are unlikely to provide all relevant evidence"
3-1-9	"Search regional bibliographic databases if other databases are unlikely to provide all relevant evidence"
3-2-1	"Search grey literature databases, clinical trial registries, and other sources of unpublished information about studies"
3-2-2	"Invite researchers to clarify information about study eligibility, study characteristics, and risk of bias"
3-2-3	"Invite all study sponsors and researchers to submit unpublished data, including unreported outcomes, for possible inclusion in the systematic review"
3-2-4	"Hand search selected journals and conference abstracts"
3-2-5	"Conduct a web search"
3-2-6	"Search for studies reported in languages other than English if appropriate"
3-4-1	"Key words, subject headings, terms"

Source: Institute of Medicine, 2011

the studies and evaluating their qualities, two researchers (ASh, RZ) performed the analysis of the studies independently. The score for the quality of reporting the search strategy in each study was estimated by summing up the scores in the IOM checklist (with a maximum score of 15). In case of any disagreement in scoring, a third researcher (SP) was consulted.

Stage Two: Examining Librarians' Participation in Reporting Search Strategy in Systematic Review Studies Done by Iranian Researchers

A short questionnaire was used for examining the level of librarians' participation in designing and reporting search strategy in systematic review studies. Meert et al. (2016) used this questionnaire for investigating the role of librarians in reporting search strategy in

systematic review studies conducted in pediatrics. The questionnaire's face validity was approved by several faculty members of the Medical Library and Information Sciences Department. The questionnaire included questions about the type and extent of librarians' participation in the design, implementation, and reporting of the search strategy in systematic review studies.

To examine the librarians' role, the corresponding authors were queried, through the questionnaire's items, about whether the study was informed by a librarian's consultation and participation. In the case of the librarian's participation, the author was asked to determine the type and quality of the role or participation. The role of librarians was divided into three groups: a non-participant, a counselor, or a

member of the research team and an author. "Non-participant" indicates that the librarian had no participation in designing and reporting search strategy in the systematic review. A "counselor" means that the research team received consultative services from the librarian in designing and reporting search strategy, and, therefore, the librarian was not among the authors of the research study. "A member of the research team" refers to a librarian who was one of the main members and authors of the research team in the systematic review study.

The questionnaires were designed online in Google Docs and sent to the academic emails of the 310 corresponding authors of the retrieved studies in the first stage in November 2018. In some cases, the authors' academic emails were not valid. To solve this problem, the authors of this study searched the names of the corresponding authors on ResearchGate, or, in the case of having their phone number, they were contacted about sending the questionnaire. If no response was received after two weeks, a reminder was sent to the author.

From 310 submitted questionnaires for identifying the librarians' participation in systematic review studies, 229 questionnaires were returned (response rate = 73.8%) by the corresponding authors of the included studies. The 81 studies whose corresponding authors did not respond were excluded from further analysis. The above-mentioned 229 studies were evaluated by the IOM checklist.

Statistical Analysis

In this study, descriptive statistics such as frequency, percentage, mean, median, variance, and standard deviation were used. Also, a Kolmogorov-Smirnov test was used to evaluate the data normalization. The non-parametric Mann-Whitney U test was used to analyze non-normal data. The Chi-Square test was also used for examining the relationship between the two qualitative variables. The data were analyzed using SPSS 22 software.

Results

The Quality of Reporting Search Strategy in Systematic Reviews Published by Iranian Researchers

