SPINAL PALPATION: THE CHALLENGES OF INFORMATION RETRIEVAL USING AVAILABLE DATABASES

Linda S. Murphy, MLIS,[a] Sibylle Reinsch, PhD,[a] Wadie I. Najm, MD,[a] Vivian M. Dickerson, MD,[a] Michael A. Seffinger, DO,[a] Alan Adams, DC,[a] and Shiraz I. Mishra, MD, PhD[a]

ABSTRACT

Purpose: This study addressed 2 questions: first, what is the yield of PubMed MEDLINE for complementary and alternative medicine (CAM) studies compared to other databases; second, what is an effective search strategy to answer a sample research question on spinal palpation?

Methods: We formulated the following research question: "What is the reliability of spinal palpation procedures?" We identified specific Medical Subject Headings (MeSH) and key terms as used in osteopathic medicine, allopathic medicine, chiropractic, and physical therapy. Using PubMed, we formulated an initial search template and applied it to 12 additional selected databases. Subsequently, we applied the inclusion criteria and evaluated the yield in terms of precision and sensitivity in identifying relevant studies.

Results: The online search result of the 13 databases identified 1189 citations potentially addressing the research question. After excluding overlapping and nonpertinent citations and those not meeting the inclusion criteria, 49 citations remained. PubMed yielded 19, while MANTIS (Manual Alternative and Natural Therapy Index System), a manual therapy database, yielded 35 citations. Twenty-six of the 49 online citations were repeatedly indexed in 3 or more databases. Content experts and selective manual searches identified 11 additional studies. In all, we identified 60 studies that addressed the research question. The cost of the databases used for conducting this search ranged from free-of-charge to $43,000 per year for a single network subscription.

Conclusions: Commonly used databases often do not provide accurate indexing or coverage of CAM publications. Subject-specific specialized databases are recommended. Access, cost, and ease of using specialized databases are limiting factors. (J Manipulative Physiol Ther 2003;26:374-82)

Key Indexing Terms: *Complementary Therapies; Palpation; Manual Exam; Spine; Reliability; Interexaminer; Intraexaminer; Information Storage and Retrieval*

INTRODUCTION

Over the last decade, several surveys have reported heightened interest in and use of complementary and alternative medicine (CAM) in the United States. Consumer interest and demand for CAM continues to grow (30% to 50% from 1990 to 1997).[1,2] This has sparked attention by the media, insurance companies, clinicians, educators, and researchers.[3] In response to the growing interest in CAM, the Office of Alternative Medicine was established in 1993; Congress elevated it to the National Center for Complementary and Alternative Medicine (NCCAM) at the National Institutes of Health in 1998 (http://nccam.nih.gov/). In that same year, 75 out of 117 US allopathic medical schools reported offering CAM courses or included CAM topics in required courses.[4] Simultaneously, insurance companies across the US have increasingly incorporated CAM services under their medical plans.[5]

The use of CAM by the public has tremendously increased. Nearly half of the visits to CAM practitioners were to chiropractic and massage therapists. Conditions commonly treated by CAM practitioners include back pain, neck problems, arthritis, and headache.[1] While substantial evidence suggests that manipulative therapy of the spine has value in relieving back pain and other conditions of the spine,[6,7] there is also a growing concern about the reliability

[a]Susan Samueli Center for Complementary and Alternative Medicine, University of California Irvine, College of Medicine, Irvine, Calif.

This project was supported in part by the University of California Irvine (UCI) College of Medicine 41st Trust; The Susan Samueli Center for Complementary and Alternative Medicine at UCI; The Center for Statistical Consulting, UCI; Western University—College of Osteopathic Medicine of the Pacific; and the Southern California University of Health Sciences.

Submit requests for reprints to: Linda Murphy, Health Sciences Librarian, Science Library Reference Dept, PO Box 19557, Irvine, CA 92623-9557 (e-mail: *lmurphy@uci.edu*).

Paper submitted May 2, 2002; in revised form June 11, 2002.

0161-4754/2003/$30.00 + 0
doi:10.1016/S0161-4754(03)00076-9

of manipulative diagnostic procedures such as spinal palpation.[8]

As the utilization of CAM therapies continues to grow, clinicians and health practitioners are increasingly being called upon to make "thoughtful, informed, evidence-based recommendations" about CAM treatments.[9] Many physicians, however, have difficulty accessing CAM journals because of restricted distribution and unavailability in most commonly used allied health databases.[10,11] For the same reason, researchers and librarians interested in CAM are faced with challenges accessing, searching, and retrieving specialized CAM literature from available databases. The National Library of Medicine and NCCAM recognized the importance of making the access to CAM literature easier and developed CAM on PubMed as a subset of the MEDLINE database.[12]

