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Raechel Damarell, Nikki May, Sue Hammond, Ruth Sladek ...+1 more authors

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Topic search filters: A systematic scoping review

Authors

Raechel A. Damarell[1]
Nikki May[2]
Sue Hammond[3]
Ruth M. Sladek[4]
Jennifer J. Tieman[1]

1. College of Nursing and Health Sciences, Flinders University, Bedford Park, SA, Australia
2. South Australian Health Library Service, Flinders Medical Centre, Bedford Park, SA, Australia
3. Flinders University Library, Flinders University, Bedford Park, SA, Australia
4. College of Medicine and Public Health, Flinders University, Bedford Park, SA, Australia

Corresponding author:
Raechel A. Damarell, email Raechel.damarell@flinders.edu.au.

Abstract

Background: Searching for topics within large biomedical databases can be challenging, especially when topics are complex, diffuse, emerging, or lack definitional clarity. Experimentally-derived topic search filters offer a reliable solution to effective retrieval however their number and range of subject foci remain unknown.

Objectives: This systematic scoping review aims to identify and describe available experimentally-developed topic search filters.

Methods: Reports on topic search filter development (1990-) were sought using grey literature sources and 15 databases. Reports describing the conception and

prospective development of a database-specific topic search and including an objectively measured estimate of its performance ('sensitivity') were included.

Results: Fifty-four reports met inclusion criteria. Data were extracted and thematically synthesised to describe the characteristics of 58 topic search filters.

Discussion: Topic search filters are proliferating and cover a wide range of subjects. Filter reports, however, often lack clear definitions of concepts and topic scope to guide users. Without standardised terminology, filters are challenging to find. Information specialists may benefit from a centralised topic filter repository and appraisal checklists to facilitate quality assessment.

Conclusion: Findings will help information specialists identify existing topic search filters and assist filter developers to build on current knowledge in the field.

Keywords

Search filters, search strategies, bibliographic databases, information storage and retrieval, literature searching, precision, recall, review.

Key messages

- Librarians and information specialists have access to a large number of experimentally-developed topic search filters covering a broad range of subject areas.

- Topic search filters are challenging to find as they are dispersed throughout the published and unpublished literature and lack standardised terminology for clear identification.
- Information specialists may benefit from a centralised topic search filter repository and a quality appraisal checklist adapted to topic searching for ascertaining filter fitness for purpose.

Introduction

The 'evidence-based practice' paradigm for improving health outcomes places the responsibility on clinicians and healthcare decision-makers to be self-sufficient, efficient searchers after 'best' research evidence (Farokhzadian, Khajouei, & Ahmadian, 2015; Straus, 2011). Widespread clinician awareness of the existence of high-quality primary research such as randomised controlled trials and research syntheses in the form of systematic reviews and clinical practice guidelines is an important factor in shortening the time lag between research production and its implementation into routine clinical practice (Fischer, Lange, Klose, Greiner, & Kraemer, 2016). Timelier identification of well-designed, clinically relevant research evidence is also likely to minimise resource wastage and reduce the possibility of patients being administered ineffective, or even harmful, therapies (Brassil, Gunn, Shenoy, & Blanchard, 2017; Dunn, Marshall, Wells, & Backus, 2017; Klein, Ross, Adams, & Gilbert, 1994).

The challenges of searching for evidence

Unfortunately, research into clinician information-seeking behaviour indicates numerous, significant barriers to locating evidence at the point of need (Clarke et al., 2013; Davies, 2011). Chief among these is the convergent experiences of practice time pressures, ever more complex patient care requirements, and the exponential growth in the size of the evidence base and options for accessing it (Bastian, Glasziou, & Chalmers, 2010; Cook, Sorensen, Wilkinson, & Berger, 2013). The fact that clinicians can no longer expect to stay abreast of developments in their own area of specialisation, let alone explore advances across multiple disciplines, has necessitated a 'just in time' rather than 'just in case' approach to clinical practice and professional learning (Fraser & Dunstan, 2010). It has also elevated the importance of having effective personal strategies for recognising and addressing knowledge gaps.

In recent years, the specialist searching skills of information professionals, especially those with a background in health, have been increasingly acknowledged as important in the teaching of evidence-based practice and a critical component in the creation of high quality evidence-based products such as systematic reviews (Meert, Torabi, & Costella, 2016), health technology assessments, and clinical practice guidelines (Cruse & Protzko, 2014). This recognition has led to increased participation in health care research work, often in the role of co-author (Rethlefsen, Farrell, Osterhaus Trzasko, & Brigham, 2015). While these activities represent new and emerging roles for information specialists, there remains the problem of how to support the unmediated clinician searcher in a search for research evidence to support clinical practice. For clinicians with limited searching skills, the process of searching online resources to resolve decisional uncertainty can be fraught with

challenges. Searching is both a conceptual and technical activity that requires more than domain knowledge for success (Damarell & Tieman, 2016). A range of domain-independent skills, optimally obtained across multiple instructional sessions, are also crucial (Ilic, Tepper, & Misso, 2012; Kai-Wah Chu & Law, 2008; Pell, 2017). These skills include: identifying appropriate resources for searching, efficiently extracting and converting key concepts and their numerous semantic expressions to searchable components and executing technically accurate searches based on specific database interfaces and algorithms. Just as important is the ability to critically analyse the quality and quantity of search results and modify an approach if the outcome is suspected to be suboptimal. This capacity to iteratively refine one's own search technique appears to be particularly susceptible to clinician searching overconfidence or time pressures (Damarell & Tieman, 2016; Sladek, Tieman, Tyndall, & Phillips, 2013; Swartz, Ratcliff, & Ivanitskaya, 2015). Without effective information retrieval skills, clinicians risk incomplete knowledge discovery and a biased view of the existing evidence.

Search filters as one solution to search inefficiencies

Search filters are tools that have emerged in tandem with evidence-based practice in acknowledgement of the challenges to quality evidence retrieval presented by large biomedical databases and a rapidly growing evidence base. Search filters are differentiated from other search strategies by the fact that they have been tested for their ability to focus search results within a target database in some way. Many have been developed by librarians or information specialists to help researchers with

specific information retrieval projects or time-pressured clinicians to rapidly identify the literature of relevance to them (Damarell, Tieman, Sladek, & Davidson, 2011; Hayman & Tieman, 2015; Shaheem & Tieman, 2014). By embedding the best evidence about searching into a predefined strategy, search filters seek to minimise variations and deficits in individuals' searching knowledge and skills and can prevent 'reinventing the wheel' for commonly sought searches. Several studies have demonstrated search filter superiority in direct head-to-head comparisons with clinician subject specialist searches (Damarell & Tieman, 2016; Garg et al., 2009; Hildebrand et al., 2014; Hildebrand et al., 2012; Iansavichus et al., 2012; Iansavichus et al., 2010; Iansavichus et al., 2015; Lee, Iansavichus, et al., 2012).

Search filters are usually designated 'methodological' or 'topical' in focus. Methodological search filters comprise search terms capable of identifying articles based on their underlying research design, for example, randomised controlled trials (Glanville, Lefebvre, Miles, & Camosso-Stefinovic, 2006; Haynes, Wilczynski, McKibbon, Walker, & Sinclair, 1994; McKibbon, Wilczynski, & Haynes, 2009) or systematic reviews (Lee, Dobbins, et al., 2012; White, Glanville, Lefebvre, & Sheldon, 2001). Topic search filters, however, identify articles based on their subject focus. Subjects may relate to population characteristics (e.g. gender or age) or—within a health context—clinical conditions such as hypertension or cancer, therapeutic interventions, or modes of care delivery (e.g. integrated care or emergency department services). Of course, study methodologies could also be considered topics if, for example, a searcher wanted to find articles *about* randomized

controlled trials instead of studies based on the randomized controlled trial methodology.

Methodological filters are now well-established and plentiful, to the extent that they have their own repository on the InterTASC website ("ISSG Search Filter Resource", 2008) and are embedded in PubMed as Clinical Queries (http://www.ncbi.nlm.nih.gov/pubmed/clinical) and in other database interfaces (e.g. Ovid). They are also routinely employed within systematic review and clinical practice guideline development processes (Lefebvre, Manheimer, & Glanville, 2011; Deurenberg et al., 2008). Furthermore, several critical appraisal instruments exist to help users evaluate their quality (Bak, Mierzwinski-Urban, Fitzsimmons, Morrison, & Maden-Jenkins, 2009; Glanville et al., 2008). Jenkins (2004) produced a review of available methodological filters and the methods used to develop them. This review highlighted a distinct lack of clarification and standardisation in search filter terminology, including the existence of at least 8 synonyms for 'search filters' in the literature. It also drew attention to significant heterogeneity in search filter development methods at that time. Since this review was published there has been a growing interest in the application of text mining and artificial intelligence methods such as machine learning to the development of guidelines and systematic reviews (Bian, Morid, Jonnalagadda, Luo, & Del Fiol, G. 2017; Shekelle, Shetty, Newberry, Maglione, & Motala, 2017). How these advances will impact on the field of search filter development is as yet unclear.

Search filter performance

Everyday database searching is often a 'best guess' activity. Searchers hope to capture all relevant articles while minimising the number of irrelevant ones, without any means of really knowing if that goal has been achieved. In comparison, the methodology used to develop experimentally-based search filters can make it possible to estimate a search filter's expected level of performance. Potential users therefore have a basis on which to judge a filter's fitness for purpose. In a questionnaire and interview-based study of information specialists working for the National Institute for Health and Care Excellence (NICE), it was found that these expert searchers were more likely to select a filter for use if it provided accompanying information on its expected level of performance (Beale et al., 2014).

Search filters are typically developed and then tested using a method comparable to that used in medicine to assess the performance of a new diagnostic test, namely, a gold standard comparison study (Haynes et al., 1994). At the heart of this method is the identification of a set of articles of known relevance to the concept of interest and which, when considered cumulatively, should ideally represent the full scope of that concept. Bibliographic citations for these articles are then sourced and pooled within the target database. This collection of citations is termed the 'gold standard' or 'reference set'. How these citations are identified is often the first point at which filter development methodologies diverge. If sought via a database search alone, the final product will inevitably comprise the same terms as those used in the original search (the 'self-fulfilling prophecy') rather than revealing key terms beyond the searcher's own comprehension (Jenkins, 2004).

One well-established method of forming a gold standard is the 'hand search' approach. This involves identifying relevant articles by reviewing (often dually) each and every published item in a circumscribed set of nominated journals. By tagging all articles as relevant or irrelevant to the concept of interest according to strict and explicit criteria, filter developers have the means of creating a bibliographic database 'microcosm' for testing search performance.

A more pragmatic, less-time consuming approach is the relative recall method which relies on the included studies within a set of systematic reviews or clinical practice guidelines on the concept of interest to form a gold standard. This method might be deemed a suitable alternative to the hand search approach when the evidence syntheses used are underpinned by multiple exhaustive and high-quality searches across a broad range of sources, as well as a rigorous screening process based on clear eligibility criteria. Regardless of how the gold standard is formed, its main purpose is to allow developers to evaluate how well their product retrieves relevant citations and, under certain conditions, effectively fails to retrieve non-relevant ones.

