REVIEW

How to run an effective journal club: a systematic review

Y. Deenadayalan BPT IMMP BEHM (MBA),[1] K. Grimmer-Somers PhD MMedSci BPhty,[2] M. Prior BPhty (Hons)[1] and S. Kumar PhD MPT BPT[3]

[1]Researcher, Centre for Allied Health Evidence, University of South Australia, City East Campus, Adelaide, Australia
[2]Director, Centre for Allied Health Evidence, University of South Australia, City East Campus, Adelaide, Australia
[3]Deputy Director, Centre for Allied Health Evidence, University of South Australia, City East Campus, Adelaide, Australia

Keywords
effectiveness, evidence-based, format, health, journal club, processes

Correspondence
Professor Karen Grimmer-Somers
Centre for Allied Health Evidence
University of South Australia
Division of Health Sciences
GPO Box 2471
Adelaide
SA
Australia 5000
E-mail: karen.grimmer-somers@unisa.edu.au

Accepted for publication: 18 April 2008

doi:10.1111/j.1365-2753.2008.01050.x

Abstract

Background Health-based journal clubs have been in place for over 100 years. Participants meet regularly to critique research articles, to improve their understanding of research design, statistics and critical appraisal. However, there is no standard process of conducting an effective journal club. We conducted a systematic literature review to identify core processes of a successful health journal club.
Method We searched a range of library databases using established keywords. All research designs were initially considered to establish the body of evidence. Experimental or comparative papers were then critically appraised for methodological quality and information was extracted on effective journal club processes.
Results We identified 101 articles, of which 21 comprised the body of evidence. Of these, 12 described journal club effectiveness. Methodological quality was moderate. The papers described many processes of effective journal clubs. Over 80% papers reported that journal club intervention was effective in improving knowledge and critical appraisal skills. Few papers reported on the psychometric properties of their outcome instruments. No paper reported on the translation of evidence from journal club into clinical practice.
Conclusion Characteristics of successful journal clubs included regular and anticipated meetings, mandatory attendance, clear long- and short-term purpose, appropriate meeting timing and incentives, a trained journal club leader to choose papers and lead discussion, circulating papers prior to the meeting, using the internet for wider dissemination and data storage, using established critical appraisal processes and summarizing journal club findings.

Background

Journal clubs are a well-recognized quality improvement strategy used by health practitioners to critique and keep up-to-date with relevant health literature [1]. A number of authors [2,3,1] report that Sir William Osler started the first recorded journal club in Britain in 1875, as a way of sharing scant educational resources. He encouraged journal club attendees to apply their updated knowledge from attending the journal club to relevant patient cases [3]. Thus the philosophy of journal club from its inception was to share current knowledge, and translate it into evidence-based patient care.

While there is considerable published literature describing journal clubs conducted in different settings and for different health consumers, there appear to be no 'Gold Standard' processes for conducting a journal club, or to evaluate journal club effectiveness in assisting practitioners translate knowledge into practice. It is therefore an ongoing challenge for clinicians to design and maintain a stimulating, educational and sustainable journal club format that assists the participants to stay up to date with the literature, and to translate journal club activities into evidence-based practice [2]. Thus for clinicians wishing to initiate a journal club in their workplace, reading and evaluating the volume of literature on how to conduct a journal club presents a substantial barrier to establishing the activity.

This paper presents the findings of a systematic review from which information on how to conduct a journal club was extracted. This paper provides recommendations for establishing and conducting journal clubs in a health care setting in a manner which is likely to be effective and sustainable.

Method

Process of systematic review

We first scanned the literature using broad inclusion/exclusion criteria for any peer-reviewed published literature reporting on journal clubs conducted in health environments. From this body of

 © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd,

evidence, after a series of steps, we included in our review those papers which reported on comparative studies and/or controlled trials of the journal club activity, which established measures of its effectiveness. We extracted information from these papers on how journal clubs were conducted, with the aim of developing recommendations regarding the process of running an effective and sustainable journal club in a health setting.

