Effects of librarian-provided services in healthcare settings: a systematic review

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ABSTRACT

Objective To assess the effects of librarian-provided services in healthcare settings on patient, healthcare provider, and researcher outcomes.

Materials and methods Medline, CINAHL, ERIC, LISA (Library and Information Science Abstracts), and the Cochrane Central Register of Controlled Trials were searched from inception to June 2013. Studies involving librarian-provided services for patients encountering the healthcare system, healthcare providers, or researchers were eligible for inclusion. All librarian-provided services in healthcare settings were considered as an intervention, including hospitals, primary care settings, or public health clinics.

Results Twenty-five articles fulfilled our eligibility criteria, including 22 primary publications and three companion reports. The majority of studies (15/22 primary publications) examined librarians providing instruction in literature searching to healthcare trainees, and measured literature searching proficiency. Other studies analyzed librarian-provided literature searching services and instruction in question formulation as well as the impact of librarian-provided services on patient length of stay in hospital. No studies were found that investigated librarians providing direct services to researchers or patients in healthcare settings.

Conclusions Librarian-provided services directed to participants in training programs (eg, students, residents) improve skills in searching the literature to facilitate the integration of research evidence into clinical decision-making. Services provided to clinicians were shown to be effective in saving time for health professionals and providing relevant information for decision-making. Two studies indicated patient length of stay was reduced when clinicians requested literature searches related to a patient's case.

BACKGROUND AND SIGNIFICANCE

Clinical librarians work in academic and healthcare settings performing diverse functions related to the needs of clinicians, trainees, patients, and researchers. For example, clinicians often have questions about the care of their patients but may not have the time or expertise to find the evidence to answer these questions. Ely and colleagues[1] studied 103 family physicians who generated an average of 3.2 questions per 10 patients seen resulting in a need for clinical information. Time constraints often prevent clinicians from obtaining the answers to their questions, indicating that other professionals, such as librarians, can contribute to improving the efficiency and effectiveness of patient care.[2–7] Although information literacy is an essential skill for both residents and trainees,[8] a longitudinal study on students' information seeking indicated that convenience outweighed other factors.[9] Additionally, the simple progression through educational stages did not increase the sophistication of digital literacy, identifying the need for instruction and training in the area of information science.[9] Similarly, consumers and patients need skills to access, understand, and use information related to their health for decision-making.[10] A systematic review examining health literacy among consumers identified that limited health literacy is "consistently associated with increased hospitalizations, greater emergency care use, lower use of mammography, lower receipt of influenza vaccine, poorer ability to demonstrate taking medications appropriately, poorer ability to interpret labels and health messages, and, among seniors, poorer overall health status and higher mortality".[11] Librarians are identified in national strategies for the USA and Canada as integral to improving health literacy so that health information and services are provided in ways that meet the needs of individuals.[12–14] Access to librarians and libraries was recognized as essential in a survey of over 1000 academic and associate staff at six universities in the UK.[15] Clinical librarians play a key role in contributing to the information literacy of health professionals, the health literacy of patients, and provide support for researchers in medicine and health.

Four previous reviews examining librarian-provided services were identified. Two of these reviews focused specifically on outcomes related to clinicians and/or patient care;[16] [17] however, Weightman and Williamson[16] did not examine information skills training. One review solely examined interventions that are considered to be outreach services (eg, moving the librarian away from the traditional, in-library reference desk into a clinical setting),[18] and another, contextualized all data by reporting outcomes categorized into models of service (such as question and answer, or outreach).[19] None of these reviews examined librarians offering services directly to patients. The purpose of this systematic review is to assess the effects of librarian-provided services in healthcare settings on outcomes relevant to patients, healthcare providers, and researchers.

METHODS

We registered our study with PROSPERO, the international prospective register of systematic

reviews (registration number CRD42013004612). Our research question was, "What are the effects of librarian-provided services in healthcare settings on outcomes relevant to patients, healthcare providers, or researchers?"