While MEDLINE is considered the premier source for accessing clinical medical information, several studies found that searching MEDLINE alone generally fails to identify all possible studies for inclusion in systematic reviews.[13-16] In addition, a large number of CAM journals and studies are not indexed in MEDLINE or other more commonly used health-related databases and hence cannot be easily identified. Also, inadequate indexing of literature within journals and online databases hinders the effectiveness of retrieval.[17,18] To protect against bias and ensure that all relevant data are taken into consideration, it is important to search not only PubMed but also multiple sources of information.[11] Guidelines have been established for conducting systematic review searches that extend beyond MEDLINE. Librarians and researchers must consider searching the subject-specific and specialized databases.[19,20]

Despite the need and interest, few articles have explored the strengths and weaknesses of the commonly used allied health databases when searching for CAM literature. This study addressed 2 questions: first, what is the yield of the PubMed MEDLINE compared to select specialized databases; and second, what is an effective search strategy to answer a sample research question on spinal palpation? To answer these questions, we constructed and defined an appropriate search strategy to retrieve literature for a systematic review that addressed the question, "What is the reliability of spinal palpatory procedures?"

Methods

To conduct a comprehensive search of the literature, we designed a 4-part search strategy. First, we developed an online search strategy of relevant literature. Second, we identified databases relevant to the topic under study. Third, a review committee of experts applied the Cochrane criteria to develop inclusion/exclusion criteria. Fourth, we conducted additional search methods to retrieve literature not identified through online searches.

Table 1. *Identification of terms*

Reliability Terms	Spine Terms	Procedure Terms
Reliability	Spine (mh)	Palpation (mh)
Reproducibility (mh)	Spinal	Palpatory
Reproducibility	Neck	Manual exam*
Agreement	Cervical	Manual diagnosis
Observer variation (mh)	Thoracic	
Intra-examiner	Lumbar	
Inter-examiner	Vertebra*	
Intra-observer	Paraspinal	
Inter-observer		
Intra-rater		
Inter-rater		

*Manual exam**, retrieved manual exam(s) or manual examination(s); *vertebra**, retrieved vertebrae or vertebral.

Online Search Strategy

Three major steps were involved in constructing a search strategy:

A. Break down the research question, "What is the reliability of spinal palpatory procedures?" to the 3 relevant components: reliability, spine, and procedure terms.
B. Identify specific MeSH related key terms and their variations for each component (the use of MeSH is qualified as [mh]) (Table 1).
C. Apply Boolean operators to formulate a search strategy. For each component, the terms were expanded using the "OR" operator. The result of each set, as shown below, was combined using the "AND" operator:
   1. Reliability OR reproducibility of results OR reproducibility OR agreement OR observer variation OR intraexaminer OR intra-examiner OR interexaminer OR inter-examiner OR intraobserver OR intra-observer OR interobserver OR inter-observer OR intrarater OR intra-rater OR interrater OR inter-rater
   2. Spine OR spinal OR neck OR cervical OR thoracic OR lumbar OR vertebra* OR paraspinal
   3. Palpation OR palpatory OR manual exam* OR manual diagnosis
   4. #1 AND #2 AND #3

Identification of Databases

Using PubMed, we formulated an initial search template and applied it to appropriate bibliographic databases that had potential coverage for the areas of osteopathic medicine, allopathic medicine, chiropractic, and physical therapy. The selection of databases was based mostly on the availability of online resources that we could access from our affiliated institution libraries. As a result, we identified 12 allied health databases that were available to us in a variety of platforms through the University of California

Table 2. *Summary of online search process*

Online Databases	No. of citations identified by search template	No. of citations based on screening titles and abstracts	No. of citations after applying inclusion and exclusion criteria
PubMed	141	51	19
MANTIS	126	88	35
MD Consult	462	51	19
Web of Science	66	37	11
EMBase	57	29	16
CINAHL	232	36	19
BIOSIS Previews	36	13	5
ICL	12	9	6
Osteopathic Database	28	17	8
OCLC FirstSearch	11	6	1
Digital Dissertation	7	1	1
PEDro	0	0	0
Cochrane Database of Systematic Reviews	11	9	5
Total No. of citations	1189	347	145
No. of nonoverlapping articles	797	154	49

MANTIS, Manual, Alternative, and Natural Therapy Index System; *CINAHL,* Cumulative Index to Nursing and Allied Healthy Literature; *ICL,* Index to Chiropractic Literature; *OCLC,* Online Computer Library Center, Inc; *PEDro,* Physiotherapy Evidence Database.

Irvine (UCI) Library and the Southern California University of Health Sciences Learning Resources Center.

