Flinders UNIVERSITY

Research Centre for Palliative Care, Death & Dying

Managing the Knowledge Base for Primary Health Care

Report on the Development of a Primary Health Care Search Filter, PubMed topic Searches, and Web Guidance for Retrieving the Primary Health Care Literature

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About this White Paper

This publication is a RePaDD White Paper and Research Report. The RePaDD White Paper and Research Report Series provide researchers and policy makers with evidence-based data and recommendations. By organising, summarising and disseminating previous and current studies, the series aim to inform ongoing and future research in palliative care, death, and dying.

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About the RePaDD

The Flinders Research Centre for Palliative Care, Death, and Dying (RePaDD) works to make a difference to the care of persons at the end of life.

RePaDD researchers examine the universal experience of dying and create innovative solutions for people living with a life-limiting illness, their carers, and the clinicians caring for them.

RePaDD leads major national palliative care projects in Australia. Its team of multidisciplinary researchers and experts work collaboratively with various organisations and funding agencies to deliver impact. The Centre also strengthens research capacity by offering evidence-based resources, researcher education and training, and scholarships.

RePaDD's current research areas are:

- Palliative care across the health system
- Death and dying across the community
- Online evidence and practice translation

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Executive Summary

As the literature and evidence base on which health care professionals depend continues to grow, identifying what works in relation to primary health care (PHC) becomes more and more challenging. The publication and storage of materials in different repositories, different indexing and description methods along with multiple concepts and associated terminologies, all mean that the efficient and timely retrieval of vital information can be difficult.

This White Paper/Research Report details the development of a high-performance PHC search filter and associated topic searches that provide health care professionals with a more efficient, reliable, and timely means of retrieving relevant PHC information.

Guided by an Expert Advisory Group (EAG), our research team developed a draft search filter in the Ovid Medline database. This filter was tested for performance and translated for PubMed - the open access version of this database. To facilitate more focused searching within the context of PHC, the final search filter was combined with a range of key PHC issues (e.g. chronic disease management) that were previously put forward by the EAG. Strategies for searching the web using Google were also devised and tested for their effectiveness.

The PHC Search Filter is estimated to retrieve 77% of relevant citations in the Medline database. To enable users to execute real-time, continually updated PubMed searches with a simple click on a link, the tools created have been embedded as hyperlinks on the Primary Health Care Research and Information Service (PHCRIS) Website (to access the PHC Search Filter, click here). Users are also be able to use the free text search facility provided to combine the PHC Search Filter with their own topic of interest.

By making the tools described in this White Paper available, it is hoped that patient outcomes can be measurably improved by providing primary health care professionals and others with access to more efficient and reliable evidence searches.

Introduction

The literature and evidence base developed by, and relevant to, PHC is growing. It is published and stored in different repositories and is described and indexed in different ways. The PHCRIS and the Flinders Filters Team agreed to collaborate to develop a systematic approach to the retrieval of PHC literature including the development of a PHC filter as outlined in the proposal put to the PHCRIS Strategic Advisory Group (Appendix 1).

This report details the work undertaken to develop searching resources to support the work of PHCRIS and the wider PHC community. The project work comprised several major phases which are described in this report:

- scoping of concepts and agreement on a "gold standard"
- development of the PHC filter in Ovid Medline including constructing the gold standard, term identification and testing, filter testing and validation
- translating for use in PubMed
- topic searches for use in PHCRIS website utilising the PubMed PHC filter
- testing of searching outside of Medline. (specifically Informit and the open web)

The final products from the research conducted by the Flinders Filters Team include:

- A validated OvidSP Medline PHC search filter, capable of retrieving 79% of literature of known relevance to primary health care
- A validated PubMed translation of this filter that has an equivalent level of performance in the Medical Subject Heading (MeSH) indexed subset of PubMed
- An experimentally-derived textword translation of the validated PubMed filter for retrieving PubMed's unindexed, or not-yet-indexed, citations with optimal efficacy
- A trial set of hyperlinked PHC PubMed searches on topics of interest to PHCRIS that can be launched as one-click, real-time searches of the PubMed database
- Instructions to create these PubMed topic searches to enable ongoing development of the resource
- Medline autoalerts based on the PHC filter that deliver the most recent primary health care citations to the email inboxes of interested researchers
- An Australia-only search strategy that can be combined with a PubMed topic search to limit retrieval to Australian-based or Australian-focused research
- Guidance on web searching for PHC grey literature.

Part 1. Scoping of concepts for the purpose of flilter development

The project began with a preliminary analysis of PHC core concepts, terminology, and sources of literature. This activity illuminated some of the controversies and complexities that exist in establishing the definitional boundaries of the concept, 'primary health care' for the purposes of this project. The findings and possible implications were presented to the project's EAG for discussion and clarification.

1.1 Identifying PHC concepts and terminology

In order to identify core, overlapping, and more peripheral themes running through the PHC literature, the project required a discrete set of articles which, when taken as a whole, adequately represented the breadth and depth of PHC concepts and components. The PHCRIS National Primary Health Care Strategy (NPHCS) Submissions Dataset[1] was made available to the project for this purpose. This dataset comprises references to the literature used in strategy submissions and commissioned papers. A major advantage in using this dataset is that each strategy reference has already been reviewed and coded by PHCRIS for its relevance to Australian PHC research.

The project reviewed the scope and characteristics of the included materials, establishing where each item was published and its publication type.

As the PHC filter will be specifically developed for the OvidSP Medline database, Medline citations were sought for all journal article references within the dataset. These citations, where available, were downloaded into an EndNote Library, complete with their MeSH terms (thesaurus terms assigned by indexers at the U.S. National Library of Medicine).

All MeSH terms associated with the Medline citations were then exported into an Excel spreadsheet and tallied to identify the MeSH terms most frequently assigned to this set of PHC literature. In a separate exercise, all citation titles and abstracts were exported as a single text file and analysed using the Concordance textword analysis software program.[2] This program identified individual words and phrases used by authors to describe the PHC literature in the dataset and ranked them according to their frequency across all citations.

MeSH and title/abstract terms identified in this way were then listed for subsequent review by the EAG (Appendix 1).

1.2 Options for creating a 'gold standard' set of citations

A 'gold standard' is a set of known, relevant citations from which a filter is developed, tested and validated. This set makes it possible to measure the filter's performance and iteratively improve it within a controlled environment. One measure of filter performance is recall (also called sensitivity). Recall is the number of relevant records actually retrieved from a gold standard set as a proportion of all relevant records in the set.

As a filter's performance in a gold standard set is then generalized across the entire database for which it is designed, the choice of a gold standard can greatly influence the generalisability of the final filter, i.e. its ability to retrieve citations beyond the gold standard set. The gold standard should comprise the kinds of articles the filter will eventually be expected to retrieve in terms of currency, study design, and topic coverage. Using a non-representative gold standard could

produce a search filter that is idiosyncratic to the gold standard alone.

A range of options for creating a gold standard set of citations for developing a PHC filter were explored and the potential biases associated with each documented for the benefit of the EAG. These options, (outlined in more detail in Appendix 2), included:

- all articles within a nominated primary health care specialty journal title, or set of titles, across a pre-established range of dates, e.g. 2005-2008
- all articles included in a PHC specific topic subsection of a major journal, e.g. MJA's General practice and primary care subset
- all included studies from a nominated set of PHC systematic reviews
- articles within an existing PHC dataset, such as one belonging to a PHC organization, citations included in relevant submissions to the National Health Reform, or those included in relevant National Health Reform final reports
- dual review of 10,000 citations randomly selected from the PubMed database.

1.3 The expert advisory group

The EAG established to guide the project comprised members of the PHCRIS project team and stakeholder representatives (Appendix 3). The group was asked to contribute content knowledge at a number of critical points in the filter development process.

The EAG first reviewed the terms identified by preliminary NPHCS Submissions Dataset analysis and advised on each term's centrality to the concept of PHC. Members identified 11 terms which they deemed exclusive to a PHC domain. These terms, to be considered for obligatory inclusion in the final filter, are shown in Table 1 below.

Table 1. Mesh and textword terms deemed exclusive to the PHC context

Mesh Terms	Title/abstract text words
Family practice	General practice
Primary health care	General practitioners
Family physicians	PHC Primary care Primary health Primary health care Community health GPs

This review exercise provided the project team with the subsequent means to spot inherent biases in the gold standard, such as a predominance of US-centric literature and/or an underrepresentation of Australian research and hence Australian terminology (e.g. Medicare Locals).

The EAG highlighted concepts of interest and importance to PHC which don't exist exclusively within the PHC context (e.g. heart failure). These concepts will be considered as 'topic searches' to be combined with the final PHC filter.

The EAG also advised on the most appropriate source of articles for the PHC gold standard set. It recommended a gold standard based on the included studies of Australian Primary Health Care Research Institute (APHCRI) systematic reviews.

Part 2. Developing the PHC filter

The PHC Filter was created following approaches outlined in several key filter methodology papers.[3,4,5] Its development followed four phases: the construction of the gold standard set; term identification; filter development; and filter validation.

2.1. Construction of the PHC gold standard set

Ten APHCRI systematic reviews met the eligibility criteria for the gold standard by being primarily focused on PHC and explicitly listing all included and excluded studies. These systematic reviews are listed as Appendix 4.

Gold standard characteristics

The 10 systematic reviews contained a total of 777 journal references. Medline citations were available for 617 of these, once duplicate references were removed. A further 55 Medline citations were excluded because they did not include an abstract which is crucial for the textword frequency analysis stage.

The remaining 562 citations were dual reviewed by members of the EAG. A third reviewer was used to resolve uncertainties and disagreements. A total of 529 citations were considered of primary relevance and 33 deemed irrelevant.

