Høgskulen på Vestlandet

Masteroppgave

MAKP601

Predefinert informasjon

Startdato:	08-05-2019 09:00	**Termin:**	2019 VÅR
Sluttdato:	15-05-2019 14:00	**Vurderingsform:**	Norsk 6-trinns skala (A-F)
Eksamensform:	Masteroppgave	**Studiepoeng:**	45
SIS-kode:	203 MAKP601 1 MG 2019 VÅR		
Intern sensor:	(Anonymisert)		

Deltaker

Kandidatnr.:	404

Informasjon fra deltaker

Antall ord *:	17117		
Egenerklæring *:	Ja	**Inneholder besvarelsen konfidensiell materiale?:**	Nei
Jeg bekrefter at jeg har registrert oppgavetittelen på norsk og engelsk i StudentWeb og vet at denne vil stå på vitnemålet mitt *:	Ja		

Gruppe

Gruppenavn:	(Anonymisert)
Gruppenummer:	10
Andre medlemmer i gruppen:	Deltakeren har innlevert i en enkeltmannsgruppe

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Nei

Western Norway University of Applied Sciences

MASTER'S THESIS

Journal requirements for reporting systematic review searching: a survey of author instructions

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Journal requirements for reporting systematic review searching: a survey of author instructions

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Word count: 17117

Abstract

Introduction

To use systematic reviews to inform clinical guidelines, the methodology needs to be conducted and reported in an open and reproducible manner. Studies show that reporting of literature searches is poor despite that there are reporting guidelines. This survey investigates which requirements on systematic review searching journals include in their author instructions.

Methods

A cross sectional survey was conducted. The sample consist of 179 medical journals. The journals´ author instructions were reviewed and any information regarding requirements for reporting literature searches was collected and categorized.

Results

Of the 179 journals, 54% included instructions on how to report systematic review searches; by the use of established reporting guidelines (48%), mostly PRISMA, or journal specific requirements (24%). 6% of the journals rely only on journal specific requirements. The most requested reporting items are 1) Search strategy should be reported (14%), 2) Databases/ information-/ data sources (12%) and 3) Describe search methods/ process (9%).

Discussion

Reporting items in journal specific requirements are reflecting the content of established reporting guidelines. There are some additional reporting items not covered by the reporting guidelines. To a great extent, in journals recommending reporting guidelines, the journals specific requirements included are overlapping with the content of the recommended reporting guidelines. Journals only relying on journal specific requirements, have few and vague reporting items.

Keywords: systematic reviews as topic (MeSH), systematic review searching, literature search, reporting, journal author instructions.

Sammendrag

Introduksjon

For at systematiske oversikter skal kunne brukes som kunnskapsgrunnlag i kliniske retningslinjer, må metoden utføres og rapporteres på en åpen og etterprøvbar måte. Tidligere studier viser at rapporteringen av litteratursøk ofte er mangelfull selv om det finnes retningslinjer for rapportering. I denne studien undersøkes hvilke krav vitenskapelige tidsskrift stiller til rapporteringen av litteratursøk til systematiske oversikter, ved å undersøke et utvalg forfatterveiledninger.

Metode

Dette er en tverrsnittstudie med et utvalg av 179 tidsskrifter. Forfatterveiledningen til tidsskriftene er gjennomgått og informasjon angående krav til rapportering av litteratursøk er samlet inn og kategorisert.

Resultat

Av de 179 inkluderte tidsskriftene har 54% krav til rapportering av søk til systematiske oversikter, i form av bruk av etablerte retningslinjer for rapportering (48%), eller at tidsskriftene har egne instruksjoner (24%). 6 % av tidsskriftene belager seg kun på egne kriterier for rapportering av litteratursøk til systematiske oversikter. Av tidsskriftspesifikke rapporteringskrav er de mest etterspurte 1) at søkestrategien skal rapporteres (14%), 2) databaser/ informasjonskilder skal navngis (12%), og 3) beskriv søkemetoder/søkeprosess (9%).

Diskusjon

Rapporteringselementer i tidsskriftspesifikke krav er i overensstemmelse med innholdet i etablerte retningslinjer for rapportering. Men det er avdekket noen elementer som ikke er dekket av retningslinjene. I tidsskrift som bruker retningslinjer er det i stor grad av overlapp mellom disse og tidsskriftenes egne krav. Tidsskrift som kun baserer seg på egne krav har få og vage krav.

Emneord

Systematiske oversikter som emne (MeSH), litteratursøk, systematiske søk, rapportering, forskningsrapportering, forfatterveiledning

Preface

These are exiting times for being a librarian in a medical library. These days, the quality of systematic review searches, including reporting, is on everyone's tongue. In 2014, the Lancet published new guidelines for authors, which emphasized research in context even more. From now (then) on, authors of all kinds of research articles had to include a segment in their article concerning research in context, where they had to justify their own study in the context of other evidence. Authors had to report which sources they had searched, how and when, to find the evidence they based the justification of their own study on. As a librarian, this was new. We were used to these requirements concerning systematic reviews, but not other types of research studies. After this statement from The Lancet, it became a saying among myself and other colleagues, that the journal requirements on literature searches are increasing. But where they? Or was it just in The Lancet? For all kinds of studies or only systematic reviews? And what are the requirements? What does the author guidelines say about searching and reporting of searches? These were some questions I were curious about, and I am trying to answer some of them in this thesis.

There are several people who has helped me with this thesis and who deserves acknowledgement. First, I must thank my supervisor professor Hans Lund for your interest, enthusiasm and supervision on this project. Your enthusiastic feedback has helped me during the time working on this project. Also, my co-supervisor Gunhild Austheim, you have given me valuable feedback on writing. I would like to thank my fellow students Brynhildur Axelsdottir and Sølvi Biedilæ for helping me piloting the data extraction form in this survey. Your input made me change the way of data collection, and made it easier. I also would like to thank my fellow students and faculty for the years spent in Bergen. At last I would like to thank my employer, the Medical library at University of Oslo, for letting me use work time on the master studies and this thesis.

Johan, thank you for your patience and invaluable help finishing the thesis.
(Nils (5 months), you didn't exactly help…)
Finally!

Marte Ødegaard, Oslo, May 2019.

Table of content

List of tables, figures and appendices

Acronyms used

AMSTAR	A MeaSurement Tool to Assess systematic Reviews
CRD	The Centre for Reviews and Dissemination
HuGENet	Guidelines for systematic review and meta-analysis of gene disease association studies
ICMJE	The International Committee of Medical Journal Editors
MEDLINE	Medical Literature Analysis and Retrieval System Online or MEDLARS Online
MECIR	The Methodological Expectations of Cochrane Intervention Reviews
MeSH	Medical Subject Headings
MOOSE	Meta-analyses of observational studies in epidemiology
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QUOROM	Quality of Reporting of Meta-analyses

1 Introduction

This master thesis is a survey on what requirements journals state in their author instructions regarding reporting of systematic review searches. Several studies show that there are being published systematic reviews with unclear reporting of methodology, inclusive the literature search (Faggion, Huivin, Aranda, Pandis, & Alarcon, 2018; Koffel & Rethlefsen, 2016; Mullins, DeLuca, Crepaz, & Lyles, 2014). This makes it impossible to reproduce the reviews, and their clinical value is limited.

1.1 Background for the thesis

Systematic review is a review type where the purpose is to identify, organize and synthesize all research on a specific research question (Green et al., 2011). Systematic reviews of randomized controlled trials are the strongest evidence on clinical questions of effect of interventions. These reviews are an important part of informing clinical decision-making, guideline development, health technology assessments and policymaking (Polit & Beck, 2017, pp. 25-27). In a systematic review, searching for literature in various ways is the method for retrieving studies for inclusion, and the first important step in collecting data.

In the larger field of systematic reviews there exists some variabilities in approach and definitions, even if the key characteristics of the methodology is shared. Organizations specializing in conducting systematic reviews, such as Cochrane and Centre for Reviews and Dissemination, University of York, define *systematic review* in slightly different terms. According to Cochrane, the key characteristics of a systematic review are (Green et al., 2011):

> *1) a clearly stated set of objectives with pre-defined eligibility criteria for studies; 2) an explicit, reproducible methodology; 3) a systematic search that attempts to identify all studies that meet the eligibility criteria; 4) an assessment of the validity of the findings of the included studies, for example through the assessment of risk of bias; and 5) a systematic presentation, and synthesis, of the characteristics and findings of the included studies.*

In their handbook, The Centre for Reviews and Dissemination present this definition on systematic reviews (Centre for Reviews and Dissemination, 2009, p. v; Green et al., 2011):

> *Systematic reviews aim to identify, evaluate and summarize the findings of all relevant individual studies, thereby making the available evidence more accessible to decision-makers. When appropriate, combining the results of several studies gives a more*

reliable and precise estimate of an intervention's effectiveness than one study alone. Systematic reviews adhere to a strict scientific design based on explicit, pre-specified and reproducible methods.

Whereas Cochrane emphasizes to identify *all studies* that fit the research question, the definition by Centre for Reviews and Dissemination defines a systematic review to seek to find *as many potential studies as possible* (Centre for Reviews and Dissemination, 2009, p. v; Green et al., 2011). These definitions have in common that they emphasize the data collection.

1.1.1 Systematic review searching

As the purpose of the systematic review is to synthesize all research on a specific question, there is a need for thorough, systematic searches for all possible studies that meet the inclusion criteria and that may answer the research question. The literature search is the methods for collecting the data.

Transparency and reproducibility are two main principles in research. For others to be able to appraise the quality of research and reproduce the result, authors of scientific articles must be clear on their methodological choices and the reporting of this. These principles also apply to systematic reviews. If the methodology is insufficiently reported, it weakens the study's trustworthiness and conclusion, it allows for unnecessary duplication of work, it may be an obstacle in updating systematic reviews and for research on systematic review methodology (Liberati, A. et al., 2009; Mullins et al., 2014; Sampson, McGowan, Tetzlaff, Cogo, & Moher, 2008). All of this can lead to ineffective, inappropriate or harmful guidelines and policies (Foster & Jewell, 2017, p. 3). Several studies indeed have examined searches in published systematic reviews, and conclude that they are reported mainly in an non-reproducible way and the result of the systematic review is therefore not verifiable (Faggion, Atieh, & Park, 2013; Koffel & Rethlefsen, 2016; Maggio, Tannery, & Kanter, 2011; Mullins et al., 2014; Yoshii, Plaut, McGraw, Anderson, & Wellik, 2009). This applies both to systematic reviews published in journals and by Cochrane.

There is a difference in searching for literature in general and searching for studies to include in systematic reviews of interventional studies. Systematic review searches require rigorously systematic searches across several sources and methods. The searches need to be balanced by sensitivity, specificity and recall, and one must prove that one has done its best to retrieve all

potentially relevant studies within the resources available in order to achieve a reliable estimate of effect (Lefebvre, Manheimer, & Glanville, 2011, p. 6.1.1.2).

Literature searches for systematic reviews are occasionally called systematic searches. «Thorough literature searches» and «replicable literature searches» are other terms that occur in different handbooks for systematic reviews (Cooper, Booth, Varley-Campbell, Britten, & Garside, 2018). In this thesis, the term *systematic review searching* will be used for all types of information retrieval for systematic reviews.

A systematic review search requires the use of both database specific subject headings and text words. Not reporting search terms and how they were combined (Boolean search), will weaken a systematic review as it will not possible to know what the search consists of and what terms that may be missing. Providing a full copy of the search history of the searches done, is reported ranging from 13% (Mullins et al., 2014), to 14% (Koffel & Rethlefsen, 2016), and 62% (Faggion et al., 2018). The quality of systematic review searches is somewhat low, and they often contain errors. Some of the errors documented are the lack of use of synonyms and thesaurus, lack of utilizing database specific field codes, incorrect use of Boolean logic and wrong use of parenthesis or quotation marks. In addition, there is often used few databases and few other sources or methods for retrieving information other than searching databases (Greyson et al., 2019; Maggio et al., 2011; Salvador-Olivan, Marco-Cuenca, & Arquero-Aviles, 2019; Sampson & McGowan, 2006).

Journals often have a maximum length for submitted articles, which makes it challenging to integrate all details of a search into the methodology chapter and this often leads to an abbreviated reporting of the literature search. Sampson et al. (2008) looked into reporting practices in systematic reviews and found a difference in reporting for systematic reviews published in journals and those published by Cochrane. Systematic reviews published in journals more frequently reported the search by listing key words; without mentioning whether they were subject headings or text words, and without describing how they were combined. Cochrane reviews more often presented a full Boolean search. However, as the study is ten years old one could assume this practice may have slightly changed due to an increased focus on reporting, but as shown, this is not the reality.

Inaccurate naming of databases is a common problem (Koffel & Rethlefsen, 2016). This may lead the reader not to know precisely which sources are searched. The explanation for it is that platform names are sometimes mistakenly reported as name of databases in reviews, such as EBSCO or Ovid, which are two of the platforms many databases is offered through (Rethlefsen, Murad, & Livingston, 2014). Databases can be accessed through several interfaces and thereby have different search syntax and they may have different coverage of content from different vendors (Rader, Mann, Stansfield, Cooper, & Sampson, 2014). Another common problem is the lack of a search dates in the reviews (Faggion et al., 2018; Koffel & Rethlefsen, 2016; Maggio et al., 2011; Mullins et al., 2014). Lack of search dates will make it impossible to know which studies could potentially have been included based on their publication date, and how up to date the review is (Rader et al., 2014).

In order to guide authors on reporting, several reporting guidelines has been developed. For systematic reviews, PRISMA is the most common. PRISMA includes two reporting items related to the conducting of systematic review searches. Journals endorsing PRISMA has been documented to vary in different fields, from 11% in hematology and oncology journals (Toews et al., 2017) 19% in surgery journals (Smith et al., 2015), 28% in nursing journals (Tam, Lo, & Khalechelvam, 2017). Reporting guidelines are also meant as a tool in the peer review process to ensure quality on the reporting of systematic reviews. But PRISMA has only been documented to appear in peer reviewers instructions in only one out of five journals (Hirst & Altman, 2012). In this thesis, reporting standards are elaborated in chapter 2.5.

1.1.2 Journal author instructions

Through its instructions for authors, journals give guidance on the expectations for manuscripts submitted for publication. There are no standards for what the instructions for authors should include, but the information can be categorized in four categories: formatting, general information, specific information and scientific information, where methodological requirements are categorized as scientific information (Schriger, Arora, & Altman, 2006). In their study, 57% of 166 journals included scientific information.