Eligibility criteria

Studies involving patients encountering the healthcare system, healthcare providers, or researchers were eligible for inclusion. Patients include those receiving healthcare and their family members or informal caregiver. All healthcare providers, including physicians, nurses, and allied health professionals (eg, physiotherapists, speech pathologists, social workers, pharmacists) involved in direct patient care, were included. Examples include clinicians practicing in hospitals, primary care settings, or public health clinics. Studies that included participants in training programs who are responsible for patient care (residents, fellows, and other pre-licensure healthcare professionals) were eligible for inclusion. A researcher was defined as a professional engaged in investigation or experimentation aimed at discovering or revising facts, theories, or applications in order to understand or treat a human disease or health condition. Studies that included participants in training programs (such as graduate students, postdoctoral students, residents) were eligible for inclusion. All librarian-provided services in healthcare settings were considered as an intervention. The term clinical librarian, medical librarian, clinical information specialist/scientist, and medical information specialist/scientist were considered synonyms for the purposes of this systematic review. A clinical librarian is defined as an individual who has obtained a graduate degree accredited by a professional association, such as the American Library Association or the Chartered Institute of Library and Information Professionals.[20 21]

There is no agreed terminology for defining librarian-provided services in healthcare settings and for the purposes of this review, this service could be provided in any healthcare setting involving patients, healthcare providers, or researchers. Examples of these services include participating in grand rounds or teaching search skills. Studies that included provision of services by clinical librarians and skilled paraprofessionals (such as library technicians, library assistants) were eligible for inclusion. Only experimental (eg, randomized clinical trials (RCTs), quasi-RCTs, non-RCTs), quasi-experimental (eg, interrupted time series, controlled before-and-after study) or observational (eg, cohort, case–control) designs reporting patient-relevant outcomes (such as hospital readmission, adverse events), clinician-relevant outcomes (such as choice of therapy, choice of tests), the knowledge and skills of participants in training programs (such as medical licensing examination scores), and research funding were eligible for inclusion.

Outcome measures

Primary outcomes for the review were patient-relevant outcomes (eg, patient length of stay), clinician-relevant outcomes (eg, choice of therapy, choice of tests), the knowledge and skills of participants in training programs (eg, medical licensing examination scores), and research funding. Secondary outcomes were satisfaction with services provided by clinical librarians, relevance of answers provided to clinical or health-related questions, and the cost of services provided.

Literature search

We searched the following literature databases: Medline, CINAHL, ERIC, LISA (Library and Information Science Abstracts), and the Cochrane Central Register of Controlled Trials from inception to 10 June 2013. We supplemented our database search by examining websites of librarian-related organizations (eg, Medical Library Association, Canadian Health Libraries Association), websites of organizations focused on evidence in healthcare (eg, Agency for Healthcare Research and Quality), and abstracts from conference proceedings. In addition, the reference lists of relevant reviews and included studies were searched.

We conducted a peer review of the Medline literature search according to the Peer Review of Electronic Search Strategies checklist.[22] After revising the search strategy in consultation with the research team, an experienced librarian (AF) conducted the literature searches. The final Medline search is available in online Appendix A and the other search strategies are available from the authors upon request. All languages of dissemination, years of publication, and types of articles (both published and unpublished) were eligible for inclusion.

Study selection

After a team training exercise, each citation (title and abstract) was screened by two authors independently using our pre-established eligibility criteria. Conflicts were resolved by discussion or the involvement of a third reviewer. The same process was followed to screen potentially relevant full-text articles. If necessary, authors were contacted to retrieve additional information to determine study eligibility.

Data abstraction

A draft data extraction form was developed, piloted, and modified as necessary. We extracted the following information: study authors, year of publication, study design, study setting, participant characteristics (age, sex, race/ethnicity), intervention strategy, control strategy, outcome measure, and study outcomes. Two reviewers independently extracted all the data using the standardized data extraction form, and data extraction was verified by a third reviewer. When multiple study publications reported data from the same population (ie, companion reports), the study reporting the primary outcome of interest was considered the major publication, and the other report was used for supplementary data. Companion reports were identified by examining the date when the study was conducted, the list of study authors, and participant information.

Quality assessment

The Cochrane EPOC (Effective Practice and Organization of Care) risk-of-bias tool (Cochrane 2014) was used to appraise the risk of bias of the included RCTs, non-RCTs, interrupted times series, and controlled before–after studies. Cohort and case–control studies were assessed with the Newcastle–Ottawa Scale.[23] After calibrating the tools within the team, each of the included studies was appraised by two members independently. Conflicts were resolved by the involvement of a third reviewer.

Data synthesis

We synthesized the studies descriptively, with a summary of study characteristics, study outcome results, and the results of appraisals of methodological quality. The results of the studies were not combined for meta-analysis owing to the heterogeneity in interventions, training programs, and assessment tools.

