

Identification of Randomized Controlled Trials From the Emergency Medicine Literature: Comparison of Hand Searching Versus MEDLINE Searching

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See related articles, p. 75 and p. 86.

Study objective: As part of an ongoing project to identify all the randomized controlled trials (RCTs) in the emergency medicine literature, in association with the Cochrane Collaboration, 2 discrete studies were undertaken; the first, to compare motives for active participation in hand searching of the literature by emergency medicine professionals, and the second, to compare hand searching with MEDLINE searching of a number of emergency medicine journals.

Methods: All listed members of the British Association for Emergency Medicine (BAEM) and the Society for Academic Emergency Medicine (SAEM) received a standard letter outlining the objectives of the project, with 1 of 3 headings assigned on an alternate basis. Recruited volunteers hand searched journals prioritized from the emergency medicine literature. Each issue of each journal was hand searched for RCTs. In addition, a comprehensive MEDLINE search was conducted for each journal. The yields of RCTs from the 2 searching methods were compared for all journals and for each journal individually.

Results: No clear motivation for participation in this work could be ascertained because of the low response rates from BAEM and SAEM (10.1% and 1.8%, respectively). Only 18 (29.0%) of the 62 journals identified were indexed by MEDLINE. In the 14 journals indexed by MEDLINE for which hand searching was completed, a total of 710 RCTs were identified by a combination of the 2 approaches; of these, 592 (83.4%) were identified by hand searching alone and 483 (68.0%) by MEDLINE searching alone. Both methods identified 365 (51.4%) RCTs; hand searching revealed an additional 227 (32.0%) that were not identified by MEDLINE searching, and MEDLINE searching found 118 (16.6%) that were not identified by hand searching. The difference between the proportions identified by hand searching and by MEDLINE searching (15.4%; 95% confidence interval [CI], 12.7% to 17.9%) was statistically signifi-

cant (McNemar's χ^2 test, 1 *df*, 33.8; $P < .0001$). This difference was not significant for 8 of the journals.

Conclusion: The response rates from mailing to members of the relevant professional organizations letters requesting participation in this work were very low and suggested that such an approach was not cost-effective. However, no formal costing exercise was undertaken. Searching results showed that, in the 14 emergency medicine journals indexed by MEDLINE for which hand searching was completed, hand searching led to identification of additional RCTs (primary articles) not found through MEDLINE searching. However, hand searching, although statistically significantly better than MEDLINE searching, failed to identify some of the RCTs found by MEDLINE searching, suggesting that hand searching is not a "gold standard" method and that the dual approach, promoted by the Cochrane Collaboration, may be the optimal approach for journals indexed by MEDLINE.

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INTRODUCTION

With the advent of new journals, the amount of scientific literature is ever increasing. As a result, health care professionals are more likely to rely on review articles to keep abreast of developments. Review articles are therefore very influential, but they often are subjective appraisals and syntheses of selected published works and consequently carry a potential for the introduction of bias by the reviewers.¹ In addition, reviews carried out nonsystematically may lead to seriously misleading recommendations for clinical practice.² In contrast, rigorous systematic reviews of the scientific literature employ more standardized, reproducible methods to identify eligible studies and to abstract and analyze relevant data.³

Rigorously conducted experiments—that is, randomized controlled trials (RCTs) of sufficient statistical power—are deemed to represent the "gold standard" in research design to detect important beneficial or harmful effects of existing or new interventions, particularly if a pragmatic rather than an explanatory design is adopted.⁴ However, because individual RCTs are often too small to provide estimates of treatment differences of acceptable precision,⁵ any single RCT can provide only limited

guidance for clinical practice. As a result, systematic reviews of all relevant RCTs have been suggested as useful to guide both clinical practice and future research.

There are 2 initial and essential steps in preparing systematic reviews of RCTs: identifying the relevant sources and searching the relevant sources to identify the eligible studies. These tasks are not straightforward,^{6,7} because not all journals are indexed by MEDLINE, and those that are indexed are more likely to be English-language journals. Even for journals indexed by MEDLINE, it may be difficult to retrieve all relevant studies. Research in other areas has shown that MEDLINE electronic searching for RCTs results in retrieval of approximately only half of the relevant studies, due to inaccurate indexing by MEDLINE.⁸ RCTs are sometimes published as conference proceedings, which are not indexed by MEDLINE. Again, research in other areas has shown that, on average, only half of conference abstracts reporting results of RCTs reach full publication,⁹ and such studies are more likely to be published if they show a positive result.¹⁰ Therefore reviews of primary research using only trials identified through MEDLINE are liable to be subject to selection bias, English-language bias, and publication bias.