Besides PubMed MEDLINE, the selected databases included MANTIS (Manual Alternative and Natural Therapy Index System), CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, EMBase, Biosis Previews, OCLC (Online Computer Library Center, Inc.) FirstSearch, Digital Dissertation, Osteopathic database, PEDro (Physiotherapy Evidence Database), Cochrane Library, ICL (Index to Chiropractic Literature), and MD Consult. The scope and content of each database are described in Appendix 1.

AMED (Allied and Complementary Medicine Database) is one of the unique bibliographic CAM databases covering 510 journals in CAM, physiotherapy, occupational therapy, rehabilitation, and podiatry, but our affiliated institution libraries did not have subscription access at the time we conducted the search. Therefore, AMED was not included in this study.

Once the databases were identified, the search template was modified to optimize and enhance the search outcome of other databases. For example, certain databases and search platforms allowed the use of filters to apply limits to further refine the search template. Limits for the search template included human studies, publication in all languages, and publication dates between 1966 and 2001. We used OVID to search MANTIS, CINAHL, and Cochrane and applied "All Fields (.af.)" to the search terms. In addition, some search platforms could not directly handle our search template. Either the expansions were too large or set-based searching was not available. We modified the search template, as shown below, for databases such as MD Consult, Web of Science, EMBase, and Biosis Previews:

> ((spine or spinal or neck or cervical or thoracic or lumbar or vertebrae or vertebral or paraspinal) and (palpation or palpatory or manual exam or manual examination or manual diagnosis)) and (reliability or reproducibility or reproducibility of results or agreement or observer variation or intra-examiner or intraexaminer or interexaminer or inter-examiner or intraobserver or intra-observer or inter-observer or interobserver or intra-rater or intrarater or interrater or inter-rater).

We also simplified the search template by using major key terms such as palpation, palpatory, or manual exam to perform separate searches for OCLC FirstSearch, Digital Dissertation, and PEDro.

Applying Inclusion/Exclusion Criteria

A committee of experts developed inclusion/exclusion criteria based on the review question and relying on previous criteria developed by the Cochrane Group and in other systematic reviews. Appendix 2 provides the Study Selection Form, which incorporated the inclusion/exclusion criteria.

Additional Searches

After completing the online searches, the committee derived a plan to retrieve literature not identified through online searches. This included gleaning references that were cited in selected studies from the preliminary screening of online search results, consulting experts in the fields of chiropractic and osteopathic medicine, contacting authors of eligible conference abstracts, and manually searching 3 specific journals. The journals were *Manuelle Medizin*, *American Academy of Osteopathy Yearbook* (formerly *Year Book, Academy of Applied Osteopathy*), and the *AAO Journal*.

The online table of contents of a German publication, *Manuelle Medizin*, was screened starting with volume 35 (1997) to volume 39 (2001) by one of the committee members who is fluent in German. Due to restrictions of the library's subscription, only those years were searched. While *Manuelle Medizin* is indexed in several of the selected databases, the translation of MeSH or key terms may have been inadequate. The doctor of osteopathic medicine on our committee screened the titles in the respective indexes of the *AAO Journal* and the *American Academy of Osteopathy Yearbook*.

Results

Online Searches

Using our search template, PubMed identified 141 citations. Subsequently, the search of 12 additional online databases identified 1048 citations, resulting in a total of 1189 potential citations for the systematic review on the reliability of spinal palpation (Table 2). Screening titles and abstracts, we arrived at 154 nonoverlapping citations. Using the Study Selection Form, members of the review team screened the 154 articles. This resulted in 49 eligible reliability studies for the systematic review. PubMed and MANTIS combined obtained 39 of the 49 relevant studies with 15 studies overlapping. The process of the online search is summarized in Table 2.

Performance of Individual Databases

For PubMed, we screened 141 citations of titles and abstracts, which resulted in 51 citations for the preliminary inclusion studies. Nineteen of these qualified for the systematic review based on screening complete articles (Table 2); 1 study was picked up by the PubMed search but missed by the search template in CINAHL, Web of Science, and Biosis Previews.

For MANTIS, we screened 126 citations of titles and abstracts, which resulted in 88 for the preliminary inclusion studies. Thirty-five qualified for the systematic review; 10 studies were only retrieved by MANTIS but were missed or not indexed in other selected databases.

We used the modified search template for MD Consult Journal Search. The search was further limited to human studies with the thesaurus on and was done in 2 different database files, "1980 to present" and "1966 to 1997." These 2 searches together retrieved a total of 462 citations. Prescreening the titles and abstracts resulted in 51 citations. Nineteen were included in the systematic review. In this study, MD Consult resulted in the exact same studies for inclusion as PubMed but with 411 irrelevant studies. Over 300 of these studies consisted of irrelevant full-text and yearbook reviews that MD Consult offers.