The analysis of the data obtained by evaluating the quality of reporting the search strategy showed that the mean score of the search strategy report for all of the 229 systematic review articles, based on the IOM checklist, was 4.23 (SD = 1.69) out of 15. In only 32% of these studies had the procedures been fully presented as specified by the standard, "Design the search strategy to address each key research question" (Standard 3.1.2). The highest score was for the item of "search bibliographic databases" (Standard 3.1.4), 97.8%. The lowest scores were also related to the items of "Invite researchers to clarify information about study eligibility, study characteristics, and risk of bias" (Standard 3.2.2), 1.7%; "Invite all study sponsors and researchers to submit unpublished data, including unreported outcomes, for possible inclusion in the systematic review" (Standard 3.2.2), 4.4%; and "Work with a librarian or other information specialist trained in performing systematic reviews to plan the search strategy" (Standard 3.1.1), 5.3%. The item "Search grey literature databases, clinical trial registries, and other sources of unpublished information about studies" (Standard 3.2.1) was reported in only 15.3% of these studies. The results of evaluating the quality of the search strategy for systematic review studies are presented in Figure 3.

Librarians' Participation in the Quality of Reporting Search Strategy in Systematic Review Studies Published by Iranian Researchers

Findings showed that a librarian was employed in 13.6% of the systematic review studies, either as a co-author (7.0%) or just as a search counselor (6.6%), contributing in designing and reporting the reviews' search strategies. The role and the level of librarians' participation were
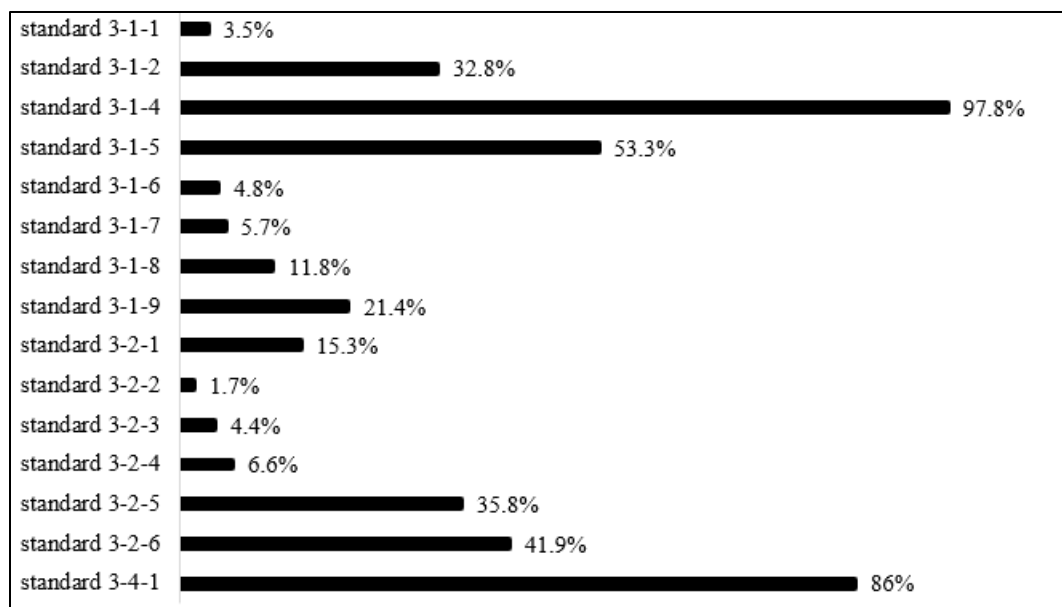
Figure 3

The frequency of presenting each of the items in the IOM checklist for reporting search strategy in systematic review studies (n = 229).

Table 2

The Type of Librarians' Participation Based on Their Role in the Process of Conducting Systematic Review Studies

Activities	Team Member/ Co-author (n = 16)	Search Counselor (n = 15)	Total (n = 229)
Consulting for selecting resources, databases, and suggested strategies	13 (81.2%)	8 (53.3%)	21 (9.1%)
Reviewing the search strategies written by the main researchers	9 (56.2%)	5 (33.3%)	14 (6.1%)
Designing a complete search strategy	12 (75.0%)	1 (6.6%)	13 (5.6%)
Modifying and reviewing the references	8 (50.0%)	2 (13.3%)	10 (4.3%)
Searching and collecting the required information and all resources about research	12 (75.0%)	2 (13.3%)	14 (6.1%)
Implementing manual search	9 (56.2%)	3 (20.0%)	12 (5.2%)
Searching for gray literature	6 (37.5%)	4 (26.6%)	10 (4.3%)
Writing some parts of the study	4 (25.0%)	0 (0.0%)	4 (1.7%)
Article editing	4 (25.0%)	0 (0.0%)	4 (1.7%)