Filter developers usually report search filter performance as 'sensitivity' or ('recall') which is the number of relevant citations retrieved as a proportion of all relevant citations in a dataset. Depending on the method used to form the gold standard set, it may also be possible for other performance measures to be calculated. This includes 'precision' (or 'positive predictive value'), defined as the number of relevant citations retrieved divided by the total number of relevant and irrelevant citations

retrieved. In comparison to sensitivity/recall, which might be conceptualised as the 'completeness of retrieval', precision can be said to measure the 'purity of retrieval' (Buckland & Gey, 1994). A further term, 'specificity', refers to the correct exclusion of irrelevant citations from the search results. These definitions can be expressed as formulae (Table 1).

Table 1. Search strategy performance measures

Search results	**Relevant citations**	**Irrelevant citations**
Citations retrieved by search	a	b
Citations not retrieved by search	c	d
Formulae Sensitivity (recall) = a/(a + c) Specificity = d/(b + d) Precision = a/(a + b) Accuracy = (a + d)/(a + b + c + d) Number Needed to Read = 1/Precision		

Some filters provide two sets of performance figures—one set obtained from the citations used to develop the search filter, and a second set derived from testing performance in an additional, hitherto unused dataset of citations. This secondary check of performance, or 'validation', constitutes external validation of the filter and indicates how generalisable users might expect performance to be across the full database in question.

Filters based on included studies of evidence syntheses usually differentiate their methodology from that of the hand search by using the term 'relative recall' instead of 'sensitivity'. In information retrieval terms, relative recall is 'the proportion that any specific system retrieves of the total or pooled relevant documents retrieved by all systems considered to be working as a composite' (Fricke, 1998). In the context of search filters, this definition of relative recall might be paraphrased as 'the proportion of citations retrieved from a total, pooled set of citations which were originally identified using multiple search approaches considered to be working as a composite'. Ideally systematic reviews and guidelines will employ a wide range of

search strategies to identify relevant evidence and thereby minimise the potential for bias in the synthesis of results. Such 'systems' might include databases, mechanisms for or identifying grey literature, or even the process of scanning reference lists of relevant articles, forward and backwards citation tracking, and hand searching.

Often filter developers provide different versions of a filter, each with a different level of search performance. The same filter may be represented, for example, by a highly sensitive filter and a highly specific filter (Iansavichus et al., 2012), and even an 'optimised' version that minimises the difference between these two metrics (McKibbon et al., 2012). These variants are a recognition that not all end-users have the same information retrieval needs. Researchers may require a comprehensive approach to finding evidence, therefore prizing sensitivity above specificity and precision. Clinicians, however, may value high precision over sensitivity, as they usually haven't the resources to screen extensive sets of records for what they need. Ideally searches would have high sensitivity and high precision. In reality, there is always a trade off at play between these two measures (Sampson et al., 2006).

Search filter functionality

The way in which a search filter can be utilised is a function of the database for which it was designed. A search filter designed for Ovid Medline, for example, will usually capitalise on that database's advanced search capabilities such as phrase searching, subject heading explosion, and adjacency and frequency operators. Search filters designed using Ovid Medline but not integrated into that database (e.g. Clinical Queries) can often comprise multiple search lines which users must key

into the database exactly, one line at a time, to achieve a successful search. Complex search filters might, therefore, be quite onerous for busy clinician searchers to recreate. Saving a frequently used search filter to a personal account is one solution. However, time-pressured clinicians may find password-controlled systems a deterrent to use. Furthermore, saved search facilities don't facilitate widespread use of a search strategy beyond a single account holder. This can hinder their utility within collaborative research or clinical practice teams.

In contrast, PubMed (which includes the free version of Medline) provides the means to contract a long complex search filter into one long search string which clinicians can copy and paste into a database search box. Even more conveniently, PubMed's open accessibility allows search filters to be built behind a hyperlink and embedded in any HTML environment. Clinicians therefore trigger a real time, up-to-date search of PubMed simply by clicking on a hyperlink or choosing a drop-down menu option. Clinical Queries is a prime example of this convenient mode of access.

What this review offers

While the upper limit on the number of potential methodological search filters is circumscribed by the number of research architectures in use, the subject possibilities for topic filter development are virtually inexhaustible. Despite this, no review of topic search filters exists to indicate their number or scope. We have therefore undertaken a comprehensive scoping review (Peters et al., 2015) of the topic filters available, mapping their characteristics, availability, and specified users. This review's findings will inform information specialists as to the range of topic

filters available and alert them to their various levels of performance. Furthermore, in highlighting differences in the ways in which filters are described and reported, the findings may also lay the groundwork for a subsequent detailed critical analysis of topic filter methodologies, reporting standards, and approaches to critical appraisal. Detailed analyses of this kind already exist for methodological search filters (Jenkins, 2004; Lefebvre, 2017), however, the unique considerations and challenges associated with developing topic filters, especially on complex, multi-dimensional topics, may warrant further investigation of their own. These findings might then contribute to a broader discussion on search filter design approaches across methodological and topic lines.

Objectives

The primary objective of this scoping review is to systematically identify empirical studies describing the development of search filters for retrieving articles in bibliographic databases based on a subject, rather than methodological focus. This study will also seek to understand the terminology and definitions used to describe topic filters and explore boundaries between what is considered a topic search and what is defined as a methods-based search.

Methods

Identification of studies

The search for topic-based filters included both published and unpublished literature. An electronic database search was first drafted and then iteratively

developed within Ovid Medline (1946- ; Includes Epub Ahead of Print, In-Process & Other Non-Indexed Citations, and Ovid Medline Daily subsets). This included testing the search's ability to retrieve relevant citations from within the authors' personal libraries of search filter papers.

As there is no universally recognized term for what we have called ‘search filters’, our search strategy attempts to identify these tools based on their purpose (to retrieve literature), application (databases), and essential reporting outcomes (performance measurement). This strategy closely reflects our final inclusion criteria. Full search strategies are provided as Appendix 1.

Once satisfied that the strategy was optimally sensitive, we translated it for a range of databases using each database's native syntax and subject headings (where available). Databases were selected based on their potential to contain content focusing on 'information retrieval'. We therefore included databases with multidisciplinary coverage, as well as products focusing on health, library and information science, computing, and information technology.

Included databases (searched 4 September 2016):

- Medline (Ovid, 1946-)
- PubMed (non-indexed subset only)
- PsycINFO (Ovid, 1806-)
- Embase (Ovid, 1974-)
- CINAHL (EBSCOhost)

- LILACS (http://lilacs.bvsalud.org/en/)
- Cochrane Methodology Register (Cochrane Library, Wiley)
- Scopus
- Web of Science Core Collection
- ProQuest, including:
    - ABI/INFORM Collection (1971-)
    - ERIC (1966-)
    - Library & Information Science Abstracts: LISA (1969-)
    - Library Science Database (1970-)
    - ProQuest Dissertations & Theses Global
    - Social Science Premium Collection
- Informit
- Australian Library and Information Science Abstracts: ALISA (Informit)
- Library, Information Science & Technology Abstracts: LISTA (EBSCOhost)
- IEEE Xplore Digital Library
- ACM Digital Library
- ArXiv.org

We supplemented database searches with an online 'hand search' of selected journal content pages across the years 2012-2016. We targeted journals known or highly likely to contain relevant papers: Health Information & Libraries Journal (HILJ); Journal of the Canadian Health Libraries Association; Journal of the American Medical Informatics Association; and Journal of the Medical Library Association. We also checked the reference lists of our final selection of papers and used the forward

citation tracking feature of Scopus to check for more recent studies which electronic searches may have missed. Authors were contacted to gain more information about search filters when there was insufficient detail provided in original reports, or when the full text report proved difficult to locate.

Our grey literature search strategy targeted a range of sources deemed likely to contain topic search filter content.

- Cochrane Methods Group (http://methods.cochrane.org)
- Cochrane Colloquia (http://community.cochrane.org/news/events/colloquium)
- InterTASC Information Specialists' Sub-Group Search Filter Resource (https://sites.google.com/a/york.ac.uk/issg-search-filters-resource/home)
- Health Information Research Unit (HIRU) at McMaster University (https://hiru.mcmaster.ca/hiru/), and
- Selected health librarian weblogs and wikis (e.g. Krafty Librarian, Tom Roper's Weblog, Laika's MedLibLog, HLWIKI Canada)

A Google Advanced search was conducted on 16 January 2017 using a range of search variants to identify websites with the potential to reveal additional unpublished filters or lead to organisational websites that might do so. (See Appendix 1.) As a final strategy, we used Twitter to solicit information on search filters from health librarians involved in online exchanges within established Health Library groups.

Inclusion criteria

Study focus

Studies describing the empirical development of a *topic search filter* for a specific bibliographic or full-text database were included. We define a 'search filter' as a search strategy developed and tested for its ability to restrict search retrieval in some way within a specific electronic database. 'Topic' is defined broadly as any subject area capable of being the focus of a research study, as distinct from the study design method underpinning that study (e.g. randomised controlled trials). The topic need not be unique to health or medicine. Filters that contained both topic and methodological aspects were only included if the performance of the topic-specific section was reported independently. Databases could be relevant to any subject area but only those that were designed to aid in the discovery of research citations, as distinct from primary data, were included.

Types of studies

Only primary development studies were eligible for consideration. We define a development study as a prospective study reporting the conception, development, and testing of a new search filter.

Types of methods

As this review hoped to identify any novel approaches to search filter development in addition to more established processes, we considered any method of filter development eligible for inclusion providing it facilitated a measurement or

assessment of the filter's performance in some way. This commonly includes the formation of a ‘gold standard’ set of citations for identifying search terms and the iterative testing of terms and their combinations. Filter validation was not an inclusion criterion for this scoping review, despite the rigour this process confers, as there appears to exist a degree of confusion amongst filter developers as to when and how it is conducted (LeFebvre et al., 2017). It is hoped this issue, along with other methodological inconsistencies identified in the course of this study, will be the subject of a subsequent, more detailed analysis of topic search filters.

Types of outcome measures

Eligible studies reported sensitivity, or recall, as a measure of search filter performance. Other metrics could be reported in addition to this, for example specificity, accuracy, precision, or number needed to read.

Types of publications

Both published and unpublished reports were included.

Language

Only articles published in English were included in the review.

Date limits

All topic search filters were sought, regardless of their age, in order to trace the history of topic filter development over time. However, we restricted the database searches to the date range of 1990 onwards as, according to Pritchard and

Weightman (2005), this date covers the beginning of ubiquitous unmediated electronic database searching. Search filter development reports are therefore unlikely to appear in the literature before this time.