In April 1993, a project commenced with the objective of identifying all RCTs in the emergency medicine literature. This work formed part of the then-emerging international Cochrane Collaboration, which was developed in response to the need for more reliable reviews of research evidence. The Cochrane Collaboration has an overall objective to prepare, maintain, and disseminate systematic, up-to-date reviews of the effects of health care.¹¹ The Cochrane Collaboration consists of topic-based Collaborative Review Groups, with each group responsible for the preparation of systematic reviews relevant to their particular topic (eg, health care interventions in pregnancy and childbirth). To ensure wide dissemination of the systematic reviews, they are published by the electronic Cochrane Library in the Cochrane Database of Systematic Reviews.¹²

To overcome the potential biases of relying solely on identification of RCTs through MEDLINE and other electronic databases, the Cochrane Collaboration promotes the use of hand searching of the literature. Given the laborious nature of hand searching, 2 discrete studies were undertaken as part of the ongoing project. The objective of the first study was to compare motives for active participation in hand searching of the literature by emergency medicine professionals. The objective of

the second study was to compare hand searching with MEDLINE searching of a number of emergency medicine journals.

MATERIALS AND METHODS

Volunteers to assist with hand searching of the emergency medicine literature were identified by 4 different approaches. First, all listed members of the British Association for Emergency Medicine (BAEM) and the Society for Academic Emergency Medicine (SAEM) received a standard letter outlining the objectives of the work and the background to the Cochrane Collaboration and requesting help with the hand searching of the emergency medicine literature. Every member from the alphabetical listing for both organizations was assigned, on an alternate basis as part of a quasirandomized study, to receive the same letter with 1 of 3 headings: "The pursuit of medical practice based on scientific evidence"; "The chance of a free journal subscription"; or "Join leading colleagues in an exciting new venture" (Figure 1).

The second approach to identify volunteers was to ask known professional contacts to assist with hand searching and to nominate colleagues who might be interested in collaborating. The third approach was through publicity: The authors were invited both to exhibit and to present a paper about the work at the annual conference of the BAEM in the years 1994 and 1995. In 1994, the BAEM hosted the Fifth International Conference on Emergency Medicine in association with the American College of Emergency Physicians, the Australasian College of Emergency Physicians, and the Canadian Association of Emergency Physicians, providing an international audience. During the presentation of the work in the plenary session, delegates were encouraged to visit the Cochrane exhibit to register their interest in participating in the work. Indications of interest were followed by direct correspondence after the conference. The fourth approach was to journal editors, requesting assistance with the hand searching of their own journals.

When a volunteer indicated an interest in a specific topic in emergency medicine or an interest in collaborating in a systematic review, such information was communicated to the volunteer's local Cochrane Centre and to the Australasian Cochrane Centre, which maintains a global directory of individuals' interests on behalf of the Cochrane Collaboration.

For the second study, to compare hand searching with MEDLINE searching in a subset of the emergency

medicine literature, the relevant journals had to be identified and prioritized. Four approaches were used. First, relevant journals were identified in ULRICH's Plus International Serials Database¹³ by a text search using the keywords "trauma," "accident medicine," and "emergency medicine." Second, the shelves of major medical

Figure 1.

Text of recruitment letter.

Dear _____

*The pursuit of medical practice based on scientific evidence
or
The chance of a free journal subscription
or
Join leading colleagues in an exciting new venture*

As a member of the British Association for Accident and Emergency Medicine/Society for Academic Emergency Medicine, I thought you may be interested in participating in an international endeavour to develop, maintain and disseminate systematic, up-to-date reviews of randomized controlled trials (RCTs) in accident and emergency (A&E) medicine.

In the past year, three regional Cochrane Centres have been set up, one in the UK (as part of the new Research and Development Programme established to support the NHS in England), one in Canada and one in Scandinavia. The Centres provide experience and support for the preparation, maintenance and dissemination of systematic reviews of RCTs in health care.

As part of this work, a Cochrane Collaborative Network for A&E medicine is being established by leading clinicians including Professor Miles Irving and Professor David Yates. The Network has two objectives: first, all relevant A&E journals need to be hand searched for RCTs to establish a comprehensive register; and second, systematic reviews of specific topics need to be prepared, maintained and freely disseminated. Currently, the Network is working on the first objective and is looking for help in hand searching journals for relevant RCTs.

Would you be interested in helping with this?