Search strategy

The search was formulated using the following broad parameters:

Population health practitioners of any discipline
Intervention any form of journal club
Comparison any comparator
Outcomes any outcome measure relating to journal club effectiveness, including but not limited to, knowledge, attitudes, skill acquisition, practice behaviours, satisfaction.

Databases and search terms

We searched all available health databases in an attempt to identify relevant journal club literature. These included CINAHL, PsycINFO, PsychARTICLES, ERIC, Medline, AMED, Embase, AARP ageline, Google. For the search we used variations on keywords including 'Journal club', 'health', 'effectiveness' and 'Evidence-based'.

Inclusion criteria

No date limit was set for the search. Articles included in the review were primary research only, available in full text, and written in English. Included papers should reflect the processes of running a health-based journal club (as opposed to journal clubs conducted in other settings), they should report on the health discipline(s) involved in the club as well as the methods/processes by which the journal club was conducted.

Hierarchy of evidence

We searched initially for any article of any research design to establish the size and strength of the body of evidence in this area. We used the CEBM (Oxford Centre for Evidence-based Medicine Levels of Evidence) hierarchy of evidence for intervention studies [4]. We then narrowed our search to only those experimental studies which directly and concurrently compared outcomes from journal club activities with outcomes from other forms of education, or to quasi-experimental or comparative studies which assessed outcomes pre- and post journal club inception.

Search validation

Potentially relevant articles were independently assessed by the authors, who then met to agree on article inclusion.

Additional references

We searched the reference lists of identified articles for other pertinent references that had not been identified during the primary search (Pearling). If secondary evidence was found, the reference list of included primary research papers would be used rather than the individual secondary evidence reference.

Table 1 Criteria for analysis

Participants	Number of participants
	Field of health of participants
Intervention	Group leader
	Preparation (pre-reading)
	Frequency of meeting
	Setting
	Mandatory attendance
	Article choice
	Clinical focus
Format	Case-based format
	Structured evaluation processes
	Faculty supervised
	Internet-based
	Time of day noted
	Formal process
	Food provided
Results	Results reported
	Specific outcomes tested
	Statistical significance

Analysis of the selected articles

The included articles were critically appraised with the McMaster University instrument [5]. This is a generic critical appraisal instrument relevant to any quantitative study. Equally weighted scores are given to 14 criteria, providing a quality rating reflecting how well the authors considered internal and external validity issues in their study design, and reporting.

A purpose-built analytical instrument was then constructed for the review, seeking details on the processes of conducting the journal club, and how the effectiveness of the journal club had been evaluated. This instrument was collated using the range of information found on journal club processes when reading the identified studies in this area. The components of the analytical instrument are provided in Table 1. This instrument underpinned data extraction, as well as a secondary quality evaluation of the included studies. Each element listed in Table 1 was given an equally weighted score, thus studies which reported in detail on journal club processes and evaluation were rated more highly than studies that reported few details.

Results

Search findings

The search yielded 101 articles in the first step of the review. All these articles came directly from searching the listed library databases, and all but one article [6] reflected primary research evidence. This article was a review paper [6] which was not directly relevant to the objective of this review; however, its reference list contained four of the primary articles which had already been identified in our search.

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Table 2 Papers excluded at Step 2, as not being relevant to the review criteria