Exclusion criteria

We excluded:

- Studies describing the development of a search filter for retrieving studies based on their research design, rather than their topic focus;
- Studies describing the development of a filter for retrieving studies on a topic with a specific research design (e.g. systematic reviews on sleep) where the topic component was not validated independently of the research methods component;
- Studies reporting the comparison, evaluation, or iterative development of existing filters whose development may or may not be reported elsewhere;
- Review articles;
- Articles published before 1990;
- Studies not reporting the total number of relevant citations within the system (or a representative subset of that system) which the search must aim to retrieve (i.e. a gold standard or test set). Without such a set, it is not possible to measure search performance using sensitivity (recall).
- Strategies for interrogating non-literature database items such as images (fingerprints, faces, radiologic), audio, video, protein or DNA sequences, electronic medical records, and population databases or registries.

Study records

Retrieved citations were downloaded to EndNote X7 where duplicates were removed. EndNote records were manually created for grey literature resources for which no citation could be identified in Google Scholar. Citations were then uploaded to Covidence, a web-based program that enables reviewers to collaborate online during the study selection process ("Covidence systematic review software" 2015).

Before the formal screening process, the team developed and tested screening questions and forms based on the inclusion and exclusion criteria. A calibration exercise ensured all reviewers interpreted and applied the criteria in the same way. Three reviewers (RD, NM, SH) independently screened titles and abstracts against the eligibility criteria using the standardized form. Full reports were obtained for studies meeting the inclusion criteria, or where further information was required to make a decision on inclusion. Disagreements were resolved through discussion. Where consensus could not be reached, a third reviewer (JT) was asked to adjudicate.

Data extraction and synthesis

Three reviewers (RD, NM, SH) independently extracted predetermined data elements from the included studies using a standardised Excel data extraction table to ensure consistency between extractors. Data extraction was based on two categories:

1. Filter characteristics such as topic, database, purpose, intended users, performance, and availability;
2. Terminology and definitions used in the process of reporting search filter development.

Results

Database searches were conducted on 4 September 2016 and retrieved a total of 16,948 potentially relevant citations. An additional 28 search filter resources were identified in the grey literature (searches conducted 16 January 2017). Once duplicates were removed, 11,317 citations were uploaded into Covidence for dual review. Based on screening by title and abstract alone, 262 citations went on to a full text review. Of these, 54 papers met all inclusion criteria and were therefore included in the synthesis.

Figure 1 details the search and selection process of the review according to the PRISMA reporting standard (Moher, Liberati, Tetzlaff, & Altman, 2009).

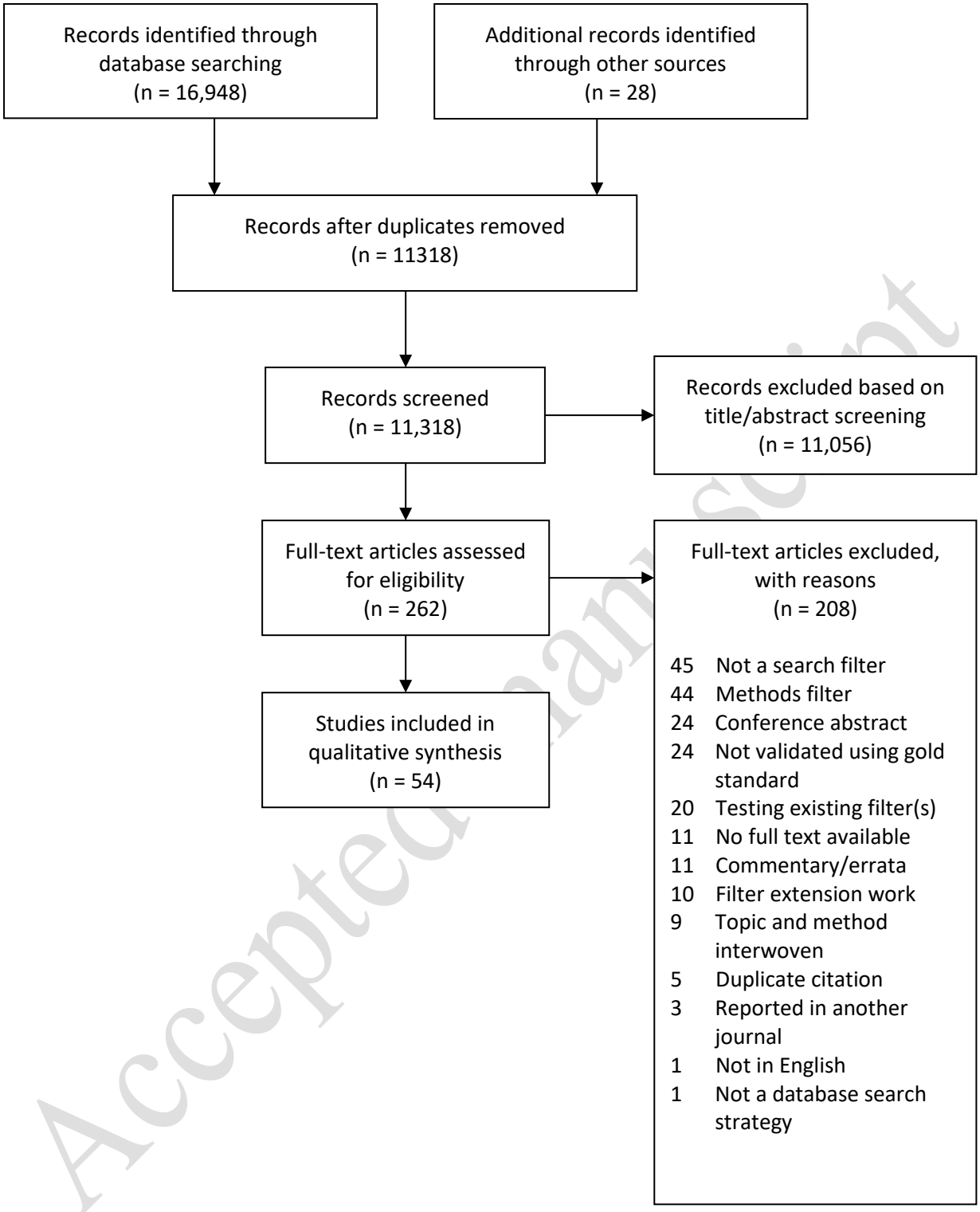

Figure 1. PRISMA flow diagram of selection decisions in this review

General characteristics of topic filters

Table 2 details search filter characteristics.

Table 2. General characteristics and selected performance metrics of included topic search filters

Study	Filter topic(s)	Database (platform)	Number of versions per database±	Translations to other databases and/or platforms	Filter availability	Performance values		
						Best sensitivity %	Related precision %	Difference between sensitivity & precision %
Ayiku et al. (2017)	United Kingdom	Medline (Ovid)	1		Published article InterTASC	87.6	-	-
Brown et al. (2014)	Primary Health Care	Medline (Ovid)	1		Published article Website search portal: http://www.phcris.org.au/phcsearchfilter/	77.0	78.3	-1.3
Curti et al. (2016)	Putative environmental determinants of diseases related to outdoor air pollution	PubMed	2		Published article	98.5	-	-
Damarell, Tieman, Sladek, & Davidson (2011)	Heart failure	Medline (Ovid)	1	PubMed	Published article Website hyperlinks: https://www.caresearch.com.au/ca	98.2	75.0	23.2

					research/tabid/1763/Default.aspx			
Damarell, Tieman, Olver, & Currow (2011)	Lung cancer	Medline (Ovid)	1	PubMed	Unpublished conference poster Website hyperlinks: https://www.caresearch.com.au/caresearch/tabid/1940/Default.aspx	97.9	-	-
Durão, Kredo, & Volmink (2015)	Diet and nutrition trials	PubMed	1		Published article	88.6	-	-
Garg et al. (2009)	Nephrology and renal medicine	Medline (Ovid)	12	PubMed	Published article Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	97.8	84.9	12.9
Gehanno et al. (2009)	Return to work	PubMed	29		Published article	100.0	0.3	99.7
Gill, Roberts, Wang, & Heneghan (2014)	Primary care	Medline (Ovid)	4	PubMed	Published article InterTASC	95.7	11.3	84.4

Goss, Lowenstein, Roberts, & DiGuiseppi (2007)	Alcohol-impaired driving	ISI Web of Science; validated in Ovid versions of Medline, CINAHL, and PsycINFO	1	Same search used across databases	Published article	85.7	3.5	82.2
Haslinghuis-Bajan et al. (2001)	Gamma camera emission tomography using coincidence imaging	Embase & Medline (versions not stated)	1	Same search used across databases	Published article	100.0	-	-
Hayman & Tieman (2015)	Dementia	Medline (Ovid)	1	PubMed	Published article Website hyperlinks: http://www.flinders.edu.au/clinical-change/research/flinders-filters/search-filters/dementia/dementia-search-filter.cfm	97.2	77.6	19.6
Hempel et al. (2011)	Quality Improvement	Medline (Ovid) and PubMed	7		Published paper InterTASC	53.0	-	-

Hildebrand et al. (2012)	Glomerular disease	Embase (Ovid), Medline (Ovid), and PubMed	6		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	96.7	43.4	53.3
Hildebrand et al. (2014)	Acute kidney injury	Embase (Ovid), Medline (Ovid), and PubMed	6		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	97.2	31.5	65.7
Hooijmans, Tillema, Leenaars, & Ritskes-Hoitinga (2010)	Animal studies	PubMed	1		Published paper	100.0 (reported as 106.3%)	-	-
Iansavichus et al. (2010)	Renal medicine	Embase (Ovid)	10		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	98.7	74.7	24.0

Iansavichus et al. (2012)	Dialysis (covers haemodialysis or peritoneal forms)	Embase (Ovid), Medline (Ovid), and PubMed	6		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	98.3	48.7	49.6
Iansavichus et al. (2015)	Chronic kidney disease	Embase (Ovid), Medline (Ovid), and PubMed	2		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	99.0	36.5	62.5
Jenuwine & Floyd (2004)	Sleep	PubMed	2		Published paper	64.0 (mean of combined strategies)	-	-
Johnson, Tongbram, Ndirangu, Ogden, & Bay (2016)	Medication adherence	Embase (Ovid)	1	Medline (Ovid)	Published paper InterTASC	89	-	-
Kastner, Wilczynski, Walker-Dilks, McKibbon, &	Age groups: 1. Paediatric 2. Geriatric 3. Neonatal 4. Adult	Medline (Ovid)	3		Published conference presentation InterTASC	1. 98.0 2. 96.4 3. 95.3 4. 94.9 5. 82.0	1. 24.6 2. 13.7 3. 7.4 4. 47.3 5. 23.4	1. 73.4 2. 82.7 3. 87.9 4. 47.6 5. 58.6

Haynes (2006)	5. Obstetrics							
Kirk, Damarell, Tieman, & Harvey (2013)	Contraception: 1. General contraception 2. Emergency contraception 3. Long Acting Reversible Contraception (LARC)	Medline (Ovid)	2 for General Contraception filter 1 for other 2 topics	PubMed	Unpublished conference poster Website hyperlinks: http://www.flinders.edu.au/clinical-change/research/flinders-filters/search-filters/contraception/contraception.cfm	1. 96.4 2. 100.0 3. 94.9	-	-
Leclercq, Leeflang, van Dalen, & Kremer (2013)	Paediatric studies	PubMed	1		Published paper InterTASC	99.5	69.0	30.5
C. W. C. Lee et al. (2012)	Kidney transplantation	Embase (Ovid), Medline (Ovid), and PubMed	2		Published paper Website search portal: https://hiru.mcmaster.ca/hiru/HIRU_Hedges_Nephrology_Filters.aspx	98.5	61.6	36.9