This could involve searching back issues of journals or taking on the responsibility to monitor new issues as they appear. The amount people may choose to take on will vary and will depend on how much time they feel able to allocate. While such work is dependent on people's goodwill, some journal editors are prepared to provide a free subscription to the individual responsible for searching new issues.

The Cochrane Collaborative network could do a lot to bring together the knowledge of those working in A&E medicine throughout the world and could help transform current practice into evidence-based medicine. I look forward to hearing from you if you are interested in participating.

Yours sincerely

libraries in Boston (USA) and London (UK) were searched for relevant journals. Third, all relevant journals indexed by MEDLINE¹⁴ were identified with the use of keywords similar to those used for ULRICH's. Finally, professional contacts in the field of emergency medicine were asked to identify any additional journals omitted from the list. Special emphasis was placed on the identification of non-English-language journals through professional contacts.

A priority list of journals for hand searching was identified in 2 ways. First, all of the identified journals indexed by MEDLINE were ranked by potential yield of RCTs. This was achieved either by undertaking a quick search on

MEDLINE for the word "random\$" (\$=wildcard) in the text of the title or abstract of articles published from 1989 to 1993 or by using Phase One of a comprehensive search strategy for RCTs (Figure 2), which was developed by, and is available from, the Cochrane Collaboration.⁸ Second, as part of the ongoing work, hand searching priority was given to journals for which volunteers showed a particular interest and to journals readily available to a volunteer or to the project team.

Prioritized journals were hand searched retrospectively, from January 1948 or from the first issue forward, and prospectively, as each new issue of the journal was published. The year 1948 was selected by the Cochrane Collaboration because it is generally agreed that the first clinical trial with a properly randomized control group (a trial of streptomycin for the treatment of pulmonary tuberculosis) was published in that year.¹⁵ Each volunteer was asked to hand search the journal to which the volunteer was assigned, either retrospectively for a given period (usually 5 years) or prospectively.

Each hand searcher received an information package that included details of the allocated issues of the journal to be hand searched; guidelines for hand searching developed by the project team; a thesaurus of terms used to describe RCTs; a form to be completed for each RCT identified; examples of RCTs identified in other emergency medicine journals; information about the Cochrane Collaboration; and an agreement form to undertake the work, which was to be signed and returned by the hand searcher.

The RCTs to be included were *primary articles* reporting the results of an RCT, *conference abstracts* reporting the results of an RCT, and *abstracts* reporting the results of an RCT published elsewhere. For all RCTs identified, a form was completed and sent with the photocopied RCT to the project team.

To assist those prospectively hand searching journals, editors of journals on the priority list were approached by letter explaining the objectives of the work and requesting a complimentary subscription to their journal so that it could be allocated to a volunteer hand searcher.

To ensure that there was no duplication in hand searching activities within the Cochrane Collaboration, information about ongoing and completed hand searching activities was communicated to the International Register of RCTs located at the Baltimore Cochrane Center.

The reliability of the hand searching done by an individual volunteer was checked by assigning an overlapping year of the same journal to a second volunteer and to a member of the project team (JL, ET). However, formal testing was not undertaken.

Figure 2.

Comprehensive MEDLINE search strategy to identify RCTs.

Set No.	Term Searched or Sets Combined
Phase One	
1	RANDOMIZED-CONTROLLED-TRIAL in PT
2	RANDOMIZED CONTROLLED TRIALS
3	RANDOM ALLOCATION
4	DOUBLE-BLIND METHOD
5	SINGLE-BLIND METHOD
6	1 or 2 or 3 or 4 or 5
7	TG = ANIMAL not (TG = HUMAN and TG = ANIMAL)
8	6 not 7
Phase Two	
9	CLINICAL TRIALS in PT
10	explode CLINICAL TRIALS
11	(clin* near trial*) in TI
12	(clin* near trial*) in AB
13	(singl* or doubl* or trebl* or tripl*) near (blind* or mask*)
14	(13 in TI) or (12 in AB)
15	PLACEBOS
16	placebo* in TI
17	placebo* in AB
18	random* in TI
19	random* in AB
20	RESEARCH-DESIGN
21	9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20
22	TG = ANIMAL not (TG = HUMAN and TG = ANIMAL)
23	21 not 22
24	23 not 8

Note: Format shown is for silver platter version 3.10. Upper case denotes controlled vocabulary; lower case denotes freetext terms. Those wishing to run this search strategy are recommended to seek the advice of a trained medical librarian.⁸

A comprehensive MEDLINE search strategy for RCTs (Figure 2) was conducted by a member of the project team (JL, ET) for each of the journals indexed by MEDLINE for which hand searching was completed. The searches were carried out from 1966 (when MEDLINE commenced indexing), or from the year the journal was first indexed, until the end of 1995. To account for the lag that occurs between publication of an article and data entry onto MEDLINE, searches were conducted from at least 6 months after the end of 1995.