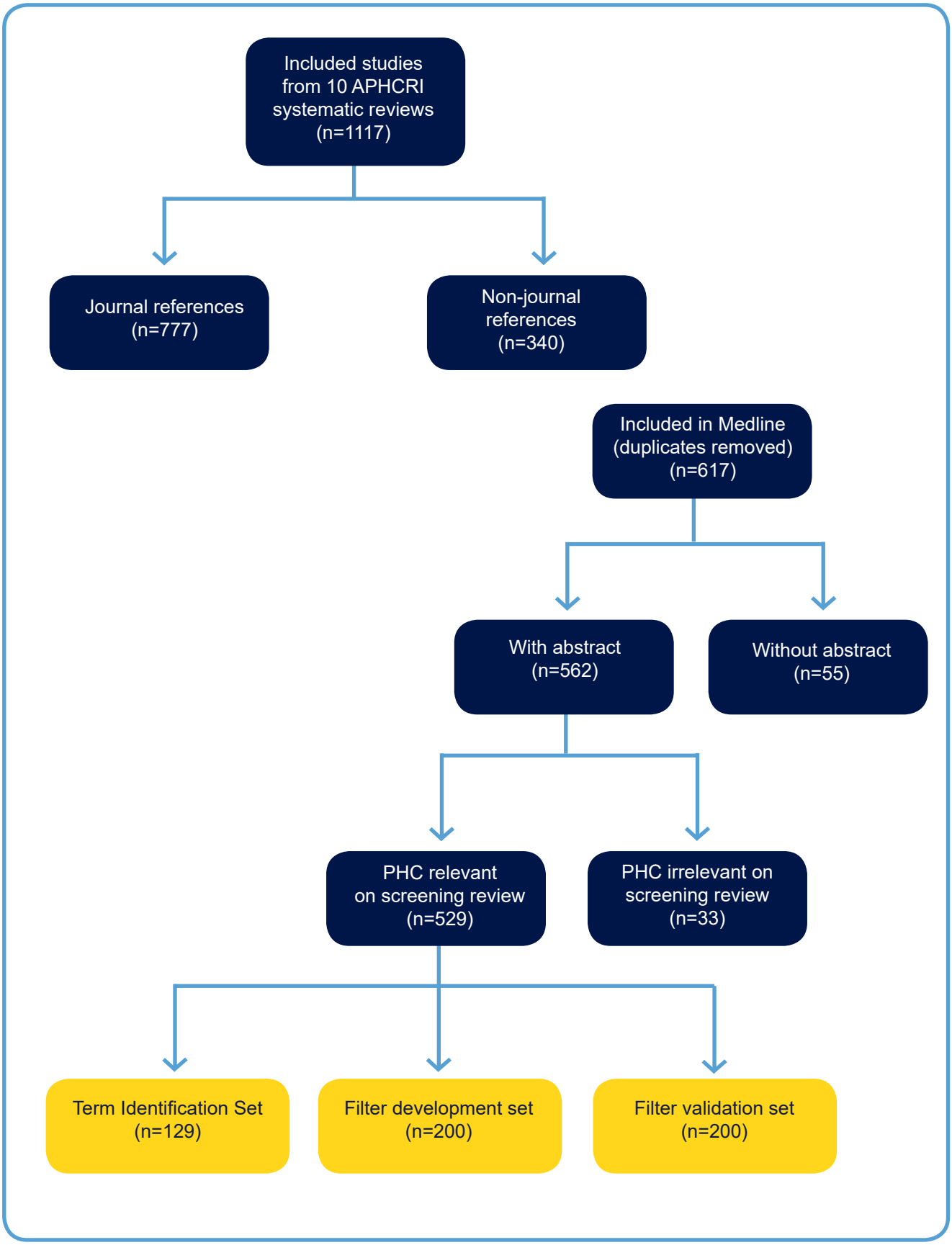
The PHC citations in the final gold standard set (n=529) spanned the years 1987-2009.

Division of the gold standard

The gold standard set was then divided into three sets to avoid the bias inherent in validating a filter within the same set of citations used to create it. The freely available Research Randomizer program was used to divide the sets.[6] It first randomly sampled 129 citations from the gold standard set by EndNote record number. This set of citations was copied to a new EndNote library and designated the Term Identification Set. The remaining 400 gold standard citations were then randomly assigned into two separate EndNote libraries of 200 citations each. These sets became the Filter Development Set and Filter Validation Set respectively. Both were recreated on OvidSP Medline for the testing and validation phases.

The steps involved in finalising the gold standard set are shown in Figure 1.

Figure 1. Development of the gold standard set



2.2 PHC term identification

Potential PHC filter search terms were identified via:

1. Feedback from the EAG on the relative significance of terms identified in the preliminary dataset analysis
2. A review of the relevant Medline MeSH thesaurus scope notes and hierarchical concept 'trees' for an overview of term interrelationships
3. A review of search strategies used in Cochrane systematic reviews on the topic of PHC
4. Separate frequency analyses of the MeSH terms and title/abstract textwords of the 129 citations in the Term Identification Set.

Frequency analysis of MeSH terms

All MeSH terms associated with the 129 citations in the Term Identification Set were exported and saved as a list in text file format. All MeSH subheadings (e.g. prevention and control) were removed and the major focus symbol (*) was stripped from the start of terms to facilitate correct filing.

Once the data had been cleaned in this way, the file was opened in Excel and the MeSH term list sorted alphabetically. Terms not semantically associated with PHC, such as those describing gender, a specific research design, or age group, were removed. The remaining terms were then tallied and the list re-sorted to show MeSH terms ranked by their 'term frequency' (total number of term appearances across all 129 citations).

Term frequency is an informative measure of a term's ubiquity across a set of citations. It does not, however, equate to the number of citations a term can retrieve from that set, a metric of more relevance to filter development. A term may have high term frequency because indexers applied it multiple times within the same citation, attaching different subheadings to denote different facets of the concept. As a retrieval term, it may only retrieve a small number of citations compared to a term applied once per citation but applied across a large number of citations. A more meaningful measure of a term's retrieval power than term frequency is therefore 'citation occurrence,' defined as the total number of unique citations containing a specific term. Citation occurrence is determined by searching each MeSH term in the Term Identification Set and noting the number of unique citations retrieved.

Frequency analysis of textwords in citation titles and abstracts

The titles and abstracts of all citations in the EndNote Term Identification Set were exported and saved as a text file. This file was then imported into the text analysis programme Concordance, which created a list of single textwords with predefined stop words omitted. Terms not relevant to PHC were removed. Multiword phrasal terms and their frequencies were then identified using the concordance 'contexts' function. The final product was a list of single and multiword textwords ranked by term frequency. Again, the citation occurrence of each textword was deemed the more relevant metric. This was determined by searching each textword across all titles and abstracts of Term Identification Set citations to identify the number of unique citations each term retrieved on its own.

PHC terms with the highest citation occurrences in the Term Identification Set ($n \geq 13$; or 10% of set) are shown in Table 2 below. The fuller, unedited list of MeSH and textwords identified in the Term Identification Set ($n \geq 4$, or 3%) is available as Appendix 5.

Table 2. Term identification set MeSH and textword terms ranked by citation occurrence

Term	Citation occurence (n=129)	Citation Occurence (%)
MeSH		
Primay health care	44	34.1
Family practice	33	25.6
Patient care team	20	15.5
Referral and consultation	18	14.0
Patient satisfaction	16	12.4
Rural health services	15	11.6
Outcome assessment (Health care)	13	10.1
Textwords		
Primary care	69	53.5
Health care	44	34.1
Community	41	31.8
General practitioners	28	21.7
Access	24	18.6
Clinic	20	15.5
Rural	16	12.4
GPs	16	12.4
General practice	16	12.4
Health service	16	12.4
GP	15	11.6
Consultation	15	11.6
Health services	15	11.6
General practitioner	15	11.6
Referral	14	10.9

PHC filter development

All high frequency terms identified in the Term Identification Set were now searched in the Filter Development Set, recreated in Medline, and ranked according to the number of citations they retrieved (their recall).

MeSH terms were only searched in the MeSH field of each citation. Title and abstract textwords, however, were searched on the MeSH field in addition to the title and abstract fields. This changed the frequency ranking to some extent by increasing the recall of textwords which exist as MeSH terms (e.g. Patient satisfaction) or as part of one or more MeSH terms (e.g. Health services). MeSH and textword terms with highest recall in the Filter Development Set, retrieving n ≥ 20 citations (or 10% of the set), are shown in Table 3 below.

Table 3. Best performing PHC terms in the Filter Development Set with their recall

Term	Recall (total n=200)	Recall (%)
MeSH		
Primary health care	77	38.5
Family practice	48	24.0
Patient care team	48	24.0
Patient satisfaction	36	18.0
Referral and consultation	31	15.5
Rural health services	30	15.5
Patient education as topic	22	11.0
Quality of life	21	10.5
Attitude of health personnel	21	10.5
Textwords		
Health care	136	68.0
Health services	110	55.0
Primary care	97	48.5
Primary health	81	40.5
Primary health care	79	39.5
Patient care	68	34.0
Community	66	33.0
Family	63	31.5
Consultation	43	21.5
Rural	41	20.5
Referral	39	19.5
Physicians	38	19.0
Integrated	36	18.0
Patient satisfaction	36	18.0
General practitioners	30	15.0
Access	26	13.0
Patient education	25	12.5
GPs	23	11.5
General practice	23	11.5
Clinic	22	11.0
General practitioner	22	11.0
Collaborative care	21	10.5
Communication	20	10.0

It is clear from this list of terms that many high recall MeSH and textword terms are relevant, even important, to PHC but are far too general on their own to make a useful contribution to a PHC search filter. Examples are: Patient care team and Patient satisfaction (MeSH terms); and Health care, Health services, Family, Access, Community, Consultation, Integrated, and Referral (textwords). The inclusion of these terms on their own would significantly reduce the quality of the results returned (i.e. search precision) by bringing in citations describing a wide range of health care contexts. The predominance of these terms, however, in the PHC literature indicates they should not be overlooked in developing the PHC filter.

To account for both high and low precision terms with high recall, the project took two separate approaches to building the PHC filter. First, an objective, statistical approach was followed to develop a 'core PHC filter' based on high recall-high precision PHC terms with prima facie relevance to PHC. Second, the project trialled combining low precision terms to create more precise search concepts. The relevance of citations retrieved by these combined searches was then determined.

The core PHC filter

The following terms with high recall in the Filter Development Set had been marked as core PHC terms by the EAG. These were immediately shortlisted as candidate filter terms.

- Primary health care (MeSH)
- Family practice (MeSH)
- Family physicians (MeSH)
- Primary care (textword)
- Primary health care (textword)
- General practitioners (textword)
- General practice (textword)
- General practitioner (textword)

Despite being identified by the EAG as core PHC terms, the terms GPs, PHC, and Primary health could not be considered for the filter as they retrieved a large number of irrelevant citations (e.g. GPs retrieved citations on Global Positioning Systems and glycoproteins).

Two additional high frequency MeSH terms were added to this list. As these terms had not been identified by the preliminary analysis of PHC terminology, they had not been included in the EAG's relevance appraisal. These terms were Community mental health services and Home health services. Both terms were included as candidate terms for the time being based on their recall and MeSH scope note definitions. Their effect on the relevance of retrievals would be ascertained later during the post-hoc precision analysis stage (See section 3.2).