In Web of Science, we used the modified search template with the exception of applying limits or using the thesaurus because of the limitation of the search engine. It retrieved 66 citations, and we identified 37 studies for the preliminary inclusion by screening the titles and abstracts. Eleven were included in the systematic review. None of the studies were unique.

We used the modified search template for EMBase through SciDirect and retrieved 57 citations. We identified 29 of these for preliminary inclusion. Sixteen were included in the systematic review. None of these studies were unique.

Using OVID CINAHL interface retrieved 232 citations, with 36 studies identified for the preliminary inclusion. Nineteen of the 36 studies were relevant for the systematic review; 7 studies were retrieved only by CINAHL but were missed or not indexed by other selected databases.

BIOSIS Previews, accessed through the CDL/MELVYL and using Power Search with the modified search template, retrieved 36 citations. We identified 13 studies for the preliminary inclusion. After screening the complete articles, we selected 5 studies. None of these studies were unique.

ICL retrieved 12 citations, with 9 studies identified for preliminary inclusion. Six qualified for the systematic review. None were unique.

We accessed Cochrane through the OVID interface and retrieved 11 citations. Nine studies qualified for the preliminary inclusion and 5 qualified for the systematic review. None were unique.

Searching the Osteopathic Database retrieved 28 citations. Seventeen studies were identified for preliminary inclusion. Eight qualified for the systematic review. The database did not identify any unique studies.

The web-based interface of OCLC FirstSearch only allowed the use of simple key term search. We ran separate searches with major key terms: spinal palpation, spinal palpatory, and manual exam. The searches retrieved 11 abstracts. While 6 were potentially relevant, only 1 full publication could be obtained for the inclusion, which had been identified by MANTIS as well. The remaining 5 relevant citations were available in abstract format only.

We performed multiple searches with major key terms using Digital Dissertation. Seven citations were retrieved with only 1 being relevant to our study. Using simple key terms in PEDro did not identify any citations.

Additional Searches

The review committee identified 9 unique studies through gleaning references cited in the 49 eligible studies. One of these unique studies was a dissertation, which was not identified through the online search of Digital Dissertation. We found 1 study by contacting experts in the field and none through contacting authors of conference proceedings. We identified 3 relevant studies for the systematic review by manually reviewing the online table of contents of *Manuelle Medizin*. One of these studies had been identified by online searches and 1 appeared in an American journal as well. No additional studies were found from the *American Academy*

Table 3. *Sensitivity and precision of online databases*

Online Databases	Sensitivity of the search template	Precision of the search in respective databases
PubMed	19/60 (32%)	19/36 (53%)
MANTIS	35/60 (58%)	35/42 (83%)
MD Consult	19/60 (32%)	19/36 (53%)
Web of Science	11/60 (18%)	11/30 (37%)
EMBase	16/60 (27%)	N/A
CINAHL	19/60 (32%)	18/27 (67%)
Cochrane Database of Systemic Reviews	5/60 (8.3%)	5/7 (71%)
BIOSIS Previews	5/60 (8.3%)	5/8 (63%)
ICL	6/60 (10%)	6/16 (38%)
Osteopathic Database	8/60 (13%)	N/A
OCLC FirstSearch	1/60 (1.7%)	1/1
Digital Dissertation	1/60 (1.7%)	1/1

MANTIS, Manual, Alternative, and Natural Therapy Index; *CINAHL,* Cumulative Index to Nursing and Allied Health Literature; *ICL,* Index to Chiropractic Literature; *OCLC,* Online Computer Library Center, Inc.

of Osteopathy Yearbook and the *AAO Journal*. In all, we identified 11 studies from additional searches.

Overall Results

The search results of online databases and additional searches together identified 60 unique studies relevant to the reliability of spinal palpation, which were included in the systematic review.

Sensitivity and Precision

With the 60 studies, we went back to the databases that were available to us and verified how many of these 60 citations were actually indexed in each respective database. This endeavor provided information about the sensitivity and precision of searching online databases.

The sensitivity of a search refers to the number of relevant studies identified by the search template from a specific database (eg, PubMed = 19), divided by the total number of known relevant articles identified by all searches (eg, 60 articles). For instance, the sensitivity of PubMed is calculated as 19/60 (32%; Table 3, column 1).

The precision of a search refers to the number of relevant studies identified by the search template from a specific database (eg, PubMed = 19) divided by the total number of relevant studies identified by all searches that were actually indexed in this database but missed by the search template (eg, PubMed = 36). For instance, the precision of PubMed is calculated as 19/36 (53%; Table 3, column 2).