All studies identified as RCTs, either by hand searching or by MEDLINE searching, were coded by the project team according to the Cochrane guidelines.¹⁶ Studies were coded as *definite RCT*—a clinical study on humans in which individual subjects were definitely assigned prospectively to 1 of 2 or more alternative forms of health care using a random method of allocation (eg, randomization table); as a *quasi-RCT*—a similar study but one in which the method of allocation was quasirandom (eg, alternation, date of birth, case record number); or as a *possible RCT*—a study in which the subjects were possibly assigned prospectively by a random or quasirandom method of allocation but for which inadequate reporting made the method impossible to discern. For RCTs identified by MEDLINE, when such coding was not possible from the title and abstract alone, the original article was checked.

RESULTS

The results of the comparison of motives for active participation in hand searching of the literature by emergency medicine professionals are presented as response rates from members of the BAEM and SAEM by type of letter heading in Table 1. Response rates were very low for both organizations, although significantly more members responded from the BAEM (10.1% versus 1.8%, χ^2 , 1 *df*, 107.2; $P < .0001$). For both organizations, Heading 1 (“The pursuit of medical practice based on scientific evidence”) attracted the largest response, followed by Heading 2, then Heading 3. However, differences were not significant: for BAEM, 11.6% versus 10.4% versus 8.4% (χ^2 , 2 *df*, 1.42; $P = .23$); for SAEM, 2.3% versus 1.9% versus 1.5% (χ^2 , 2 *df*, 1.46; $P = .23$).

In total, 179 volunteers indicated an interest in assisting with the hand searching of the emergency medicine literature. However, interest was translated into action by only 46 persons (25.7%). The final yield of active hand searchers was lowest for journal editors and then for the professional organizations. Editors of 16 journals were approached for complimentary subscriptions of their journals; 11 (68.8%)

obliged. Although no editor refused, 5 did not respond despite repeated requests by mail.

As part of the ongoing project, 62 journals were identified by the 4 approaches described. The journals are listed alphabetically by country of publication in Table 2. There are obvious omissions from the list, for example the journal *Chest* (formerly *Diseases of the Chest*). These omissions arise in part because of the existence of other allied Cochrane groups, such as those relevant to intensive care, and surgery and anesthesia. For example, hand searching of the journal *Chest* has been undertaken by the group working on intensive care medicine.

Of the 62 emergency medicine journals identified to date, only 18 (29.0%) are indexed by MEDLINE. The list in Table 3 shows the initial 12 journals ordered by the yield from the MEDLINE search of entries from 1989 through 1993 for “random\$” in the text of the title or abstract. A further 6 journals are ordered by the yield from the MEDLINE search using Phase One of the comprehensive search strategy for RCTs (Figure 2) for the years 1991 through 1995. Finally, an additional 8 journals were added to the priority list because of interest or availability to volunteers. Of the 26 prioritized journals,

Table 1.

Comparison of motives for active participation in hand searching of the emergency medicine literature by emergency medicine professionals.

Approach	Total No. of Contacts	No. of Responders (% of Contacts)	Total No. of Actual Hand Searchers (% of Contacts)
Professional organizations			
BAEM			
Heading 1	241	28 (11.6)	6 (2.5)
Heading 2	241	25 (10.4)	8 (3.3)
Heading 3	239	20 (8.4)	4 (1.7)
Total	721	73 (10.1)	18 (2.5)
SAEM			
Heading 1	913	21 (2.3)	10 (1.1)
Heading 2	913	17 (1.9)	3 (.3)
Heading 3	913	14 (1.5)	4 (.4)
Total	2,739	52 (1.8)	17 (.6)
Professional contacts	14	14 (100.0)	8 (57.1)
Conference contacts	23	23 (100.0)	3 (13.0)
Journal editors	54	17 (31.5)	0 (0)
Total	3,551	179 (5.0)	46 (1.3)

BAEM, British Association for Emergency Medicine (UK); **SAEM**, Society for Academic Emergency Medicine (USA); **Heading 1**, “The pursuit of medical practice based on scientific evidence”; **Heading 2**, “The chance of a free journal subscription”; **Heading 3**, “Join leading colleagues in an exciting new venture.”