Li & Lu (2013)	1. Nephrology 2. Diabetes 3. Pregnancy 4. Depression	PubMed	1		Published paper InterTASC	1. 91.3 2. 94.2 3. 99.0 4. 97.1	1. 94.6 2. 91.1 3. 98.2 4. 96.8	1. -3.3 2. 3.1 3. 0.8 4. 0.3
Lokker et al. (2010)	Knowledge translation (KT): 1. KT content 2. KT content – no instruments 3. KT applications 4. KT theory	CINAHL (EBSCO)	3		Published paper Website: https://hiru.mcmaster.ca/hiru/HIRU_KT_MEDLINE_Filters.aspx	1. 62.9 2. 75.2 3. 78.5 4. 80.3	1. 29.5 2. 20.9 3. 11.8 4. 9.5	1. 33.4 2. 54.3 3. 66.7 4. 70.8
McKibbon et al. (2012)	Knowledge translation (KT): 1. KT content 2. KT content – no instruments 3. KT applications 4. KT theory	Medline (Ovid)	3		Published paper Website: https://hiru.mcmaster.ca/hiru/HIRU_KT_MEDLINE_Filters.aspx	1. 84.7 2. 88.7 3. 91.0 4. 94.1	1. 33.7 2. 22.7 3. 12.8 4. 10.6	1. 51.0 2. 66.0 3. 78.2 4. 83.5
Mesgarpour, Muller, & Herkner (2012a)	Off-label drug use	Embase (Ovid)	3		Published paper InterTASC	94.0	69.5	24.5
Mesgarpour, Muller, & Herkner (2012b)	Off-label drug use	Medline (Ovid)	3		Published paper InterTASC	99.5	60.3	39.2
Moerman, Deurenberg,	Sex-specific information	Medline (Ovid)	1		Published paper InterTASC	83.0	65.0	18.0

& Haafkens (2009)								
Olaussen, Semple, Oteir, Todd, & Williams (2017)	Paramedic literature	Medline (Ovid)	2		Published paper	98.4	-	-
Petrova, Sutcliffe, Fulford, & Dale (2012)	Health-related values	Medline (Ovid)	1		Published paper	76.8	86.8	-10.0
Pienaar, Grobler, Busgeeth, Eisinga, & Siegfried (2011)	African research	Embase (Ovid) and PubMed	1		Published paper InterTASC	74.0	9.4	64.6
Pols, Bramer, Bindels, van de Laar, & Bohnen (2015)	Family medicine	PubMed	2	Cochrane Library, Embase (Ovid & Embase.com), Medline (Ovid)	Published paper InterTASC	96.8 (mean across all databases)	-	-
Rogers, Bethel, & Boddy (2017)	Patient and public involvement in health research	Medline (Ovid)	1		Published paper InterTASC	98.5	-	-

Schaafsma et al. (2006)	Occupational origin of diseases 1. Asthma 2. Eczema 3. Chronic toxic encephalopathy 4. Carpal tunnel syndrome	Medline (Ovid)	2		Published paper InterTASC	1. 95.0 2. 93.3 3. 80.0 4. 100.0	1. 12.8 2. 11.2 3. 9.1 4. 8.0	1. 82.2 2. 82.1 3. 70.9 4. 92.0
Selva et al. (2017)	Patients' views and preferences	PubMed	1		Published paper InterTASC	88.7	-	-
Shaheem & Tieman (2014)	Glaucoma	Medline (Ovid)	1	PubMed	Unpublished report Website hyperlinks: http://www.flinders.edu.au/medicine/sites/ophthalmology/research/glaucoma/glaucoma-search-filter.cfm	95.7	85.4	10.3
Simon, Hausner, Klaus, & Dunton (2010)	Nurse staffing	PubMed	3		Published paper InterTASC	98.7	0.2	98.5
Sladek, Tieman,	Palliative care	Medline (Ovid)	1	PubMed	Published paper Website	56.9	22.0	34.9

Fazekas, Abernethy, & Currow (2006)					hyperlinks: https://www.caresearch.com.au/caresearch/tabid/567/Default.aspx			
Song, Simonsen, Wilson, & Jenkins (2016)	Sex and gender: 1. Combined with 'stroke' 2. Combined with 'diabetes'	PubMed	1		Published paper Website: https://www.sexandgenderhealth.org/ InterTASC	1. 81.9 2. 85.3	-	-
Stewart et al. (2014)	Males	Embase (Ovid) and Medline (Ovid)	2		Published paper	100.0	0.2	99.8
Tanon et al. (2010)	Patient safety	CINAHL (EBSCO), Embase (Ovid), and Medline (Ovid)	3		Published paper InterTASC	100.0	30.0	70.0
Tieman, Lawrence, Damarell, Sladek, & Nikolof (2014)	Australian Aboriginal and Torres Strait Islanders	Medline (Ovid)	1	PubMed	Published paper Website search portal: https://www.lowitja.org.au/litsearch InterTASC	93.6	81.2	12.4

Tieman, Hayman, & Hall (2015)	Bereavement	Medline (Ovid)	1	PubMed	Published paper Website hyperlinks: https://www.caresearch.com.au/caresearch/tabid/2949/Default.aspx	81.2	72.4	8.8
Valderas, Mendivil, Parada, Losada-Yanez, & Alonso (2006)	Spanish research	PubMed	1		Published paper InterTASC	88.1	-	-
Van de Glind, van Munster, Spijker, Scholten, & Hooft (2012)	Geriatric medicine	PubMed	3		Published paper InterTASC	94.8	73.0	21.8
Van Hoorn et al. (2016)	Patient preferences	PubMed	4		Published paper InterTASC	100	-	-
Varela-Lema, Punal-Rioboo, Accion, Ruano-Ravina, & Garcia (2012)	New or emerging technologies in health	PubMed	1		Published paper	83.0	7.0	76.0

Wentz et al. (2001)	Road safety interventions	TRANSPORT	2		Published paper	97.0	0.5	96.5
Wessels, Hielkema, & van der Weijden (2016)	Patient knowledge, views, and values	Medline (Ovid)	1	PubMed, Embase (Elsevier?)	Published paper InterTASC	93.1	81.8	11.3
Wilczynski, Haynes, & Hedges (2006)	Mental health	Medline (Ovid)	3		Published paper	98.4	41.9	56.5
Wilczynski & Haynes (2010)	Quality Improvement	Medline (Ovid)	3		Published paper InterTASC	98.4	1.9	96.5

Filter topic foci

The 54 included papers described the experimental development of 58 topic filters on a broad range of topics with minimal duplication of subject coverage. These topics have been categorised into 8 groups:

- Clinical conditions (Damarell, Tieman, Olver, & Currow, 2011; Damarell, Tieman, Sladek, et al., 2011; Hayman & Tieman, 2015; Hildebrand et al., 2014; Hildebrand et al., 2012; Iansavichus et al., 2015; Jenuwine & Floyd, 2004; Li & Lu, 2013; Shaheem & Tieman, 2014; Wilczynski & Haynes, 2006)
- Clinical disciplines (Brown et al., 2014; Durão, Kredo, & Volmink, 2015; Garg et al., 2009; Gill, Roberts, Wang, & Heneghan, 2014; Iansavichus et al., 2010; Jenuwine & Floyd, 2004; Li & Lu, 2013; Olaussen, Semple, Oteir, Todd, & Williams, 2017; Pols, Bramer, Bindels, van de Laar, & Bohnen, 2015; Sladek, Tieman, Fazekas, Abernethy, & Currow, 2006; van de Glind, van Munster, Spijker, Scholten, & Hooft, 2012)
- Clinical interventions (Haslinghuis-Bajan et al., 2001; Iansavichus et al., 2012; Kirk, Damarell, Tieman, & Harvey, 2013; Lee, Iansavichus, et al., 2012)
- Demography (Hooijmans, Tillema, Leenaars, & Ritskes-Hoitinga, 2010; Kastner, Wilczynski, Walker-Dilks, McKibbon, & Haynes, 2006; Leclercq, Leeflang, van Dalen, & Kremer, 2013; Moerman, Deurenberg, & Haafkens, 2009; Song, Simonsen, Wilson, & Jenkins, 2016; Stewart et al., 2014; Tieman, Lawrence, Damarell, Sladek, & Nikolof, 2014)
- Geography (Ayiku et al., 2017; Pienaar, Grobler, Busgeeth, Eisinga, & Siegfried, 2011; Valderas, Mendivil, Parada, Losada-Yanez, & Alonso, 2006)

- Health care delivery issues (Hempel et al., 2011; Lokker et al., 2010; McKibbon et al., 2012; Mesgarpour, Muller, & Herkner, 2012a, 2012b; Simon, Hausner, Klaus, & Dunton, 2010; Tanon et al., 2010; Varela-Lema, Punal-Rioboo, Accion, Ruano-Ravina, & Garcia, 2012; Wilczynski & Haynes, 2010)
- Non-clinical patient and carer issues (Johnson, Tongbram, Ndirangu, Ogden, & Bay, 2016; Petrova, Sutcliffe, Fulford, & Dale, 2012; Rogers, Bethel, & Boddy, 2017; Selva et al., 2017; Tieman, Hayman, & Hall, 2015; van Hoorn et al., 2016; Wessels, Hielkema, & van der Weijden, 2016)
- Public health issues (Curti et al., 2016; Gehanno et al., 2009; Goss, Lowenstein, Roberts, & DiGuiseppi, 2007; Schaafsma et al., 2006; Wentz et al., 2001).

Excluding the same topic developed for different databases (e.g. *off-label drug use*), duplicated topics were *primary health care/family medicine* (three filters), *renal medicine/nephrology* (two filters), *paediatrics* (two filters), and *quality improvement* (two filters). Some topics possessed similarities but were designed for different contexts. These included *geriatric medicine/patients* (two variants) and *patient views and preferences* (three variants). Table 3 lists the topics by broad subject category.