Using author and title word search, we identified the number of citations our search template had missed in each database. The results in Table 3 indicate that the sensitivity and precision in this study did not necessarily correlate. For instance, Biosis Previews and Cochrane had a low sensitivity (8.3%) but a high precision (63% and 71%, respectively). Compared to the other online databases shown in Table 3, MANTIS demonstrated a high sensitivity (58%) and precision (83%). ICL and Web of Science had low sensitivity (10% and 18%, respectively) and low precision (38% and 37%, respectively).

Cost of Online Searches

The cost of the databases used for conducting the search ranged from free-of-charge for PubMed to $43,000 per year for a single network subscription for EMBase. If institutional subscriptions are not available for a specific database needed for the search, both OVID and Dialog offer the "Online Pay-as-You-Go" service. Connect time and cost per full record are available from both vendors' web sites. For instance, OVID MANTIS connect time is $45 per hour and $0.66 per full record (http://www.ovid.com/sales/paygo_pricing.cfm). In this study, approximately 45 minutes connect time was spent, and 126 records were printed. Thus, the total cost for the MANTIS online search would be $116.91. The ICL, a free-of-charge web-based database indexing 41 chiropractic journals, had a much lower sensitivity and precision than MANTIS. The cost analysis was more favorable for MANTIS than for ICL.

Cost of Additional Searches

The cost incurred from the time required to conduct the additional searches for this study could not be quantified for the following reasons: First, the expert reviewers were thoroughly familiar with their collection of scientific publications and thus did not require as much time as librarians or other investigators to conduct additional searches. Second, we sent the inclusion list to content experts who spent an unspecified amount of time conducting additional searches. Third, we contacted authors of proceedings mainly by e-mail and phone, which did not require much cost. However, waiting for responses involved an unspecified cost of time.

Discussion

When reviewing the strengths and weaknesses of all 13 databases in our study, PubMed, with CAM on PubMed set

as default, did not demonstrate the highest sensitivity of relevant studies for this review. The highest sensitivity (58%) and precision (83%) were obtained through MANTIS, since MANTIS specializes in osteopathic medicine, allopathic medicine, chiropractic, and physical therapy, which is the focus area of our systematic review.

While using PubMed to develop our search template seemed to produce a cost-effective outcome, it did create difficulty implementing that search template in other selected databases. A predefined search template for a specific database and platform frequently does not work well with another database or platform due to the lack of standardized commands and functions from one database to another. For example, the unique features of automatic mapping and exploding MeSH terms in PubMed are not available in any other selected database that we evaluated in our study. Therefore, multiple search strategies and expansion of key terms should be used in databases other than PubMed.

The selection of 13 databases in varied platforms can create a problem for researchers and librarians who might not be familiar with all these databases and take advantage of all available features from each database, thereby affecting the search results (eg, OVID CINAHL). The original search without qualifying the search terms with "All Fields, .af." retrieved only 19 citations. Repeating the search to qualify all search terms with ".af." resulted in 232 citations, with 7 studies that were either missed or not indexed by other selected databases. In addition, previous studies found that conducting the same search with the same database (eg, searching MANTIS through OVID versus Healthindex) but different platforms yielded different results.[21]

Several factors contributed to lower sensitivity and precision in search outcomes of our study: the accuracy of indexing, the comprehensiveness of a search strategy, the strength and weakness of a database search engine/platform, and the subject coverage on a particular topic. Similarly, as previous studies pointed out, incompleteness or errors in citation indexing or misused keywords by authors may result in citations not being retrievable despite the use of a good search strategy.[16,17,22] In our study, most user-friendly web-based search engine/platforms could not handle a complex search template as the one we used. For these reasons, the overall online search of some databases resulted in a low sensitivity and precision. For example, Web of Science, one of the major health and life sciences commercial databases, resulted in a low sensitivity (18%) and a low precision (37%). On the other hand, Biosis Previews provided a much lower sensitivity (8.3%) and a high precision (63%), which might be due to the limited scope in subject coverage. Thus, all the constraints mentioned above contributed to retrieval results in this study (ie, indexing, search strategy, platform, and subject coverage problems).

Our results showed that 35 of the 60 relevant studies (58%) from all searches were repeatedly indexed in 3 or more databases. This suggests it is not necessary to search all the selected databases that we identified in the study, especially if one does not have access to some of the expensive databases (eg, EMBase, Biosis Previews, Web of Science, and MD Consult). However, multiple search strategies should be utilized to retrieve the maximum number of citations. In our study, we discovered that our search template had missed a significant number of relevant studies from each selected database (eg, PubMed missed 17 relevant studies).