Table 2.

Alphabetical list by country of publication of the 62 emergency medicine journals identified to date, with translations () or former names {}.

Country	Journal
Australia	Emergency Medicine
Belgium	European Journal of Emergency Medicine
Canada	Emergency Prehospital Medicine Perspectives in Emergency Medicine Wound and Skin Care
Cuba	Revista Cubana De Medicina General Integral
France	Urgences Médicales
Germany	Archives of Orthopaedic and Trauma Surgery
Hungary	Journal of Hungarian Ambulance and Emergency Care
Italy	Rassegna Di Medicina D'Urgenza
Japan	Kokyu-To-Junkan (Respiration and Circulation)
South Africa	Trauma and Emergency Medicine
Sweden	Journal of Traffic Medicine
United Kingdom	Accident and Emergency Nursing British Journal of Accident and Emergency Medicine {A&E News} Burns, Journal of the International Society for Burn Injuries {Burns including Thermal Injury} Emergency Nurse Injury, British Journal of Accident Surgery Journal of Accident and Emergency Medicine Journal of the British Association in Immediate Care Journal of Wound Care
USA	Academic Emergency Medicine Accident, Analysis and Prevention Advances in Trauma and Critical Care {Advances in Trauma} American Journal of Emergency Medicine Annals of Emergency Medicine {Journal of the American College of Emergency Physicians} Audio-Digest Emergency Medicine Case Studies in Emergency Medicine Current Concepts in Emergency Medicine Current Concepts in Trauma Care Current Concepts in Wound Care Disaster Medicine E M S Access Emergency Medical Services Emergency Medicine Abstracts Emergency Medicine Clinics of North America Emergency Medicine Emergency Medicine News {Emergency Medicine and Ambulatory Care News, Emergency Department News} Critical Decisions in Emergency Medicine Emergency Medicine Reports Emergency Medicine Reports Legal Briefings Emergency Medicine Residency Newsletter Emergency Medicine Survey Emergency Medicine Today Emergency Nurse Journal of Advanced Medical Surgical Nursing Journal of Burn Care and Rehabilitation Journal of Emergency Medicine Journal of Emergency Nursing Journal of Head Trauma Rehabilitation Journal of Neurotrauma {Central Nervous System Trauma} Journal of Orthopaedic Trauma Journal of Trauma Medical Information Systems: Critical Care and Emergency Medicine Pediatric Emergency and Critical Care {Pediatric Trauma and Acute Care} Pediatric Emergency Care Prehospital and Disaster Medicine {Journal of Prehospital Medicine, World Association for Emergency and Disaster Medicine} Resuscitation Technology for Emergency Care Nurses {Technology for Emergency Medicine, Health Devices Update: Emergency Medicine} Topics in Acute Care and Trauma Rehabilitation Topics in Emergency Medicine Trauma Quarterly

retrospective hand searching was completed for 18 (69.2%); of these, 14 were indexed by MEDLINE.

A comparison of hand searching and MEDLINE searching is presented in Table 4. The table excludes RCTs from both conference abstracts and abstracts (defined previously), because they are not indexed by MEDLINE. Results are presented solely for primary articles in the 14 journals indexed by MEDLINE for which hand searching was completed.

A total of 710 RCTs were identified by a combination of the 2 approaches, with hand searching identifying 592 (83.4%) and MEDLINE 483 (68.0%). Both methods identified 365 (51.4%) RCTs; hand searching revealed an additional 227 (32.0%) that were not identified by MEDLINE searching, and MEDLINE searching found 118 (16.6%) that were not identified by hand searching. The difference between the proportions identified by hand searching and by MEDLINE searching (15.4%; 95% CI, 12.7% to 17.9%) was statistically significant (χ^2 , 1 df, 33.8; $P < .0001$). The same results are presented for each journal separately in Table 5. The proportional difference

between RCTs identified by hand searching and those identified by MEDLINE searching was not significant for 8 of the journals. The total hand searching yield, coded by type of RCT, and comparative results for MEDLINE searching are shown in Table 6.

A total of 1,708 RCTs were identified (1,234 definite RCTs, 131 quasi-RCTs, and 343 possible RCTs) in the 18 hand searched journals.

DISCUSSION

The response rates from mailing to members of the relevant professional organizations letters requesting participation in this work were very low and suggested that such an approach was not cost-effective. However, no formal costing exercise was undertaken, nor do any formal cost comparisons for other recruitment methods exist. The higher response rate from the British organization may have occurred because the Cochrane Collaboration was established in the United Kingdom and was only emerging at the time the letters were sent. In addition, the letter

Table 3.
Priority list of journals for hand searching (N=26).