RESULTS

Initial searches of electronic databases identified 12 967 records. After removing duplicates, 11 062 records were examined to determine potential relevance. Of these, we retrieved 169 full-

text articles that were deemed potentially relevant for inclusion (figure 1). Twenty-five articles fulfilled our eligibility criteria,[24–48] including 22 primary publications[24–30 32–36 38–45 47 48] and three companion reports,[31 37 44] reporting on a total of 12 RCTs,[26 27 30 32 33 35 38 41 43 45–47] four controlled before–after studies,[34 36 40 48] three cohort studies,[24 28 39] two non-RCTs[29 42] and one case–control study.[25]

Study characteristics
All studies were conducted between 1986 and 2013 in Australia, Canada, Hong Kong, the UK, and the USA (see online supplementary table S1). Among the 25 studies, 16 looked at trainees (including nursing students, residents, dental students),[24–29 33–36 38 40–42 47 48] five studied physicians only,[30 31 39 43 44] two looked at physicians and medical trainees,[37 45] one included interprofessional groups (including physicians, residents, and nurses),[46] and one studied public health professionals.[32]

The studies are grouped into three categories of interventions: (1) librarians teaching search skills either in person or through the development of online modules; (2) librarians providing literature searching as a direct service; or (3) a combination of librarians teaching searching skills and providing literature searching. Fifteen studies (with one companion report) involved librarians instructing face-to-face or through online modules developed by librarians.[26–29 32–38 40 42 45 47 48] Recipients were clinicians, clinical trainees, or students, and the intensity of teaching ranged from one-session workshops lasting 1–3 h[27 28 32 33 36–38 45 47] to unspecified session lengths due to teaching being integrated into other curriculum (eg, in evidence-based medicine or critical appraisal courses)[29 34 35 48] or the use of self-directed online modules.[26 40 42] Five studies (with two companion reports) examined librarians providing literature searches as a service.[25 30 31 39 43 44 46] Two studies looked at a combination of teaching searching skills and providing answers.[24 41]

Quality appraisal
Using the Cochrane EPOC risk-of-bias tool, 18 studies (with three companion reports)[26 27 29–38 40–48] were assessed (see online supplementary table S2, figure 2). Most of the studies had an unclear or high risk of bias due to contamination, other sources of bias, lack of random sequence generation, and no allocation concealment.[26 27 29–44 46–48] Other sources of bias included the lack of reliable and valid tools used for data collection, sample size calculations rarely being used, and the absence of statistical analysis in reporting the results of the study.[26 28 42] In contrast, the majority had similar baseline outcome measurements, similar baseline characteristics, blinding, a low risk of incomplete outcome data, and a low risk of selective reporting.[27 32–38 40 41 43–48]

Three cohort and one case–control study were assessed using the Newcastle–Ottawa Scale (see online supplementary table S3).[23] For the cohort studies, all studies selected the non-exposed cohort from the same community as the exposed cohort and a secure method was used to ascertain exposure to the intervention.[24 28 39] One study showed that the outcome of interest was not present at the beginning of the study and that follow-up was adequate.[39] The cohort was truly representative in one study,[24] somewhat representative of the average participant in another,[28] and a selected group of participants was used in the study by Klein et al.[39] Two studies controlled for the most important factors (such as age, gender).[24 28] Assessment was blinded for one study[24] and two studies used

questionnaires.[28 39] For the single case–control study, the case definition was deemed adequate through independent validation and the cases were considered truly representative.[25] Controls were selected from within same population as cases and a history of outcomes was not mentioned. The study controlled for the most important factors (such as age, gender) and ascertained exposure through a secure method for both cases and controls. The non-response rate was similar for cases and controls.

Primary outcomes
Patient-relevant outcomes
Two studies examined patient-relevant outcomes and both looked at length of stay in hospital.[25 39] Klein et al[39] matched inpatients with a control. These matches were made by diagnosis so that length of stay could be examined based on whether Medline searches were performed for each case. For analysis, patients were divided into four groups based on length of stay in hospital: 1–6, 7–14, 15–21, or >21 days. Librarians performed searches upon request of a clinician and results indicate that length of stay was more than double if searches were done later in the hospital stay than if it were done earlier. Similarly, Banks et al[25] examined librarians offering literature searching as a service to residents at morning report. It was found that the residents who received searches had patients with a median length of stay in hospital of 3 days compared with the control group that did not receive the literature searching service whose patients had a length of stay of 5 days.