The International Committee of Medical Journal Editors (ICMJE) encourages journals to instruct authors to follow existing reporting standards for different types of studies. For systematic reviews, they promote PRISMA (International Committee of Medical Journal Editors, 2017). According to the ICMJE criteria, it is mandatory for authors of systematic

reviews to state how they located, selected, extracted and synthesized data. Requirements concerning the quality of this reporting is not provided.

Even though more and more journals recommend PRISMA as a reporting standard, there are journals who have their own specific suggestions for systematic review reporting. One example is Implementation Science where the following is stated on how to report literature searches for systematic reviews (Implementation Science):

> ***Searches:*** *search terms and languages, comprehensiveness and effectiveness of the search, search strings and/or combinations of searches, databases, searches for grey literature i.e. contacts, searches on internet, use of specific search terms or strings, filtering or limitations and literature provided directly by stakeholders. Tables and lists of bibliographies, search terms and databases or other information can be provided as additional files.*

Biocic, Fidahic, and Puljak (2019) surveyed, among other topics, requirements to systematic review searching in journal author instructions as a commentary article. 46% of the journals mentioned reporting guidelines, and 19% gave additional instructions on reporting on the literature searches. Unfortunately, the details of these instructions are not published.

Even though there are reporting guidelines, meant for journal implementation, there are still being published systematic reviews where the searches are not adequately reported. It is therefore interesting to look into whether or not the instructions for authors are being used as a tool for reporting of systematic review searching. This can be found out by reading author guidelines. It has not been possible to identify studies on the journal requirements to systematic review searches in addition to the topics covered. With this as a background, there is a need for investigating if journals have guidelines for reporting systematic review searches, whether it is PRISMA, other guidelines or none.

1.2 Aim of study and research question

The aim of this study is to examine the author guidelines in medical journals, and investigate how, if present, written guidelines and requirements on how to report on the systematic review searches are formulated.

The research question is:

> How do a selection of medical journals instruct authors to report systematic review searches?

In this thesis, systematic review searches are limited to the use of information sources and other search related activities. This is done to set a clear limit of which steps from the process of conducting a systematic review to include in the data collection and not. Reporting of the process of turning a research question into search terms, and the selection of which sources to search are examples of activities that are not a part of this survey.

1.3 Overview of thesis

This thesis is written as a monograph and are organized as followed:
Chapter 2 describes the background and rationale for this survey. I will present the outlines of the process of literature searches for systematic reviews and how they can be documented and reported, to show the connection between executing systematic review searching and reporting the process. Chapter 2 also consists of a review of methodology for systematic review searches, and what the different reporting standards require of such searches, and will be used as a background for the analysis of the results of the survey. Research related to these will also be presented here. Chapter 3 describes the methodological choices for the survey and a description on how the data collection was planned and carried out. Findings from the survey will be presented in chapter 4 and discussed in chapter 51. In the discussion chapter, findings from the survey are seen in the context of topics covered in chapter 2. Conclusions, implications for practice and suggestions for further research is presented in chapter 6

2 Systematic review searching: methodological requirements

In this chapter, an overview of reporting of systematic review searching and existing reporting guidelines will be presented. Identified challenges in reporting will also be addressed. To set reporting in context, a presentation of the methodological requirements for systematic review searching will be given.

2.1 What is systematic review searching

A systematic review is a review article with the aim to synthesize all relevant research on a given topic and to answer a specific question. These reviews has their origin in clinical medicine and questions on effect of interventions (Green et al., 2011) . There are methodological requirements for making such a review, including the execution of the literature search, described in, among other, Cochrane Handbook for Systematic Reviews of Interventions (Higgins, Green, & Cochrane Collaboration, 2011). And in contrast to the classical narrative review, systematic reviews are considered a primary research article (Foster & Jewell, 2017).

As the literature search functions as the data collection, it needs to be prepared and executed by explicit, reproducible methodology. These searches differ from ordinary literature searching as they are prepared well in advanced of searching, are prepared by certain methodology and are targeted to a specific research question with criteria for inclusion and exclusion. Librarian time spent on supporting services in systematic reviews, has been documented to be an average on 30 hours. This includes interview of the review researches, making the search strategy and translating it into all databases, documenting and delivering the search, and write methodology for the review. Instructions of review authors and other (undefined) tasks are also included (Bullers et al., 2018), which are tasks beyond the domain of this survey.

Cooper et al. (2018) reviewed methodology handbooks from major organizations specializing in producing systematic reviews and identified eight key steps in the process of literature searching. Three of the steps concerns the preparation of the search; 1) who should literature search, 2) aims and purpose for literature searching, 3) preparation, three steps concerns the execution of the search; 1) the search strategy, 2) searching bibliographic database searching [sic], 3) supplementary searching, one step on reference management and one step on reporting the search process. The methods for literature search for systematic reviews includes systematic searching article databases, citation searches, search in reference lists, hand searching journals,

searching for unpublished studies, searching for grey literature and contacting experts in the field for additional literature and data (Centre for Reviews and Dissemination, 2009; Cooper et al., 2018; Lefebvre et al., 2011; Polit & Beck, 2017, pp. 651-652). Table 1 gives an overview of the search methods presented in handbooks from systematic review organizations in health as described by Cooper et al. (2018). This will later be compared with the content of reporting, and in the end compared with the findings of the survey.

The table is sorted by frequency of the search methods (Cooper et al., 2018). Searching electronic databases are the primary and most common method for retrieving literature, and are mentioned in all handbooks. The second most used method is hand searching key journals, followed by contacting individuals, companies or organizations for additional literature, searching the Internet and searching reference lists of relevant studies. Later in this chapter, reporting items in guidelines will be compared with the content of this table, to see how they match.

Table 1 Search methods from handbooks of leading organizations

	Campbell Handbook[1]	**The CRD handbook[2]**	**The Cochrane Handbook[3]**	**IQWiG[4]**	**JBI[5]**
Searching electronic databases[#]	√	√	√	√	√
Hand searching key journals	√	√	√		√
Contacting authors, experts or manufactures		√	√	√	
Searching relevant internet sources[$]	√	√	√		
Scanning reference lists of relevant studies	√	√			√
Searching trial registers		√		√	
Conference abstracts or proceedings	√		√		
Unpublished and ongoing studies	√		√		
Other reviews	√		√		
Citation searching		√			
Institutional repositories	√				
Clinical practice guideline databases				√	
Other data sources				√	

Reference database, electronic database, bibliographic database, online database are considered synonyms., $ Web searching/ Internet searching/ Searching specific websites. 1 Kugley S et al. (2017); The Campbell Collaboration (2014), 2 Centre for Reviews and Dissemination (2009), 3 Higgins, Green, et al. (2011), 4 Institute for Quality and Efficiency in Health Care (IQWiG) (2014), 5 The Joanna Briggs Institute (2014)

These organizations often publish their own handbooks to inform their researchers and readers about their working methodologies. The handbooks provide detailed information on how the

particular organization prepare a systematic review, given their resources and priorities. The handbooks thereby also contain information on how the process of literature searching for systematic reviews are conducted in the given organization, as the depth and breadth of the search process may vary. Researchers in these organizational are obligated to follow their handbooks. Any other researcher can conduct a systematic review, but are not obligated to follow a specific written methodology, although they should. Concerning the quality of conducting and reporting systematic reviews, it may therefore be a point to distinguish between systematic reviews published by these organizations and those published by others as articles in journals. But one should also to have in mind that these organizations may publish their reviews in journals as well, and that other researchers may use these handbooks in their work with systematic reviews.

2.2 Reducing bias in systematic reviews

In a systematic review it is crucial to reduce different biases in order to draw the right conclusions, and some biases are potentially somewhat reduced by a systematic literature search. Publication bias occur when the result of a study decides whether or not the study is being published and where, such as studies showing effect, in contrast to studies not showing effect. Negative research results are more likely not to be published, or to be published in a non-English journal, or a low-ranking journal. Positive results, in clinical trials, are more likely to be published, and to be published faster than negative results or null results (Hopewell, Loudon, Clarke, Oxman, & Dickersin, 2009; Sterne, Egger, & Moher, 2011). A systematic search includes searching across all relevant and available databases using a predefined set of search terms. The search should strive to be as objective as possible, meaning that the search terms should include all synonyms and spelling variations that can be used for the different aspects of the research question. To balance the search, should also include relevant antonyms to get a search results which include the effect of the objective (in the research question) as well as the adverse effects.

Language bias can happen when a search result is limited to some languages only. Studies have investigated the hypothesis that negative results tend to be published in non-English journals, and the results vary (Egger et al., 1997; Sterne et al., 2011). Limiting a search by date of publication, language or study design may be an option to reduce the search result and thereby ease the work of the reviewers. But, using limits should be reasoned as it is debated and one may lose relevant studies. One example is that studies with non-significant results are more

likely to be published in non-English language, and limiting by language may potentially lead to biased conclusions in the review (Egger et al., 1997; Sterne et al., 2011). Including studies from potentially all languages, a research group need to have recourses to translate the findings or handle them in other ways, and this is not always possible.

Location bias has to do with certain research results are being published in certain publications, which are available in certain ways, and how thorough they are indexed. There may be a big potential in retrieving unpublished studies as these are sources that may reduce a risk of bias as negative results is more likely not to be published (Hopewell et al., 2009). So, searching trial registers, contacting researchers and industry in the field for unpublished or preliminary data is also parts of the methodology. Grey literature, conference abstracts and other non-academic or non-peer reviewed publications are also searched. Citation searching is using relevant articles as a source for identifying additional studies. One may use a citation database to track which articles has cited another, or screen the reference list of relevant studies (Lefebvre et al., 2011). Hand searching journals is to manually go through a selection of relevant journals, page by page in order to identify relevant articles. Usually, a selection of years/ volumes is made (Centre for Reviews and Dissemination, 2009; Lefebvre et al., 2011).

When conducting a systematic review search, there is a need to balance sensitivity/ recall and specificity/ precision of the search. This means the goal for the search is to include as many relevant (ideally all relevant) studies as possible, and exclude as many non-relevant studies as possible, so the number of references needed to screen is as low as possible without it compromising the relevance. A sensitive search will include potentially all relevant studies, but the number of non-relevant studies will be very high. One may need to screen a very high number of references to find one to include. If the search strategy is very specific and have a high recall rate, one has a high number of relevant studies and low number of irrelevant studies, but one may risk to miss other relevant studies (Gillespie & Gillespie, 2003; Lefebvre et al., 2011). Measures for this is number needed to read; how many references are needed to be screened to include one relevant study, or number needed to retrieve; i.e. when is a search good enough and when to stop searching a database (Booth, 2006b; Ross-White & Godfrey, 2017).

The search results for these searches often end up being thousands of references, and unlike the ordinary literature search where the author pick some relevant references, the review authors screen the full result for studies to include, based on a list of predefined inclusion and exclusion

criteria. The searches for systematic reviews are ideally conducted in such ways that they reduce these biases as much as possible, and this needs to be communicated to the reader of the review. The review authors therefore need to prepare and report the review in such ways that readers of the review can be able to assess the quality of the systematic review, and make a judgement if it is of such quality that it is possible to use in e.g. a clinical guideline. The search needs to be transparent and documented, and should be described in detail as part of the methodology in the review article. Proper search documentation can extend across several pages due to the very complexity of searching reference databases. If a search is done in various databases (and interfaces), the search terms and search syntax need to be tailored to each source, and a transcription of each search in each database would be needed if the search is to be reproducible. An exact transcription of the searches can often be published as an attachment to the review, or they can be published in an open online repository which is done by Falconer (2014).

In order to support the different stages of literature searching and making it possible to take evidence-based choices for conducting, reporting and assessing searches, several guidelines have been developed. Some of these apply to literature searches in general, and some systematic review searching specifically. Relevant are also guidelines for systematic reviews, as they contain among other, elements relevant for literature searching. In

Table *2* such guidance is listed, in a non-exhausting list. There are guidelines developed to improve the development, the reporting and assessment of searches, organized by the work process for developing and conducting searches. Reporting guidelines are elaborated in section 2.5.

Table 2 Guidelines supporting stages of literature searching for systematic reviews

Development of literature searches	
Conducting literature searches for systematic reviews	- Cochrane Handbook of Systematic Reviews of Interventions - CRD's guidance for undertaking reviews in health care (Centre for Reviews and Dissemination, University of York) - Joanna Briggs Handbook - Searching for studies: a guide to information retrieval for Campbell systematic reviews.
Peer review of literature search	- PRESS Peer Review of Electronic Search Strategies
Reporting of literature search	
Reporting systematic reviews incl. literature search	- PRISMA – incl. its extensions - MOOSE (Meta-analyses of observational studies in epidemiology) - The Institute of Medicine's Standard for Systematic Reviews - Centre for Reviews and Dissemination Guidance - The Methodological Expectations of Cochrane Intervention Reviews (MECIR) - Joanna Briggs reviewer's manual
Reporting literature searches	- Atkinson, K. M., Koenka, A. C., Sanchez, C. E., Moshontz, H., & Cooper, H. (2015). Reporting standards for literature searches and report inclusion criteria: making research syntheses more transparent and easy to replicate. *Res Synth Methods, 6*(1), 87-95. doi:10.1002/jrsm.1127 - Booth, A. (2006). "Brimful of STARLITE": toward standards for reporting literature searches. *Journal of the Medical Library Association, 94*(4), 421-e205. - Kable, A. K., Pich, J., & Maslin-Prothero, S. E. (2012). A structured approach to documenting a search strategy for publication: a 12 step guideline for authors. *Nurse Education Today, 32*(8), 878-886. doi:10.1016/j.nedt.2012.02.022 - Kugley S, Wade A, Thomas J, Mahood Q, Jørgensen AMK, Hammerstrøm K, & N., S. (2017). *Searching for studies: a guide to information retrieval for Campbell systematic reviews*. - Niederstadt, C., & Droste, S. (2010). Reporting and presenting information retrieval processes: the need for optimizing common practice in health technology assessment. *International Journal of Technology Assessment in Health Care, 26*(4), 450-457. doi:10.1017/s0266462310001066 - Rethlefsen, M., Ayala, A. P., Kirtley, S., Koffel, J., & Waffenschmidt, S. (2019). PRISMA-S Draft 1. Retrieved from https://doi.org/10.17605/OSF.IO/7NCYS
Quality assessment of literature search	
Assessing systematic reviews incl. literature search	- AMSTAR2 - ROBIS - Checklist from CASP - The Cochrane Risk of Bias Tool

2.3 Reporting and reproducibility of literature searches

To report literature searches adequately, there is a need to document the search process while working in order to not make mistakes in the reporting. Rader et al. (2014) discuss which elements of a search should be documented, why and in what detail. The summary of their findings is that database, database platform, other sources (if non-database), search dates, timeframe of search – including database coverage dates, search strategy and number of records retrieved, are elements that needs to be documented.