Journal (year first published)	MEDLINE Yield	Issues Hand Searched (% Completed)	Prospective Hand Searching
Annals of Emergency Medicine (1972)	102*	276 (100.0)	Yes
Journal of Trauma (1961)	43*	348 (100.0)	Yes
Injury (1969)	19*	260 (100.0)	Yes
American Journal of Emergency Medicine (1983)	18*	72 (100.0)	Yes
Burns (1974)	18*	251 (100.0)	Yes
Journal of Orthopaedic Trauma (1987)	14*	32 (100.0)	No
Accident Analysis and Prevention (1969)	13*	156 (100.0)	Yes
Pediatric Emergency Care (1986)	11*	54 (100.0)	Yes
Archives of Orthopaedic and Trauma Surgery (1948)	10*	102 (100.0)	No
Journal of Emergency Medicine (1983)	8*	72 (100.0)	No
Journal of Neurotrauma (1984)	8*	44 (100.0)	Yes
Journal of Accident and Emergency Medicine (1984)	6*	44 (100.0)	Yes
Journal of Burn Care and Rehabilitation (1985)	28†	30 (100.0)	Yes
Resuscitation (1972)	10†	576 (100.0)	Yes
Kokyu-To-Junkan (Respiratory and Circulation) (1953)	6†	192 (37.2)	No
Emergency Medicine Clinics of North America (1983)	4†	12 (23.1)	No
Journal of Emergency Nursing (1975)	3†	0 (0)	No
Accident and Emergency Nursing (1993)	0†	8 (66.6)	Yes
Academic Emergency Medicine (1994)	—	12 (100.0)	Yes
Emergency Medicine (Australia) (1990)	—	24 (100.0)	Yes
European Journal of Emergency Medicine (1994)	—	8 (100.0)	Yes
Journal of the British Association for Immediate Care (1978)	—	18 (81.8)	No
Journal of Head Trauma Rehabilitation (1986)	—	16 (42.1)	Yes
Journal of Wilderness Medicine (1990)	—	24 (100.0)	Yes
Journal of Wound Care (1992)	—	30 (75.0)	No
Prehospital and Disaster Medicine (1981)	—	8 (16.6)	Yes

—, Journal not indexed on MEDLINE.

*Yield of MEDLINE search for "random\$" in the text of the title or abstract, 1989–1993.

†Yield of MEDLINE search for RCTs using Phase One of RCT search strategy,⁸ 1991–1995.

referred to UK- rather than US-based experts. No clear motivation for collaboration in this work could be determined because of the low response rates. The heading, “The pursuit of medical practice based on scientific evidence” yielded the highest response from both organizations, but the results did not reach statistical significance.

The 62 journals on the current list of emergency medicine journals is by no means comprehensive. In part, this is a result of the incorporation of some relevant journals into the work of other groups within the Cochrane Collaboration. However, it may also reflect a failure to identify other rele-

vant journals, especially non-English-language ones. It is acknowledged that not all journals on the current list publish primary research. It should be noted, however, that only 18 (29.0%) of the 62 emergency medicine journals identified in this study were indexed by MEDLINE.

Searching results showed that, for the 14 emergency medicine journals indexed by MEDLINE for which hand searching was completed, hand searching led to the identification of 227 (32.0%) RCTs (primary articles) not found through MEDLINE searching. However, hand searching, although statistically significantly better than MEDLINE searching, failed to identify 118 (16.6%) of the RCTs found by MEDLINE searching, suggesting that hand searching is not a “gold standard” method and that the dual approach, promoted by the Cochrane Collaboration, may be the optimal approach for journals indexed by MEDLINE.

One possible explanation for this last result may be that the volunteer hand searchers did not have the specific knowledge required to identify RCTs and were trained at a distance through receipt of a training package. The number of missed RCTs may have been reduced if we had instituted a minimum scientific knowledge requirement or trained hand searchers in person before commencing the task. Results of hand searching for RCTs by persons recruited and trained by other techniques have not been published.

Table 4.

Number of primary RCTs identified from MEDLINE searching and hand searching in 14 emergency medicine journals indexed by MEDLINE.*

Hand Searching	MEDLINE Searching		Total
	Identified	Not Identified	
Identified	365	227	592
Not identified	118	0	118
Total	483	227	710

*McNemar’s χ^2 test (1 df), 33.8 ($P < .0001$). Proportional difference (proportion identified by hand searching and MEDLINE searching), 15.4 (95% CI, 10.4 to 20.4; $P < .0001$).