As PHC retrieves well as both a textword and MeSH term, it was included in the filter as a textword term and tagged with the .mp. command. This command forces a search on title, abstract and MeSH fields within the OvidSP Medline database.

The three textwords *General practice, General practitioner, and General practitioners* were combined into a single search construction by applying the truncation symbol $ to the common word stem (i.e. General practi$). This symbol finds all variant endings of the term after the point at which it is placed.

All shortlisted candidate terms were then searched in combination with each other in the Filter Development Set to determine if each successive addition improved search performance, or if the addition of a subsequent term added nothing to recall. The results of this cumulative addition process are show in Table 4 below.

Table 4. Cumulative recall of core PHC terms in the Filter Development Set

Best search structure	Terms Included	Recall in filter development set (n=200)	Recall in Filter Development Set (%)
Single term	Primary care.mp.	79/200	39.5
Two-term	Primary care.mp. OR General practi$.mp.	127/200	63.5
Three-term	Primary care.mp. OR General practi$.mp. OR Primary health care.mp.	136/200	68.0
Four-term	Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/	141/200	70.5
Five-term	Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/ OR Family practice/	142/200	71.0
Six-term	Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/ OR Family practice/ OR Home care services/	150/200	75.0
Seven-term	Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/ OR Family practice/ OR Home care services/ OR Family physicians/	150/200	75.0

Note: the / sign in search indicates a MeSH field search.

Although the addition of Family physicians/ did not increase recall in the Filter Development Set, it was retained due to its unique association with PHC.

The core PHC filter therefore consists of three textwords and four MeSH terms: Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/ OR Family practice/ OR Home care services/ OR Family physicians/

High recall-low precision terms

The project trialled various strategies to account for high recall-low precision terms in the search filter.

Strategy 1. Determine the precision of MeSH terms outside the Filter Development Set

High recall MeSH terms identified in the Term Identification Set that were not considered core PHC terms by the EAG were searched outside the gold standard. The citations retrieved were scanned for their relevance to PHC.

As a result, several high recall MeSH terms were excluded from filter candidature because they retrieved a large proportion of non-relevant citations outside the Filter Development Set. Some of these exclusions were clear-cut, e.g. Patient care team, Patient satisfaction, Patient education as topic, Quality of life, and Attitude of health personnel. Other exclusions based on poor relevance outside the Filter Development Set were less clear-cut, e.g. Rural health services, Referral and consultation, and Continuity of patient care. The EAG had tagged some of these excluded terms as potential topic searches to be combined with the final PHC filter.

Strategy 2. Test textword combinations

High recall terms describing important PHC themes (e.g. community, family, access or integrated) were combined with high recall terms for patient care/health care to see if this produced a search of higher precision than individual terms on their own. The following structure comprising high recall terms was thereby trialled: ((community OR family OR access OR integrated) AND (patient care OR health care OR health service$)).mp.

This search retrieved more than half the Filter Development Set citations (n = 101) but returned a large number of mostly irrelevant citations when run outside this set. Based on this, the structure could not be included in the PHC filter.

Strategy 3. Identify MeSH terms associated with high recall textwords

The project analysed the MeSH terms associated with high recall-low precision textwords to identify any MeSH terms that had been overlooked in the frequency analysis that should be considered potential filter terms.

This showed that the high recall of many of these textwords was due to their occurrence across a wide range of potentially relevant MeSH terms. Many of these MeSH terms had not appeared near the top of the frequency analysis rankings due to the diffuse nature of the textword.

A prime example is the high recall-low precision term community. Community occurred across a large number of PHC-relevant MeSH terms such as Community health services, Community health nursing, Community pharmacy services, and Community health workers. These MeSH terms were checked for their relevance to the PHC concept and found to be exclusive to it. They were therefore directly incorporated into the filter.

Another example is the textword preventive. This was diffused across MeSH terms Preventive health services, Preventive dentistry, Preventive medicine, and Preventive psychiatry. The broad MeSH term Preventive health services was checked for relevance and automatically included in the search filter.

The full PHC filter

The five additional candidate MeSH terms identified in strategy 3 above were incorporated into the PHC core filter. These were:

- Community health services
- Community health nursing
- Community pharmacy services
- Community health workers
- Preventive health services

Their inclusion increased filter recall in the Filter Development Set from 75% (150/200) to 77% (154/200)

The final OvidSP Medline Primary Health Care Filter therefore comprises twelve terms: three textwords and nine MeSH terms.

Primary care.mp. OR General practi$.mp. OR Primary health care.mp. OR Community mental health services/ OR Family practice/ OR Home care services/ OR Family physicians/ OR Community health services/ OR Community health nursing/ OR Community pharmacy services/ OR Community health workers/ OR Preventive health services/

2.3 PHC filter testing

The final PHC filter was run in three additional datasets to check its consistency of performance.

The first of these was the Filter Validation Set, derived from the gold standard set of citations (n=200). The second was an External Validation Set comprising all Medline-indexed citations with abstracts from the Journals Primary health care research & development; Journal of primary health care; and Australian journal of primary health. This validation check used the '1946 to February Week 4 2012' Medline database.

The third check used the full, reconstructed gold standard set of PHC citations (n=529). Results are shown in Table 5.

Table 5. PHC filter performance in three validation sets

Testing set	No. citations retrieved from set	Recall (%)
Filter validation set	154/200	77.0
External validation set	175/237	73.8
Full gold standard set	415/529	78.5

Part 3. Translating the OvidSP Medline PHC filter for PubMed

The OvidSP Medline filter was translated for PubMed. PubMed offers several advantages over OvidSP Medline:

1. PubMed searches can be converted into hyperlinks for real time interrogation of the PubMed database
2. PubMed provides access to more content than OvidSP Medline
3. PubMed is freely available and readily accessible without institutional subscription.

The PubMed database consists of two components: Medline citations indexed with the National Library of Medicine's MeSH terms; and other citations not yet indexed with MeSH terms due to their stage of processing (e.g. in process), or those not selected for MeSH indexing. Optimal translation of a Medline search filter for PubMed requires an awareness of these two categories of citations within the database.

Where the MeSH-indexed proportion is concerned, an accurately translated filter should retrieve the exact same set of references as the set retrieved in Medline. To achieve this equivalency, the OvidSP search syntax has to be carefully converted into PubMed's own unique search syntax.

To retrieve references not yet indexed with MeSH terms, the PubMed version of the filter must include a textword translation of the validated filter. This translation is restricted to searching on the non-indexed portion of PubMed so that it does not overlap with the component designed to retrieve the MeSH-indexed references. This textword translation is not expected to retrieve with the same degree of sensitivity and precision as a search based on MeSH terms. Low sensitivity and precision are not vital concerns in this portion of the search as its inclusion is only an interim measure. Relevant but as yet non-indexed PHC citations missed by the textword search translation should eventually be retrieved by MeSH terms once they have been assigned.

3.1 Translation of the Medline-indexed component

Once OvidSP syntax has been converted to PubMed search syntax, an equivalence test is necessary to ensure that no error has been made and that both versions retrieve the same set of references. The methodology for performing this check was as follows:

1. The full gold standard set (n=529) was constructed in OvidSP Medline
2. The OvidSP Medline PHC filter was run and combined with the full gold standard set using 'AND'
3. Both the full gold standard set and the set of citations retrieved by the OvidSP Medline filter (n=415) were recreated in PubMed using citation Unique Identifier numbers
4. The translated version of the filter was run in PubMed
5. The set retrieved by the translated filter was combined with the full gold standard set reproduced in PubMed using 'AND'. The PubMed translation had also retrieved n=415 citations
6. To ascertain that the 415 citations retrieved by the PubMed translation were the same as the 415 citations retrieved by the OvidSP Medline version, the two sets were combined with each other using 'NOT'. No unique citations were returned, indicating the searches have 100% equivalency.

The PubMed translation for retrieving PHC citations in the indexed subset of PubMed is:

```
Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]
```

Note: The [tw] tag is equivalent to the .mp. search command in OvidSP Medline. It forces a search on title, abstract and MeSH term fields. The [mh:noexp] tag is equivalent to the / command in Medline. It forces a search on the MeSH term field, turning off PubMed's auto-explode function in the meantime.

3.2. PHC filter post-hoc precision estimate

The project sought to measure the validated PubMed filter's real-world precision by calculating the number of relevant citations retrieved as a subset of the first 500 citations retrieved.

The PubMed translation was therefore run in PubMed on 9 December 2011, without restriction to a specific dataset. The titles and abstracts of the first 500 citations retrieved were downloaded and formatted into a Word document. Two EAG members dual reviewed 250 of these retrievals for relevance to PHC while another two members of the group dual reviewed the remaining 250 citations. A third reviewer was used to arbitrate on disagreements and uncertainties.

Of the 500 citations retrieved by the PubMed translation, reviewers deemed 442 citations as relevant to PHC and 58 irrelevant. The filter's post-hoc precision is therefore estimated as 88.4%.

The MeSH terms associated with citations deemed irrelevant by reviewers were analysed to see if a specific term or terms were overrepresented in this set. Community mental health services had the highest appearance in the set of irrelevant citations, occurring in 27.6% of all citations (16/58). However, this term could not be excluded outright from the filter as it also appeared in 4.5% of relevant citations (20/442). The remaining filter MeSH terms were found to have higher or equivalent frequency in the relevant set compared to the irrelevant set and were therefore deemed valid filter terms.

3.3. Textword translation for retrieving citations not indexed for Medline

To retrieve citations not yet assigned MeSH terms, filter MeSH terms must be carefully translated into the most appropriate and best performing textwords. The following methodology was used to identify textword equivalents of PHC filter MeSH terms:

1. The translated filter was run in PubMed and the results limited to English language, MeSH-indexed citations with abstracts published between 2010 and 2011.
2. The translated filter was then run again with all MeSH search terms restricted to searching on the title and abstract fields of each citation by converting the [mh:noexp] search tag to the [tiab] one. This search simulates a search on PubMed's non-indexed subset where retrieval depends on term occurrence in the citation's title and/or abstract.
3. The citations retrieved by filter MeSH terms (step 1) but not their textword equivalents (step 2) were identified. Of the citations originally retrieved, 33.2% were rendered irretrievable when MeSH indexing terms were taken out of the equation.
4. Frequency analysis of the titles and abstracts of these 'lost citations' revealed alternative natural language terms that could be incorporated in the filter to enhance its retrieval of PubMed's non-indexed literature. These were tested individually and together to find the best performing combination of terms.
5. The final textword translation was then run across the full PubMed database. Retrieved citations were checked for their relevance to PHC. A series of adjustments were then made to optimize search precision.