Clinician-relevant outcomes
Five studies,[24 30 32 43 46] along with two companion reports,[31 44] examined clinician-relevant outcomes. Cheng[30 31] conducted a 3 h educational workshop with clinicians and examined clinical question formulation in an RCT. Instructional classes led to a significant improvement in clinical question formulation for the intervention group when examining the number of components in questions (participant, intervention, comparator). Eldredge et al[32] also offered a single 3 h training session delivered to public health professionals (including nurses, physicians, and nutritionists) but found no statistically significant difference between the intervention and control group in the number of questions generated, and the sophistication of the questions. Mulvaney et al[46] and McGowan et al[43 44] both conducted RCTs offering a literature searching service to clinicians. Examining the impact on clinical decision-making, Mulvaney et al[46] found that evidence provided by librarians delivering this service influenced the use of a new or different treatment. McGowan et al[43 44] found that the intervention group (receiving the literature searching service) required a mean of 13.6 min to have each clinical question answered by a librarian, and the control group (not receiving the literature searching service) required a mean of 20.29 min for each clinician to search the question themselves. In the study by Aitken et al[24] a librarian joined morning rounds with the clinical team and also provided formal instruction to groups in order to look at the impact on clinical decision-making in a cohort study. Although 88% of participants (30/34) in the intervention group reported changing a treatment plan based on skills taught by the librarian compared with 79% of participants (27/34) in the control group, results were not statistically significant.

Knowledge and skills of participants in training programs
Fifteen studies and one companion report looked at librarians providing instruction in literature searching to

Figure 1 Flow diagram of systematic review to identify eligible studies.
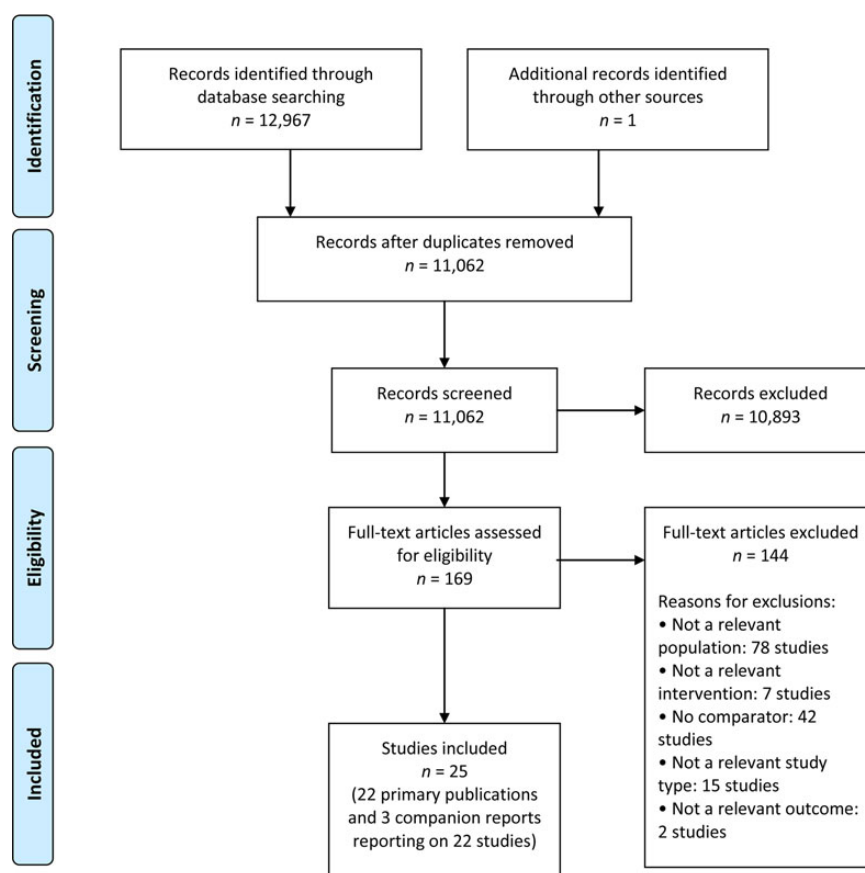
trainees and assessed their proficiency in literature searching skills.[26–29][33–38][40–42][45][47][48] Six studies involved medical students,[29][34][36][38][40][47] two included nursing students,[27][28] one targeted occupational/physical therapy students,[42] and one studied allied health students.[48] For medical residents, three studies examined residents,[26][33][35] and one included residents mixed with clerks and medical school faculty.[37][41][45] Koufogiannakis et al[41] studied a mixture of medical and dental students and assessed their class examination scores.