Searches are ideally reported in way so that readers can make their own judgement on whether the decisions concerning which sources searched, search terms used, language limitations, filters for study designs, among other are good enough or if important elements are missing. Some examples of details that needs to be elaborated in search reporting is shown below.

Concerning reporting the names of academic reference databases, these are often offered by various vendors, with their own platforms/ interfaces. Different search interfaces have different solutions for how a literature search is executed. The differences are often how search terms and search fields are expressed (Rethlefsen et al., 2014). Examples are MEDLINE which is available through the platforms from EBSCO, ProQuest, Ovid and PubMed, and PsycInfo is available through EBSCO and Ovid. Concerning MEDLINE on Ovid, there are also different years covered depending on the subscription, so years covered by the search also needs to be reported (Rader et al., 2014). Trying to execute a search in the wrong database, in the wrong interface, or with the wrong field codes may return a very different search than the original search (Bell, 2018), so this should be clear for the ones assessing a literature search.

There is also a variation in possible limitations, example whether or not it is possible to limit by study design, and which filter is being used for this. This has implications for the search results. In Ovid MEDLINE and PubMed, the search filters for retrieving randomized controlled trials are somewhat different in the way they are set up, and they will possibly retrieve different number of records (Health Information Research Unit, 2016). Using validated and published search filters, there is also good scientific practice to cite them, and this should be explicit in the reporting of the search (Lefebvre et al., 2011).

If screening a selection of journals is done, called hand searching, one much used approach on reporting it is to state "relevant journals are screened for additional studies". There is a need to report which titles and years/ volumes/ issues is included. And how much of the content is screened; is it only table of content that is screened, or a more in depth reading of the content (Lefebvre et al., 2011).

Most medical databases use subject headings in their indexing, and these are also utilized when searching in combination with free text terms. The subject headings are tailored to specific databases and are expressed differently from one another. Free text terms are the authors own words in searchable fields such as title and abstract (Lefebvre et al., 2011). Documenting searches who has utilized both free text terms and subject headings, it is important that it is possible to distinguish them from each other, and to know which search fields are used when.

There are several dates that needs to be reported in systematic review searching. The dates covered by the databases, the dates of execution of searches and if any date limitations is done. If an update of searches is done during the time of preparing the review, these dates also needs to be reported.

Database searches are difficult to report in the body of text in an article, so as mentioned earlier, including these in the appendices of the review by copying and pasting them exactly as run, is the preferred way of documenting the searches as reproducible as possible (Lefebvre et al., 2011). As text mining and machine learning are emerging as a methods in systematic review searching, transparency and reproducibility will meet new challenges (Lefebvre, Glanville, Wieland, Coles, & Weightman, 2013). And even though reproducibility is an ideal, and are addressed in several studies (Koffel & Rethlefsen, 2016; Maggio et al., 2011; Mullins et al., 2014), these have investigated whether searches are reported in full, and not necessary rerun the searches, see if they retrieved the same results and thereby observed the actual reproducibility.

2.4 Critical appraisal of systematic reviews

To include a systematic review in a clinical guideline, it needs to be critically appraised and the methodological quality needs to be at an acceptable level (Shea et al., 2017). Critically appraising is concerned the methodological quality of a review and not the results of the review. The results of the appraisal will say something about the quality of the results and whether or

not one may trust them. For readers to make a qualitative judgement of the methodologies in the review, this needs to be reported (Higgins, Altman, & Sterne, 2011; Polit & Beck, 2017).

Critically appraising a systematic review, includes an assessment of the literature search, and it is therefore necessary that the literature searches are reported so it is possible for others to assess how they was carried out (and potentially replicate them). If the literature search is not comprehensive, the data collection is insufficient and one may miss relevant studies and data, which may lead to a biased conclusion in the systematic review (Young & Eldermire, 2017). What is crucial in reporting a literature search as reproducible as possible is to report it in such detail that it is possible for others to replicate the same search in the same sources and retrieve the same result. A systematic review search is typically reported by describing the search in the methodology section, by including an exact transcription of the search in an appendix, or both. This means that they are describe in such detail that it should be possible for others to reproduce the search and (in theory) get the same result. To do this one must know which databases are used and which search interface or platform are being used.

There are developed several tools for critical appraisal of systematic reviews, see

Table 2. In the following, *Table 3 AMSTAR2 appraisal items concerning search* an example of the questions related to searching in AMSTAR2, reporting items 2 and 4 (Shea et al., 2017) is given:

Table 3 AMSTAR2 appraisal items concerning search

2. Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?	
For Partial Yes: The authors state that they had a written protocol or guide that included ALL the following:	For Yes: As for partial yes, plus the protocol should be registered and should also have specified:
- review question(s) - a search strategy - inclusion/exclusion criteria - a risk of bias assessment	- a meta-analysis/synthesis plan, if appropriate, and - a plan for investigating causes of heterogeneity - a plan for investigating causes of heterogeneity
4. Did the review authors use a comprehensive literature search strategy?	
For Partial Yes (all the following):	For Yes, should also have (all the following)
- searched at least 2 databases (relevant to research question) - provided key word and/or search strategy - justified publication restrictions (e.g. language)	- searched the reference lists / bibliographies of included studies - searched trial/study registries - included/consulted content experts in the field - where relevant, searched for grey literature - conducted search within 24 months of completion of the review

Search strategy must be reported in order to get partial yes, though there are no requirements to what a search strategy should include. AMSTAR2 list a series of sources needed to be searched in order to minimize bias. Dates of searches must be listed, as well as search terms and potential limitations of the search.

2.5 Guidelines for reporting systematic review searches

To standardize methods for reporting research and thereby help the authors, several reporting guidelines have been developed and tailored to specific research designs (Foster & Jewell, 2017). A reporting guideline is not a handbook on how to do research, but an aid for authors on

how to describe the methodological choices taken, in order to make their articles comprehensible, reproducible and trustworthy. In the context of this thesis, there are two relevant types of guidelines: the reporting guidelines for systematic reviews, which includes how to report the searches, and reporting guidelines for literature searches.

Some of the organizations specializing in conducting systematic reviews publish their own reporting guidelines their researchers have to follow, such as MECIR from Cochrane (Higgins, Lasserson, Chandler, Tovey, & Churchill, 2018), CRD's guidance for undertaking reviews in health care (Centre for Reviews and Dissemination, 2009) Campbell (Collaborations) systematic reviews: policies and guidelines and their guide for information retrieval which includes a chapter on reporting (Kugley S et al., 2017), and Joanna Briggs Institute's reviewers manual (The Joanna Briggs Institute, 2014). Other guidelines are targeted to researchers in general, are validated and published in scientific journals, such as MOOSE and PRISMA and its extensions.

Cochrane developed MECIR as a reporting guideline with a minimum set of requirements their authors need to follow (Higgins et al., 2018). This reporting guideline consists of a number of requirements that are either mandatory or highly desirable, where standard C24-C38 concerns the literature search. By following MECIR, it would be possible to recreate all searches in all databases (MECIR standard C36 Documenting the search process).

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is an evidence-based guideline for reporting methodology for systematic reviews. It is developed on the background of lacking common reporting practices (Moher, Liberati, Tetzlaff, Altman, & Group, 2009; PRISMA group, n.d.). It can be regarded as an update of QUOROM (QUality Of Reporting Of Meta-analyses) which was published in 1999. According to the PRISMA website, five editorial organizations and 179 journals endorsing PRISMA (September 2018).

PRISMA is tailored to journal publication of systematic reviews, where there often is a limitation on article length by a word count, which may compromise reporting of the methodology. It consists of a checklist and a flowchart for authors to fill in and attach to their publication. The background and development are described in one article and explained and elaborated in another (Liberati, A. et al., 2009; Moher et al., 2009). The checklist has several

extensions tailored to different aspects of systematic reviews and more is in development[1]. In March 2018, the PRISMA website announced that an update of the PRISMA Statement is under development, but it was not published until this thesis was finished.

In Table 4 the reporting items in handbooks from selected organizations, and PRISMA are summarized for comparison. The handbooks differ slightly in which search elements should be reported, and the only common reporting items are date of search in reference databases and naming of databases. The terminology for the same element can also differ from one guideline to another. The most common reporting items are date of search in reference databases, name of reference databases and contact with study authors or industry (which are merged in this summary), followed by reporting of a full, reproducible search of minimum one database.

Comparing these reporting items with the summary of search methods in Table 1, database searching is the most common way of searching for systematic reviews, next is hand searching and contacting authors, experts and/ or manufactures. This is to a great extent reflected among the reporting guidelines, expect that hand searching is only mentioned in two of the reporting guidelines. Guidance on how to conduct searches are mainly about which sources to use, while guidance on reporting include reporting of sources, as well as present when and how the sources were used. Although there are variations in the level of details.

Table 4 Reporting items from reporting guidelines

	The CRD Handbook	**Campbell Handbook**	**MECIR**	**PRISMA**	**IQWiG**	**JBI**
Date of search: reference databases	√	√	√	√	√	√
Name of reference database	√*	√	√*	√*		√
Contact with study authors or industry[#]	√	√	√	√	√	
Present full search strategy of *one* database, incl. limits, so it can be replicated	√			√		√
Grey literature sources		√	√			√
Database platform/ provider	√		√		√	
Number of references retrieved from search	√			√	√	

[1] PRISMA for Abstracts; PRISMA Equity; PRISMA Harms (for reviews including Harm outcomes); PRISMA Individual Patient Data; PRISMA for Network Meta-Analyses; PRISMA for Protocols; PRISMA for Diagnostic Test Accuracy. In addition, there are extensions in development: for Scoping Reviews (PRISMA-ScR); for Children (PRISMA-C) and Protocols for Children (PRISMA-PC).
http://prisma-statement.org/Extensions/Default.aspx

Present full search strategy of *all* databases, incl. limits, so it can be replicated		√	√		√	
Web sites incl. full name and URL	√		√			
Hand search of journals, provide list of journals, years, possible missing issues not searched.	√	√				
Search for conference proceedings: conference name	√	√				
Reference lists of included studies	√	√				
Web sites, include search terms, date searched	√	√				
Detailed description of search in appendix	√		√			
Information sources such as Trial registers			√			
Search terms for trial registers			√			
Search terms for grey literature			√			
Other search methods, not specified	√					
Citation searching	√					
Data sources in abstract				√		
Describe the search process	√					
Language restrictions		√				
Publication status restrictions		√				

*= included date coverage of database, #: Contact with authors or industry are merged in this summary.

There have also been other initiatives on developing a standard for documenting and reporting literature searches. This has mainly come from the domain of information specialists, who has seen the need for standardizing search reporting. (Atkinson, Koenka, Sanchez, Moshontz, & Cooper, 2015; Booth, 2006a; Kable, Pich, & Maslin-Prothero, 2012; Niederstadt & Droste, 2010). Whether these are established and utilizes by librarians and information specialists are unknown.

As of March 2019, PRISMA-Search is under development (Rethlefsen, M., Ayala, A.P., Kirtley, S., Koffel, J., & Waffenschmidt, S. , 2019). The rationale behind PRISMA-Search is the lack of attention to details in search reporting in other reporting guidelines and from review authors, which is reflected in the research on reporting quality. Other reporting guidelines have not been detailed enough concerning important details on how to make a search reproducible, for example date ranges searched and how to report web searches. PRISMA-Search will also include the use of new technologies in searching, such as text mining and artificial intelligence. In order to keep transparency in reporting of these, there is a need for special reporting

guidelines such as this one. Now being able to link a reporting guideline for search to PRISMA is considered a huge advantage in regards to implementing it in journals (Rethlefsen, Koffel, & Kirtley, 2019).The draft of PRISMA-Search consist of 13 reporting items for searching and include elements on innovations such as text mining, use and citation of search filters and the peer review process of development of the search (Rethlefsen, M. , Ayala, A.P., Kirtley, S., Koffel, J., & Waffenschmidt, S. , 2019).

2.6 Identified challenges of reporting of systematic review searching

Problems in reporting occurs when details get lost on expense of word count and other crucial details in a systematic review. This is documented in a survey among 180 information specialists, Rader et al. (2014) surveyed practices and difficulties on internal documenting and reporting. Their main findings relate to the importance of reporting, and the need researchers have of help regarding which elements to report. Enough time is mentioned as a key factor for better documentation and adequately reporting. They also revealed unclear roles regarding who has the responsibility for reporting the search: the authors of the article or the information specialists who did the searches. Half of their 180 respondents among information specialists assumed they were responsible for the methods section and reporting of the search. Another majority of the respondents said they often provided authors with a text draft of the search, and left it to the authors to finish the text. If this implies there are authors not doing the search, but nonetheless report on it in an article. They may lack attention to details on the search and willingness to use precious manuscript space to report searches, and this may be reasons for inadequate reporting of searches. Involving librarians in systematic review searching correlates with better quality on the searches, and better reporting of the searches in the finished reviews, although there still are room for improvement (Koffel, 2015; Meert, Torabi, & Costella, 2016; Rethlefsen, Farrell, Osterhaus Trzasko, & Brigham, 2015).

Journals often have a maximum length for submitted articles, which makes it challenging to integrate all details of a literature search into the methodology which often leads to an abbreviated reporting of the literature search. (Sampson et al., 2008) looked at differences in reporting practices in systematic reviews published in journals and those published by Cochrane. Systematic reviews published in journals more frequently reported the search by listing key words; without mentioning whether they were subject headings or text terms, and without describing the combination of the terms. In this, a small number of the included systematic reviews did not present search terms or databases. Cochrane reviews more often

presented a full Boolean search. However, as the study is ten years old, this practice may have changed due to an increased focus on reporting.

Another objective of Sampson et al. (2008) was to identify consensus on how to report literature searches for systematic reviews. They identified eleven guiding documents: appraisal instruments, reporting checklists, reporting standards and reporting guidelines. These were both reporting guidelines for systematic reviews and guidelines specifically for reporting searches. Across the eleven documents, 18 different reporting items were identified, though only one of these appeared in all documents: name databases used. Since this review was published, more reporting guidelines has been published or updated. Nonetheless, no new comparison of the reporting items concerning search has been identified.