The final textword translation of the validated PubMed filter, designed to retrieve content in PubMed non- indexed subset, contains the following 20 terms:

Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR GP[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]

When put together with the search component designed for retrieving indexed content, the full and final PubMed PHC filter becomes:

((Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) *OR ((Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb])*

Note: the textword translation is shown in italics.

Part 4. Trial set of PHC expert topic searches

A list of potential PHC topic searches was created from a number of sources:

- Important textwork and MeSH terms nominated by the expert advisory group
- MeSH and textwords with high frequency identified in the frequency analysis stages of the project
- Topics included in the PHC policy document Building a 21st century primary health care system: Australia's first national primary health care strategy.[7]
- The most frequiently occuring cancer in Australia, occuring to the AIHW, were included as cancer topics
- Priority areas for chronic disease, as detailed on the Department of Health and Ageing website, were included.

This list is presented as Table 6 below.

Table 6. Long list of potential PHC topic searches

Diseases and Conditions	Specific Needs	Health and Social Care Issues	Health professionals	Policy Issues and Service Models
Allergy	Aged	Alcohol use	Allied health professionals	Chronic disease management
Arthritis	Children and Youth	Cancer care	Audiologists	Electronic health records
Asthma	Indigenous health	Consumer participation	Dentists	Health care reform
Breast Cancer	Intellectual disability	Continuity of patient care	Diabetes educators	Health services accessibility
Bowel Cancer	Men's health	Diet	Dietitians	Inter-professional relations
Coronary heart disease	Mental illness	Drug use	Exercise physiologists	Organisational models
Dementia	Physical disability	Health literacy	General practitioners	Population health planning
Depression	Rural and remote health	Health promotion	Indigenous health workers	Primary health care organisations
Diabetes	terminally ill	Patient experience	Occupational therapists	
Heart attack		Patient satisfaction	Pharmacists	

Diseases and Conditions	Specific Needs	Health and Social Care Issues	Health professionals	Policy Issues and Service Models
Heart failure		Pallative care	Physiotherapists	
Hypertension		Physical activity	Podiatrists	
Lung cancer		Safety and quality	Practice nurse	
Obesity		Self-care	Psychologists	
Osteoporosis		Smoking	Speech pathologists	
Prostate cancer			Social workers	
Respiratory				
Sexual health				
Skin cancer				
Stroke				

PHCRIS and CareSearch representatives were then asked to identify gaps within the final list.

From this long list, the following 12 topics were shortlisted to be developed into topic searches:

- Chronic disease management
- Continuity of patient care
- Coronary heart disease
- Diabetes
- General practitioners
- Health services accessibility
- Heart failure
- Indigenous health
- Mental illness/health
- Palliative care
- Patient experience
- Rural and remote health

Limits applied to topic searches

Several options will be made available to searchers for limiting topic search results, including free full text only, high level evidence only, and Australia only.

The Australia-only search strategy

A highly sensitive 'Australia-only' expert search strategy has been designed to isolate work by Australian researchers and research focusing on the Australian health care context. It is recommended that this be combined with all non-clinical topics only (e.g. health services accessibility) as clinical topics are less likely to have a geographic focus. The strategy is as follows:

(.au[ad] OR Australia*[tw] OR Australia*[ad] OR New South Wales[tw] OR New South Wales[ad] OR Victoria[tw] OR Victoria[ad] OR Queensland[tw] OR Queensland[ad] OR South Australia[tw] OR South Australia[ad] OR Western Australia[tw] OR Western Australia[ad] OR Tasmania[tw] OR Tasmania[ad] OR Australian Capital Territory[tw] OR Northern Territory[tw] OR Northern Territory[ad])

A methodological search filter

A methodological search filter will be built into clinical topics (e.g. diabetes) to offer searchers the option to limit results to the highest levels of evidence only, i.e. systematic reviews and randomized controlled trials. This filter combines the PubMed Clinical Queries systematic review filter (sensitive) with the Clinical Queries therapy filter (sensitive).[8]

For more detail on the topic searches, see Guidance for creating a PubMed topic search, set out as Appendix 6.

Part 5. PHC and Informit

The Informit database is a premier source of grey and commercially published Australasian research and professional resources. As such, the project wished to evaluate the efficacy of the PHC filter textwords in retrieving citations of known relevance to Australian PHC research from within this database.

To do this, all gold standard citations (journal and non-journal) indexed in Informit but not in Medline were identified (n=68). It was important that only citations unique to Informit were included in the analysis as those citations duplicated across databases contain MeSH indexing terms. We needed to eliminate the effect of MeSH on retrieval in this case to test the power of the filter's textwords in retrieving citations of widely variable indexing.

The Informit-only citations were downloaded into an EndNote library. Of the 68 citations, 36 described journal articles and 32 described non-journal documents such as conference papers, books, and government reports.

The textword-only part of the PHC filter was then searched in this dataset within EndNote. The filter retrieved only 31/68 citations (45.6%). Those citations not retrieved were on topics such as rural and remote health services, indigenous health, and health services accessibility. These concepts will be included as PubMed search topics in the longer term to ensure that their significance is not overlooked.

Part 6. Searching outside of bibliographic databases: Web based searching

While the Ovid Medline/PubMed primary health care search filters will enable automated searching in this major biomedical database, one of the challenges for primary health care is retrieving literature and evidence not held on this source. Many documents and reports are only available on specific websites or agencies and there continues to be a range of studies, evaluations and reviews that are not published in journals. To be retrieved, textword searches will need to be conducted in relevant websites and on the open web.

Appendix 7 provides a guide to creating effective searches for PHC literature outside the indexed bibliographic databases.

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Appendices

Appendix 1. The MeSH and textword term review task

Purpose:

1. To select MeSH and textwords to inform scope of the PHC filter.
    a) (MeSH = Medical Subject Heading. A thesaurus created by the US National Library of Medicine).
    b) Textwords=terms and phrases in citation titles, abstracts and subject headings.
2. To identify terms so specific and unique to PHC that they will retrieve all articles PHC researchers could not afford to miss.
3. To identify terms of central importance to PHC that don't belong exclusively to PHC.
4. To identify specific issues that occur in wide ranging contexts outside of PHC which are also of interest to PHC.

MeSH Heading Task

Place an X in one of the four columns for each MeSH Heading. Consider the MeSH heading as either a potential filter term or topic search term.

	Potential Filter terms		**Specific issues to be considered for topic searches**	
	Unique- must be retrieved	Definitive- needs to be considered	Must have as a topic search	Nice to have as a topic search
Adolescent				
Adult				
Aged				
Aged, 80 and over				
Attityde of health personnel				
Australia				
Cardiovascular diseases				
Child				
Chronic diseases				
Delivery of health care				
Dementia				
Family practice				
Female				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Definitive- needs to be considered	Must have as a topic search	Nice to have as a topic search
Great Britian				
Health policy				
Health promotion				
Health services				
Health services accessibility				
Health services research				
Health status				
Humans				
Male				
Mental retardation				
Middle aged				
National health programs				
Oceanic ancestry group				
Outcome assessment (health care)				
Patient care team				
Patient education as topic				
Patient satisfaction				
Physician-patient relations				
Physicians practice patterns				
Physicians, family				
Primary health care				
Program evaluation				
Quality of health care				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique - must be retrieved	Definitive- needs to be considered	Must have as a topic search	Nice to have as a topic search
Questionnaires				
Retrospective studies				
Risk factors				
Rural health services				
Rural population				
Socioeconomic factors				
United States				
Victoria				

Place an X in one of the four columns for each textword. Consider the textword as either a potential filter term or topic search term.

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Important and generalisable but not uniquely PHC- needs to be discussed	Must have as a topic search	Nice to have as a topic search
Aboriginal				
Aboriginal and Torres Strait Islander				
Access				
Aged				
Alcohol				
Allied health				
Ambulance				
Assessment				
Asthma				
Australia				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Important and generalisable but not uniquely PHC- needs to be discussed	Must have as a topic search	Nice to have as a topic search
Back pain				
Barriers				
Blood pressure				
Breast cancer				
Cancer				
Children				
Cholesterol				
Chronic disease				
Chronic illness				
Clinical practice				
Communication				
Community based				
Community health				
Controlled trial				
Costs				
Dementia				
Depression				
Diabetes				
Disability				
Disease management				
Equity				
Evaluation				
Family				
General practice				
General practitioners				
GPs				
Guidelines				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Important and generalisable but not uniquely PHC- needs to be discussed	Must have as a topic search	Nice to have as a topic search
Health outcomes				
Health professionals				
Health promotion				
Health service				
Health status				
Heart disease				
Hospital				
Incentives				
Income				
Indigenous				
Integrated				
Intellectual disability				
Interventions				
Interviews				
Lifestyle				
Medicare				
Medication				
Medicines				
Men				
Mental health				
Morbidity				
Mortality				
Multidisciplinary				
Not for profit				
Nurse/nursing				
Nurse led				
Outcome measures				
Paramedic				
Partnerships				
Patient centred				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Important and generalisable but not uniquely PHC- needs to be discussed	Must have as a topic search	Nice to have as a topic search
Payments				
Performance				
Pharmarcy				
PHC				
Physicians				
Policy				
Practice nurses				
Prehospital				
Prevention				
Primary care				
Primary health				
Primary health care				
Psychological				
Qualitative				
Quality				
Queensland				
Questionnaire				
Randomised controlled				
Recruitment				
Referral				
Reflexology				
Refugees				
Regional				
Remote				
Risk factors				
Rural				
Self-management				
Service delivery				

	Potential Filter terms		Specific issues to be considered for topic searches	
	Unique- must be retrieved	Important and generalisable but not uniquely PHC- needs to be discussed	Must have as a topic search	Nice to have as a topic search
Smoking				
Students				
Survey				
Systematic review				
Telephone				
Training				
United States				
Urban				
Visits				
Women				
Workforce				
Young people				

Appendix 2. Gold standard set options

Gold standard option 1: PHC specialty journals

Proposal:

Form a gold standard comprising all articles within a nominated primary health care specialty journal title, or set of titles, across a pre-established range of dates, e.g. 2005-2008.

Considerations for the gold standard:

- This method takes all included articles as a set based on the assumption all articles within the specialty title are of specific relevance to PHC. Individual articles are not screened for relevance.
- Is a single specialty title of sufficient scope to capture all concepts of interest, or are multiple titles required to represent all domains of PHC? E.g. A rural health title + GP title + Policy title International PHC titles vs those only focusing on the Australian health care system.
- Titles need to be comprehensively (not selectively) indexed in Medline (problematic with Australian Journal of Primary Health)
- Should items under the headings news, editorials, book reviews, letters etc. be included? What is the most appropriate range of years to include? Need to reflect historical as well as current perspectives?