Twelve studies, along with one companion report, showed a positive impact of training on search skills[26–29][34–37][40][42][45][47][48] and two studies[33][38] indicated no difference in participants' searching skills. Kolner et al[40] found that medical students using

Figure 2 Aggregate of appraisal of risk of bias of the included studies using the Cochrane Effective Practice and Organization of Care risk-of-bias tool for randomized controlled trials, non-randomized controlled trials, controlled before-after studies.

instructional modules developed by a librarian scored significantly higher on post-tests than students not using modules. Rosenberg et al[47] examined live instruction and found medical students attending a 3 h training session improved their search performance. Two studies examined face-to-face instruction and found that medical students scored significantly higher than controls receiving no instruction when search skills were tested.[34][36] When Chen et al[29] measured the frequency of citing primary sources and the number of citations with complete documentation, they found that a workshop with librarian support produced the best results compared with medical students who received a workshop alone, or who had no intervention at all.

Carlock and Anderson[28] studied nursing students and found that the intervention group showed improvement when their performance in search skills was assessed. Bradley et al[26] and Gardois et al[35] both studied residents. Bradley et al[26] randomized residents into an intervention group that received individualized active instruction from librarians on questions generated from rounds, or a control group that did not receive this customized teaching. Results showed that teaching by a librarian improved search skills as assessed by a search score. Gardois et al[35] included interns with residents who were randomized into one group receiving training from a librarian, or a control group who received no training. Groups were asked to perform predetermined tasks, including conducting searches in PubMed based on clinical scenarios, and results showed that instruction improved search skills. Allied health students were studied by Van Moorsel,[48] who provided instruction in occupational, physical, and respiratory therapy programs and compared them with a control group of physician assistant students who received no formal training in literature searching. They found that mean post-test scores were significantly greater than mean
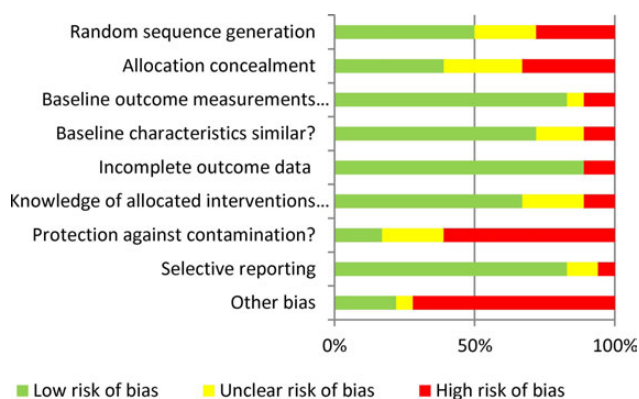
pre-test scores, suggesting a positive net effect on participants' cognitive understanding of literature searching. When residents were combined with the medical faculty, it was found that search performance for both intervention and control groups improved with an increase in the average number of relevant references retrieved per search.[37 45]

Whereas all other studies with positive results compared a group receiving instruction with a control group that received no instruction, Lechner[42] and also Brettle and Raynor[27] compared face-to-face instruction by a librarian with an electronic tutorial of the same materials. Lechner[42] found that occupational/physical therapy students using the electronic tutorial showed greater improvement in post-test scores than those attending the face-to-face instruction. The results from the study by Brettle and Raynor,[27] which looked at nursing students, showed that search skills improved for both methods. Two studies[33 38] showed no difference in the search skills of participants who attended a formal workshop and participants who did not.

One study looked at the impact of librarians joining problem-based learning groups in a first-year medical and dental program. Librarians offered assistance and support, handled student questions, and provided guidance with selection of resources. The control group did not have a librarian in their problem-based learning groups and it was found that there was no statistically significant difference between the intervention and control groups on final examination scores, the medical information portion of questions on the examination, or the final grade for the course.[41]

Research funding

No studies were identified that met the criteria for research funding.