Although our study demonstrated that it is important to search subject-specific databases to ensure adequate coverage of a given CAM subject, one might not have access to it. In particular, some databases are so specialized that many institutions or academic libraries do not have enough interest to justify a subscription. For example, since the University of California Irvine has neither a chiropractic nor osteopathic medical school, subscribing to MANTIS or AMED is a lower priority. For this study, we accessed MANTIS through the research collaboration with the Southern California University of Health Sciences. Furthermore, CAM research is a relatively new area of investigation in many academic institutions, making CAM databases and collections a low priority for funding.

In addition, some databases are so expensive that many institutions or academic libraries simply cannot afford a subscription. The annual subscription fee for a single-user-network access to EMBase is over $43,000. Although one can subscribe to the online "Pay-as-You-Go" through either OVID or Dialog, the fee is based on connect time and per citation (eg, OVID charges $129 per hour connect time and $1.90 per record to access EMBase). For this study, the EMBase search could easily cost up to $200. At the time of this research, we were able to access EMBase through the California Digital Library trial contract with SciDirect. Unfortunately, the trial ended before we completed the analysis of our study, and it was too costly for us to evaluate the precision.

Further studies should be done to evaluate the cost analysis of online databases for searching CAM literature. For instance, our study has shown that most databases yielded a high number of irrelevant citations that are quite costly to obtain through the online "Pay-as-You-Go" service.

To save time and money, it is important to clarify the purpose and overall goal of a literature search. For instance, a clinician or practitioner might want to access evidence-based CAM literature through PubMed to obtain the safety and efficacy of CAM modalities. At the same time, if a subject-specific specialized CAM database is available, clinicians and practitioners should consider searching that database for completeness. For example, MANTIS comprehensively indexes 140 specialized journal titles, while PubMed only covers about 22 of these titles.[21]

On the other hand, librarians and researchers conducting systematic reviews want to capture every study in the area of their review. Our study found 18% of the 60 relevant

studies by using other search methods, like screening foreign publications, gleaning references of the relevant articles, and contacting content experts. Thus, we support the Cochrane recommendation to glean references from selected studies and manually search specialized journals.

Study Limitations

Our study had several limitations that might have affected the total number of relevant studies being included in this review. We used a predefined online search template with a variety of databases and platforms. The simplicity of a web-based search engine did not allow us to fine-tune our search template. Selected databases were not all available to us or too expensive to use.

Due to potential bias in a given platform, researchers in this field might want to perform their searches using different platforms and search strategies within the same database. However, cost would be a constraint.

We limited the expansion of related key terms (eg, assessment, soft tissue, motion test, etc.) to avoid a large number of irrelevant citations. The initial search of PubMed with the expansion of related key terms retrieved almost 900 citations and fewer than 10% of these were relevant. On the other hand, we might have missed articles about the reliability of palpation in general that could have been relevant to our study. The reason is that articles about the reliability of palpation for all areas of the body will not include a term like *spine* unless a significant part of that study specifically addressed the spine. For comparison, further evaluations of web-based search interface with few constraint terms should be tested.

Conclusion

In summary, we found that conducting a comprehensive search of CAM evidence is challenging for the following reasons:

1. Some user-friendly web-based search interfaces cannot handle complex search strategies.

2. Search platforms from various databases are not standardized and some do not have the capability to fine-tune a specific search.

3. A substantial amount of CAM literature has been published in languages other than English, and budget constraints might not allow for translation expenses. While this was not an issue in our study (only 2 relevant studies were found in a foreign language), searches on other topics are likely to identify studies published in foreign journals.

4. Many online databases provide inadequate indexing and categorization of CAM publications.

5. CAM on PubMed only covers a relatively small segment of CAM literature, making access to a specialized database very important. However, access is frequently expensive.

6. A great number of CAM studies were available only in abstract format. Full studies had not been published.

Our study confirmed an extended observation made by others recently. Researchers and librarians conducting a systematic review in a particular area of CAM should first develop the search strategy using PubMed and then adapt the PubMed search approach to their subject-specific specialized databases. Researchers have to be aware that biases can be introduced on platforms that they use.

Our study shows that a specialized database such as MANTIS does offer unique resources that are not typically indexed by commonly used databases (eg, PubMed). As health care institutions and providers are increasing their services in the areas of CAM to meet public demands, an ever-growing number of subject-specific bibliographic databases are becoming available within the field of CAM. Libraries and research centers must find funding to increase access to specialized databases for CAM if institutional priorities focus on this growing area of medicine.

It is important to use additional search methods (gleaning reference lists, contacting experts in the field, and searching manually) to conduct systematic reviews. While this endeavor is time consuming and costly, it adds significantly to the completeness of a systematic review.