Gold standard option 2: A specific topic subsection of a journal

Proposal:

- To form a gold standard using all articles included in a PHC specific topic subsection of a major journal, e.g. MJA's General practice and primary care subset or BMJ's General practice/family medicine subset

Considerations for the gold standard:

- This approach assumes all articles in the specific topic subsection are of central relevance to PHC. The specific topic subsection may be too narrow in scope and therefore non-representative of all concepts of interest. E.g. a general practice subset may not represent all domains of PHC.
- Is there a balance between clinical content and health services research/ policy content? Special focus subsections in major general biomedical titles may be predominantly clinical in focus.
- International vs. Australian focus
- What is the most appropriate range of years to include? Need to reflect historical as well as current perspectives?
- These sections typically include news, editorials, letters, book reviews etc.
- Take all article types? Article types may be selectively indexed in Medline.

Gold standard option 3: Systematic review set

Proposal:

To use the included studies from a nominated set of PHC systematic reviews to form the gold standard. The EAG will appraise each systematic review for relevance at the title level. The included articles within these reviews will then be appraised as a separate task.

Considerations for the gold standard:

- The systematic reviews selected for the gold standard should collectively cover a wide range of topics. This will help to offset the characteristically narrow topic focus of individual systematic reviews.
- Systematic review topics should

also be quantitatively balanced. For example, if three reviews on depression in primary health care are selected and their citations pooled in the gold standard set, 'depression' as a term will be overrepresented in the frequency analysis, to the potential exclusion of integral PHC concepts.
- The systematic review methodology elevates certain study designs above others. Some designs will therefore predominate over others in the gold standard, e.g. RCTs. If the filter is expected to retrieve other study designs, or even letters, editorials etc., these types need to be included in the gold standard.
- Australian PHC areas of interest may not be as adequately covered in some systematic review sets (e.g. Cochrane).

Gold standard option 4: An existing PHC dataset

Proposal:

To form a gold standard using an existing dataset, such as one belonging to a PHC organization, citations included in relevant submissions to the National Health Reform, or those included in relevant National Health Reform final reports.

Considerations for the gold standard:

- The availability of a suitable dataset
- Organizational factors will determine the scope of what is collected in a dataset. The scope may not be broad enough to represent all domains of interest to PHC.

Gold standard option 5: A random selection of citations

Proposal:

To form a gold standard by dual review of 10,000 citations randomly selected from the PubMed database.

Task outline:

This task would require 40 (20 x 2) reviewers to dual review a maximum of 500 citations each.

For each citation, reviewers answer yes/no/uncertain to question: Is this article describing primary health care? Citations judged by both reviewers as relevant are automatically included in the gold standard. Where one reviewer says yes and the other no, the citation goes to a third reviewer.

Considerations for the gold standard:

- This is the purest, most unbiased method for identifying relevant citations. However, the set-up and review stages are both very cost and labor intensive.
- The prevalence of PHC literature within the sample of 10,000 is unknown. The scope of PHC citations within the sample is also an unknown.
- Difficulty in getting 40 people to commit to doing the task within a tight time frame.

Appendix 3. PHC filter Expert Reference Group members

Name	Position	Organisation
Julie McDonals	Research Fellow	Centre for Primary Health Care and Equity (CPHCE), UNSW
Catherine Hurley	Senior Research Officer	South Australian Community Health Research Unit
Peter McInnes	PHCRED Liason Officer	Australian Primary Health Care Research Institute (APHCRI)
Ellen Mcintyre	Director	Primary Health Care Research & Information Service (PHC RIS)
Petra Bywood	Research Manager	Primary Health Care Research & Information Service (PHC RIS)
Christina Hagger	Research Fellow	Primary Health Care Research & Information Service (PHC RIS)
Rachel Katterl	Research Associate	Primary Health Care Research & Information Service (PHC RIS)
Simon Patterson	Information Systems Manager	Primary Health Care Research & Information Service (PHC RIS)
Ruth Sladek	Senior Lecturer	Flinders University, School of Medicine

Appendix 4. APHCRI Systematic Reviews used to create the gold standard

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Appendix 5. Full list of Term Identification Set MeSH and textword terms

Textword	Frequency (total n=129)	Mesh term	frequency (total n=129)
Primary care	69	Humans	124
general practi$	45	Female	72
health care	44	Male	70
Community	41	Aged	59
Mental Health	28	Middle aged	47
General practitioners	28	Primary health care	44
Depression	26	Adult	35
Usual care	24	Family practice	33
Access	24	Patient care team	20
gp$	23	Treatment outcome	20
Integrat$	23	Aged, 80 and over	19
Clinic	20	United states	19
Rural	16	Referral and Consultation	18
GPs	16	Cost-benefit analysis	16
General practice	16	Patient satisfaction	16
Health service	16	Rural health services	15
GP	15	Adolescent	15
consultation	15	Mental disorders	14
health services	15	Questionaires	14
General practitioner	15	Outcome assessment (Health care)	13
Referral	14	Follow-up studies	12
Physicians	13	Interprofessional relations	12
Blood pressure	12	Mental health services	11
Cost effectiveness	12	Health services for the aged	11
Collaboration	11	Great Britian	11
Psychiatric	11	Health services research	11
Integrated	11	Models, organizational	11
Community based	11	Patient education as topic	11
Patient satisfaction	11	Depressive disorder	10
appointment$	11	Continuity of patient care	10
Collaborative care	10	Australia	10
Pharmacists	10	Chronic disease	10
Health status	10	Cooperative behaviour	10

Textword	Frequency (total n=129)	Mesh term	frequency (total n=129)
Primary care physician	10	Community mental health services	9
General practices	10	Patient compliance	9
NHS	9	Child	9
Communication	9	England	9
Health professionals	9	Health status	9
Guidelines	9	Pilot projects	9
Cost effective	9	Program evaluation	9
Psychiatrist	9	Quality of life	9
Integration	9	Delivery of health care	9
Literacy	8	Depression	8
Diabetes	8	Home care services	8
Hypertension	8	State medicine	8
Adherence	8	Antidepressive agents	8
Multidiscplinary	8	Patient acceptance of health care	8
Self management	8	Quality of health care	8
Referred	8	Hypertension	7
Depressed	8	Nurse practitioners	7
High risk	8	Case management	7
Health literacy	7	Self care	7
Pharmacist	7	Geriatric assessment	7
Screening	7	Outcome and process assessment (health care	7
Health outcomes	7	Prospective studies	7
Case management	7	Randomized controlled trials as topic	7
Hospital admissions	7	Social support	7
anxiety	7	Diabetes mellitus, type 2	6
Coordinated	7	Health promotion	6
Appointments	7	Attitude of health personnel	6
Rural areas	6	Nursing homes	4
Well being	6	Pharmaceitucal services	4
Primary Health	6	Pharmacists	4

Textword	Frequency (total n=129)	Mesh term	frequency (total n=129)
Primary health care	6		
Major depression	6		
Primary care physicians	6		
Major depression	6		
primary care physicians	6		
referrals	6		
rural and remote	6		
Asthma	5		
Older people	5		
Nurse practitioner	5		

Textword	frequency (total n=129)
Primary care physicians	6
Major depression	6
primary care physicians	6
referrals	6
rural and remote	6
Asthma	5
Older people	5
Nurse practitioner	5
Community health	5
Heart disease	5
Allied health	5
Community pharmacists	5
Evidence based	5
Chronic obstructive pulmonary disease	5
Secondary care	5
Fee	5
GP practices	5
Clinical outcomes	5

Textword	frequency (total n=129)
Chronic diseases	5
Health related quality of life	5
HIV	4
Pharmaceutical care	4
Home care	4
Exercise	4
Type 2 diabetes	4
Community care	4
Functional health literacy	4
Veterans	4
Smoking	4
Depression treatment	4
fee for service	4
Health needs	4
Primary mental health	4
Patient outcomes	4

Appendix 6: Guidance for creating PubMed topic searches

This document outlines the decisions and steps required to develop a PubMed topic search for inclusion on the PHCRIS website. The five major steps are as follows:

1. Choose a few MeSH terms and decide whether or not to 'explode' them. MeSH terms are combined with the part of the PHC filter that searches for indexed citations only (i.e. those that have been assigned MeSH terms).

2. Choose a few natural language terms that commonly describe the topic in titles and abstracts. It may be appropriate to truncate them using the * symbol. These terms will be combined with the part of the PHC filter that searches for newly added citations not yet assigned MeSH terms.

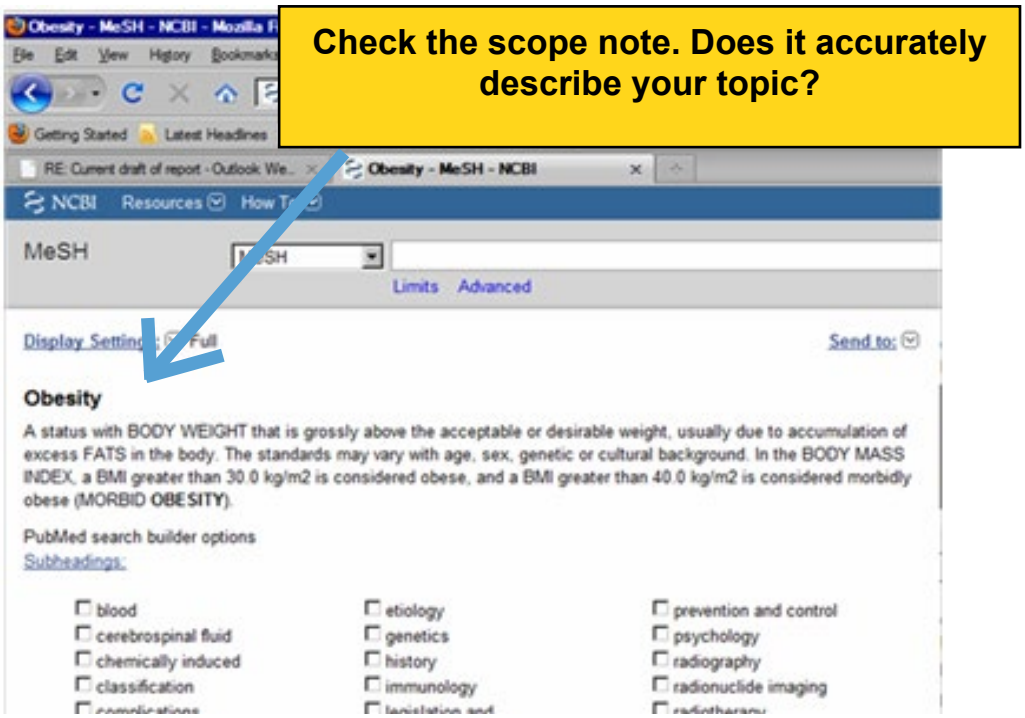
3. Enter MeSH and natural language terms in the template provided