Table 3. Broad subject categorization of topic filters

Clinical conditions	**Geography**
Acute kidney injury Chronic kidney disease Dementia Depression Diabetes Glaucoma Glomerular disease Heart failure Lung cancer Mental health	African research Spanish research United Kingdom
Clinical disciplines	**Health care delivery issues**
Diet and nutrition Family medicine Geriatric medicine Nephrology & renal medicine Palliative care Paramedic literature Primary (health) care Sleep	Knowledge translation New or emerging technologies in health Nurse staffing Off-label drug use Patient safety Quality improvement
Clinical interventions	**Non-clinical patient and carer issues**
Contraception: • Emergency contraception • General contraception • Long acting reversible contraception Dialysis Gamma camera emission tomography Kidney transplantation	Bereavement Health-related values Medication adherence Patient and public involvement in health research Patient knowledge, views, and values Patient preferences for treatment outcomes Patients' views and preferences
Demography	**Public health issues**
Age groups: • Adult patients • Geriatric patients • Neonatal patients • Obstetric patients	Alcohol-impaired driving Occupational origins of: • Asthma • Eczema • Chronic toxic encephalopathy

• Paediatric patients Animals Australian Aboriginal & Torres Strait Islanders Males Pregnant women Sex-specific information Sex and gender differences	• Carpal tunnel syndrome Putative environmental determinants of diseases related to outdoor air pollution Return to work Road safety interventions

Definition of topic scope

Most reports provided at least a brief description of the subject area covered by the search filter. Twenty-six percent (14/54) provided an explicit and detailed statement of what the filter could be expected to retrieve and what, by extension, it might reasonably exclude (Durão et al., 2015; Gill et al., 2014; Hildebrand et al., 2014; Hildebrand et al., 2012; Iansavichus et al., 2012; Iansavichus et al., 2015; McKibbon et al., 2012; Pols et al., 2015; Sladek et al., 2006; Stewart et al., 2014; Valderas et al., 2006; van de Glind et al., 2012; Varela-Lema et al., 2012; Wessels et al., 2016). In 15% (8/54) of filter reports, this statement was an attempt to operationalise a highly complex topic for specific, but not necessarily universal, purposes (Hempel et al., 2011; Jenuwine & Floyd, 2004; Mesgarpour et al., 2012b; Petrova et al., 2012; Rogers et al., 2017; Song et al. 2016; Tieman et al., 2015; Wentz et al., 2001). A further 13% of reports (7/54) provided topic filter scope indirectly by including a clear list of eligibility criteria for selecting the gold standard source (e.g. systematic reviews), or the individual citations making up the gold standard (Damarell, Tieman, Sladek, et al., 2011; Garg et al., 2009; Moerman et al., 2009; Schaafsma et al., 2006; Simon et al., 2010; Wilczynski & Haynes, 2010; Wilczynski & Haynes, 2006). The inference here is that the gold standard itself defined the topic boundaries of the

filter. Nineteen percent (10/54) of filter reports, however, did not provide a definition of their topic or attempt to clarify its scope (Curti et al., 2016; Damarell, Tieman, Olver, et al., 2011; Haslinghuis-Bajan et al., 2001; Hayman & Tieman, 2015; Hooijmans et al., 2010; Kastner et al., 2006; Lee, Iansavichus, et al., 2012; Li & Lu, 2013; Pienaar et al., 2011; Shaheem & Tieman, 2014).

Temporal growth in number of topic search filters

The earliest topic filters appeared in 2001 and were designed to retrieve literature on topics as diverse as *gamma camera emission tomography using coincidence imaging* and *road safety interventions* (Haslinghuis-Bajan et al., 2001; Wentz et al., 2001). The four most recently published filters retrieve literature on the *United Kingdom* (Ayiku et al., 2017), *paramedicine* (Olaussen et al., 2017), *patient and public involvement in health research* (Rogers et al., 2017), and *patients' views and preferences* (Selva et al., 2017). More than half of the topic search filters (n=32; 59%) were reported in or after 2012.

Figure 2 shows the spread of years for filter development.

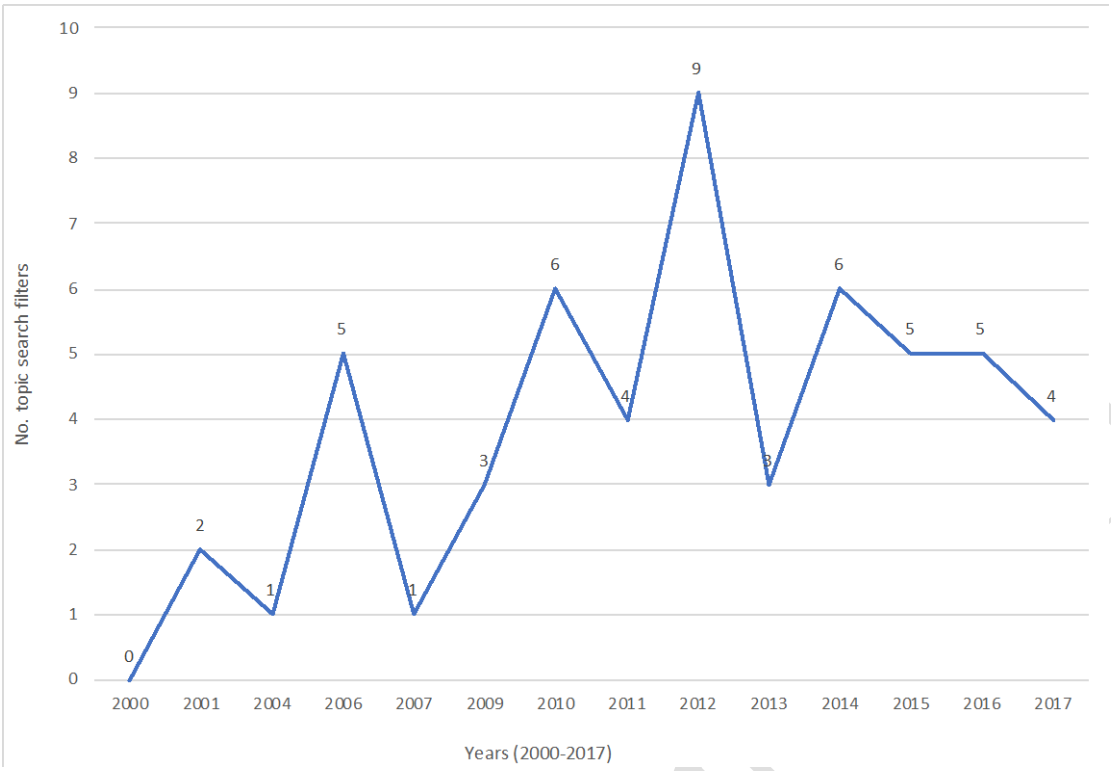

Figure 2. Topic search filter development 2000-2017

Search filter nomenclature and definition

More than half of the included reports used the term 'search filter' to describe the final product (36/54; 67%). The second most frequent label was 'search strategy' (n=16) while two reports used both terms interchangeably (Tanon et al., 2010; van Hoorn et al., 2016). Additional descriptors were 'algorithm' (Haslinghuis-Bajan et al., 2001) and 'hedge' (Wilczynski & Haynes, 2010). Several reports prefaced the name of their tool with 'optimal' (Iansavichus et al., 2010; Wilczynski & Haynes, 2010; Wilczynski & Haynes, 2006). The most common and simplest description of a search filter is as a combination or 'collection' of search terms, including controlled subject vocabulary and naturally-occurring text words (Ayiku et al., 2017; Damarell, Tieman, Olver, et al., 2011; Garg et al., 2009; Gehanno et al., 2009; Gill et al., 2014; Hildebrand et al., 2014; Hildebrand et al., 2012; Hooijmans et al., 2010; Jenuwine &

Floyd, 2004; Lee, Iansavichus, et al., 2012; Simon et al., 2010; Stewart et al., 2014; Tanon et al., 2010; van de Glind et al., 2012; Wessels et al., 2016; Wilczynski & Haynes, 2010).

Slightly more than half of the filter reports (29/54; 54%) provided at least a rudimentary definition of the purpose of their product in order to distinguish it from other types of searches. These definitions commonly focused on three aspects—what a filter comprises, its purpose, and the rigorous methodology underpinning its development—with the two most comprehensive definitions of the set covering all three (Ayiku et al., 2017; Petrova et al., 2012). Filter purpose is generally described as retrieving literature with some common feature (Ayiku et al., 2017; Damarell, Tieman, Olver, et al., 2011; Gill et al., 2014; Hildebrand et al., 2014; Hildebrand et al., 2012; Rogers et al., 2017; Stewart et al., 2014; Tanon et al., 2010; Tieman et al., 2014) within a specified database (Ayiku et al., 2017; Damarell, Tieman, Sladek, et al., 2011; Hayman & Tieman, 2015; Hildebrand et al., 2014; Li & Lu, 2013; Rogers et al., 2017; Stewart et al., 2014; Tanon et al., 2010; Tieman et al. 2014; Wilczynski & Haynes, 2010). Only three reports defined filters in terms of what they don't retrieve, as well as what they should retrieve, introducing the concept of *specificity* to search effectiveness (Ayiku et al., 2017; Rogers et al., 2017; Song et al., 2016). Other definitions of purpose focused on the time-saving, ready-to-use nature of filters for the end-user (Brown et al., 2014; Curti et al., 2016; Garg et al., 2009; Valderas et al., 2006), their accuracy (Curti et al., 2016; Damarell, Tieman, Olver, et al., 2011; Valderas et al., 2006; Wilczynski & Haynes, 2010) or comprehensiveness of retrieval (Curti et al., 2016; Gehanno et al., 2009; Jenuwine & Floyd, 2004; Song et

al., 2016), as well as their reproducible, standardised character of performance (Brown et al., 2014; Damarell, Tieman, Sladek, et al., 2011; Valderas et al., 2006; Wessels et al., 2016). One report emphasised their value for harvesting new literature on an ongoing basis (Damarell, Tieman, Olver, et al., 2011).

Authors differentiated search 'filters' from other types of searches by their rigorous and explicit method of development in 13 of 54 reports (24%). These definitions used terms such as ‘validated’ (Ayiku et al., 2017; Damarell, Tieman, Olver, et al., 2011; Damarell, Tieman, Sladek, et al., 2011; Hayman & Tieman, 2015; Rogers et al., 2017), ‘experimentally created’, ‘pre-tested’, ‘objectively derived’, ‘strategically developed’, ‘evidence based’ or ‘research based’ (Brown et al., 2014; Damarell, Tieman, Sladek, et al., 2011; Gill et al., 2014; Hildebrand et al., 2014; Hildebrand et al., 2012; Olaussen et al., 2017; Petrova et al., 2012; Tieman et al., 2014). A further differentiation was the search filter’s known level of performance (Brown et al., 2014; Damarell, Tieman, Sladek, et al., 2011; Hayman & Tieman, 2015). Only one report incorporated the use of a gold standard set for testing performance into its definition of a search filter (Ayiku et al., 2017).

Database platforms and translations

The majority of topic filters (n=31) were developed for Ovid Medline, followed by PubMed (n=22) and Ovid Embase (n=11). The CINAHL, Web of Science, and TRANSPORT databases had one filter each. One paper did not specify database platform (Haslinghuis-Bajan et al., 2001). A total of 19 filters were translated for

another database. The most common target database for translation was PubMed (n=11).

Filter versions

Almost half of the topic filter reports (26/54; 48%) provide only one version of the filter per target database, invariably a version maximising sensitivity. However, twenty-two filter papers offered between two to four versions, while seven offered five or more versions for users to choose from according to their needs. One filter offered 29 search options for retrieving literature on the single topic 'return to work' (Gehanno et al., 2009).