References

1. Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, et al. Trends in alternative medicine use in the United States, 1990-1997: results of a follow-up national survey. JAMA 1998;280:1569-75.
2. Astin JA, Marie A, Pelletier KR, Hansen E, Haskell WL. A review of the incorporation of complementary and alternative medicine by mainstream physicians. Arch Intern Med 1998; 158:2303-10.
3. Chez RA, Jonas WB, Crawford C. A survey of medical students' opinions about complementary and alternative medicine. Am J Obstet Gynecol 2001;185:754-7.
4. Wetzel MS, Eisenberg DM, Kaptchuk TJ. Courses involving complementary and alternative medicine at US medical schools. JAMA 1998;280:784-7.
5. Pelletier KR, Astin JA. Integration and reimbursement of complementary and alternative medicine by managed care and insurance providers: 2000 update and cohort analysis. Altern Ther Health Med 2002;8:38-44 [passim].
6. Bronfort G. Spinal manipulation: current state of research and its indications. Neurol Clin 1999;17:91-111.
7. Van Tulder MW, Koes BW, Bouter LM. Conservative treatment of acute and chronic nonspecific low back pain. A systematic review of randomized controlled trials of the most common interventions. Spine 1997;22:2128-56.
8. Huijbregts P. Spinal motion palpation: a review of reliability studies. J Manual Manipulative Ther 2002;10:24-39.
9. Ezzo J, Berman BM, Vickers AJ, Linde K. Complementary medicine and the Cochrane Collaboration. JAMA 1998;280: 1628-30.
10. Bloom BS, Retbi A, Dahan S, Jonsson E. Evaluation of randomized controlled trials on complementary and alternative medicine. Int J Technol Assess Health Care 2000;16:13-21.

11. Allais G, Voghera D, De Lorenzo C, Mana O, Benedetto C. Access to databases in complementary medicine. J Altern Complement Med 2000;6:265-74.
12. National Center for Complementary and Alternative Medicine. NIH launches CAM on PubMed—a comprehensive source of complementary and alternative medicine information on the internet. Bethesda (MD): National Center for Complementary and Alternative Medicine (NCCAM); 2001. Available at: http://www.nlm.nih.gov/nccam/camonpubmed.html.
13. Helmer D, Savoie I, Green C, Kazanjian A. Evidence-based practice: extending the search to find material for the systematic review. Bull Med Libr Assoc 2001;89:346-52.
14. Topfer LA, Parada A, Menon D, Noorani H, Perras C, Serra-Prat M. Comparison of literature searches on quality and costs for health technology assessment using the MEDLINE and EMBASE databases. Int J Technol Assess Health Care 1999; 15:297-303.
15. Suarez-Almazor ME, Belseck E, Homik J, Dorgan M, Ramos-Remus C. Identifying clinical trials in the medical literature with electronic databases: MEDLINE alone is not enough. Control Clin Trials 2000;21:476-87.
16. Aker PD, McDermaid C, Opitz BG, White MW. Searching chiropractic literature: a comparison of three computerized databases. J Manipulative Physiol Ther 1996;19:518-24.
17. Dickersin K, Hewitt P, Mutch L, Chalmers I, Chalmers TC. Perusing the literature: comparison of MEDLINE searching with a perinatal trials database. Control Clin Trials 1985;6: 306-17.
18. Dumbrigue HB, Esquivel JF, Jones JS. Assessment of MEDLINE search strategies for randomized controlled trials in prosthodontics. J Prosthodont 2000;9:8-13.
19. Goodman C. Literature searching and evidence interpretation for assessing health care practices. Stockholm: Swedish Council on Technology Assessment in Health Care; 1993.
20. Mulrow C, Oxman A. Cochrane collaboration handbook. Oxford: The Cochrane Library; 1997, [updated September 1997] [database on disk and CD Rom].
21. Tomasulo P. MANTIS—manual, alternative, and natural therapy index system database. Med Ref Serv Q 2001;20:45-55.
22. Dickersin K, Scherer R, Lefebvre C. Identifying relevant studies for systematic reviews. BMJ 1994;309:1286-91.

Appendix I

DATABASE DESCRIPTION

PubMed is the most widely used scientific literature database. It is available via the NCBI Entrez system (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed). PubMed provides free access to over 11 million citations from MEDLINE from 1966 and some additional life science journals that submit full text to PubMedCentral". In addition, the Linkout feature of PubMed provides direct access to publisher sites for full text articles and other related resources. Furthermore, one can select CAM on PubMed (http://www.nlm.nih.gov/nccam/camonpubmed.html) for CAM studies only.