The role Cochrane has as an organization producing a large number of systematic reviews according to a well-established handbook, and their effort in doing methodology research, their systematic reviews is currently recognized as a gold standard. One could therefore expect the execution of their searches and reporting would be satisfying. An assessment done by of the reporting of searches in 65 systematic reviews published by Cochrane, found that neither of them included the seven criteria for the then current reporting standard for literature searches (Yoshii et al., 2009). At that time, the Cochrane Handbook (version 4.2.5, updated May 2005) included the following reporting items: Databases searched, Name of host, Date search was run, Years covered by the search, Complete search strategy, One or two sentence summary of the search strategy, Language restrictions. Most commonly (35%), four of the reporting items was present. All systematic reviews included name of databases. The least reported items were date of search (11%) and name of database host (17%). The implications of an unaccounted date of search makes its novelty and originality uncertain - how recent or how far back in time the search was conducted. When updating a systematic review, one may meet unnecessary obstacles when the search dates or database host are missing. None of the studies mentioned has considered is that the authors may have documented the searches in full and have a copy available on request, but it should not be necessary to contact authors for this essential information.

There are several studies examining the quality of reporting of systematic reviews published in journals who have endorsed PRISMA. Concerning the literature search, one study including 74 nursing journals, concludes that the adherence to PRISMA checklist item #7 is respectively

100% in journals endorsing PRISMA, and 97% by journals not endorsing the checklist. However, endorsing PRISMA gives no impact on reporting of these two reporting items or not. The result also reveals that presenting a full search strategy (item #8) is relatively low in both groups of journals, 14% for endorsed journals and 11% for journals not endorsing PRISMA (Tam et al., 2017).

Page et al. (2016) reviewed 300 published systematic reviews, and 29% of the included reviews used PRISMA. This study is an update of a study from 2004 and a comparison between the two were done. Regarding the characteristics of literature search, the criterion for reporting a complete search strategy for one or more databases has only increased by 3 percentage points (from 42% - 45%). Yet, the results did not distinguish between presenting one or all search strategies (Page et al., 2016).

Concerning the use of reporting guidelines in the peer-review process, one study of medical journal is identified. In a sample of 116 journals, 19 journals were included in a sub-sample mentioning reporting guidelines, and PRISMA was referenced as the guidelines for systematic reviews in 21% of the journals. Interestingly, QUOROM which is the precursor of PRISMA since 2009, was also referenced in 21% of the journals, meaning that for systematic reviews there were provided guidelines in 42% of the sub-sample, 7% of the sample of 116 (Hirst & Altman, 2012).

In July 2018, a meta-analysis was retracted partly due to an inadequately literature search, as the quality of the reporting of literature search was insufficient (Plos One Editors, 2018). A PRISMA checklist was attached to the article, with a presentation of a "full electronic search strategy for at least one database, including any limits used, such that it could be repeated». Nonetheless, this was nowhere to be found in the whole article. So, even though reporting according to PRISMA is recommended and required, there are still being published systematic reviews where reporting of the literature search is unsatisfying. And the consequence of that may be a retraction of the review. With this as a background, there is a need for improvement of the quality of reporting of the systematic review searches.

2.7 Summary

As seen in this chapter, reproducible reporting of systematic review searching is crucial for the quality of systematic reviews, and further – for making trustworthy guidelines. The quality on

reported searches are shown to be low, and studies have shown published systematic review searches have limitations that affect the search result and plausibly the result of the review.

There are guidelines for conducting systematic review searches, and there are guidelines on how to report these searches in review articles. These serves as support for review authors on how to report adequately, and makes it possible for readers to critical appraise systematic reviews, and their searches, in order to include them in clinical practice guidelines.

If the reporting of searches is poor, it will be difficult to assess how the searches are done, as it will be difficult (or even impossible) to distinguish poor reporting from potentially poor conducting of searching. This also complicates research on systematic review searches.

3 Methods

In this chapter I will present the methodological choices made in this study, give a description of the sample, design of the data extraction form and explain how the data was extracted and analyzed. Finally, ethical considerations are addressed.

3.1 Methodological choices

This master thesis is a survey with a cross sectional survey design, which is a design for obtaining information of a phenomenon at a given time in a certain population (Jann & Hinz, 2016; Joye, Wolf, Smith, & Fu, 2016; Polit & Beck, 2017, pp. 168-170). Since there are several thousand medical journals, it would not be possible to investigate author instructions in all of these, and therefore a sample is used. With a representative sample, the result from the survey can be used to generalize from the sample to a bigger population. The findings will be presented by descriptive statistics in chapter 4 and discussed in chapter 5.

3.2 Sample

Other studies on similar topics (reporting and quality of literature searches, adherence to reporting guidelines, adherence to author instructions) have chosen their sample mainly in four different ways (a non-exhaustive list): a) journals from the top 10 journals in specific Journal Impact Categories (Biocic et al., 2019; Koffel & Rethlefsen, 2016; Rethlefsen et al., 2015); b) journals on a specific topic which are indexed in a specific database, e.g. dentistry journals indexed in MEDLINE (Faggion et al., 2018); c) journals retrieved by searching a specific topic or methodology (Mullins et al., 2014; Page et al., 2016; Pieper & Mathes, 2017); or d) investigating Cochrane reviews specifically (Yoshii et al., 2009).

As I wanted to investigate the research topic on medical journals in general, I was looking for a more random sample. Taking into the account the benefits of data sharing and investigating the same data from different perspectives, such an approach was chosen for this study. Page et al. (2016) published a big study on the reporting characteristics in 300 systematic reviews published in 182[2] different journals. The data set was selected because it is open and available. Other reasons are the size, it is quite big, and it is broad in clinical specialties. The sample is also used in other studies (Pieper & Mathes, 2017).

[2] The study reports that 185 journals were identified. But counting journals in their available data, it turned out to be 182 unique journals.

Page et al. (2016) retrieved their sample by searching for systematic reviews indexed in Ovid MEDLINE[3] February 2014 using the following search strategy:

	Search strategy	Explanation of search strategy
1	201402$.ed;	Searching for articles that entered MEDLINE February 2014. Ed=entry date, search field for the entry date of references to the database. 2014 = year 2014. 02 = February.
2	limit 1 to English;	Limiting the search result to articles written in English.
3	2 and (cochrane database of systematic reviews.jn. or search.tw. or metaanalysis.pt. or medline. tw. or systematic review.tw. or ((metaanalysis.mp,pt. or review.pt. or search$.tw.) and methods.ab.)).	Search for: *The Cochrane database of systematic reviews* as journal title, or *search* as text word, or *medline* as text word, or *systematic review* as text word, or *Metaanalysis* as text word or publication type, or *review* as publication type combined with *methods* as text word in abstract.

Title and abstract of the search result were screened by the authors to meet the inclusion criteria, which was "… a systematic review if the authors' stated objective was to summarize evidence from multiple studies and the article described explicit methods, regardless of the details provided." (Moher, Tetzlaff, Tricco, Sampson, & Altman, 2007; Page et al., 2016). Finally, the included studies were screened using PRISMA-P to decide upon inclusion. Using this approach, the researchers made sure not to include other reviews which could be mistaken as systematic reviews. By doing this, journals publishing systematic reviews were identified and a random sample of journals considering clinical specialties is provided.

The data available from Page et al. (2016) consists of, among other, an Excel document of full reference to the systematic reviews included in their article (Page, Shamseer, & Moher, 2016).

[3] Ovid MEDLINE In-Process & Other Non-Indexed Citations and Ovid MEDLINE 1946 to Present

This document is available as supplementary material at the Open Science Framework[4] . The article and dataset are licensed with a Creative Commons Attributes License, which allows "unrestricted use and distribution, and reproduction in any medium, provided the original author and source are credited"[5]. For this survey, the list of references was reviewed and journal names of included studies were retrieved from the document. The author instruction of these journals was identified by searching Google for the journal home page, and from there find the link to the author instruction. Exclusion criteria for this survey were; a) author instructions were not openly available online; b) instructions were not in English; or c) the journal had been discontinued.

3.3 Designing the data extraction form

For collecting data, a data extraction form was developed. This was done to standardize the data collection as much as possible, and for having a tool to ease the work. Below, I describe the development, piloting and revision of the data extraction form. In a survey study it is crucial that the survey questions correspond with the research question, so the data collected can be used to answer the research question (Jann & Hinz, 2016). In this case, the research question was open for any requirements on reporting of systematic review searches.

The data extraction form consisted of two parts: 1) collection of background information, and 2) information on requirements on reporting of systematic review searches. Part one of the form contained open fields for filling out journal names, URL to journal home page, name of publisher, date of publication of author instruction etc. Part two was developed by looking at criteria in methodology literature for systematic review searches, reporting guidelines for these and other studies surveying reporting of searches as outlined in the previous chapter.

Information on whether the use of a reporting guideline was a requirement or a recommendation was noted. By doing this the form contained a matrix with over 100 boxes to tick off, in addition to the fields for filling out background data. The form was meant for internal use only, and set up as a webform hosted by my employer[6]. Output of the form could easily be exported as an Excel-form.

[4] osf.io/7mn8e
[5] https://creativecommons.org/licenses/by/4.0/
[6] https://nettskjema.uio.no

3.3.1 Piloting of the data extraction form

The data extraction form was piloted to test the criteria, the wording and the technical solution for the form, which could lead to a revision if necessary (Polit & Beck, 2017, pp. 175-176, 623-625) . Two librarians with experience in systematic review searching did the pilot together with myself. The pilot was done on 20 randomly selected journals. Randomness was achieved by using an online random number generator[7], the number corresponded with journals on a title list sorted alphabetical. My colleagues assessed 10 different each, and I assessed all 20 journals. This way the 20 journal author instructions were examined twice. These were later included in the final data collection. The data extracted from each journal was compared to see if there were conflicts or not. The major findings from the pilot test revealed that the form was inexpedient: if a journal had few or no recommendations on how to report systematic review searches, the form would end up with a lot of boxes ticked off in the "No" category. This was also making the data extraction complicated as the exported Excel form would be very difficult to read. The pilot also revealed that there were reporting items not retrieved by the setup of the form, e.g. *report search in abstract*. Because of these reasons, the form was heavily revised and simplified.

After the revision, the matrix of detailed questions on reporting was replaced by one open free text field: if there was identified requirements to report the literature search, the exact sentences would be extracted as they were for further analysis. The approach was turned from trying to fit the reporting requirements into predefined categories, into making categories out of the findings. The revised form was then tested on a sample of ten journals, where every 10th journal was selected, after which no more changes were deemed necessary. Due to time, this testing was done only by myself. Originally, the form was set up in Norwegian as it was only used as a tool for myself, but for this thesis, it is translated into English, and is available in Appendix I.

3.4 Data extraction

All author guidelines were downloaded on May 21 2018. The guidelines were saved as PDF for easy access and storage. Data were extracted from the author guidelines by close reading and searching the documents, using CRTL+F, for relevant information. Keywords used to search the texts were: systematic review, search, literature, information, retrieval, database, sources, prisma, mecir, moose, report. In addition, if the author guidelines linked to other

[7] https://www.random.org

instructive web pages (e.g. BMJ Author Hub, which is common for BMJ journals), these were also included in the data extraction.

3.4.1 Extraction of background information

For background information of the journals, webpages and author instructions were reviewed for information on publisher, publication date of author instructions. Information on Journal Impact Factor 2017 and Journal Impact Factor Subject Category was derived from InCites Journal Citation Reports. Journals may change publisher and it was therefore important to collect the publisher name at the same time as the data collection. Originally, the plan was to retrieve this information from various authoritative sources as the ISSN portal[8], Ulrichsweb[9], the National Library of Medicine Catalog[10], and the journals home pages. But, tests on retrieving this information uncovered discordance between the different sources and thus the information on the journal home page at the time of downloading the author instructions was used. The publication date of author guidelines was retrieved from the journal webpage.

Background information retrieved was: name of publisher, publication date, or update date for author guideline, Journal Impact Factor for 2017, Journal Impact Factor Category. This information was added to the same Excel-form as the other extracted data. General dates on the webpages such as Copyright date, or date for downloading is not considered a date of publication of the author instruction, and is therefore not collected.

3.4.2 Extraction of reporting instructions

Information related to reporting guidelines for systematic reviews was extracted.

These two definitions are used:

1. *Established reporting guidelines* are used for published and validated reporting guidelines such as PRISMA, MOOSE and MECIR etc.
2. *Journal specific instructions* are reporting instructions on searching mentioned in the author instructions, which are not related to the established reporting guidelines.

If reporting guidelines were mentioned, the name of the guideline was noted. The level of enforcement of reporting guidelines was categorized as either compulsory to use, or if the

[8] https://portal.issn.org/
[9] https://ulrichsweb.serialssolutions.com/
[10] https://www.ncbi.nlm.nih.gov/nlmcatalog

authors are encouraged to use them. Words like *advised, suggested, prefer, encouraged* were rated as recommended, and words like *required, must, should, need,* were graded as compulsory.

Compulsory:	Required/ must/ should
Optional requirement:	Recommended/ advised/ suggested/ encouraged
No requirement:	Not mentioned

Other than the established reporting guidelines, any information that could be linked to reporting the process of searching was collected. The exact text containing reporting requirements was copied as it was and pasted into the data extraction form.

How search related reporting was extracted and categorized is show below in *Table 5*. The example is included in the survey.

Table 5 Example of data extraction

Text from author instructions	**Extraction of search related reporting items**	**Categorizing of reporting items**
Review articles should include details of the authors' literature search methodology in the body of the paper, including selection of studies in Introduction, databases searched, search terms, inclusive dates, selection criteria.; The methods section of a Review should include details of the authors' literature search methodology in the abstract.	- details of the literature search methodology in the body of the paper	Describe search methods/ process
	- databases searched	Databases/ information-/ data sources
	- search terms	Search terms
	- inclusive dates	Date/ year limits in search
	- should include literature search methodology in the abstract	Describe search in abstract

Some author guidelines include formulations on research reporting that are so general that they are applicable to all kinds of research. One example is from the journal Cancer Science, which state that **"**Description of methods should be brief, but with sufficient detail to enable others to reproduce the experiments". These kinds of general formulations are not extracted as they are not targeted especially to literature searching.

3.5 Analysis of data

The collected data was analyzed quantitatively and are presented as descriptive statistics in the next chapter. The occurrence of the reporting guidelines mentioned is summarized and presented in numbers and percentages. The journal specific instructions were categorized according to what can be defined as separate stages of literature searching for systematic reviews, based on Table *2* and Table 4 in chapter 2. If the wording of two reporting elements was different, but could be interpreted as the same, these were merged in the summary table. An example of this is: a) report databases, b) report information sources, c) report data sources. The occurrence of each reporting stage was counted and presented in numbers and percentages. In the discussion chapter, the occurrence of journal specific instructions is set in the context of reporting guidelines of systematic review organizations and established reporting guidelines to see whether or not the journals are following best practice or not.