Intended end-users

Most topic filters were intended for use by more than one type of user, for example both clinicians and researchers. Some filters solely targeted 'time-poor' clinicians, declaring to make searching processes more efficient and reliable. This is particularly evident with filters focused on clinical conditions such as heart failure (Damarell, Tieman, Sladek, et al., 2011), kidney conditions (Garg et al., 2009; Lee, Iansavichus, et al., 2012), and lung cancer (Damarell, Tieman, Olver, et al., 2011), or clinical disciplines such as palliative care (Sladek et al., 2006) or primary care (Gill et al., 2014). Other filters have specific utility for researchers or systematic reviewers requiring comprehensive retrieval (Ayiku et al., 2017; Durão et al., 2015; Goss et al., 2007; Hempel et al., 2011; Pienaar et al., 2011; Simon et al., 2010). Scientists

working with laboratory animals are the target user group for the Animals filter in PubMed (Hooijmans et al., 2010).

Policy- and decision-makers are acknowledged as a potential user group for filters retrieving research on *primary health care* (Brown et al., 2014), *chronic kidney disease* (Iansavichus et al., 2015), *contraception* (Kirk et al., 2013), *knowledge translation* (Lokker et al., 2010; McKibbon et al., 2012), *health-related values* (Petrova et al., 2012), *patient safety* (Tanon et al., 2010), *Australian Aboriginal and Torres Strait Islanders* (Tieman et al., 2014), *bereavement care* (Tieman et al., 2015), and *patient preferences* (van Hoorn et al., 2016). One filter was designed for automatized horizon scanning systems charged with identifying new or emerging health technologies for potential inclusion in health technology assessments (Varela-Lema et al., 2012). A filter for retrieving literature on *patient knowledge, views, and values* was designed for patient advocates and those wishing to develop patient-directed educational, counselling, or empowerment resources (Wessels et al., 2016).

Filter search performance

All included studies evaluated the performance of a search filter against a set of citations of known relevance and reported the proportion of relevant citations the filter could retrieve from this set. This metric, called 'sensitivity', 'recall', or 'relative recall', ranged from 53% for *quality improvement* (Hempel et al., 2011) to 100% for *males* (Stewart et al., 2014), *animals* (Hooijmans et al., 2010), *emergency*

contraception (Kirk et al., 2013), *return-to-work* (Gehanno et al., 2009), and *gamma camera emission tomography* (Haslinghuis-Bajan et al., 2001).

Most studies (37/54; 69%) included a measure of precision for search filters, occasionally expressed as 'positive predictive value' (Iansavichus et al., 2015; Wentz et al., 2001). In considering only the most sensitive multi-term versions of each filter (i.e. excluding single term searches), we also calculated the difference between that sensitivity and its corresponding precision, where this was available. This revealed the substantial loss in precision that comes with high sensitivity and vice-versa. The *males* filter, for example, reports 100% sensitivity and 0.2% precision, a difference of 99.8%. Similarly, the r*eturn-to-work* filter has a gap of 99.7%.

Thirteen search filters kept the difference between maximum sensitivity and its corresponding precision to ≤ 25% (Brown et al., 2014; Damarell, Tieman, Sladek, et al., 2011; Garg et al., 2009; Hayman & Tieman, 2015; Iansavichus et al., 2010; Li & Lu, 2013; Mesgarpour et al., 2012a; Moerman et al., 2009; Petrova et al., 2012; Shaheem & Tieman, 2014; Tieman et al., 2015; Tieman et al., 2014; van de Glind et al., 2012). Eleven search filters, however, had a gap of ≥ 75% between these metrics (Gill et al., 2014; Goss et al., 2007; Kastner et al., 2006; McKibbon et al., 2012; Pienaar et al., 2011; Schaafsma et al., 2006; Simon et al., 2010; Stewart et al., 2014; Varela-Lema et al., 2012; Wentz et al., 2001; Wilczynski & Haynes, 2010). The topics of these latter filters were often complex, for example: *quality improvement, new and emerging topics, nurse staffing, occupational origins of diseases, alcohol-impaired driving* and *road safety interventions.* Some, however, appear to be relatively more straightforward, for example *males* and *African research.* Two

duplicated topics appear in both the largest gap and the smallest gap categories *(primary care* and *geriatric medicine).*

These performance metrics are provided in Table 2.

Topic filter availability

All search filters were reported in the published literature with the exception of two unpublished conference posters (Damarell, Tieman, Olver, et al., 2011; Kirk et al., 2013) and one unpublished report (Shaheem & Tieman, 2014). A significant number of the topic filters (16/54; 30%) have been implemented into websites as one-click, hyperlink searches (Damarell, Tieman, Olver, et al., 2011; Damarell, Tieman, Sladek, et al., 2011; Hayman & Tieman, 2015; Kirk et al., 2013; Shaheem & Tieman, 2014; Sladek et al., 2006; Tieman et al., 2015) or in the form of a search portal allowing users to enter their own search terms in combination with the filter (Brown et al., 2014; Garg et al., 2009; Hildebrand et al., 2014; Hildebrand et al., 2012; Iansavichus et al., 2012; Iansavichus et al., 2010; Iansavichus et al., 2015; Lee, Iansavichus, et al., 2012; Tieman et al., 2014). Some are provided as search strings on websites for direct copy and paste into database search boxes (Lokker et al., 2010; McKibbon et al., 2012; Song et al., 2016).

Although the stated purpose of the InterTASC Information Specialists' Sub-Group Search Filter Resource is to 'retrieve research by study design or focus' ("ISSG Search

Filter Resource", 2008), we note that 24 of the 54 topic filters identified by this review (44%) are acknowledged by this resource.

Details on topic filter availability are listed in Table 2.

Intentions to update search filters

Few topic filter reports signalled the importance of keeping track of changes to terminology or indexing practices over coming years to ensure search filters remain current and perform optimally (Ayiku et al., 2017; Brown et al., 2014; Curti et al., 2016; Garg et al., 2009; Gill et al., 2014; Iansavichus et al., 2015; Lee, Iansavichus, et al., 2012; Wessels et al., 2016). However, one report cautioned against adaptations to an existing validated search filter that might compromise its baseline performance, creating a 'new search strategy of unknown performance' (Ayiku et al., 2017).

Discussion

Topic search filters appear to be proliferating, with more than half appearing after 2012. Many come in more than one 'version' in terms of their level of performance, acknowledging and allowing for the different information retrieval needs of their intended users. Potential users are also quite clearly defined with the focus being on clinicians, researchers, policymakers, and even patient advocates.

Our search for filters included a number of multidisciplinary databases in the hope of identifying topic filters designed for retrieving literature on any subject. Interestingly, topic filters clustered tightly around a small number of biomedical and health databases, namely Medline, Embase, PubMed, and CINAHL. The exceptions to this were Web of Science and TRANSPORT. This seems to indicate that efficiency and reliability in database search retrieval may be primarily a concern of the health and medical disciplines. If this is so, it would be interesting to know why there exists a lack of imperative for such search tools outside the health domains.

As filter development is a resource-intensive, costly activity, we were interested in understanding the reasons why certain topics were selected for search filter development out of the many possibilities. The absence of many current day health priority areas in the topic filter list seems to indicate other, more localised priorities may be in play. Notable omissions include conditions such as the common cancer types, chronic obstructive pulmonary disease, asthma, and growing health system concerns such as comorbidity and multimorbidity. Reasons for topic choice were not always stated and those that were provided usually indicated a practical purpose such as the information needs of a larger project. The *United Kingdom* search filter, for example, came out of a project relating to NICE guideline development, the *patient preferences* filter from an INTEGRATE-HTA project, while both the *nutrition* and *alcohol-impaired driving* filters were created to populate specialised trial registers. One *quality improvement* filter was part of a project aimed at the classification and critical appraisal of quality improvement publications, and one of the filters on *patient views and preferences* was designed with specific knowledge

synthesis projects in mind. Other filters were designed for incorporation into Horizon Scanning Systems or to aid guideline developers to identify patient-centred concerns.

A second group of developers choose to develop a particular search filter because of known topic-specific difficulties associated with searching in that area. These difficulties might be the result of a rapidly evolving, or diffuse knowledge base, insufficient database indexing terms, or 'immature' terminology in the field. Curiously, a number of reports simply listed database search challenges in general as the reason for developing a filter, without connecting the topic under consideration with these challenges in any way.

Some developers linked the topic of their filter with a strongly stated imperative for improving evidence retrieval and knowledge translation within that subject area. Tieman et al. (2014, p. 545), for example, justify an Indigenous health search filter with the statement, '(e)ffective information retrieval is an essential step in using knowledge from research and practice to improve outcomes in Aboriginal and Torres Strait Islander health'. Similarly, in describing the purpose of a paramedic search filter, Olaussen et al. (2017, p. 1) draw a direct connection between efficient evidence retrieval, evidence-based practice, and an increased recognition of paramedics as a professional group. Arguably, all topic search filters are designed to improve evidence retrieval for the purpose of shortening the process between the production of that evidence, its implementation into practice and, ultimately, improved health care outcomes. In describing their purpose using the language of

evidence-based practice and knowledge translation, search filters reinforce the importance of effective searching of the kind underpinning systematic reviews, health technology assessments, and guidelines (McGowan et al., 2016), as well as evidence-based clinical decision making (Pluye et al., 2013; Van Duppen et al., 2007).

Despite growth in the number of topic filters available, this review, like the Jenkins one before it, highlights considerable variability in the terminology associated with search filters. The term 'search filter' was most commonly used to describe the products of this scoping review, however, a range of other terms also appear. This lack of consistency in naming has the serious, perhaps somewhat ironic consequence of making search filters themselves difficult to identify within databases. To illustrate this point, in conducting this review we were required to create a complex search strategy employing a range of tactics to come at the topic, in order to avoid missing any unique and unforeseen nomenclature. The topic has no useful controlled vocabulary term and preliminary scoping searches indicated we were obliged to include the very general term 'search strategy' in our strategy. This term naturally identified a large number of systematic reviews simply reporting the use of a 'search strategy'. In all, this meant having to screen 11, 318 citations, many of which contained the term 'search filter' or 'hedges' but applied in contexts outside of information retrieval (e.g. 'Hedges' g'—a measure of effect size).

If filter designers are concerned with the findability of their tools, there needs to be some consensus around terminology and use of more descriptive, standardised language in the titles and abstracts of published search filter papers. This will also

improve discovery of search filters in the grey literature. The field may also benefit from a centralised resource that curates topic-based search filters in the same way that InterTASC identifies and organises methodological search filters.

Only slightly more than half the filter development reports attempted to define what a search filter does and why an experimentally-developed search may claim superiority over searches not developed in this way. This is an important consideration if filter developers wish to promote the value of their rigorously-developed product, as well as search filters in general. It shouldn't be assumed that clinicians and researchers immediately recognise the value of evidence-based searching, especially in an age where they are expected to have the skills to conduct their own searches.

