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Is citation searching useful when conducting searches for systematic reviews in terms of unique records retrieved and time saved?

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Background: *The Cochrane Handbook*[1] and the Centre for Reviews and Dissemination's *Systematic Reviews: CRD's guidance for undertaking systematic reviews in health care*[2] both state that citation searching should be carried out in addition to searching bibliographic databases, but there is little supporting evidence to demonstrate its value as part of the literature searching process.

Objectives: Our case study aimed to evaluate whether using the citation resources Google Scholar, Scopus, Web of Science and OvidSP MEDLINE identified any additional studies not identified by traditional database searching for a scoping review of interventions for multiple risk behaviours.[3] We also considered whether citation searching could offer any efficiencies in the time spent in information retrieval.

Methods: Database searches of MEDLINE, Embase, PsycINFO, ASSIA, CENTRAL and Science Citation Index (SCI) carried out between 15-18 January 2013 identified a total of 21,835 records and 40 of these were selected for inclusion in the review. We retrieved the details of all papers that cited the 40 included studies from the four citation resources being evaluated.

A total of 4,161 citations were identified, reducing to 1,789 after deduplication and this set was loaded into bibliographic software and scanned for further potentially relevant studies.

We compared the performance of the database searching and the citation tracking by calculating the sensitivity, precision and number needed to read (NRR) (Box 1).

Box 1. Number Needed to Read (NNR)

The NNR is the number of irrelevant references you have to screen to find one of relevance.[4]

Results: The titles and abstracts of the 1,789 citation tracking records produced 26 potentially relevant studies. After assessment against the review's inclusion criteria nine studies were selected, of which eight had already been identified by the traditional databases searches. The one additional study not identified by MEDLINE, Embase, PsycINFO, SCI, ASSIA or CENTRAL was included in the scoping review.[5]

The additional study was still not available in ASSIA, CENTRAL, MEDLINE or PsycINFO when checked on 15 November 2013. By this date the Embase and Science Citation Index databases did include a record for the paper and re-running the search strategy demonstrated that it would have been identified in both databases using the original search strategy if the search had been carried out at a later date.

The best performing database in terms of recall was MEDLINE (75%) although its precision was low (0.36; NRR=276). The recall for each of the citation tracking resources Google Scholar, Scopus and Web of Science was much lower at 20%. The full results of the analysis of the database performance and the citation tracking are presented in tables A and B.

Conclusions: Citation searching identified one additional study for inclusion in the scoping review. Using Google Scholar added a significant amount of extra time to the retrieval of evidence as, unlike bibliographic databases, there is no facility to easily and quickly download records into bibliographic software. In addition, citation searching, using any of the available resources, can only be done after the database searches have been carried out and the included studies identified so there is also the potential for delay. References from websites and grey literature included in Google Scholar were of poor quality with consequent limited value. While citation searching appears to have performed well when measured using the NRR it did identify only nine of the 40 studies that met the review's inclusion criteria.

Based on the results of our study, routinely incorporating citation searching into the systematic review search process is not the best use of time and resources.

Table A Performance of bibliographic databases

Database	Total records identified	Total included studies available	Included studies retrieved	Recall % (n=40)	Precision %	Number needed to read (NNR)
SCI	7048	40	12	30	0.17	587
Embase	13176	38	25	63	0.19	527
MEDLINE	8279	39	30	75	0.36	276
PsycINFO	5475	29	21	53	0.38	261
ASSIA	881	16	4	10	0.45	220
CENTRAL	1059	34	11	28	1.04	96

Table B Performance of citation tracking resources

Database	Total records identified	Total included studies available	Included studies retrieved	Recall % (n=40)	Precision %	Number needed to read (NNR)
Google Scholar	1680	38	8	20	0.48	210
Scopus	1173	39	8	20	0.68	147
Web of Science	1095	40	8	20	0.73	137
OVIDSP MEDLINE	213	39	2	5	0.94	107
Citation searching all sources	1789	40	9	23	0.50	199

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The work presented here was undertaken independently by the authors. The scoping review used in the case study was undertaken by the Centre for Reviews and Dissemination as part of the Public Health Research Consortium.

The Public Health Research Consortium is funded by the Department of Health Policy Research Programme. The views expressed in this poster are those of the authors alone and not necessarily those of CRD, the PHRC or the DH.