analyzed through nine questions administered through a questionnaire (Table 2). The results showed that the highest participation was for "Consulting for selecting resources, databases and suggested strategies" with 9.1% and the lowest participation was for "Writing some parts of the study" and "Article editing" with 1.7%. The details are presented in Table 2.

Examining the Relationship between Librarians' Participation and the Quality of Reporting Search Strategy in Systematic Review Studies

The Mann-Whitney U test was used to test for significant differences between librarians' participation and the mean score obtained from evaluating the quality of reporting search strategy in systematic review studies done by Iranian researchers. The results indicated that there is no significant difference between librarians' participation and the mean score obtained from evaluating the quality of reporting search strategy in systematic review studies. However, the mean score and the median of the quality of reporting search strategy for the group that employed a librarian were higher than those in the group without a librarian. The results are shown in Table 3.

The Chi-Square test was used to examine the hypothesis that there is a relationship between librarians' participation and the quality of reporting search strategy in systematic review studies based on each of the items in the IOM checklist. The results showed that there was a meaningful relationship between librarians' participation and the rate of presenting the items in the IOM checklist in reporting search strategy in systematic review studies in five items ($p < 0.05$). In the three items of "Work with a librarian or other information specialist trained in performing systematic reviews to plan the search strategy" (Standard 3.1.1), "Design the search strategy to address each key research question" (Standard 3.1.2), and "Search subject-specific databases if other databases are unlikely to provide all relevant evidence" (Standard 3.1.8), the rate of reporting these items in the search strategy for studies with librarians was higher than that of studies without a librarian. For the two items of "Search for studies reported in languages other than English" (Standard 3.2.6) and "Search citation indexes" (Standard 3.1.5), the rate of reporting these items in the search strategy for studies without a librarian was higher than that of those with a librarian. Additionally, the results showed that, on average, the rate of reporting the items in the IOM checklist was higher in studies with a librarian. The results are shown in Table 4.

Table 3
The Significant Difference between Librarians' Participation and the Mean Score of the Quality of Reporting Search Strategy in Systematic Review Studies

Use of librarian	N	Mean Score (SD)	Median Rank	Median	Mann-Whitney U Test
Without librarian	198	4.17 (±1.69)	113.6	4	*Z*: -0.824
With librarian	31	4.54 (±1.68)	123.9	4	*p* value: 0.4

Table 4

Frequencies and Chi-Square Results of Librarians' Participation in Studies, Sorted by the IOM Standard

IOM Standard	Without Librarian (*n* = 198)	With Librarian (*n* = 31)	Total (*n* = 229)	*p* Value	Chi-Square Test Value
3.1.1	0 (0.0%)	8 (25.8%)	8 (3.5%)	0.00*	52.94
3.1.2	60 (30.3%)	15 (48.4%)	75 (32.8%)	0.04*	3.98
3.1.4	193 (97.5%)	31 (100%)	224 (97.8%)	0.37	0.80
3.1.5	111 (56.1%)	11 (35.5%)	122 (53.3%)	0.03*	4.55
3.1.6	8 (4.0%)	3 (9.7%)	11 (4.8%)	0.17	1.86
3.1.7	10 (5.1%)	3 (9.7%)	13 (5.7%)	0.30	1.07
3.1.8	20 (10.1%)	7 (22.6%)	27 (11.8%)	0.04*	4.01
3.1.9	41 (20.7%)	8 (25.8%)	49 (21.4%)	0.52	0.41
3.2.1	32 (16.2%)	3 (9.7%)	35 (15.3%)	0.35	0.87
3.2.2	4 (2.0%)	0 (0.0%)	4 (1.7%)	0.42	0.63
3.2.3	10 (5.1%)	0 (0.0%)	10 (4.4%)	0.20	1.63
3.2.4	11 (5.6%)	4 (12.9%)	15 (6.6%)	0.12	2.36
3.2.5	71 (35.9%)	11 (35.5%)	82 (35.8%)	0.96	0.00
3.2.6	88 (44.4%)	8 (25.8%)	96 (41.9%)	0.05*	3.82
3.4.1	168 (84.8%)	29 (93.5%)	197 (86%)	0.19	1.68