Filter studies also varied considerably in the quality of definitions provided for the topic of the filter itself, with some reports lacking any definition. Some reported receiving guidance from a group of experts in the field (and therefore potential end-users) in defining the topic (Brown et al., 2014; Hayman & Tieman, 2015; Tieman et al. 2015; Tieman et al., 2014). Others worked within a definition established by a recognised body (e.g. World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians (WONCA) for *primary care* (Pols et al., 2015) and Canadian Institutes of Health Research (CIHR) for *knowledge translation* (Lokker et al., 2010; McKibbon et al., 2012). A number of reports also omitted to include an unequivocal statement of the *scope* of their topic, or what users should reasonably expect it to retrieve, or not retrieve. Scope of

coverage was left to the reader to discern from the types of citations selected for the gold standard, or else it was not referred to at all. The link between the nature of the gold standard and the topic under consideration may be clear to filter developers but is possibly lost on the general reader. The need for scope clarity may be even more crucial for topic filters than methods filters as, unlike randomised controlled trials, very few subject areas have one facet only, or exist in a single context. Arguably, topics that don't require clarification would be those easiest to search and therefore in little need of a validated search tool.

One exemplar in reporting topic scope was the report on *health-related values* topic search development (Petrova et al. 2012). This study acknowledged the lack of an established definition for the topic but proceeded to provide a clear record of the ways in which it chose to operationalise the concept for the purpose of search strategy development. The background work involved in operationalising the concept was also provided as an online supplementary file.

Future research

This review was limited to identifying and characterising topic search filters, without consideration of filter quality. However, it was clear that many of the filters identified are clearly dated and based on less than optimal gold standards. Future research should apply a critical appraisal lens to the topic search filters identified here and comment on how their methods of development impact their performance. This may involve testing the appropriateness of existing critical

appraisal checklists developed for methodological search filters (Bak et al., 2009; Glanville et al., 2008). Whether or not a citation describes a particular methodology is often a binary decision, while context alone may challenge decisions of relevance where some topics are concerned. The multi-faceted, complex, diffuse, and ill-defined nature of many topics may necessitate the development of a topic-specific appraisal checklist.

For information specialists interested in developing topic search filters, we recommend the development of a standard search filter reporting checklist along the lines of PRISMA for systematic reviews (Moher et al., 2009) and STROBE for observational studies (Vandenbroucke et al., 2014). Such a checklist and accompanying explanation document could greatly improve reporting quality and therefore readability of filter development papers and hasten the adoption of more standardised and defined terminology. It might also address concerns around keeping topic search filters current—a further issue that may impact topic filters differently to methodology ones. We note that guidance of this kind was recently published for methodological search filters (Lefevbre et al., 2017). Chapter five of this document provides clear suggestions for measuring and reporting search performance which apply equally well to both methodological and topic search filters. However, the overall focus of the document is still on methodological search filter performance. This review has arguably highlighted sufficient topic filter activity to warrant further investigation into topic-specific methods, concerns, and guidance.

This scoping review has several limitations. Firstly, we only included search filters if they reported search sensitivity. The assumption here is that sensitivity is universally

the most valued characteristic of searches. This led to the exclusion of some papers describing experimentally-derived filters concerned only with search precision. We won't know how these studies might have informed discussions around the relative value of specific metrics for specific end-users. We also experienced considerable difficulties in delineating topic and method search filters when screening citations for relevance. This may have resulted in some contentious decisions to exclude filters that other reviewers might consider relevant to topic-based retrieval. In fact, there appears to be a general lack of clarity around the criteria used to discriminate between 'methodological' and 'topic' search filters, or indeed, whether it is meaningful to do so. For example, the InterTASC Search Filter Resource omits references to many of the topic search filters listed in table 2, however it also includes a reasonable proportion of them (e.g. filters for *patient views and preferences*, *quality improvement, age groups*, *geography*, and *gender*). We originally chose to include search filters on *adverse effects* and *measurement properties of measurement instruments* as, on face value, they align well with our definition of 'topic'. However, after much discussion these were eliminated, largely on the basis of their prominent inclusion on the InterTASC website. In our experience, the line between topic and methodology filter is not always clear and may require a conceptual debate if search filters are to continue to be delineated along these lines.

This review also has strengths. It is based on a comprehensive and highly sensitive search of both the published and unpublished literature. In ensuring all topics were uncovered regardless of discipline, the search was not restricted to health databases

only, even though this meant screening in excess of 11,000 citations. Furthermore, in anticipating some of the difficulties in separating topic filters from those designed to retrieve by methodological focus, the search was kept open to both filter types. Decisions to include or exclude were only made after extensive discussion within the team. We believe this led to more reliable, considered screening decisions.

Conclusion

Topic search filters on a wide range of subjects are currently available to clinicians, researchers, policymakers and the information specialists that work alongside them. Many of these can be accessed by a simple click of a hyperlink embedded within a webpage. However, despite appearing in reasonable numbers in recent times, reports of available search filters are challenging to find in databases and often difficult to read due to considerable variability in nomenclature and the quality of definitions provided. Information specialists and other potential end-users may benefit from a centralised repository of topic search filters so that they can readily identify relevant ones for their own use or for recommending to other searchers. The development of a quality appraisal checklist specifically for topic search filters may be warranted. For information specialists interested in developing search filters themselves, there is an identified need for further research and guidance on questions of terminology and the impact of specific development decisions on the quality of the end product.

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Appendices

Appendix 1. Record of search strategies

Ovid MEDLINE (1946-)

Includes subsets: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, and Ovid MEDLINE(R) Daily

#	Searches
1	search filter*.tw,kw.
2	pubmed/ or medline/ or databases as topic/ or databases, bibliographic/
3	(Database* or Medline* or PubMed* or Embase* or Cochrane* or CINAHL* or PsycINFO* or PsychINFO* or Scopus* or "Web of Science*" or AMED* or LILACs).tw,kw.
4	2 or 3
5	"information storage and retrieval"/
6	((search* or retriev*) adj3 (filter* or strateg*)).tw,kw.
7	((methodologic* or topic* or discipline* or subject* or content) adj3 (filter* or strateg*)).tw,kw.
8	(hedge or hedges).tw,kw.
9	((retriev* or find* or identif* or locat* or detect* or search*) adj3 (research or literature or trial* or paper* or article* or evidence or citation* or review* or studies or information or reference*)).ti.
10	5 or 6 or 7 or 8 or 9
11	"Sensitivity and Specificity"/ or "reproducibility of results"/ or Validation Studies/
12	(sensitiv* or validat* or specificit* or precis* or predict* or accurac* or recall or "number needed to read" or NNR).tw,kw.
13	((search or retriev* or filter*) adj2 (perform* or efficac* or effective* or test*)).tw,kw.
14	(test set or test dataset or test data set or gold standard or reference set or reference standard).tw,kw.
15	11 or 12 or 13 or 14
16	1 or (4 and 10 and 15)
17	review.pt.

18	16 not 17
19	Limit 18 to yr="1990 -Current"

Notes: / denotes MeSH term search; .tw = title and abstract search; .kw = author keyword search; .ti = search on title; .pt = publication type search; adj2 = adjacency search where two intervening terms are allowed between search terms which can be in any order.

PsycINFO (Ovid, 1806-)

#	Searches
1	search filter*.tw,id.
2	Databases/
3	(Database* or Medline* or PubMed* or Embase* or Cochrane* or CINAHL* or PsycINFO* or PsychINFO* or Scopus* or "Web of Science*" or AMED* or LILACs).tw,id.
4	2 or 3
5	automated information retrieval/ or automated information storage/
6	((search* or retriev*) adj3 (filter* or strateg*)).tw,id.
7	((methodologic* or topic* or discipline* or subject* or content) adj3 (filter* or strateg*)).tw,id.
8	(hedge or hedges).tw,id.
9	((retriev* or find* or identif* or locat* or detect* or search*) adj3 (research or literature or trial* or paper* or article* or evidence or citation* or review* or studies or information or reference*)).ti.
10	5 or 6 or 7 or 8 or 9
11	Test Validity/
12	(sensitiv* or validat* or specificit* or precis* or predict* or accurac* or recall or "number needed to read" or NNR).tw,id.
13	((search or retriev* or filter*) adj2 (perform* or efficac* or effective* or test*)).tw,id.
14	(test set or test dataset or test data set or gold standard or reference set or reference standard).tw,id.
15	11 or 12 or 13 or 14
16	1 or (4 and 10 and 15)
17	limit 16 to yr="1990 -Current"
18	limit 17 to ("0800 literature review" or "0830 systematic review")
19	17 not 18

Embase (Ovid, 1974-)

#	Searches
1	search filter*.tw,kw.
2	bibliographic database/ or data base/ or cinahl/ or cochrane library/ or embase/ or medline/ or psycinfo/ or scopus/ or "web of science"/
3	(Database* or Medline* or PubMed* or Embase* or Cochrane* or CINAHL* or PsycINFO* or PsychINFO* or Scopus* or "Web of Science*" or AMED* or LILACs).tw,kw.
4	2 or 3
5	information retrieval/
6	((search* or retriev*) adj3 (filter* or strateg*)).tw,kw.
7	((methodologic* or topic* or discipline* or subject* or content) adj3 (filter* or strateg*)).tw,kw.
8	(hedge or hedges).tw,kw.
9	((retriev* or find* or identif* or locat* or detect* or search*) adj3 (research or literature or trial* or paper* or article* or evidence or citation* or review* or studies or information or reference*)).ti.
10	5 or 6 or 7 or 8 or 9
11	"sensitivity and specificity"/ or reproducibility/ or validation study/
12	(sensitiv* or validat* or specificit* or precis* or predict* or accurac* or recall or "number needed to read" or NNR).tw,kw.
13	((search or retriev* or filter*) adj2 (perform* or efficac* or effective* or test*)).tw,kw.
14	(test set or test dataset or test data set or gold standard or reference set or reference standard).tw,kw.
15	11 or 12 or 13 or 14
16	4 and 10 and 15
17	1 or 16
18	review.pt.
19	17 not 18
20	limit 19 to yr="1990 -Current"

PubMed (non-indexed set only)

(Search filter*[tw] OR ((Database*[tw] OR Medline*[tw] OR PubMed*[tw] OR Embase*[tw] OR Cochrane*[tw] OR CINAHL*[tw] OR PsycINFO*[tw] OR PsychINFO*[tw] OR Scopus*[tw] OR "Web of Science*”[tw] OR AMED*[tw] OR LILACs[tw]) AND (search strateg*[tw] OR Hedge[tw] OR hedges[tw] OR ((retriev*[ti] OR find*[ti] OR identif*[ti] OR locat*[ti] OR detect*[ti] OR search*[ti]) AND (research[ti] OR literature[ti] OR trial*[ti] OR paper*[ti] OR article*[ti] OR

evidence[ti] OR citation*[ti] OR review*[ti] OR studies[ti] OR information[ti] OR reference*[ti])))) AND (sensitiv*[tw] OR validat*[tw] OR specificit*[tw] OR precis*[tw] OR predict*[tw] OR accurac*[tw] OR recall[tw] OR "number needed to read"[tw] OR NNR[tw] OR “test set”[tw] OR “test dataset”[tw] OR “test data set”[tw] OR “gold standard”[tw] OR “reference set”[tw] OR “reference standard”[tw] OR ((search[tw] OR retriev*[tw] OR filter*[tw]) AND (perform*[tw] OR efficac*[tw] OR effective*[tw] OR test[tw] OR tests[tw] OR tested[tw] OR testing[tw])))) AND English[la] AND 1990:2017[dp]) AND ((publisher[sb] NOT pubstatusnihms NOT pubstatuspmcsd NOT pmcbook) OR (pubstatusnihms AND publisher[sb]) OR (pubstatuspmcsd AND publisher[sb]) OR pubmednotmedline[sb]) NOT Review[pt]