MANTIS (Manual, Alternative, and Natural Therapy Index System) is a fee-based database available via Ovid, Dialog, or directly from the Health Index web site (http://www.healthindex.com). Mantis provides coverage to over 1000 biomedical journals in the fields of osteopathic medicine, allopathic medicine, chiropractic, and physiotherapy. Its core emphasis is on research relating to the etiology, physiopathology, diagnosis, and treatment of neuromusculoskeletal conditions, such as low back pain, headache, scoliosis, nerve compression syndromes, and sports injuries. Other treatment coverage includes acupuncture, biofeedback, exercise therapy, joint manipulation, and physical therapy.

MD Consult is another fee-based database designed for primary care physicians, residents, and medical students (available via www.mdconsult.com.) The Journal Search interface provides full-text articles from selected clinical journals and the Clinics of North America. It also provides complete access to MEDLINE, AIDSLINE, HealthSTAR, and CANCERLIT citations.

ISI Web of Science is a fee-based database for science, social science, and the arts and humanities produced by the Institute for Scientific Information (http://www.isinet.com/isi/). It provides references to over 8000 scholarly journals and conference proceedings from 1981 to the present. The General Search interface of Web of Science is designed for basic searches (eg, keyword, title).

EMBase is a fee-based database and is often referred to as the European version of MEDLINE. It is a product of Elsevier Science (www.elsevier.nl/). Most users access EMBase through their institution subscription. It is available through vendors such as OVID, Dialog, and SciDirect. In comparison to MEDLINE, EMBase provides better coverage of European journals dating back to 1974 and includes more references to drugs and therapeutics. Instead of using MeSH, EMBase uses EMTREE thesaurus of keywords for indexing articles.

CINAHL (Cumulative Index to Nursing and Allied Health Literature) is a bibliographic database for the fields of nursing and allied health literature and provides coverage to over 1200 journals. Subscription is available through CD-ROM, direct online access, or vendors such as OVID and SilverPlatter. Detailed information can be located at the CINAHL web site: http://www.cinahl.com/.

BIOSIS Previews is a fee-based life sciences and biology database, which indexes 6000 journals, books, conference proceedings, and technical reports from 1985 to present (http://www.biosis.org/).

ICL (Index to Chiropractic Literature) is a free web-based database funded by the Association of Chiropractic Colleges (http://www.chiroindex.org/). Librarians from 13 different chiropractic colleges contribute toward its indexing. This database indexes 41 chiropractic journals using terms from MeSH and CHIROSH from 1985 to the present.

The Osteopathic Database is sponsored by the American Osteopathic Association. The database is presently under development and not yet available to the public. We submitted the search template to the librarian at the University

of North Texas Health Sciences Center where the database is under construction.

OCLC FirstSearch is an index of papers presented at international conferences, symposia, meetings, expositions, workshops, and congresses produced by the Online Computer Library Center, Inc. (http://www.oclc.org/home/). The index covers a wide variety of disciplines from 1993 to the present. It also incorporates published information received from the British Library Document Supply Center.

Digital Dissertation indexes more than 1.6 million doctoral dissertations and master's theses covering over 1000 graduate schools and universities.

Cochrane Database of Systematic Reviews (CDSR) is a fee-based Evidence-Based Medicine (EBM) database (http://www.cochranelibrary.com/clibhome/clib.htm). It includes full text of regularly updated systematic reviews. Abstracts of Cochrane reviews are performed by the Cochrane Centers and are available free of charge.

PEDro (Physiotherapy Evidence Database) is a free web-based database (http://ptwww.cchs.usyd.edu.au/pedro/). It provides bibliographic details and abstracts of randomized controlled trials and systematic reviews in physiotherapy.

Appendix 2

STUDY SELECTION FORM

UID: _____

Author: _____ Year: _____

Title:

_____

Level of Review (please check): Abstract__ Article__ Conf Proceedings__ Other__

Name of Reviewer:_____ Date of Review:_____

SELECTION CRITERIA

Study Questions:

Current question: What is the reliability of spinal palpatory procedure(s)?

Future question: What is the validity of spinal palpatory procedure(s) for

screening and diagnosis of patients with spinal neuromuscular dysfunction?

(Indicate with a check mark if each of the following criteria is met)

Study type (circle one): Reliability Validity Background

If the study is of "reliability" continue with questions 1-5 (circle the appropriate response).

1. Study Population:
   a. Is the study population described? Y N
   b. Does the study population fit the question being addressed? Y N
2. Palpation Procedure:
   a. Is the procedure described? Y N
3. Examiners:
   a. Is the examiner population described? Y N
4. Study Conditions:
   a. Are the study conditions described? Y N
5. Data:
   a. Are data presented? Y N

Action: (circle one) Include Exclude

List reasons for exclusion:

_____
_____
_____
_____