Secondary outcomes

Eight studies (with three companion reports) reported satisfaction with services provided by librarians.[26 29–31 33 37 38 43–45 47] All studies used questionnaires prepared by the authors to collect data and were filled out independently by participants.[26 29–31 33 37 38 43–45 47] One study (with a companion report)[43 44] evaluated librarians delivering literature searching as a direct service and the rest of the studies examined librarians providing instruction on searching skills.[26 29–31 33 37 38 45 47] Seven studies (with three companion reports) reported good satisfaction with librarian services.[26 30 31 33 37 38 43–45 47] Chen et al[29] reported that participants felt that interaction with the librarian had limited usefulness for improving search skills.

Two studies (with one companion report) asked participants about the relevance of answers provided by librarians.[25 43 44] House officers indicated that the usefulness/relevance of answers provided positively influenced patient management in the study conducted by Banks et al.[25] McGowan et al[43 44] found that 83% of participants assessed felt that the literature searching service provided relevant information for their question in an appropriate time.

Three studies (with one companion report) looked at the costs of the interventions studied.[25 39 43 44] Two studies calculated hospitalization costs[25 39] and one study (with a companion report) assessed the cost of librarians responding to search requests.[43 44] The study by Klein et al,[39] in which librarians conducted Medline searches within the first half of the patients' hospital stay, found that these patients had significantly lower hospital costs. Banks et al[25] reported no statistical significance in the total charge for each hospitalization between the

intervention group that received a literature searching service and the control group that received no such service. McGowan et al[43 44] calculated the average cost for a librarian to respond to a question as $C7.15 (based on 15 min) compared with a range of $C20.75–27.69 for a physician to respond to the same question (based on 15 min) (year not reported: estimated as 2006 Canadian dollars). The average cost savings and cost avoidance (such as diagnostic tests not ordered) for each question was estimated at $C11.55, and it was calculated that the time savings would translate into an additional 24 patients who could be seen each year.

DISCUSSION

Positive outcomes were shown in the majority of studies focusing on librarians teaching search skills to participants in training programs and then evaluating their abilities in using those skills to show that participants were more effective at retrieving relevant literature.[26–29 34–37 40 42 45 47 48] The increasing importance of information literacy[12 13 49] combined with the lack of time experienced by busy clinicians[2–7] indicates that providing training opportunities to enhance skills in efficient retrieval of relevant clinical literature is valuable. In particular, doing this at an early point in a clinician's career is an effective strategy. Two studies compared face-to-face teaching with online modules,[27 42] showing significantly better outcomes when using online modules in one study[42] and improved search skills with either method of teaching. Online modules may provide significant cost and instructor-time savings and this is an area for further research.

The research examining librarians providing literature searching as a service,[25 39 43 44 46] showed a positive effect on decreasing the time to providing relevant information for clinical decision-making[43 44 46] and decreased the length of hospital stay.[25 39] Well-designed trials, similar to that by McGowan et al,[43 44] demonstrate the effectiveness of librarians searching the literature in order to answer clinical questions upon request, and identify the substantial cost savings that a service like this provides.

Although patient-relevant outcomes were assessed in two studies by looking at length of stay in hospital,[25 39] no direct services to patients were studied, and no studies looked at interventions involving researchers.

Limitations

Overall, methodological quality was moderate for the studies that met our review inclusion criteria. At least half of the RCTs failed to describe, or did not use, random sequence generation (9/17 studies), or concealed allocation (10/17 studies). The content of data collection tools was highly investigator driven. There was little evidence that the tools were assessed for reliability and validity before being used for data collection. Sample size calculations were rarely used, making it unclear whether there was adequate power to detect statistical significance. The reported results of three studies included no statistical analysis of the data presented.[26 28 42]

CONCLUSION

Twenty-five studies were identified that used experimental, quasi-experimental, or observational research methods to examine librarian-provided services in healthcare settings. Quality appraisals using the Cochrane EPOC risk-of-bias tool and Newcastle–Ottawa Scale indicated that methodological quality was moderate for the included studies, and had concerns about allocation concealment, other sources of bias, and

contamination. This systematic review has shown that services directed towards participants in training programs (such as students or residents) improve skills in searching the literature, facilitating the integration of research evidence into clinical decision-making. Future studies of the outcomes of librarian-provided search skills instruction would be greatly enhanced with validated tools to reliably assess these skills. Services provided to clinicians were shown to save time for health professionals and provide relevant information for decision-making. This area warrants further attention in order to better understand how to effectively deliver information to support evidence-informed clinical decisions. No studies met our eligibility criteria for examining librarians providing direct services to researchers and patients in healthcare settings, suggesting that research is needed in this area to determine the effect of these services.

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