Background information is summarized and presented in numbers and percentages. The results are presented by basic descriptive statistics: frequency counts, ranking and percentages, calculated using Microsoft Excel.

3.6 Ethical considerations

This survey did not involve human or animal research, neither is it based on sensitive information or personal data of any kind, and approval from an ethics committee is therefore not needed (NSD Data Protection Services, 2019).

The reuse of the data from Page et al. (2016) is regulated by the Creative commons license their article is attributed with. Attribution 4.0 International (CC BY 4.0) allows for others to 1) Share: copy and redistribute the material in any medium or format and 2) Adapt: remix, transform, and build upon the material for any purpose, even commercially, as long as credit is given to the original creators.

The downloaded author guidelines and the extracted data is available from the author on request, as the format of it did not fit the format for appendix in this thesis.

The author has no conflicts of interests in this survey.

3.7 Summary

A cross sectional survey was chosen as method for answering the frequency of reporting items for systematic review searches. A freely available data set of 182 journals was selected, 179 journals were included in the survey. The author guidelines from these journals were reviewed and all reporting items concerning literature searches were extracted. These were categorized and are presented by frequency in numbers and percentages.

4 Results

In this chapter, the results of the survey are presented. In the first section the included journals will be described by publisher, Journal Impact Factor and Journal Impact Factor category. Publishing date of the author instructions will also be covered. In the second section, the main findings of this survey will be presented; the occurrence of instructions on reporting of systematic review searches.

As in chapter 3, these two definitions will be used to describe the findings:

1. *Established reporting guidelines* are used for published and validated reporting guidelines such as PRISMA, MOOSE and MECIR etc.
2. *Journal specific instructions* are reporting instructions on searching mentioned in the author instructions, which are not related to the established reporting guidelines.

In addition, it is distinguished between whether or not the instruction on using a reporting guideline is compulsory or an optional recommendation, as described in section 3.4.2.

Journal characteristics are presented by frequency in descriptive statistics, numbers and percentage (Polit & Beck, 2017, p. 356). Results related to requirements of reporting of literature searching are categorized into topics, summarized and presented in tables, by frequency, in numbers and percentages.

4.1 Description of the included journals

In this section, the inclusion process of the journals is described. Background information of the included journals is presented by publisher, Journal Impact Factor for 2017 and their Impact Factor Category. In addition, information on publishing date of the journal author guidelines are presented.

From Page et al. (2016), the list of included studies was reviewed for unique journal names, and 182 journals were checked for eligibility. Of these, three journals were excluded with reasons; The journal Evidence-Based Child Health was ceased in December 2014, Journal of the National Cancer Institute, Monographs are by invitation only and the author instructions are therefore not online. In addition to the predefined exclusion criteria mentioned in chapter 3, Journal of Periodontology no longer accept submissions of systematic reviews (source: author

instructions updated May 2017), and was therefore excluded. Five journals had a change of title since their inclusion in Page et al. (2016). The author instructions of the new journal title were therefore included in the survey (

Table *6*). After checking for eligibility criteria, 179 journals were included in this survey, Figure 1. The included journals are listed in Appendix II.

Figure 1 Flow diagram of inclusion of journals.

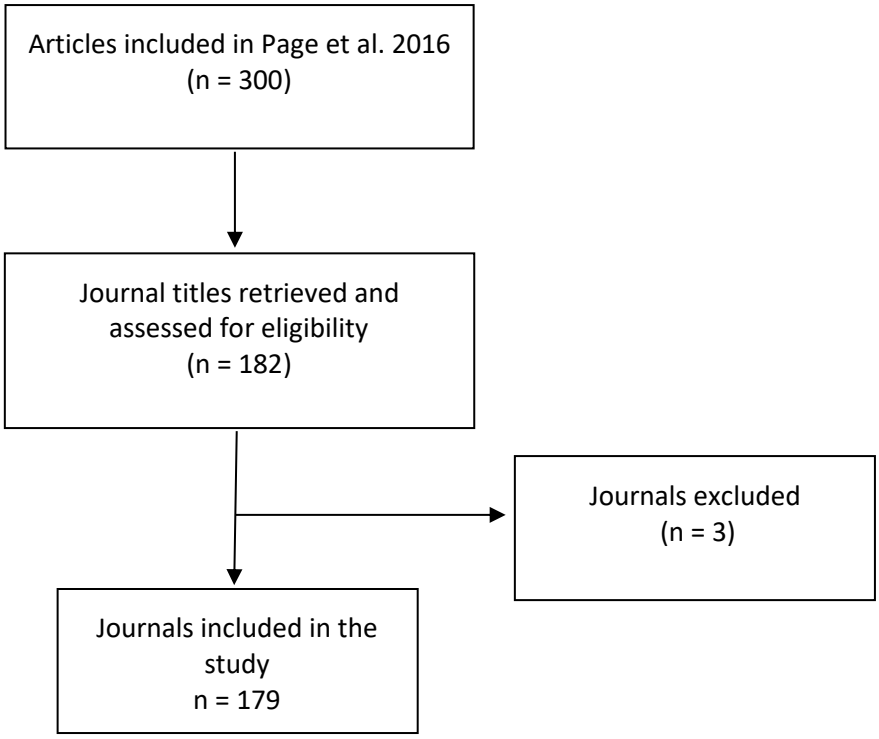

Table 6 Journals with title change

Journal title in Page et al 2016	**New journal title**
Birth Defects Research Part A (2003-2016)	Birth Defects Research (2017 – Current)
Canadian Journal of Gastroenterology (1987 – 2013)	Canadian Journal of Gastroenterology and Hepatology (2014 - Current)
Frontiers of medicine in China (2007-2010)	Frontiers of Medicine (2011 - Current)
Journal of Evidence-Based Social Work (2004 - 2014)	Journal of Evidence-Informed Social Work (2015 - current)
Manual Therapy (1995 - 2016)	Musculoskeletal Science and Practice (2017 - Current)

Publishers

The journals were published by 42 different publishers, the median number of journals per publisher was 4 (range 1-38) see Table 7. The majority (67%, 120/79) is published by big international academic publishing houses. Followed the medical associations in UK (3%, 6/179) and US (3%, 5/179).

Journal Impact Factor 2017

The distribution of Journal Impact Factor 2017 and Impact Factor categories are also presented in Table 7. Most journals had a Journal Impact Factor below five (133/ 74%). The average Impact Factor was 3,962, and median Impact Factor 2,816. The distribution of Impact Factor ranging from 0,484 (Open Medicine) to 27,138 (Lancet Neurology). For a journal to have a Journal Impact Factor, it needs to be indexed in the Journal Citation Report, and there are 15 (8%) journals that are not, and therefore had no Impact Factor. Journal Impact Factor Subject Categories is the subject category which a journal is assigned to in the Web of Science and Journal Citation Report, and journals may be categorized in more than one category. There was a wide diversity of Journal Impact Factor categories in the sample; 56 different categories, with surgery as the most common at 12%. Beyond that, there is a predominance of clinical medicine, but the clinical specialties vary. This was to be expected, as systematic reviews have its longest tradition in these fields and are the main content of MEDLINE, where the sample was retrieved from.

Publication date of author instructions

Publication date, or update date of author instructions were extracted as this will give the reader information on how current the author instructions are, and whether or not they change over time. Only 37 (21%) of the journal included publication/ update date of their author instructions. The majority of these were published/ updated in 2018. The oldest dated author instruction was published in 2011, which are the Cochrane Handbook of Systematic Reviews of Interventions, the author instruction for the Cochrane reviews.

Table 7 Description of the included journals.

Characteristic	Category	Number (Percent)
Total number of journals		179 (100%)
Publishers of included journals		
	Elsevier	38 (21%)
	Wiley	30 (17%)
	Lippincott Williams & Wilkins	15 (8%)
	Springer	12 (7%)
	Taylor and Francis	12 (7%)
	Sage	7 (4%)
	BioMed Central	6 (3%)
	British Medical Association	6 (3%)
	American Medical Association	5 (3%)
	Other (Publishers represented less than 5 times)	48 (27%)
Journal Impact Factor 2017*		
	> 10,1	11 (6%)
	5,1-10,0	20 (11%)
	0,1-5,0	133 (74%)
	No Impact Factor	15 (8%)
	Distribution of Impact Factor	0,484 - 27,138
	Average Impact Factor	3,962
	Median Impact Factor	2,816
Journal Impact Factor Subject Categories represented		
	Surgery	22 (12 %)
	Public, Environmental & Occupational Health	15 (8%)
	Clinical Neurology	13 (7%)
	Medicine, General & Internal	13 (7%)
	Gastroenterology & Hepatology	11 (6%)
	Oncology	11 (6%)
	Cardiac & Cardiovascular Systems	10 (10%)
	Pediatrics	9 (5%)
	Pharmacology & Pharmacy	9 (5%)
	Psychiatry	8 (4%)
	Dentistry, Oral Surgery & Medicine	7 (4%)
	Health Care Sciences & Services	7 (4%)
	Medicine, Research & Experimental	7 (4%)
	Orthopedics	7 (4%)
	Sport Sciences	7 (4%)
	Nutrition & Dietetics	6 (3%)
	Obstetrics & Gynecology	6 (3%)
	Infectious Diseases	5 (3%)
	Neurosciences	5 (3%)

	Nursing	5 (3%)
	Other (Categories where less than 5 journals are represented)	65 (36%)
	No Impact Factor Category	11 (6%)
Publication date of author instructions		
	Dated author instructions	37 (21%)
	Not dated	142 (79%)
Publication/ update year of author instructions		
	2018	23 (13%)
	2017	6 (3%)
	2016	2 (1%)
	2015	3 (1%)
	2014	1 (1%)
	2012	1 (1%)
	2011	1 (1%)

*= Calculated on the 164 journals with Journal Impact Factor

4.2 Reporting of searches in author instructions

In this section the results related to the instruction of reporting of searches are presented. First, the instructive use of established reporting guidelines is presented, then the journal specific instructions.

Of the 179 journals, 96 (54%), included some sort of instruction for reporting systematic review searches, either by suggesting a reporting guideline or by explicitly stating reporting instructions in the author instructions (Table 8). Reporting guideline was mentioned in 86/179 (48%) journals, these are elaborated in Table 9 and Table 10. Journals instruct on using a reporting guideline without having additional journal specific instructions, was 53/179 (30%).

Of the 179 journals, 43 (24%) mentioned reporting of literature searches explicitly in their author instructions. Of these, 33/179 (18%) referenced a reporting guideline *and* had journal specific requirements in their author instructions. 10/179 (6%) journals only included journal specific requirements.

Table 8 Journals with instructions on search reporting

Characteristic	**Number (Percent)**
Has instructions on reporting searches (either *Established reporting guideline OR Journal specific instructions*)	96 (54%)
Established reporting guidelines	53 (30%)

NOT *Journal specific instructions*	
Established reporting guidelines AND *Journal specific instructions*	33 (18%)
Journal specific instructions NOT Established reporting guidelines	10 (6%)
No instructions on reporting searches	83 (46%)

Comparing the different types of reporting instructions based on Journal Impact Factor, there are differences, see Table 9. Journals with Impact Factor above 10.1 is the group of journals with the highest total of journals with instructions on reporting (9/179 [82%]). These journals have the highest use including both established reporting guidelines and journal specific instructions in their author instructions. The average Impact Factor for these journals are 5,88, and median 3,09. The group of journals which only included their own requirements has a notably lower Impact Factor, all below 5 and an average 2,06 and median 1,96.

Table 9 Journal Impact Factor and search reporting

Journal Impact Factor	**Total sample**	**Established reporting guidelines only**	**Established and Journal specific instructions**	**Journal specific instructions only**	**Total with any reporting instructions**
>10.1	11 (6%)	4 (36%)	5 (45%)	0 (0%)	9 (82%)
5.1-10.0	20 (11%)	9 (45%)	5 (25%)	0 (0%)	14 (70%)
0.1-5	133 (74%)	34 (26%)	21 (16%)	10 (14%)	65 (49%)
No Impact Factor	15 (8%)	6 (40%)	2 (13%)	0 (0%)	8 (53%)
Total	179	53 (30%)	33 (18%)	10 (6%)	96 (54%)
Average IF[1]	3,962	4,30	5,88	2,06	4,6
Median IF[1]	2,816	3,35	3,09	1,96	3,06

[1]= Calculated on the 164 journals with Journal Impact Factor

4.3 Reporting guidelines in author instructions

Table 10 gives an overview of the reporting guidelines mentioned in the author instructions under the headline of systematic reviews. The guidelines mentioned are PRISMA[11], PRISMA-

[11] Preferred Reporting Items for Systematic Reviews and Meta-Analyses

A[12], PRISMA-P[13], QUOROM[14], MOOSE[15], HuGENet[16] and MECIR[17]. The PRISMA guidelines are tailored for journal published systematic reviews, and an update and revision of QUOROM. MOOSE is a reporting guideline for meta-analysis of observational studies in epidemiology. HuGENet is a guideline for reporting systematic review and meta-analysis in gene disease association studies. MECIR is The Methodological Expectations of Cochrane Intervention Reviews.

Information on whether the guideline was compulsory or an optional requirement was collected. PRISMA is compulsory in 23/179 (13%) of the journals, and optional requirement by 61/179 (34%). This means a total of 84/179 (47%) journals in some way instruct authors to use PRISMA. These are almost all journals who instruct on using a reporting guideline. All journals who instruct use of PRISMA-A or PRISMA-P, also instruct the use of the regular PRISMA. HuGENet is compulsory to use when submitting articles to the journal Diseases of the Colon & Rectum.

The use of two or three reporting guidelines was mentioned by 31 journals. The most common combinations are PRISMA and MOOSE (19 journals), and PRISMA and PRISMA-P (6 journals). Of those recommending three guidelines, one journal mentions PRISMA, MOOSE or HuGENet, while the two other journals mention PRISMA, QUOROM and MOOSE. Of the 86 journals, 55 journals mentioned only one reporting guideline, all but one of these mentioned PRISMA, the last one mentioned was MOOSE.

Table 10 Instructions on established reporting guidelines.