4. Run the search and review retrieved citations for relevance. Refine search if required.

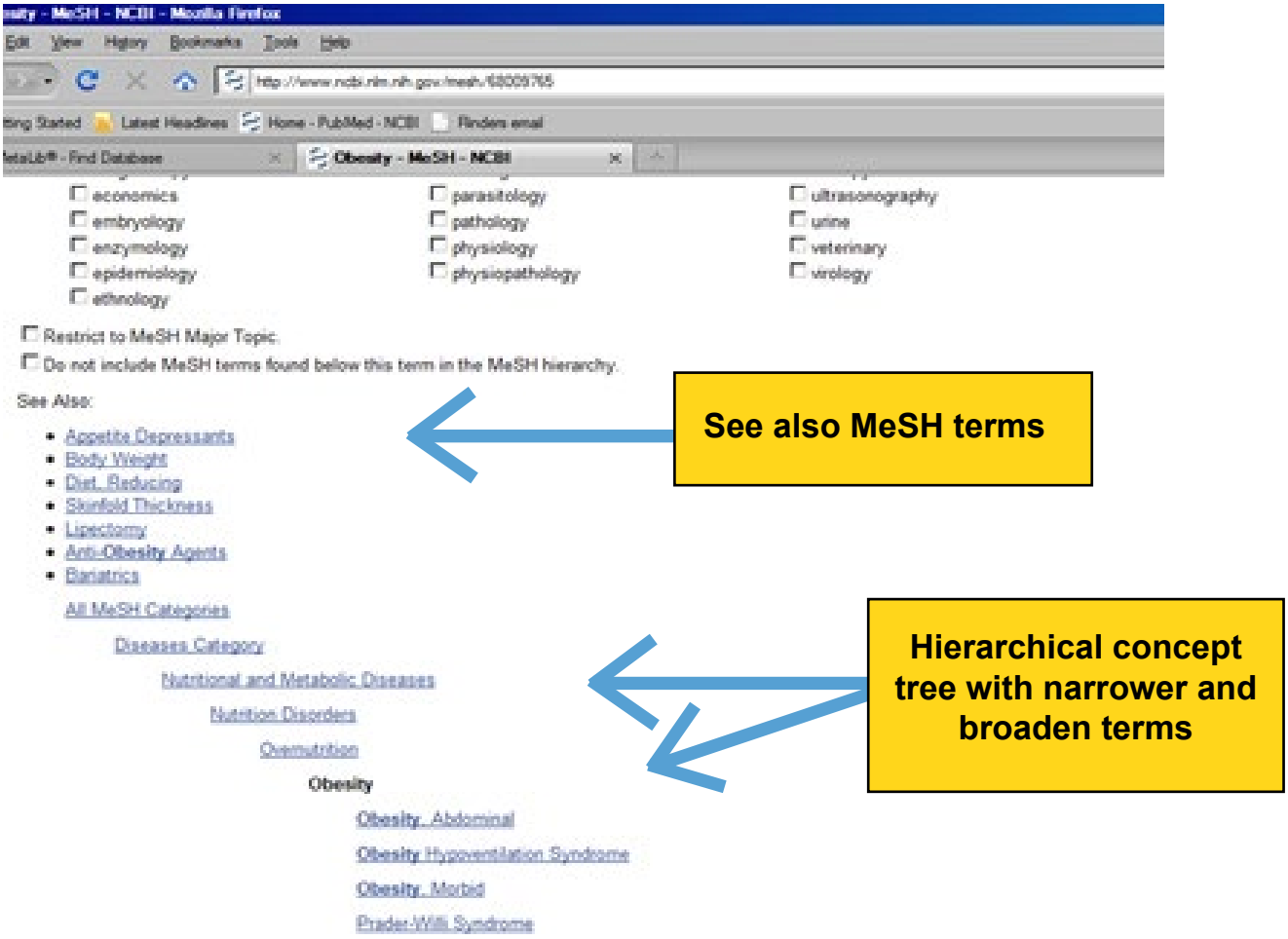
5. Add the html prefix that converts the search strategy into a hyperlink URL (i.e. http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=search&db=pubmed&term=) and replace all spaces in the search structure with + signs.

Part 1. Find the best MeSH term(s) for describing the topic

Use the National Library of Medicine's online MeSH database to identify the most appropriate MeSH terms (available at http://www.ncbi.nlm.nih.gov/mesh). Click on a MeSH term to see all the information provided for it.



Scroll down to see any related terms under ‘See also’. Note any potentially useful ones for further investigation.



Next check the hierarchical concept tree at the bottom of the screen. Find the term you entered (e.g. obesity). Is the conceptually broader term showing above it more appropriate? Or is there a narrower, more specific term in the indented list below it that would be better? Write down your term of choice. If you want to include it and ALL the narrower terms listing beneath it, write [mh] next to your term. This command makes the database search on the term entered plus all narrower terms. If you do NOT want to include all narrower terms in the search, you must write [mh:noexp] next to it.

Choose only one or two MeSH terms for the topic search, unless the topic is quite complex.

Part 2. Find the best natural language terms for the topic

A natural language term may be the same as a MeSH term (e.g. obesity) or may differ from it if the MeSH term is not one used in everyday language (e.g. 'Neoplasms' for cancer, or 'Oceanic Ancestry Group' for Indigenous Australians).

Write down a short list of very precise terms for the topic. If you need to find variants of the one word, insert the * truncation symbol at the point where variation begins. e.g. Diabet* will find diabetes and diabetic. Use the truncation symbol with great care. It can inadvertently broaden the search and make it less precise. e.g. Dent* will find dental and dentistry, but it will also find dentition and denture(s).

Write [tiab] next to each term. This command forces a search on a citation's title and abstract fields only.

Part 3. Enter MeSH and natural language terms in a template provided

The following sample search (for women's health) shows you how a topic search is constructed.

The part of the structure that searches PubMed's indexed literature is in blue. The part that searches PubMed's as yet unindexed literature is in red. The two parts are combined using the OR search operator. The whole search is limited to English language.

((Women's health[mh] OR Women's health services[mh]) AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR (Women's health[tiab] AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND English[la]

Find the appropriate template below. There are templates for:

- all citations (i.e. no limits applied)
- high level evidence only (systematic reviews and randomised controlled trials only)
- Australia only (restricts to Australian context or Australian-based research)

To create a ***free full text only*** search, simply add to the end of the search: AND free full text[sb]

Choose the template for 'single MeSH/natural language term' or 'multiple MeSH/natural language terms.'

Replace the ***red text only*** with your terms of choice. MeSH terms go at the start of the search (blue text) and natural language terms at the start of the second part (red text).

Notes:

1. If inserting more than two MeSH or natural language terms, separate each with OR.
2. The [mh] and [tiab] tags must lie flush against the terms they follow. Leave no spaces.
3. Do not remove or add any parentheses. Their placement is important.

All citations search templates

Single MeSH/natural language term (all citations)

(MeSH term with [mh] or [mh:noexp] tag AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR (Natural language term[tiab] AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND English[la]

Multiple MeSH/natural language terms (all citations)

((MeSH term 1 with [mh] or [mh:noexp] tag OR MeSH term 2 with [mh] or [mh:noexp tag]) AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR ((Term 1[tiab] OR Term 2[tiab]) AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND English[la]

High level evidence search templates

Single MeSH/natural language term (high level evidence)

(MeSH term with [mh] or [mh:noexp] tag AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR (Natural language term[tiab] AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND (systematic[sb] OR ((clinical[tiab] AND trial[tiab]) OR clinical trial[pt] OR random*[tiab] OR random allocation[mh] OR therapeutic use/sh)) AND English[la]

Multiple MeSH/natural language terms (high level evidence)

((MeSH term 1 with [mh] or [mh:noexp] tag OR MeSH term 2 with [mh] or [mh:noexp tag]) AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR ((Term 1[tiab] OR term 2[tiab]) AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND (systematic[sb] OR ((clinical[tiab] AND trial[tiab]) OR clinical trial[pt] OR random*[tiab] OR random allocation[mh] OR therapeutic use/sh)) AND English[la]

Australia-only search templates

Single MeSH/natural language term (Australia only)

(MeSH term with [mh] or [mh:noexp] tag AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR (Natural language term[tiab] AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND (.au[ad] OR Australia*[tw] OR Australia*[ad] OR New South Wales[tw] OR New South Wales[ad] OR Victoria[tw] OR Victoria[ad] OR Queensland[tw] OR Queensland[ad] OR South Australia[tw] OR South Australia[ad] OR Western Australia[tw] OR Western Australia[ad] OR Tasmania[tw] OR Tasmania[ad] OR Australian Capital Territory[tw] OR Northern Territory[tw] OR Northern Territory[ad]) AND English[la]

Multiple MeSH/natural language terms (Australia only)

((MeSH term 1 with [mh] or [mh:noexp] tag OR MeSH term 2 with [mh] or [mh:noexp tag]) AND (Primary care[tw] OR General practi*[tw] OR Primary health care[tw] OR Community mental health services[mh:noexp] OR Family practice[mh:noexp] OR Home care services[mh:noexp] OR Family physicians[mh:noexp] OR Community health services[mh:noexp] OR Community health nursing[mh:noexp] OR Community pharmacy services[mh:noexp] OR Community health workers[mh:noexp] OR Preventive health services[mh:noexp]) AND Medline[sb]) OR ((Term 1[tiab] OR term 2[tiab]) AND (Primary care[tiab] OR General practi*[tiab] OR Primary health*[tiab] OR Community mental health*[tiab] OR Family practice[tiab] OR Family medicine[tiab] OR Family physician*[tiab] OR Home care[tiab] OR Home based[tiab] OR Home health*[tiab] OR Community health*[tiab] OR Community nurs*[tiab] OR health visit*[tiab] OR Community pharmac*[tiab] OR Preventive care[tiab] OR Prevention program*[tiab] OR Preventive service*[tiab] OR Preventive health[tiab] OR Health promotion[tiab]) NOT Medline[sb]) AND (systematic[sb] OR ((clinical[tiab] AND trial[tiab]) OR clinical trial[pt] OR random*[tiab] OR random allocation[mh] OR therapeutic use/sh)) AND (.au[ad] OR Australia*[tw] OR Australia*[ad] OR New South Wales[tw] OR New South Wales[ad] OR Victoria[tw] OR Victoria[ad] OR Queensland[tw] OR Queensland[ad] OR South Australia[tw] OR South Australia[ad] OR Western Australia[tw] OR Western Australia[ad] OR Tasmania[tw] OR Tasmania[ad] OR Australian Capital Territory[tw] OR Northern Territory[tw] OR Northern Territory[ad]) AND English[la]

Part 4. Test each search

Run each search to test it by cutting and pasting it in the PubMed search box. Review retrieved citations. Are they in the main relevant to the topic? Is the number retrieved surprising or as you would expect? Refine search by trialling new terms until the quality of the search results can't be improved upon.