*Significant at *p* < .05

Discussion

The first aim of the present study was to examine the quality of reporting search strategy in systematic review studies done by Iranian researchers. Based on the results obtained from the IOM checklist, the mean score of the quality of reporting search strategy in systematic review studies was not high. Only less than one-third of the systematic reviews investigated in this study disclosed the full search strategy used in at least one database. This is consistent with the results of Page et al. (2016) and Opheim et al. (2019), where the full search strategy in at least one database was presented by one-third and less than one-third of the systematic review studies examined. A detailed and accurate reporting of the search strategy in systematic reviews allows for reproduction, particularly in those studies in which strong evidence is not gained to draw conclusions and updating the systematic review might be needed (Moher & Tsertsvadze, 2006). Presenting information on the latest date of searching in reporting the search strategy in

systematic reviews is necessary for reproducing the search strategy and updating the review (Liberati et al., 2009). Despite the importance of this issue, only a few studies had provided some information on the date of searching and its updating for searching relevant studies that might have been recently conducted. Searching the gray literature is regarded as an important factor in obtaining information that is often less accessible. In a few of the systematic reviews, searching the gray literature had been reported. This is consistent with the results of Page et al. (2016), where features of the reports in systematic reviews in biomedical research were examined and few studies were found to have reported the searching of gray literature. Given the fact that much of reporting the search strategy in systematic review studies is done based on one of the most reliable guidelines, such as PRISMA (Asar, Jalalpour, Ayoubi, Rahmani, & Rezaeian, 2016) and Cochrane (Franco et al., 2018), not reporting these issues in systematic reviews examined by this study can probably be due to: a scarcity of guidelines and

resources related to standard reporting of strategies (Moher, Tetzlaff, Tricco, Sampson, & Altman, 2007); lack of necessary training for the researchers with regard to methods of systematic searching or standard reporting (Koffel & Rethlefsen, 2016); or a lack of the required software to help researchers in reporting their systematic reviews (Page et al., 2016). Moreover, most editors or reviewers of the journals may not be well aware of the importance of reporting the search strategy in systematic review studies, often leading to lower quality and critical mistakes in search strategy (Sampson & McGowan, 2006). Seeking an expert librarian's opinion in the review process of systematic review studies might be helpful. Since most reputable journals tend to publish quality articles, using the standards such as IOM or PRESS for peer review before publishing an article can reduce the errors in this field, create a comprehensive search retrieval strategy, and increase the trust in the results of these studies and journals.

The second purpose of this study was to examine the type and the level of librarians' participation in reporting the search strategy in systematic review studies done by Iranian researchers. Librarians' participation in systematic reviews was very limited. In 13.6% of all the systematic review studies investigated in this study, the librarian was a member of the authors' team. One probable reason for the low participation of librarians might be that there is a lack of cooperation between researchers in different fields and librarians, as well as the researchers' failure to be aware of librarians' knowledge and skill in systematic review studies. The results of Meert et al.'s study (2016) showed that librarians' participation in reporting search strategy in systematic review studies was low, around 44%. This is consistent with the results of the present study. Much of the librarians' participation was in "Consulting for selecting resources, databases and suggested strategies" and "Searching and collecting the required information and all resources about research." The lowest participation of librarians