Scopus

Excluding reviews and limiting to 1990-

(TITLE-ABS-KEY ("search filter*") AND PUBYEAR > 1989) OR ((TITLE-ABS-KEY (database* OR medline* OR pubmed* OR embase* OR cochrane* OR cinahl* OR psycinfo* OR psychinfo* OR scopus* OR "Web of Science*" OR amed* OR lilacs) AND PUBYEAR > 1989) AND ((TITLE-ABS-KEY (((search* OR retriev*) W/3 (filter* OR strateg*)) OR ((methodologic* OR topic* OR discipline* OR subject* OR content) W/3 (filter* OR strateg*)) OR hedge OR hedges) OR TITLE ((retriev* OR find* OR identif* OR locat* OR detect* OR search*) W/3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*))) AND PUBYEAR > 1989) AND ((TITLE-ABS-KEY (sensitiv* OR validat* OR specificit* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR nnr) OR TITLE-ABS-KEY ("test set" OR "test dataset" OR "test data set" OR "gold standard" OR "reference set" OR "reference standard") OR TITLE-ABS-KEY ((search OR retriev* OR filter*) W/2 (perform* OR efficac* OR effective* OR test*))) AND PUBYEAR > 1989)) AND (EXCLUDE (DOCTYPE , "re"))

CINAHL (EBSCOhost)

#	Query	Limiters/Expanders
S17	S15 NOT S16	Search modes - Boolean/Phrase
S16	PT review or "systematic review"	Search modes - Boolean/Phrase
S15	S12 OR S13	Limiters - Published Date: 19900101-20161231; English Language Search modes - Boolean/Phrase

S14	S12 OR S13	Search modes - Boolean/Phrase
S13	TI "search filter*" OR AB "search filter*"	Search modes - Boolean/Phrase
S12	S3 AND S6 AND S11	Search modes - Boolean/Phrase
S11	S7 OR S8 OR S9 OR S10	Search modes - Boolean/Phrase
S10	TI (sensitiv* OR validat* OR specific* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR) OR AB (sensitiv* OR validat* OR specific* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR) OR TI (“test set” OR “test dataset” OR “test data set” OR “gold standard” OR “reference set” OR “reference standard”) OR AB (“test set” OR “test dataset” OR “test data set” OR “gold standard” OR “reference set” OR “reference standard”) OR TI ((search OR retriev* OR filter*) N2 (perform* OR efficac* OR effective* OR test*)) OR AB ((search OR retriev* OR filter*) N2 (perform* OR efficac* OR effective* OR test*))	Search modes - Boolean/Phrase
S9	(MH "Validation Studies")	Search modes - Boolean/Phrase
S8	(MH "Reproducibility of Results")	Search modes - Boolean/Phrase
S7	(MH "Sensitivity and Specificity")	Search modes - Boolean/Phrase
S6	S4 OR S5	Search modes - Boolean/Phrase
S5	TI ((search* OR retriev*) N3 (filter* OR strateg*)) OR AB ((search* OR retriev*) N3 (filter* OR strateg*)) OR TI ((methodologic* OR topic* OR discipline* OR subject* OR content) N3 (filter* OR strateg*)) OR AB ((methodologic* OR topic* OR discipline* OR subject* OR content) N3 (filter* OR strateg*)) OR TI (Hedge OR hedges) OR AB (Hedge OR hedges) OR TI ((retriev* OR find* OR identif* OR locat* OR detect* OR search*) N3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*))	Search modes - Boolean/Phrase

S4	(MH "Information Retrieval") OR (MH "Information Storage")	Search modes - Boolean/Phrase
S3	S1 OR S2	Search modes - Boolean/Phrase
S2	TI(Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs) OR AB(Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs)	Search modes - Boolean/Phrase
S1	(MH "AMED Database") OR (MH "CINAHL Database") OR (MH "Embase") OR (MH "Medline") OR (MH "PubMed") OR (MH "Databases")	Search modes - Boolean/Phrase

ProQuest databases

"search filter*" OR (((Hedge OR hedges OR ((search* OR retriev*) NEAR/3 (filter* OR strateg*)) OR ((methodologic* OR topic* OR discipline* OR subject* OR content) NEAR/3 (filter* OR strateg*))) OR ti(((retriev* OR find* OR identif* OR locat* OR detect* OR search*) NEAR/3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*)))) AND (Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs) AND (sensitiv* OR validat* OR specificit* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR OR "test set" OR "test dataset" OR "test data set" OR "gold standard" OR "reference set" OR "reference standard" OR ((search OR retriev* OR filter*) NEAR/2 (perform* OR efficac* OR effective* OR test*))))

Date: From 1990 to 2017

Cochrane Methodology Register: Issue 3 of 4, July 2012

"search filter*" OR ((Database* or Medline* or PubMed* or Embase* or Cochrane* or CINAHL* or PsycINFO* or PsychINFO* or Scopus* or "Web of Science*" or AMED* or LILACS) AND (((search* or retriev*) near/3 (filter* or strateg*)) or ((methodologic* or topic* or discipline* or subject* or content) near/3 (filter* or strateg*)) or Hedge or hedges or ((retriev* or find* or identif* or locat* or detect* or search*) near/3 (research or literature or trial* or paper* or article* or evidence or citation* or review* or studies or information or reference*))) AND (sensitiv* or validat* or specificit* or precis* or predict* or accurac* or recall or "number needed to read" or NNR or "test set" or "test dataset" or "test data set" or "gold standard" or "reference set" or "reference standard" or ((search or retriev* or filter*) near/2 (perform* or efficac* or effective* or test*))))

Library, Information Science & Technology Abstracts (EBSCOhost)

#	Query	Limiters/Expanders
S4	(S1 AND S2 AND S3) OR "search filter*"	Limiters - Publication Date: 19900101-20171231; Document Type: Article, Case Study, Conference Paper, Dissertation, Report Search modes - Boolean/Phrase
S3	(sensitiv* OR validat* OR specificit* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR) OR (“test set” OR	Search modes - Boolean/Phrase

	“test dataset” OR “test data set” OR “gold standard” OR “reference set” OR “reference standard”) OR (((search OR retriev* OR filter*) N2 (perform* OR efficac* OR effective* OR test*)))	
S2	(((search* OR retriev*) N3 (filter* OR strateg*))) OR (((methodologic* OR topic* OR discipline* OR subject* OR content) N3 (filter* OR strateg*))) OR (Hedge OR hedges) OR TI (((retriev* OR find* OR identif* OR locat* OR detect* OR search*) N3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*)))	Search modes - Boolean/Phrase
S1	Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs	Search modes - Boolean/Phrase

Web of Science

Set	Results	
# 7	307	#5 OR #1 **Refined by:** [excluding] **DOCUMENT TYPES:** (REVIEW) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 6	418	#5 OR #1 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 5	149	#4 AND #3 AND #2 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 4	7,551,095	TS=(sensitiv* OR validat* OR specific* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR OR “test set” OR “test dataset” OR “test data set” OR “gold standard” OR “reference set” OR “reference standard” OR ((search OR retriev* OR filter*) NEAR/2 (perform* OR efficac* OR effective* OR test*))) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 3	11,624	**TOPIC:** (((search* OR retriev*) NEAR/3 (filter* OR strateg*)) OR ((methodologic* OR topic* OR discipline* OR subject* OR content) NEAR/3 (filter* OR strateg*)) OR (Hedge OR hedges)) *OR* **TITLE:**

		((retriev* OR find* OR identif* OR locat* OR detect* OR search*) NEAR/3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*)) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 2	514,202	TS=(Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016
# 1	275	**TOPIC:** ("search filter*") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1990-2016

INFORMIT

("search filter"*) OR ((Database* OR Medline* OR PubMed* OR Embase* OR Cochrane* OR CINAHL* OR PsycINFO* OR PsychINFO* OR Scopus* OR "Web of Science*" OR AMED* OR LILACs) AND (((methodologic* OR topic* OR discipline* OR subject* OR content OR search* OR retriev*) %3 strateg*) OR ((methodologic* OR topic* OR discipline* OR subject* OR content OR search* OR retriev*) %3 filter*) OR (Hedge OR hedges) OR ((TI:retriev* OR TI:find* OR TI:identif* OR TI:locat* OR TI:detect* OR TI:search*) AND (TI:research OR TI:literature OR TI:trial* OR TI:paper* OR TI:article* OR TI:evidence OR TI:citation* OR TI:review* OR TI:studies OR TI:information OR TI:reference*))) AND (sensitivit* OR validat* OR specific* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR OR "test set" OR "test dataset" OR "test data set" OR "gold standard" OR "reference set" OR "reference standard" OR (((perform* OR efficac* OR effective* OR test*) %2 search) OR ((perform* OR efficac* OR effective* OR test*) %2 retriev*) OR ((perform* OR efficac* OR effective* OR test*) %2 filter*))))

IEEE Xplore Digital Library

("search filter" OR “search filters”) OR ((Database* OR Medline OR PubMed OR Embase OR Cochrane OR CINAHL OR PsycINFO OR PsychINFO OR Scopus OR "Web of Science*" OR AMED OR LILACs) AND (((search* OR retriev*) NEAR/3 (filter* OR strateg*)) OR ((methodologic* OR topic* OR discipline* OR subject* OR content) NEAR/3 (filter* OR strateg*)) OR Hedge OR hedges OR ((retriev* OR find* OR identif* OR locat* OR detect* OR search*) NEAR/3 (research OR literature OR trial* OR paper* OR article* OR evidence OR citation* OR review* OR studies OR information OR reference*))) AND (sensitiv* OR validat* OR specificit* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR OR "test

set" OR "test dataset" OR "test data set" OR "gold standard" OR "reference set" OR "reference standard" OR ((search OR retriev* OR filter*) NEAR/2 (perform* OR efficac* OR effective* OR test*))))

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Any field matches any: Database* OR Medline OR PubMed OR Embase OR Cochrane OR CINAHL OR PsycINFO OR PsychINFO OR Scopus OR "Web of Science*" OR AMED OR LILACs
AND
Any field matches any: sensitiv* OR validat* OR specificit* OR precis* OR predict* OR accurac* OR recall OR "number needed to read" OR NNR OR "test set" OR "test dataset" OR "test data set" OR "gold standard" OR "reference set" OR "reference standard"

Grey literature search strategy

Variations on this simplified version of the database search were used to search grey resources.
(“search filter" OR “search strategy” OR “search string” OR “search strategies”) AND (sensitivity OR recall OR precision OR accuracy OR specificity OR validate OR validation OR predictive OR "number needed to read" OR NNR OR "reference standard" OR "gold standard")