Requirement/ recommendation of established reporting guideline	**N=179 (100%)**
Instructions on established reporting guidelines total	86 (48%)
PRISMA	
Compulsory	23 (13%)
Optional requirement	61 (34%)
Total PRISMA	**84 (47%)**
PRISMA for Abstracts	
Compulsory	1 (1%)

[12] PRISMA for Abstracts
[13] PRISMA for Protocols
[14] Quality of Reporting of Meta-analyses
[15] Meta-analysis Of Observational Studies in Epidemiology
[16] Guidelines for systematic review and meta-analysis of gene disease association studies
[17] The Methodological Expectations of Cochrane Intervention Reviews

Optional requirement	2 (1%)
Total PRISMA-A	**3 (2%)**
PRISMA for Protocols	
Optional requirement	6 (3%)
Total PRISMA-P	**6 (3%)**
QUOROM	
Optional requirement	4 (2%)
MOOSE	
Compulsory	3 (2%)
Optional requirement	18 (10%)
Total MOOSE	**21 (12%)**
MECIR	
Compulsory	1 (1%)
HuGENet	
Compulsory	1 (1%)

4.4 Reporting of systematic review searches

This section presents an overview of the journals that have explicit instructions on how to report literature searches for systematic reviews, other than an instruction on using a reporting guideline. These reporting instructions are both overlapping and additional to what is mentioned in the established reporting guidelines.

An overview of the journal specific requirements is presented in Table 11. The table list the identified reporting items in number and percentages, sorted by frequency. Percentages are given for the total journal sample (179) and the 43 journals which has journal specific requirements. See Appendix III for reporting items per journal. Some reporting items are merged for convenience and pragmatic reasons. This is done when reporting items in the author instructions are described in terms that can be considered synonyms, such as *reference database, electronic database, bibliographic database, online database*, and contact with other people such as *researchers, study authors* or *research institutions*.

In the 43 journals author instructions, 27 different reporting items were identified. The number of reporting items per journal ranged from 1-19, and the average was 4. One journal listed 19 reporting items, which was the most, the next listed 14, and then two journals listed 11.

The most common reporting items are 1) Search strategy should be reported (25/179 [14%]), 2) Databases/ information-/ data sources (21/179 [12%]) and 3) Describe search methods/ process (17 [9%]), as shown in Table 11. 4 reporting items was listed by only 1 (1%) journal

each; the need to report 1) Internet search, 2) Hand search, 3) Contact with industry and 4) Unpublished literature.

There were 10 journals with one reporting item, 5 of these instructed authors to report the search strategy. The other requirements by journals with only one requirement were 1) state who did the searches (1 journal), 2) describe search process (3 journals), 3) Reference to research methodology (1 journal).

One may discuss whether or not Reference to research methodology is a reporting requirement, but the idea was the same as with the reporting guidelines, that research methodology may include reporting requirements, and was therefore included. Concerning search terms, 5% of the journals include reporting of search terms. Of these only one journal distinguished between reporting of subject headings (MeSH) and free text terms.

11 journals instructed on referencing methodology literature for systematic reviews, which include searching. Most of these (8) where instructing on referencing Cochrane Handbook of Systematic Reviews of Interventions, one journal expects authors to follow the handbook from the Centre for Reviews and Dissemination, one references a specific research article on systematic review methodology and one journal states authors to reference an optional guideline for preparing the review.

Table 11 All reporting items, journal specific requirements.

Reporting items	**N=179 (100%)**	**N=43 (100%)**
Search strategy should be reported	25 (14%)	25 (58%)
Name of Databases/ information-/ data sources	21 (12%)	21 (49%)
Describe search methods/ process	17 (9%)	17 (40%)
Reference to research methodology/ handbook	11 (6%)	11 (26%)
Date/ year limits in search	10 (6%)	10 (23%)
Search terms	9 (5%)	9 (21%)
Describe search in abstract	9 (5%)	9 (21%)
Language limitations	7 (4%)	7 (16%)
Flow diagram of search	6 (3%)	6 (14%)
Date of search conducted	5 (3%)	5 (12%)
Other sources searched	5 (3%)	5 (12%)
Describe findings of the search/ number of records retrieved	5 (3%)	5 (12%)

Search strategy as attachment	4 (2%)	4 (9%)
Reference lists, search	4 (2%)	4 (9%)
Search must be possible to reproduce	4 (2%)	4 (9%)
Contacting individuals/ research institutions	3 (2%)	3 (7%)
Other limitations (e.g. publication status restrictions)	3 (2%)	3 (7%)
Search as headline in article	2 (1%)	2 (5%)
Conference/ Meeting abstracts	2 (1%)	2 (5%)
Grey literature	2 (1%)	2 (5%)
Clinical trials	2 (1%)	2 (5%)
State qualifications of searcher/ who did the searches	2 (1%)	2 (5%)
Example of reporting of search is given	2 (1%)	2 (5%)
Internet searching	1 (1%)	1 (2%)
Hand search	1 (1%)	1 (2%)
Contacting industry	1 (1%)	1 (2%)
Unpublished literature, search for	1 (1%)	1 (2%)

4.5 Summary of findings

Out of 182 journals reviewed for inclusion, 179 was included in this survey. The journals come from a variety of medical disciplines, the average Impact Factor was 3,962. Of the included journals, 54% included reporting requirements for systematic review searches in some ways. This was mainly by requiring a reporting guideline, most mentioned was PRISMA. Further, 24% of the journals in the sample had their own instructions concerning search reporting, and the most common was 1) Search strategy should be reported (14%), 2) Databases/ information-/ data sources (12%) and 3) Describe search methods/ process (9%).

5 Discussion

In this chapter I will discuss the findings of the survey as presented in the previous chapter, both in terms of how they answer the research question, and how they relate to the literature reviewed in chapter 2. The aim of this thesis was to investigate how academic journals instruct authors to report their literature searches when conducting systematic reviews. First, a discussion of the result of the survey will be presented, then methodological reflections of the survey will be addressed in the second section.

5.1 Reporting requirements of journals

Findings of this survey show that journal instructions on reporting of systematic review searches are somewhat low, only half of the sample include such. In 48% of the cases, a reporting guideline is used as instructions, which is to be expected as these are tailored to journal publishing of systematic reviews. A sample of 24% of the journals have additional journal specific requirements.

5.1.1 Reporting requirements and Impact Factor

In table 6 and 7 in the previous chapter, the results on reporting requirements and Impact Factor groups were presented. The sample is skewed towards journals with Impact Factor below 5 (74% of assessed journals), so the findings from Impact Factor group 5.1-10 (11%) and >10.1 (6%) are based a smaller set of journals. Despite this however, it is worth noting the following points.

Journals of high Impact Factor have the highest share of instruction of search reporting. 82% of the journals with an Impact Factor above 10 have some kind of instruction. However, the sample is low with only a total of 11 journals in this category. These journals either refer to established reporting guidelines only, or they have journal specific requirements in addition to instruct on using reporting guidelines. No journal with Impact Factor above 10 relies only on journals specific requirements. This may be because high impact journals rely on the quality of reporting guidelines. Likewise, for journals in the Impact Factor group 5.1-10, the coverage of search reporting is 70%.

The group of journals which only have journal specific requirements, consists only of journals with Impact Factor below 5, with average Impact Factor of 2,06. In this group, the share of journals with any instructions on search reporting is 49%. This group also have the lowest

occurrence of reference to only established reporting guidelines, 26%. This category of journals, is by far the biggest category in the whole sample, with 133 journals (74% of 179).

Journals with no Impact Factor (as in not indexed in Journal Citation Report) have a slightly higher share of reporting requirements than journals with Impact Factor below 5.

Even though the correlation of Impact Factor and quality is debated, it was to be expected that high Impact Factor journals have more requirements than journals with lower Impact Factor.

5.1.2 Combinations of reporting guidelines

The most common combinations of guidelines are PRISMA and MOOSE (8 journals) and PRISMA and PRISMA-P (5 journals). PRISMA and PRISMA-A was mentioned by 3 journals. No journals recommend the use of both PRISMA, PRISMA-P and PRISMA-A, which are all part of the same family of guidelines. PRISMA-P was published in 2015, after PRISMA-A (2013), so knowing the PRISMA-P, one should know and be able to recommend PRISMA-A as well. One reason for not recommending PRISMA-P, could be if the journal do not publish protocols for systematic reviews. This information was not collected.

MOOSE is a reporting guideline for systematic reviews of epidemiological studies and was mentioned by 21 (12%) journals. Of these, 19 (11%) journals did recommend PRISMA as well, which is independent of study designs. MECIR was, as one may expect, only required for the Cochrane reviews. The HuGENet guideline was also only required by one journal, and as this is a guideline is specified to reviews on gene disease association, one could not expect this guideline in a wide range of journals.

QUOROM was recommended by 4 journals (2%), which was replaced by PRISMA in 2009, and is thereby an outdated guideline. Three of these journals also recommend authors to use PRISMA, and neither of these journals has a publication date on their author instructions.

5.1.3 Search items in reporting guidelines

In Table 12, the reporting items related to search from the guidelines mentioned in the survey are listed. In total there where 29 different reporting items identified. MOOSE is the guideline with most reporting items related to search; 16. Next is MECIR with 15. The reporting items

all the guidelines have in common, is to list the databases searched, and to include dates of search.

Table 12 Reporting items for search in reporting guidelines

Reporting item	MOOSE	MECIR	QUOROM	PRISMA-P	PRISMA	HuGENet	PRISMA-A
Dates included in search	√	√	√	√	√	√	√
Databases searched	√	√*	√	√	√*	√*	√
Description of contact with authors/ experts[1]	√	√	√	√	√	√	
Search strategy	√	√		√	√	√	
Registers searched	√	√	√	√		√	
Specify limitations		√	√	√	√		
Keywords	√					√	
Hand searching	√		√				
Reference list searching	√	√					
Unpublished studies, search	√					√	
Grey literature		√		√			
Discussion section should address incomplete retrieval of identified research		√			√		
Qualifications of searchers (e.g., librarians and investigators	√						
Effort to include all available studies	√						
Search software used	√						
List of citations located	√						
Method of addressing articles published in languages other than English	√						
Method of handling abstracts	√						
Discussion should address publication bias	√						
List all sources searched		√					
Websites, incl. full name and URL		√					
All database searches should be reproducible		√					
Search in appendix		√					
Data sources in abstract			√				
One database search should be reproducible					√		
Personal files			√				
Limits by language			√				
Search terms for registers		√					

Search terms for websites		√					
Total reporting items	16	14	9	7	6	6	2

[1]: Contacting experts and Contacting authors, are merged.
[*]: Database names should include platform or provider name (or both), and dates of coverage

MECIR, PRISMA and HuGENet clarifies that name of databases should include name of platform and the dates covered by database. By excluding QUOROM, because it is replaced by PRISMA and should not be used, and PRISMA-A which only applies to abstract, there are two more reporting item common for all reporting guidelines; contact with authors/ industry and to report search strategy. This shows the differences in reporting guidelines, and that they not necessary includes the same reporting items concerning literature search for systematic reviews.

Approximately half of the reporting items mentioned in reporting guidelines are only mentioned by one guideline. Reproducible searches are only addressed in two guidelines; MECIR require all searches to be reproducible, while PRISMA require search in one database is reproducible. MECIR is also the only reporting guidelines that includes searches to be put in appendices, which is a way of ensuring searches to be reproducible.

All reporting guidelines are organized as checklist items which consists of more than one reporting item per checklist item. MECIR is the only guideline that distinguishes between mandatory and highly desired reporting items. There are some vague formulations in some of the reporting elements which may make it difficult to interpret what the meaning really is. For instance, in PRISMA it is stated to «Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched». The reporting item says to report all information sources, and give examples on database searching and contact with study authors. By mentioning some examples, and not mentioning other sources, an author may leave out parts of their work process since it is not mentioned specifically. The reporting items in MECIR are more detailed than the others. Here are two examples of reporting items on reporting of sources:

Example from MECIR:

> R33 Search sources
>
> List all sources searched, including: databases, trials registers, websites and grey literature. Database names should include platform or provider name (or both), and dates

of coverage; websites should include full name and URL. State whether reference lists were searched and whether individuals or organizations were contacted.

Example from PRISMA:

Reporting item #7 – Information sources

Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.

PRISMA advise authors to describe all information sources, and give examples of two; databases and contact with other study authors. Date of search should also be listed. MECIR on the other hand list six types of sources. MECIR also emphasized that a database name should include the platform and provider name, and the dates the databases cover, as these may vary. PRISMA emphasize only dates of coverage. But studies show that search dates are complicated and inadequately reported (Koffel & Rethlefsen, 2016; Maggio et al., 2011).

Fulfillment of reporting items

When it comes to reporting, it may be unclear if an item is fulfilled if the authors have only included one of the subitems, e.g. to report all the sources searched without entering the date searched (see PRISMA #7) (Page et al., 2016). Though concerning PRISMA, how to report these items correctly is explained and elaborated in an additional article (Liberati, Alessandro et al., 2009). One may ask whether or not review authors read this article as the adherence to PRISMA reporting item *8 - Search* is seen as low as and 12% (in nursing, sample size 74) (Tam et al., 2017) and 53% (in emergency medicine, sample size 112) (Nawijn et al., 2019).

Dates of searches in reporting guidelines

Organizing Table 12, it became clear that the terminology used in the reporting guidelines vary slightly, which is understandable as the English language includes word variations. But in these cases, it may lead to imprecision. Concerning dates, «dates of search», «time period» and «search dates» are formulations used in the guidelines. All formulations concerning dates are merged as categories in the table; Dates included in search. The reason for doing so, is that it is not necessarily possible to know exactly what is meant as there might be nuances.

Time period for a search may mean the time period covered by the search; which often is the start year of indexed literature in the database, up to the date of search, unless specific date

limitations are applied. Search date often mean the date the search is conducted. Time period of search will often include search date. Time period covered by the database can also be included in what is meant when it is stated «time period of search». This said, all reporting guidelines include some reporting item concerning date included in search. Search dates are poorly documented in searches as shown in Page et al. (2016), with a partially reporting of search dates seen in 29% or included studies, or 65% reporting of both start and end dates of searches, or as Koffel and Rethlefsen (2016) show, only 25% reporting of start/ end dates of searches.

Search terms in reporting guidelines

The way reporting guidelines mention search terms also varies. In the table, all reporting items concerning search terms are merged. Database searching includes the use of both free text words (i.e. words by authors) and database specific thesaurus/ subject headings. These terms are not necessary used consistently; keywords, free text terms and search terms etc. are all used in the reporting guidelines and it is not possible to know if it they mean thesaurus or text terms. Reporting of search terms in systematic reviews are also somewhat low. Koffel and Rethlefsen (2016) report an occurrence of 25% while Page et al. (2016) report free text words to be reporting in 46% of included reviews, and main index terms (e.g. MeSH) in only 12%.

5.1.4 Journal specific instructions for reporting systematic review searches

This section will discuss the findings of journal specific requirements. These are the explicit reporting instructions on searching in journal author instructions, beyond the reporting guidelines, as presented in Table 11.