was in searching gray literature, authoring parts of the study, and editing the study. Employing a librarian as a team member in systematic review studies can have some advantages. Among these advantages are: saving time by performing an exact search, reducing the number of studies in the primary screening, avoiding repetitive terms in the search strategy, and finally, increasing the number of studies under investigation (Sampson et al., 2009). In some guidelines, the presence of a librarian is recommended in planning, performing, and investigating the search strategy in systematic review studies (Institute of Medicine, 2011; McGowan et al., 2016; Sampson et al., 2009). The aforementioned guidelines and journals' editors and referees can be helpful in attracting the attention of researchers doing systematic review studies toward employing librarians in designing, performing, and reporting search strategy in systematic reviews.

The third purpose of the present study was to examine the relationship between librarians' participation and the quality of reporting search strategy in systematic review studies done by Iranian researchers. We found out that there was no significant difference between the mean score of the quality of reporting the search strategy in systematic reviews and the librarians' participation, although the mean score and the median rank were higher for those groups that had used a librarian as a member of the authors' team. Results showed that, on average, the librarians' participation in systematic review studies affected increasing the level of presenting the items of the IOM checklist in reporting search strategy. Meert et al. (2016) reached the same conclusion that there was a meaningful relationship between the librarians' participation and the quality of reporting search strategy in systematic review studies. The relationship between the librarians' participation and the items on the IOM checklist was meaningful in five items. Employing a librarian in systematic review studies could result in an increase in reporting search strategy in items related to designing the search strategy,

searching subject-specific databases, and reporting the use of a librarian. The results in this study showed that the level of use and observance in the two items of "Search for studies reported in languages" (Standard 3.2.6) and "search citation index" (Standard 3.1.5) in the IOM checklist was higher in the group without a librarian. One of the reasons can be that researchers were more familiar with these two items due to the importance attached to these two items by prior research on systematic review studies.

Limitations and Future Directions

The main limitation faced by this study was that the results were limited to the systematic review studies done by Iranian researchers, and the level of librarians' participation was limited, which limits the possibility of generalizing the results to other systematic review studies.

Most of the previous studies set out to investigate the quality of the search strategy in systematic review studies and also the role of librarians in certain cases; therefore, some factors need to be recommended: examining the quality of designing, performing, and reporting other parts of the systematic review studies, such as selection and screening of the studies; evaluating the quality of the studies under investigation; reporting the risk of bias according to some standards like IOM and PRISMA; and examining the role of librarians. The quality of designing, performing, and reporting search strategy in systematic review studies in top-ranked journals should be compared to less prestigious journals in different medical fields, and the librarians' participation in this area is recommended. We also suggest that the quality of reporting the search strategy in systematic review studies done in developed countries be compared with those of developing countries, and the level of librarians' participation should be used to analyze the results.

Conclusion

The purpose of the present study was to investigate the relationship between librarians' participation and the quality of reporting search strategy in systematic review studies conducted in Iran. The results showed that the librarians' participation in designing and reporting search strategy in systematic reviews was low. Moreover, the quality of reporting the search strategy in systematic reviews based on the IOM checklist was not satisfactory. In five out of 15 items in the checklist, there was a positive correlation between the librarians' participation and the quality of reporting the search strategy in systematic reviews. In general, the level of observing the IOM checklist items in reporting the search strategy in systematic reviews was higher in groups that had used a librarian.

The methods used for reporting the search strategy in systematic reviews based on the IOM checklist can affect the judgments on the quality and capability of the results obtained by these studies. Selecting and employing experts, especially librarians, in the research team can have a positive impact on designing, performing, and reporting the search strategy. On the other hand, training researchers, proposing guidelines for reporting the search strategy in a standardized and comprehensive manner by the stakeholders and the editors of the journals, and employing librarians in evaluating and refereeing systematic review studies can help to enhance researchers' ability to prepare an exact, comprehensive, and clear report of the search strategy. Consequently, the validity of the obtained results can be verified more rigorously than before.

Acknowledgements

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