Part 5. Add the html prefix and replace spaces with the + sign

Once satisfied with the search, cut and paste the following html prefix to the beginning of the search strategy: http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=search&db=pubmed&term=

Leave no space between the two parts. This prefix converts the search strategy into a hyperlink URL which, when clicked on, launches a real time search of the PubMed database.

To complete the URL, convert all spaces in the search strategy to the character + by:

- highlighting the search strategy
- clicking on Replace
- entering a space using the space bar in the "Find what" box
- entering the + sign in the "Replace with" box and clicking on Replace All

Test the URL by pasting into the address bar of your browser, NOT the PubMed search box. Once satisfied that this is working, the URL is ready for cutting and pasting into a webpage.

Appendix 7. Searching outside of bibliographic databases: Web based searching

While the Ovid Medline/PubMed primary health care search filters will enable automated searching in this major biomedical database, one of the challenges for primary health care is retrieving literature and evidence not held on this source. Many documents and reports are only available on specific websites or agencies and there continues to be a range of studies, evaluations and reviews that are not published in journals. To be retrieved, textword searches will need to be conducted in relevant websites and on the open web.

Those seeking this grey literature will need to balance the reward of additional unique retrievals against the time involved in searching for items and screening for relevance. Specificity in grey literature searching can be problematic. Search engines such as Google will return thousands or millions of items. The search algorithm that matches and rank returns is not publicly available. Managing returns therefore requires management of the search engine features. A study of the characteristics of literature not found on bibliographic databases was undertaken to identify strategies to use when searching the web.

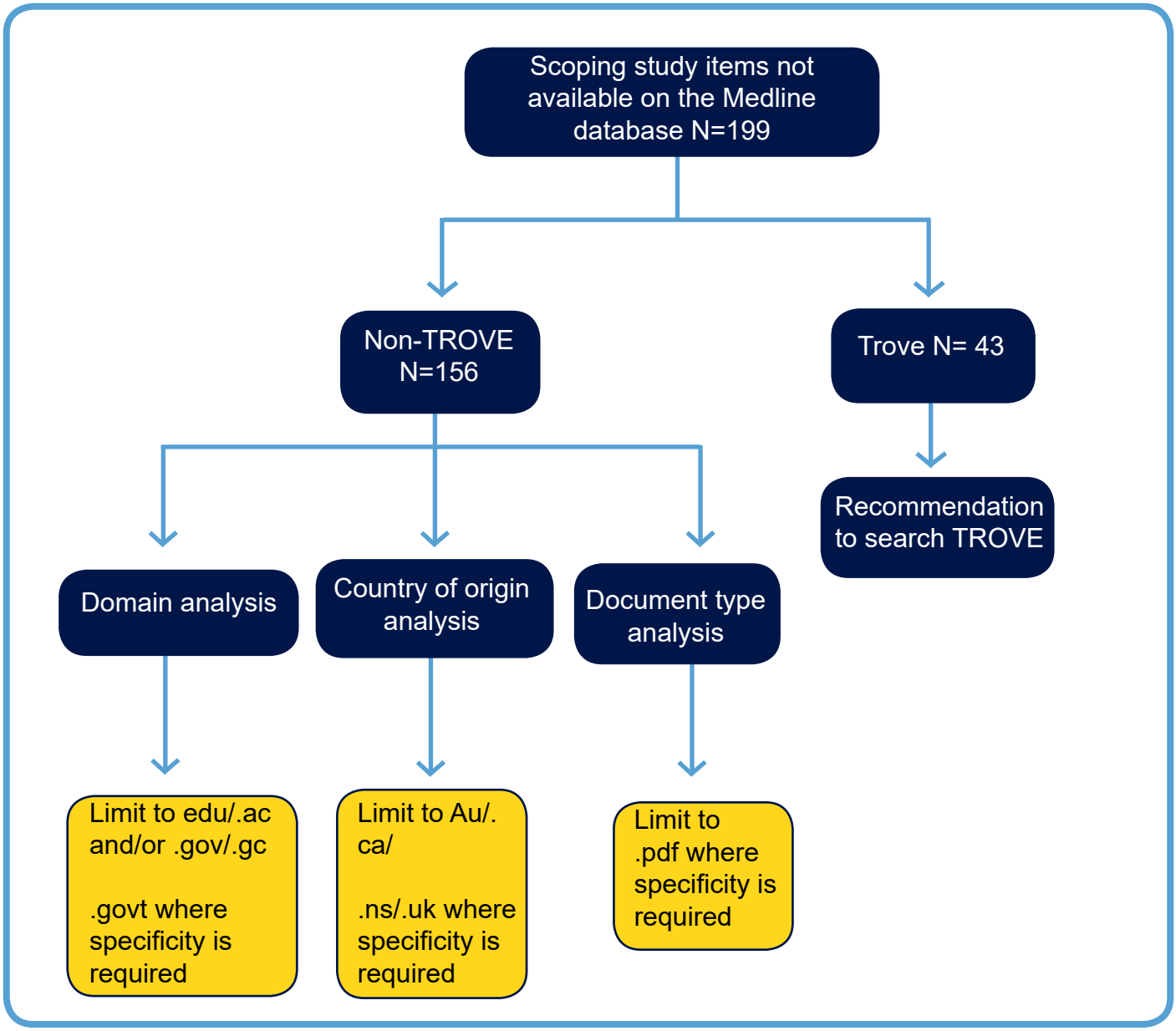
Non medline set

A set of reports, articles and documents not indexed on Medline was compiled from the initial references from the scoping study of the concept of primary healthcare. It comprised 199 items not available on the Medline database that could be retrieved from the web via a URL. The characteristics of the URLs were analysed.

Of particular note was that nearly 22% (43/199) of items were retrieved through TROVE. Trove is a free, online search engine developed by the National Library of Australia. Trove was designed to provide a single point of access to the resources of the deep web and facilitate access to a range of resources from major sources, including selected digitised material freely available online. It aims to ensure that relevant information is not missed in a search by reducing the need to search material-specific discovery services separately. The focus of the resources searched is Australia and Australians.

Given that nearly ¼ of all non Medline items could be found on TROVE, it is recommended that *TROVE should always be considered for specific grey literature searching on primary healthcare issues.*

Figure 1. Schematic representation of analysis of "grey articles"



Characteristics of “grey articles” not included on TROVE

A further analysis of the items not found on TROVE was completed. Three specific characteristics of the cited URL were analysed–domain, country of origin, and file type.

The review of the domain showed that education/academic domains (41/156) and government domains (58/156) were the most common. Practically this means that *when time and resources are scarce, restricting searches to these domains will capture most content while limiting irrelevant retrievals and screening* (Table 1).

The review of the country of origin showed that over 1/3 of the non-TROVE items came from an Australian domain. As would be expected, Australian material is the most used when discussing primary healthcare issues in Australia. Of interest is the contribution of material from Canada (.ca) New Zealand (.nz) and the UK (.uk). *These domains could be a useful limit when searching*, particularly given issues in comparability of health systems internationally (Table 2).

It is worth noting that nine items came from .int. The .INT domain is operated by IANA, and available for registration exclusively by intergovernmental organisations. In brief, the .int domain is used for registering organisations established by international treaties between or among national governments. The documents were all from the World Health Organization. *A specific search of the .int domain could also be valuable.*

Table 1. Domain analysis

Domain type	No.	Comments
.ac	14	Academic Institutions
.co	1	NA
.com	7	NA
.edu	27	NA
.gc	10	Government bodies
.gov	39	NA
.govt	9	Government bodies in New Zealand
.int	9	Intergovernmental treaty domain
.net	2	NA
.org	23	NA
none	15	NA
Total	156	NA

Table 2. Country analysis

Country Domain	No.
.ac	14
.co	1
.com	7
.edu	27
.gc	10
.gov	39
.govt	9
.int	9
.net	2
.org	23
none	15
Total	156

File type could also provide a useful mechanism for restricting web searches to improve the specificity of retrievals. Of the non-TROVE items, nearly 60% were PDFs. Again, *PDF as a file format could form a useful limit for specificity.*

Table 3. File type

File type	No.
ashx	1
aspx	2
doc	1
htm	7
html	6
pdf	89
php	10
webpage	34
none	6
total	156

Textword search options

The most commonly occurring MeSH terms and textwords have been identified in several activities during the search filter development. They have formed the following generic textword search string

Primary health* OR general practi* OR primary care OR family practice OR Family medicine OR family physician* OR GP OR Community health* OR Community nurs* OR Health visit* OR Community mental health* OR Community pharmac* OR Home care OR home based OR home health* OR Health promotion OR Preventive care OR Preventive health* OR Preventive service* OR prevention program*