There was a big variety within the journal specific instructions. As mentioned in the result chapter and in Appendix III, the number of reporting items per journal varied from 1-19, and the average number of reporting items per journals was 4. Among journals using reporting guidelines in addition to journal specific requirements, the average number of reporting items is also 4, which is in addition to reporting items in guidelines. Among the journals who rely only on journal specific requirements, the number of reporting items ranged from 1-6, with an average of 3. It is questionable if only three criteria will improve reporting.

A proper co-occurrence analyzes was not done, but some co-occurrences of the most common combinations of reporting items are visible in table in Appendix III. «Search strategy should be

reported», «Databases/ information-/ data sources» and «Describe search process» co-occurs. As well as «Date limits in search» and «Search terms»**,** are also overlapping. Among the ten journals who rely only on journal specific requirements, the most co-current reporting items were to *name databases* and *describe search methods*, see Appendix IV.

The most frequent reporting items can be described as somewhat vague; «report search strategy», name of database and «describe the search process/ search methods». Knowing there are often the details lacking in search reporting, these reporting requirements leaves it up to the review authors to decide what is needed for a search to be transparent and reproducible, this will be discussed below.

Some comments on selected reporting items:

Reporting of search strategy

The most frequent reporting items among all journals with specific requirements on search reporting, is that the *search strategy should be reported*. This was mentioned by 14% of the journals, and 58% of the 43 journals with journal specific requirements. The term *search strategy* may be problematic to use, as the meaning of it is ambiguous. It can mean something as concrete as a search history of a single database, but it can also be more reconciling and refer to the whole process of retrieving articles for inclusion of a systematic review (Cochrane, c2019). This said, it is a very common term used in literature searching, «search strategy» and «search strategies» occurs in 453 article titles in articles in PubMed, and it is used in handbooks on searching and in reporting guidelines, see tables

Table 2 and Table 4 chapter 2. Considering the low quality of search reporting, there might be needed more detailed requirements on searching. So, telling authors to *report search strategy* may be giving them too much freedom on how to report. *Report search strategy* is the only requirement on searching in 5 of the journals.

The *search strategy* term is also used in PRISMA, PRISMA-P, MOOSE and HuGENet. By stating that authors should report their search strategy, it is unclear what definitions it refers to. But, one may assume that it refers to a search history of one database, as the wording in PRISMA states «Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated".

Whatever the definition one relies on, inclusion of a search history from a database takes up space, and this may be one reason for bad reporting. Only 4% of the journals and one of the reporting guidelines (MECIR) mentions that the search strategy could be uploaded as an attachment, but this is rarely done in published reviews (Koffel & Rethlefsen, 2016; Mullins et al., 2014). Making review authors aware of the possibility of including searches in appendix may with advantage be highlighted in the author guidelines.

Reproducibility of searches

Related to this, there are only 2% of the journals that explicitly says the search needs to be reproducible. To be able to report searches in a reproducible matter, it requires knowledge on what makes a search reproducible. If more journals included in their guidelines, that searches should be reproducible, as well as encouraged authors to include searches as attachment, maybe the quality of search reporting would be raised (Koffel & Rethlefsen, 2016). Reporting full search strategies are sees as somewhat low in journal published reviews, it's reported to be 33% (Faggion et al., 2018), 62% (Koffel & Rethlefsen, 2016). Among Cochrane reviews it's better reporting ranging from 88% (Yoshii et al., 2009) 100% (Faggion et al., 2018), which are to be expected.

As shown in chapter 2, involving librarians in systematic reviews correlates with higher quality on the reporting (Meert et al., 2016; Rethlefsen et al., 2015). But, only 25% of reviews with librarian consultancy reported a full reproducible search strategy, 44% if librarian was coauthor. But in spite of this, there are still insufficiencies. Forward citation tracking, hand searching, web searching, searching grey and unpublished literature are also search methods where the

reporting is low. Librarians and information specialist should be the ones with highest knowledge on reporting searches in a reproducible manner, and if they don't get it correct, how can one expect non-librarians to know what it takes to report a search strategy so it can be reproducible.

Naming of databases

Name of databases searched are among the top reporting items in both reporting guidelines and in journal specific instructions. In the results, due to the variations in terminology, reporting of databases is merged with *information sources* and *data sources*. Naming of databases have been shown to be correct in 61% of investigated reviews, dates covered by the databases was not investigated (Koffel & Rethlefsen, 2016). So, there is still a need for detailed reporting requirements on database names. Looking at the draft for PRISMA-Search, there are three reporting items for naming a database correctly; name of database, interface and dates of coverage.

Description of search methods

11 journals (6%) instructed authors to «describe the search methods» in the article. This can also be seen as a vague formulation, partly due to the comments above on what level of details are needed for a search to be reproducible.

Referencing methodology literature for systematic reviews was instructed by 6% of the journals, and most of these specifically mentioned Cochrane Handbook of Systematic Reviews of Interventions. This corresponds well with the survey by Butler, Granholm, and Aneman (2019) who found that 6% of author instructions require the use of Cochrane Handbook for Systematic Reviews of Interventions, in a sample of 48 journals in anesthesiology and critical care.

5.1.5 Comparison of journal specific instructions and reporting guidelines

In total there are 27 journal specific reporting items identified in this survey. Table 4 in chapter 2, listed the most common reporting items in PRISMA and the reporting guidelines from Cochrane, Campbell, CRD, IQWiG and Joanna Briggs Institute. In order to see whether the findings from this survey are reflected in the reporting guidelines, a comparison of the most common reporting items are done in *Table 13*. There are similarities and differences.

In both groups the following are found; *date of search, name of databases, report search strategy*. The journal specific requirements have more of the vague formulations as; *search strategy*, *describe the search methods, describe search in abstract.* These requirements include no details that may improve reporting, other than the presence of reporting.

While the reporting guidelines address contact with authors or industry, grey literature, web sites and hand searching among the top ten reporting items, these are found in 1% of the journals with journal specific requirements (see Appendix III).

Table 13 Reporting guidelines compared to journal specific requirements

Journal specific requirements	**Reporting items from reporting guidelines**
Search strategy should be reported	Date of search of reference databases
Name of Databases/ information-/ data sources	Name of reference database
Describe search methods/ process	Contact with study authors or industry
Reference to research methodology/ handbook	Present full search strategy of *one* database, incl. limits, so it can be replicated
Date/ year limits in search	Grey literature sources
Search terms	Database platform/ provider
Describe search in abstract	Number of references retrieved from search
Language limitations	Present full search strategy of *all* databases, incl. limits, so it can be replicated
Flow diagram of search	Web sites incl. full name and URL
Date of search conducted	Hand search of journals, provide list of journals, years, possible missing issues not searched.

Most journal specific requirements are already covered by the reporting guidelines. In the journal with the most reporting items (19), most of these are already described in the reporting guidelines the journal must adhere to, PRISMA and MECIR. Additional reporting items are to list number of references retrieved, describe search in abstract and to reference methodology literature.

There are journals recommending PRISMA, QUOROM, MECIR and MOOSE which also include a journal specific requirement on describing the search in abstract. Description of search in abstract is not a part of PRISMA or MOOSE, but it is a part of QUOROM, which is, as said earlier, outdated. Including search in abstract could also have been solved by recommending PRISMA-A, which none of them had done.

There is a high degree of overlap between reporting guidelines and journal specific instructions in journals that have both. Where journal specific requirements extend the reporting guidelines, this leads to more precision. Examples of this are when review authors have to report who did the searches (1 journal), the journal provides examples on search reporting (1 journal), search as headline (2 journals) and referencing systematic review methodology (11 journals, 10 recommend reporting a guideline). See Appendix III for these details.

5.1.6 Comparing the results with Page and colleagues 2016

Page et al. (2016) surveyed reporting of systematic reviews, and has extracted data on search reporting in 300 systematic reviews, 45 of them published by Cochrane. Because of the link between this survey and their study there are some elements concerning search that can be compared.

First of all, concerning the Journal Impact Factor, the majority (74%) of journals has a factor below 5, 11% had an Impact Factor 5.1-10, and 6% was higher than 10.1. In the study by Page and colleagues (Page et al., 2016), 62% of their sample had Impact Factor (for 2012) below 5, 25% were between 5.1 and 10. and 3% had an Impact Factor above 10.

Reporting guidelines were mentioned in 29% (87/300) of the included articles, compared to 48% in this survey. This may come of an increase of how many author instructions mentioning reporting guidelines through the years, or it may come of how the articles are distributed by journals in the study by Page and colleagues.

In the section of search methods, the category *Other* (nothing more specified than personal files and citation tracking) is reported in 12% of the reviews. In this survey the category Other is used in 3% of the whole sample (179), citation searching was mentioned in 2% of the author guidelines. The use of personal files is only mentioned in the reporting guideline QUOROM, which is discontinued.

Search dates were reported in 29% of the reviews, and a reporting requirement in 6% of the journals. Use of reference lists (81%), search dates (65%), reporting of free text terms (46%) and a full Boolean search (45%), are by far the most common reported items in Page et al. (2016).

Reporting of searching non-databases (internet, hand searching, contacting industry and searching for unpublished literature) is among the least frequent requirements in this survey, and these are among the least reported items by Page and colleagues. Internet searching is not reported at all, hand searching is reported by 8% and contacting industry by 4%. Searching for unpublished studies was not mentioned as a reporting item at all.

All this said, authors of systematic reviews are more than welcome to report according to established reporting guidelines, or even more detailed, even though this is not mentioned in the author instruction of the journal they are submitting to.

5.2 Methodological reflection

This study sought to describe how medical journals instruct authors to report systematic review searches. As such, existing similar literature was scanned to look for methodological considerations and experiences. Biocic et al. (2019) is partly similar as it, among other, investigated reporting requirements in author instructions of a sample of journals in anesthesiology. The main focus of their survey is quality of searches, their survey is published as a correspondence article, and the details of the findings on author instructions are not presented. Other similar studies have investigated endorsement of established reporting guidelines, but has not included journals with their own recommendations on reporting. Another strength of this survey is that it is an independent study related to PRISMA, as the developers of PRISMA has conducted several of the other studies concerning the guideline (Page et al., 2018; Page & Moher, 2017; Page, Shamseer, Altman, et al., 2016).

There are several strengths and limitations of this study, both to the study design and the execution of the survey, these are presented below.

5.2.1 The research question

This survey does not look at reporting of the preparation of systematic review searches such as the objectives and rationale for the review, eligibility criteria or framework for research question (e.g. PICO and other) even though these factors have impact on the search. The reason for this was to draw a clear line for what to include in the survey or not, as outlined in the introduction. This thesis is written in a perspective as an information specialist working with

systematic review searches, and it wary a lot whether or not they are involved in other parts of a systematic review than the search.

Information on other methodological requirements for systematic reviews is also not a part of this survey. The reason for this is partly due to lack of resources, and partly due to lack of detailed knowledge needed for the analysis. Doing this would have been interesting in order to compare methodological requirements.

5.2.2 The study design

Concerning the design, a cross sectional design is set to answer questions on occurrence of a phenomenon at a given time. The research question has been answered with this design, but whether the results are generalizable and the validity of the results can be discussed.

The results in this study is based on how the author guidelines was designed May 2018. The guidelines can be changed and updated during this project, from the date the guidelines were downloaded until publishing this thesis. This is an issue of this study as with any cross-sectional studies, and happened during the work with this survey. Most known are the Cochrane Handbook which was updated fall 2018, but other samples show updates of other author instructions as well.

With a cross sectional design, it is not possible to draw any conclusions on the effect the author instruction has on the quality of published systematic reviews. But, this is a research question of interest, and is mentioned as a topic for further research in chapter 6.2.

5.2.3 The sample

The sample in this survey is derived from a survey by Page et al. (2016). The screening for inclusion they did was done by three authors, which serves as an assurance for the quality of the sample.

This sample has been used in an additional study examining the requirements of updating systematic reviews in author instructions (Pieper & Mathes, 2017). Page et al. (2018) also used this sample when evaluating the reproducibility of systematic reviews. Since the same sample of journals is used in several studies, it can be interesting to examine the sample from a different

perspective. Page et al. (2016) is a follow up of a study from 2007, using the same approach to retrieve their sample (Moher et al., 2007). By using this sample, the findings from Page et al. (2016) is also used as an element in the discussion, and thereby this survey adds another perspective to the same sample of journals.

One of the purposes of a cross sectional survey is to include a representative selection of the study objects. The size of the sample made it possible to get extracted data, even though some of the findings are made at a very minimum of investigated journals.

The sample surveyed is from a varied selection of medical disciplines, they are published by a variety of publishers, but mainly by the big international ones. The majority (74%) of the journals have an Impact Factor below 5. The average Impact Factor for all journals in the top ten most frequent subject categories in this survey, is 2,3.

Systematic reviews published by Cochrane is included in the sample from Page et al. (2016). I was unsure whether or not to include Cochrane in this survey due to their status as a leading organization concerning methodology, and that their handbook is a part of the framework used in the analysis and discussion of the result. There are several studies which concludes that searches from Cochrane still have some limitations (Briscoe, 2018; Franco, Garrote, Escobar Liquitay, & Vietto, 2018). After discussing this with my supervisor we decided upon inclusion of Cochrane.

5.2.4 Data collection and analyzes

This survey serves as my master thesis and most of it is therefore developed and executed only by myself, but under supervision. The thesis may therefore bear the characteristics of a certain subjectivity and unintended bias. There may have been a certain subjective judgement on the decision on what to extract and not.

Some of the author instructions also include recommendations on how to conduct systematic review searches, and to differentiate between this and a reporting requirement has not always been obvious. In cases of doubt, a second opinion from a colleague or co-student could have clarified the decision, but this has not been done. In these cases, I have given the journals the benefit of the doubt.

No validated data extraction form was used, as this was not identified. Therefore, I tried to make a data extraction form based on existing reporting guidelines for literature searches. As mentioned in the methods chapter, the pilot of the extraction form did not include all aspects mentioned in the author instructions. This is a challenge in using predefined categories in data extraction. The approach was turned from trying to fit the reporting requirements into predefined categories, into making categories out of the findings.

In order to compensate for no validated data extraction form, the categories made while analyzing the data was compared with the categories in Table 1 - Search methods from handbooks, and Table 4 - Reporting items from reporting guidelines, both in chapter 2, in order to try to make the categories as similar as possible. This was partly difficult, as it was a possibility that details of a reporting item got lost along the way. The findings are also related to reporting requirements of systematic review searches are discussed in the context of established reporting standards.

5.3 Summary

Findings of this survey conclude with only half of the included journals have instructions on how to report systematic review searches. This correlates well with findings from other studies, which show that reporting of systematic review searches are overall poor.