Table 5.

Number of primary RCTs identified by hand searching and MEDLINE searching for the 14 journals indexed by MEDLINE, by journal.

Journal	Total RCTs Identified	Hand Searching No. (%)	MEDLINE Searching No. (%)	Proportional Difference CI (95%)*
Accident Analysis and Prevention	16	14 (87.5)	2 (12.5)	75.0 (42.7 to 100.0) [†]
American Journal of Emergency Medicine	41	38 (92.7)	25 (61.0)	31.1 (13.3 to 50.1) [†]
Annals of Emergency Medicine	202	171 (84.7)	177 (87.6)	-3.0 (-10.3 to 4.3)
Archives of Orthopaedic and Trauma Surgery	37	32 (59.3)	15 (40.5)	19.0 (-12.6 to 50.6)
Burns	57	56 (98.2)	18 (31.6)	66.7 (53.5 to 79.9) [†]
Injury	63	49 (77.8)	50 (79.4)	-1.6 (-17.8 to 14.6)
Journal of Accident and Emergency Medicine	28	28 (100.0)	1 (3.6)	96.4 (89.5 to 100.0) [†]
Journal of Burn Care and Rehabilitation	54	32 (59.3)	38 (70.4)	-11.1 (-33.3 to 11.1)
Journal of Emergency Medicine	13	7 (53.8)	6 (46.2)	7.7 (-46.6 to 62.0)
Journal of Neurotrauma	9	7 (77.8)	8 (88.9)	-11.1 (-48.1 to 25.9)
Journal of Trauma	134	105 (78.4)	101 (75.4)	3.0 (-8.5 to 14.57)
Journal of Orthopaedic Trauma	23	20 (87.0)	20 (87.0)	0.0 (-20.9 to 20.9)
Pediatric Emergency Care	15	15 (100.0)	10 (66.7)	33.3 (9.1 to 56.9) [†]
Resuscitation	18	18 (100.0)	12 (66.7)	33.3 (11.2 to 54.8) [†]
Total	710	592 (83.4)	483 (68.0)	15.4 (10.4 to 20.4)[†]

*Where the proportional difference is negative, hand searching identified fewer RCTs than MEDLINE searching.

[†]The proportional difference is statistically significant ($P < .05$).

The results of the comparison of hand searching with MEDLINE searching should be interpreted with reference to the following issues. The comparison was based on the use of a comprehensive search strategy (Figure 2), optimally developed by the Cochrane Collaboration for MEDLINE. The results obtained cannot be generalized to MEDLINE searching by ad hoc search strategies nor to other electronic databases (eg, EMBASE). In addition, since this study was conducted, the Cochrane Collaboration has worked with the National Library of Medicine in the USA to ensure that RCTs not coded as such on MEDLINE are retagged. Quasi-RCTs and possible RCTs are being retagged with the medical subject heading (MeSH) and publication type (PT) "CONTROLLED CLINICAL TRIAL (CCT)." This program has dramatically increased the number of RCTs correctly indexed on MEDLINE.^{17,18}

Complete identification of relevant studies is particularly important for a systematic review. In this study, an additional 21 RCTs (primary articles) were identified in the 4 journals not indexed by MEDLINE. Similarly, 285 conference abstracts reporting the results of RCTs and 692 abstracts reporting the results of RCTs published elsewhere were identified in the 18 journals searched. It is possible that a proportion of these latter 2 categories could have been identified by MEDLINE searching as a result of being published as primary articles in journals indexed by MEDLINE. However, the rate of subsequent publication of conference abstracts as primary articles determined from research in other areas, approximately 50%, indicates that MEDLINE searching would still miss 143 of these trials.⁹ Excluding conference abstracts and abstracts of RCTs published elsewhere, there was still an excess of 248 primary RCTs identified by hand searching that were not identified by comprehensive MEDLINE searching in the 18 journals.

Systematic reviews require that every effort be made to identify all eligible RCTs, so as to avoid any bias that may arise if only "selected" reports are used. It remains to be demonstrated that the additional RCTs found by hand searching would change the results of systematic reviews comprising RCTs identified by comprehensive MEDLINE searching alone. Does selection bias, English-language bias, or publication bias have an impact on the results of systematic reviews? It is usual at the stage of systematically reviewing the evidence to assess its quality. Are better-quality studies reported more clearly and in higher-profile journals, and are they therefore more likely to be identified from comprehensive MEDLINE searching?