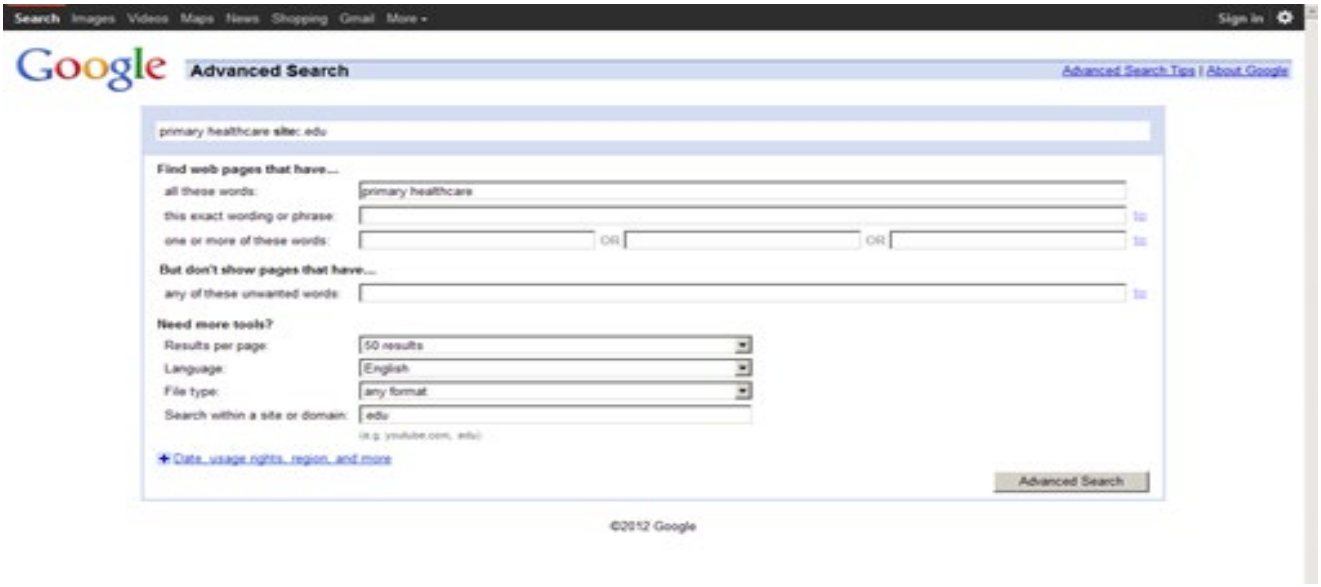
Each of these terms can be used when searching the web generally or an individual website. They represent the most common terms used to retrieve literature relevant to primary healthcare. The search construction used will be dependent on the search engine being used in the website. Some may search multiple terms simultaneously or allow term combining with OR while others may only allow single term searching. The number of terms used in the search will also depend on how important it is to retrieve all potentially relevant material.

Textword options for use
Primary health care/ Primary health care
General practice
Primary care
Family practice
Family medicine
Family physician
GP
Community health
Community nurse/community nursing
Health visit/health visitor
Community mental health
Community pharmacy/community pharmacist
Home care
Home based
Home health
Health promotion
Preventative health
Preventative service
Prevention program

Searching in Google

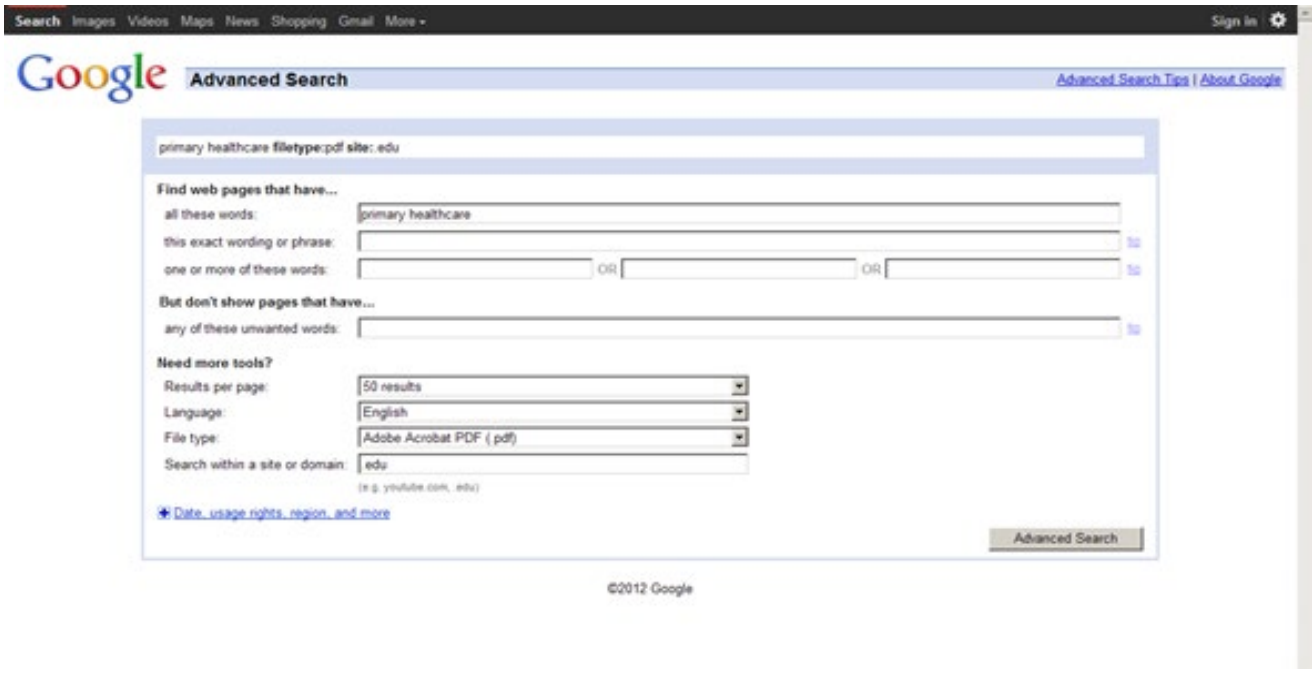
Google enables limits to be applied through its Advanced Searching feature. As an example, entering “primary healthcare” in Google retrieves 123,000,000 items. Using English as a limit and restricting to the domain .edu reduces retrievals to 668,000. (Figure 1)

Figure 1: Google Advanced Search with English limit and restricted to domain of .edu.



Adding in a file format limit of PDF reduces retrievals to 104,000.

Figure 2: Google Advanced Search with English limit, restricted to domain of .edu and file format of PDF.



A review of the first fifty documents for the following variants of the searches in Google was completed:

- Primary healthcare filetype:doc site:.uk
- Primary healthcare filetype:pdf site:.uk
- Primary healthcare filetype:pdf site:.ca
- Primary healthcare filetype:doc site:.ca

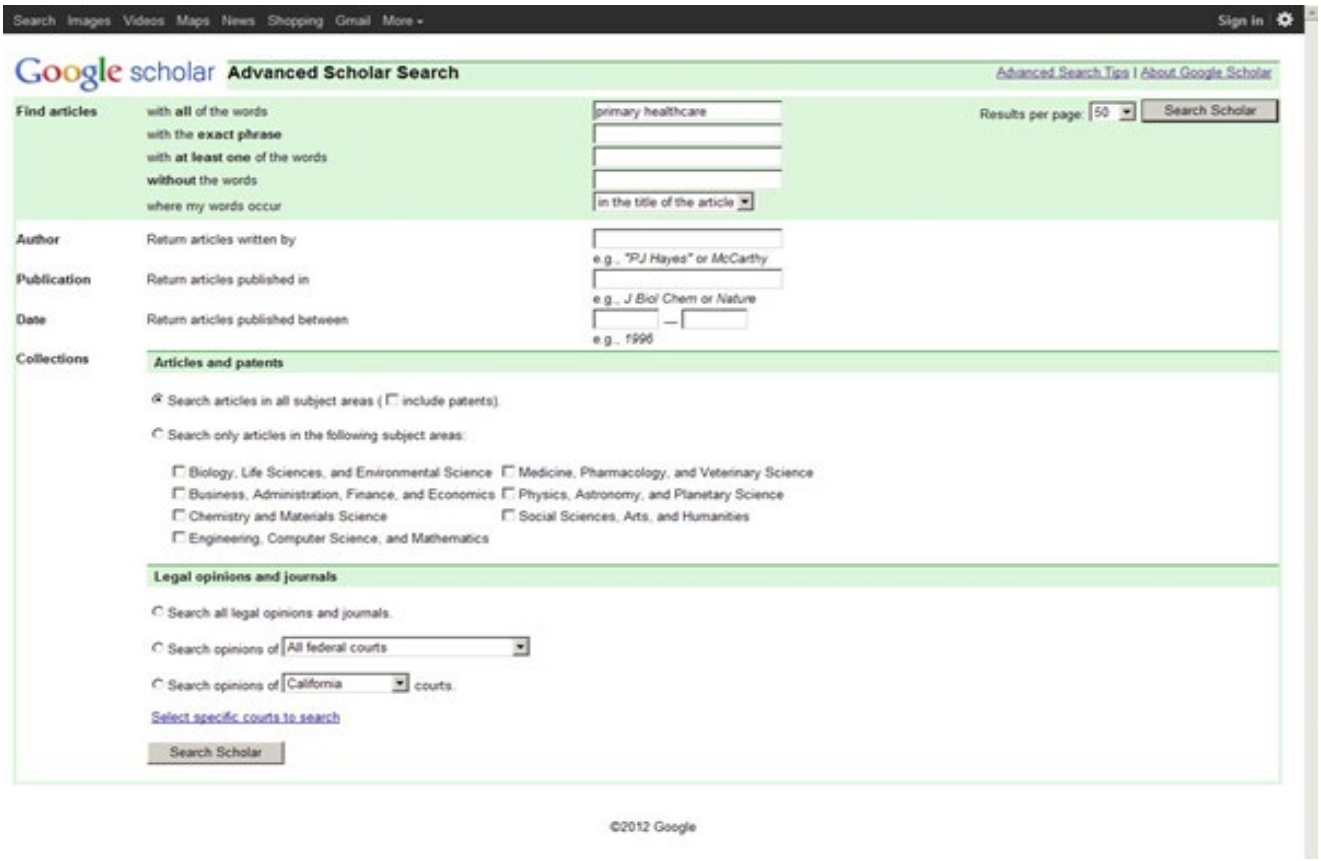
For all variants, all of the retrieved items did deal with primary healthcare. However, the PDF variants retrieved more focused items. In the .doc categories. 30% (15/50) for Canada and 42% (21/50) for the UK were either staffing documents, advertisements or conference documents rather than being reports, aticles or reviews.

Where specificity is needed, a PDF limit appears more relevant retrievals

Searching in Google Scholar

Searching in Google Scholar provides another avenue for material that may be missed. Google Scholar provides a metasearch across many disciplines and sources: articles, theses, books, abstracts and court opinions, from academic publishers, professional societies, online repositories, universities, and other web sites.

It is possible to enhance specificity of retrievals by using the Advanced Search features and the Scholar Preferences. Scholar Preferences enables you to limit retrievals to those in English. Advanced Scholar Search enables you to limit to academic discipline groups and also to “in the title.”



As an example, searching Google scholar for primary healthcare retrieves 1,230,000 items. Limiting this search to “in the title” reduces retrievals to 1,340.

Where specificity is required, searching “in the title” is likely to retrieve a more focused set of results.

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