Reporting items in journal specific requirements are reflecting the content of established reporting guidelines. There are some additional reporting items not covered by the reporting guidelines. To a great extent, in journals recommending reporting guidelines, the journals specific requirements included are overlapping with the content of the recommended reporting guidelines. Journals only relying on journal specific requirements, have few and vague reporting items.

The sample in this survey was big enough to get data, the journals came from a variety of disciplines and had a big variation in Impact Factor.

This chapter also included other methodological reflections and limitations of the survey.

6 Conclusion

The research question of this thesis was

- How do a selection of medical journals instruct authors to report systematic review searches?

In a sample of 179 medical journals, 54% included instructions on how to report systematic review searches. These journals either use of established reporting guidelines (48% of the total sample), mostly PRISMA, a combination of established reporting guidelines and journal specific requirements (24%), or solely journal specific requirements (6%). The most requested reporting items are 1) Search strategy should be reported (14%), 2) Databases/ information-/ data sources (12%) and 3) Describe search methods/ process (9%).

There is a correlation between Impact Factor and requirements, with a higher proportion of high impact factor journals having requirements, compared to low impact factor journals. The use of reporting guidelines is also more common among the higher impact factor journals.

A substantial number of journals have their own requirements in addition to existing guidelines, and these are to a great extent already covered by reporting guidelines. In a few cases the journal specific requirements provide a more precise or detailed reporting than what is included in the reporting guidelines.

A few journals, all with comparatively low Impact Factor, only use their own reporting requirements with no reference to existing guidelines. These requirements were found to lack rigorous details for reporting when compared to existing guidelines. These journals also had relatively few reporting items, so the combination of them would still result in insufficient reporting of systematic review searches.

This thesis used an open database of journals as sample, provided by Page et al (2016). The sample contained 182 unique journals, of which 179 were found relevant for the survey. Limitations of the survey include the lack of a validated data extraction form in collecting data, and a potential for certain subjectivity in the data collection as it was done by only one person.

6.1 Implications for practice

In order to raise the quality on reporting of systematic review searches, journal editors should include reporting requirements in their author instructions. The reporting requirements should

be detailed, clear and easy to follow. Review authors should not be insecure on what to report and how to report it.

Journals who want to include their own specific reporting instructions can benefit from including reporting items not included in already recommended reporting guidelines, in order to clarify reporting of systematic review searches.

6.2 Further research

Finally, I would like to point to some areas for future research.

One of the original ideas around this survey was a question whether scientific journals have standards for literature searches and how these are handled in the peer review process, in order to make systematic reviews better. Whether journals have internal guidelines on how to peer review literature searches is of interest, as well as whether experts on literature searches are contacted for peer reviewing searches. Aspects around this is not covered in the published research literature, and needs to be investigated. Investigating this will give a better understanding of the status of systematic review searches in journal editorial boards.

The scope of my work would not allow me to go into the quality of the reported searches in journals with reporting requirements. Page and colleagues did examine search reporting, but the design of the author instructions may have changed since, and findings from this survey cannot be seen in direct context with their results. But such study should be done to see if there are any correlations between reporting requirements from the author instructions, and the impact of these on search reporting. This is a critical issue since it relates to the potential impact the search has on the reviews results, and in the end clinical decision-making. Doing this, one need to know the content of the author instructions at the time of submission of the systematic review.

The publication of PRISMA Search Reporting Extension will be an important contribution to the field of reporting of systematic review searches. Research on the implementation, use and effect of PRISMA Search in journals author instructions will be needed. This also applies to the announced update of PRISMA and the possible changes of search reporting.

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Appendix I

Data collection form – template

Background information

Journal name*	
Author guideline URL*	
Publisher*	
Publication date, or update date for author guideline*	□ Yes □ Not stated
If yes, type the date as stated	

Standards for systematic reviews

Is established reporting standard for systematic reviews mentioned? *	□ Yes □ No	
If yes:	**Compulsory** (Required/ must/ should/ need)	**Optional requirement** (Recommended/ advised/ suggested/ encouraged/ prefer)
Recommendation of established reporting standard - Which		
PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)	□	□
PRISMA for Abstracts	□	□
PRISMA-P	□	□
MOOSE (Meta-analyses of observational studies in epidemiology)	□	□
MECIR (The Methodological Expectations of Cochrane Intervention Reviews)	□	□
Campbell Collaboration Guideline	□	□
Joanna Briggs Guideline	□	□

The Institute of Medicine's Standard for Systematic Reviews	□	□
Centre for Reviews and Dissemination (CDR) Guidance	□	□
Other	□	□
If Other, insert name:		

Systematic review searching

Is reporting of searching and use of sources mentioned specifically? *	□ Yes □ No
If yes, Insert text from author instructions If reporting of searching databases is mentioned in the text, insert it here.	
Other relevant comments:	

*= mandatory to fill out

Appendix II.

List of included journals

Alimentary Pharmacology & Therapeutics
American Journal of Cardiology
American Journal of Clinical Nutrition
American Journal of Medicine
Annals of Cardiothoracic Surgery
Annals of pharmacotherapy
Annals of the Rheumatic Diseases
Antimicrobial Resistance & Infection Control
Archives of Disease in Childhood: Fetal & Neonatal
Archives of gerontology and geriatrics
Archives of Medical Science
Archives of Orthopaedic and Trauma Surgery
Archives of physical medicine and rehabilitation
Arquivos de Neuro-Psiquiatria
Asian Pacific Journal of Cancer Prevention
Behavioural Neurology
Biological Psychiatry
BioMed Research International
Biomedical and Environmental Sciences
Birth Defects Research
BJOG
BMC Cardiovascular Disorders
BMC Endocrine Disorders
BMC Geriatrics
BMC Medicine
BMC Public Health
BMJ
BMJ Open
Body Image
Brazilian Journal of Epidemiology - Revista Brasileira de Epidemiologia
Breast
Breastfeeding Medicine
British journal of general practice
Bulletin of the WHO
Canadian Journal of Gastroenterology and Hepatology
Canadian journal of ophthalmology
Canadian oncology nursing journal
Cancer
Cancer Causes and Control
Cancer epidemiology
Cancer Science
Cardiology in the Young
Catheterization & Cardiovascular Interventions
Clinical Gastroenterology and Hepatology
Clinical Journal of Sport Medicine
Clinical Oncology
Cochrane Database of Systematic Reviews
Colorectal Disease
Coronary Artery Disease
Critical Care Medicine
Critical Reviews in Eukaryotic Gene Expression
Current Medical Research and Opinion
Depression and Anxiety
Dermatologic Surgery
Diabetes Research and Clinical Practice
Diseases of the Colon & Rectum
Epilepsy research
Eplasty
European Journal of Clinical Investigation
European Journal of Epidemiology
European Journal of Gastroenterology & Hepatology
European Journal of Neurology
European Journal of Nutrition
European Journal of Orthopaedic Surgery & Traumatology
European Journal of Preventive Cardiology
Expert Opinion on Pharmacotherapy
Expert Review of Anti-infective Therapy
Expert Review of Pharmacoeconomics & Outcomes Research
Frontiers of Medicine
Gene
Gynecological Endocrinology
Health and Social Care in the Community
Heart
HepatoBiliary Surgery and Nutrition
Hepatology Research
Immunological Investigations
Intensive Care Medicine
Interactive CardioVascular and Thoracic Surgery
International Endodontic Journal
International Forum of Allergy & Rhinology
International Journal of Cardiology
International Journal of Colorectal Disease
International Journal of Epidemiology
International Journal of Geriatric Psychiatry
International Journal of Gynecological Cancer
International Journal of Nursing Studies
International Journal of Occupational Medicine and Environmental Health
International Journal of Oral and Maxillofacial Surgery
International Journal of Psychology
International Journal of Tuberculosis and Lung Disease
International Journal of Urology
JAMA Internal Medicine
JAMA Neurology
JAMA Ophthalmology
JAMA Otolaryngology-Head & Neck Surgery
JAMA Pediatrics
Journal for Specialists in Pediatric Nursing
Journal of Allergy and Clinical Immunology
Journal of Animal Science
Journal of Cancer Research and Therapeutics
Journal of Clinical Epidemiology
Journal of Clinical Pharmacy and Therapeutics
Journal of Dental Education
Journal of Epidemiology and Community Health

Journal of Evidence-Informed Social Work
Journal of Gastrointestinal Oncology
Journal of Hospital Infection
Journal of Hypertension
Journal of Infection
Journal of International Medical Research
Journal of Medical Economics
Journal of Minimally Invasive Gynecology
Journal of Neurosurgical Anesthesiology
Journal of Nursing Management
Journal of Nutritional Science and Vitaminology
Journal of Ocular Pharmacology and Therapeutics
Journal of Oral Rehabilitation
Journal of Orthodontics
Journal of Orthopaedic and Sports Physical Therapy
Journal of Pediatric Gastroenterology and Nutrition
Journal of pediatric surgery
Journal of Plastic, Reconstructive & Aesthetic Surgery
Journal of Psychiatric and Mental Health Nursing.
Journal of psychiatric research
Journal of psychosomatic research
Journal of Science and Medicine in Sport
Journal of Spinal Cord Medicine
Journal of Surgical Education
Journal of Surgical Research
Journal of Telemedicine and Telecare
Journal of the National Cancer Institute
Journal of Thrombosis and Haemostasis
Journal of Trauma and Acute Care Surgery
Journal of Vascular Surgery
Journal of Veterinary Internal Medicine
Journal of Viral Hepatitis
Knee Surgery, Sports Traumatology, Arthroscopy
Lancet Neurology
Latin American Journal of Nursing
Leukemia & Lymphoma
Medical Teacher
Medicina Oral Patología Oral y Cirugia Bucal
Medicine & Science in Sports & Exercise
Musculoskeletal science and practice
Neurological Research
Nutrition in Clinical Practice
Obesity Reviews
Obesity Surgery
Open Medicine
Otolaryngology-Head and Neck Surgery
Pacing and Clinical Electrophysiology
Pain Research and Management
Pan African Medical Journal
Pediatric Dentistry
Pediatrics
Pharmacogenomics
Physical Therapy
PLOS Medicine
PLOS Neglected Tropical Diseases
PLOS ONE
Psychiatria Danubina
Public Health
Quintessence International
Resuscitation
Rheumatology
Schizophrenia Bulletin
Seizure - European Journal of Epilepsy
Simulation in Healthcare
Spine
Sports Medicine
Stroke
Surgical Endoscopy
Technology and Health Care
Therapeutic Delivery
Tropical Medicine & International Health
Tumor Biology
Vaccine
World neurosurgery
Wound Repair and Regeneration

Appendix III.

Reporting items per journal

See tables next pages

Journal ID-nr	4592825	3534886	3542633	3551587	3517533	3514092	3551434	3551613	3533794	3551292	3525337	3514608	3543792	3522898	3542652	3515076	3522964	3525352	3529215	3529360	3532584	3534956	3535205	3541582	3542987	3543801	3550910	3551192	3551218	3551251	3551257	3541633	3517627	3514060	3514185	3514841	3525299	3542610	3543120	3543770	3543810	3545483	3551001	N= 179
Guideline	P, ME	P, MO	P	P, MO	P, Q	P	P, MO	P, MO	No	P, MO	No	P	No	P, PP	No	P	P	No	P	No	P	P	Q, MO	P	P	P	No	P, PP	P, PP	P, PP	P, PP	No	No	P	P	P, PA	P, H, MO	P, Q, MO	P	P, MO	P	No	P	33(18%)
Reporting items:																																												
Search strategy should be reported	1	1	1	1	1					1		1	1	1	1	1				1	1	1			1			1	1	1	1		1	1	1		1	1					1	25(14%)
Databases/ information-/ data sources	1	1	1	1	1	1	1	1	1	1	1		1		1			1	1					1	1	1	1					1	1										21(12%)
Describe search process	1	1		1	1	1	1		1	1	1		1		1		1						1				1												1		1	1		17 (9%)
Reference to research methodology	1											1		1		1	1			1								1	1	1	1									1				11 (6%)
Date limits in search	1	1	1		1	1	1	1	1	1	1																																	10 (6%)
Search terms		1	1	1	1	1	1	1	1		1																																	9 (5%)
Describe search in abstract	1	1		1							1	1									1		1	1		1																		9 (5%)
Language limitations	1	1		1	1		1	1	1																																			7 (4%)
Flow diagram of search	1	1			1		1	1											1																										6 (3%)
Date of search conducted	1	1				1	1	1																																				5 (3%)
Other sources searched, not specified		1					1	1	1	1																																			5 (3%)
Number of records retrieved	1	1	1		1																	1																							5 (3%)
Search strategy as attachment	1	1										1		1																															4 (2%)
Reference lists	1	1		1						1																																			4 (2%)
Reproducible search	1	1	1		1																																								4 (2%)
Contacting individuals/ institutions	1		1	1																																								3 (2%)
Other limitations, not specified	1			1		1																																							3 (2%)
Search as headline													1																			1													2 (1%)
Conference/ Meeting abstracts	1			1																																									2 (1%)
Gray literature	1		1																																										2 (1%)
Clinical trials			1			1																																								2 (1%)
State who did the searches			1																																	1									2 (1%)
Example of reporting of search is given						1												1																												2 (1%)
Internet search	1																																													2 (1%)
Hand search	1																																													2 (1%)

Contacting industry				**1**																																									2 (1%)
Unpublished literature			**1**																																										2 (1%)
Number of reporting items per journal	19	14	11	11	9	8	8	7	6	6	5	4	4	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1		

Abbreviations: P=PRISMA, PA=PRISMA-Abstracts, PP=PRISMA-PROTOCOL, ME=MECIR, MO=MOOSE, Q=QUOROM, H=HUGENET

1: The terms Database, Reference database, electronic database, bibliographic database, online database is considered synonyms

Appendix IV

Journals with journals specific requirements only

ID-nr Reporting items:	3533794	3525337	3543792	3542652	3517627	3525352	3529360	3541633	3550910	3545483	total	179
Databases/ information-/ data sources	1	1	1	1	1	1		1	1		8	4 %
Describe search methods/ process	1	1	1	1					1	1	6	3 %
Search strategy should be reported			1	1	1		1				4	2 %
search as headline			1					1			2	1 %
Search terms	1	1									2	1 %
Date/ year limits in search	1	1									2	1 %
Language limitations	1										1	1 %
Other sources searched	1										1	1 %
Reference to research methodology/ handbook							1				1	1 %
Describe search in abstract		1									1	1 %
Example of reporting of search is given						1					1	1 %
Number of reporting items per journal	6	5	4	3	2	2	2	2	2	1		