All of the RCTs identified in this project are being added to the Cochrane Controlled Trials Register, available in the Cochrane Library, and to the International Register of RCTs coordinated by the Baltimore Cochrane Center. In addition, we are currently undertaking research study to further describe the RCTs identified in this study. This will help answer important questions concerning the prevalence and quality of reporting of RCTs relevant to emergency medicine. It will also make clearer those aspects of emergency medicine that have been evaluated in RCTs and are therefore ripe for systematic review. Such reviews will provide important information on the effects of interventions in emergency medicine and identify those areas that need further primary research. It is hoped that improved identification of RCTs in the emergency medicine literature will facilitate the creation of problem-based Collaborative Review Groups for carrying out systematic reviews.⁸

Finally, improved indexing of RCTs on MEDLINE relies on journal editors' and authors' ensuring that future reports of RCTs use the term "randomized controlled trial" in the title or abstract and incorporate an explicit description of how the comparison groups were generated in the methods section, to allow readers to assess the method of randomization or allocation to treatment group, as has been agreed by leading journal editors.¹⁹

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Journals providing complimentary subscriptions: *Injury, Burns, Accident and Emergency Nursing, Resuscitation, American Journal of Emergency Medicine, Annals of Emergency Medicine, Journal of Emergency Medicine, Journal of Head Trauma Rehabilitation, Journal of Neurotrauma, Journal of Trauma, and Pediatric Emergency Care.*

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REFERENCES

1. Sackett DL, Haynes RB, Guyatt GH, et al: *Clinical Epidemiology: A Basic Science for Clinical Medicine*. Toronto: Little, Brown, 1991.
2. Antman EM, Lau J, Kupelnick B, et al: A comparison of results of meta-analyses of randomized controlled trials and recommendations of clinical experts: Treatment for myocardial infarction. *JAMA* 1992;268:240-248.

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3. Peto R: Why do we need systematic overviews of randomized controlled trials? *Stat Med* 1987;6:233-240.
 4. Schwartz D, Lellouch J: Explanatory and pragmatic attitudes in therapeutical trials. *J Chronic Dis* 1967;20:637-648.
 5. Anonymous: Systematic overview of controlled trials (meta-analyses) helps clarify treatment effects. *Drugs Ther Bull* 1992;30:25-27.
 6. Chalmers I, Hetherington J, Newdick M, et al: The Oxford Database of Perinatal Trials: Developing a register of published reports of controlled trials. *Control Clin Trials* 1986;7:306-324.
 7. Chalmers I, Dickersin K, Chalmers TC: Getting to grips with Archie Cochrane's agenda [editorial]. *BMJ* 1992;305:786-788.
 8. Dickersin K, Scherer R, Lefebvre C: Identifying relevant studies for systematic reviews. *BMJ* 1994;309:1286-1291.
 9. Scherer RW, Dickersin K, Langenberg P: Full publication of results initially presented in abstracts: A meta-analysis. *JAMA* 1994;272:158-162.
 10. Dickersin K, Min YI: NIH clinical trials and publication bias. *Online J Curr Clin Trials* [serial online] 1993;doc 50.
 11. Anonymous: Cochrane's legacy [editorial]. *Lancet* 1992;340:1131-1132.
 12. *The Cochrane Library*: Issue 2. Oxford: Update Software, 1999.
 13. *ULRICH's Plus* [database on CD-ROM]. New Providence, NJ: RR Bower/Reed Reference Electronic Publishing, Winter 1992-1993.
 14. *MEDLINE: OVID for Windows 3.0, release version 5.3*. New York: OVID, 1995.
 15. Pocock SJ: *Clinical Trials: A Practical Approach*. Chichester, NY: John Wiley & Sons, 1997.
 16. Dickersin K, Larson K: Establishing and maintaining an international register of RCTs, in Sackett D, Oxman A (eds): *Cochrane Collaboration Handbook*. Oxford: The Cochrane Collaboration, 1995: V1-V51.
 17. McDonald SJ, Lefebvre C, Clarke MJ: Identifying reports of controlled trials in the *BMJ* and the *Lancet*. *BMJ* 1996;313:1116-1117.
 18. Cochrane Collaboration: CENTRAL: The building blocks of Cochrane reviews. *Cochrane News Letter* July 1997;No. 11:1. ISSN 1324-1257.
 19. Begg C, Cho M, Eastwood S, et al: Improving the quality of reporting of randomized controlled trials: The CONSORT statement. *JAMA* 1996;276:637-639.