Author (year)	Level of evidence	Reason for exclusion
Brill, G.F.H. & Yarden, A. (2003) Teachers' journal club: bringing between the dynamics of biological discoveries and biology teachers. *Journal of Biological Education,* 37 (4), 168–170.	Level 3b	Non-health-related – reported on a biology journal club
Collier, E.H., Pyke, S. (2000) Clinical effectiveness on an acute in-patient psychiatric unit. *British Journal of Clinical Governance*, 5(3), 158–163.	Level 3	Did not deal in particular with journal club
Afifi, Y., Davis J., Khan, K., Publicover, M. (2006) The journal club: a modern model for better service and training. *The Obstetrician and Gynaecologist*, 8, 186–189.	Level 5	Dealt mainly with the advantages and disadvantages of journal club
Sherratt, C. (2005) Journal club: a method for occupational therapists to bridge the theory–practice gap. *The British Journal of Occupational Therapy*, 68 (7), 301–306	Level 5	Not adequate description of the journal club process
Turner, P. (2001) Evience-based practice and physiotherapy in the 1990s. *Physiotherapy Theory and Practice*, 17 (2), 107–121	Level 5	Not adequate description of the journal club process
Pearce-Smith, N. (2006) A journal club is an effective tool for assisting librarians in the practice of evidence-based librarianship: a case-study. *Health Information and Libraries Journal*, 23, 32–40.	Level 4	Non-health-related – reported on journal club involving librarians
McGrath, J.P. (2005) Critical thinking and evidence-based practice. *Journal of Professional Nursing*, 21 (6), 364–371.	Level 5	Not adequate description of the journal club process
Atzema, C. (2004) Residents' perspective. *Annals of Emergency Medicine*, 44(2), 169–174.	Level 5	Not adequate description of the journal club process
Alguire, P. (1998) A review of journal clubs in postgraduate medical education. *Journal of General Internal Medicine*, 13, 347–353.	Level 5	Not adequate description of the journal club process
Kellum, J., Reiker, J. P. & Power, M. (2000) Teaching critical appraisal during critical care fellowship training: a foundation for evidence-based critical care medicine. *Critical Care Medicine*, 28, 3067–3070.	Level 3b	Not adequate description of the journal club process
Tucker, J., Gao, X., Wang, S., Chen, Q., Yin, Y. & Chen, X. (2004) Organising an English journal club in the developing world. *Postgraduate Medicine Journal,* 80, 436–437.	Level 5	commentary

Of the articles identified in the first step of the review, 32 were potentially relevant based on title, abstract or methods. The most common reasons for exclusion of articles from this review after Step 1 were that the articles did not relate to a health field, and they did not provide sufficient (any) detail on the processes of running a journal club. The references of the excluded articles, and the reasons for exclusion, are reported in Appendix 1.

The second step of the review was independent consideration by the research team of the 32 potentially relevant articles, of which 21 articles entered the review process. Reasons for further exclusion of articles at Step 2 were that the potentially relevant articles were unavailable in full text, they did not include information on the methods by which journal clubs were conducted (despite appearing appropriate at Step 1), or they did not report on health settings. As examples of articles excluded for this reason, Brill [7] reported on a biology journal club, and Pearce-Smith [8] reported a journal club in which librarians took part. Table 2 lists the references excluded at Step 2 and the reasons for exclusion.

Figure 1 demonstrates the process of article inclusion for this review.

The 21 included papers report journal club interventions for most major medical specialties, and nursing, thus providing a broad overview of journal clubs across health fields. The health disciplines of journal clubs included in the review comprised Obstetrics and Gynaecology, Clinical Epidemiology and Biostatistics, Internal Medicine, General surgery, Emergency Medicine, Mental Health, Psychiatrist, Nurse and Geriatric Medicine. Of note was the number of relevant articles published in the 1980s, indicating the longevity of interest in effective journal club processes.

The studies fell into two distinct groups in the research hierarchy, with 12 of the 21 articles (57%) being relevant to further analysis (experimental or comparative studies) (Hierarchy levels 1b or 2b) and the remainder being experiential, personal opinion or programme reports (Hierarchy levels 4 or 5). All 21 papers included for this review are reported in Table 3 in chronological order. Level 1b or 2b hierarchy papers were consistently published over the review time period, highlighting the lengthy interest in journal club effectiveness.

Critical appraisal of the included articles

Scores for critical appraisal of methodological quality ranged from four [9] to 12 [10]. The average quality for the 12 included articles

 © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

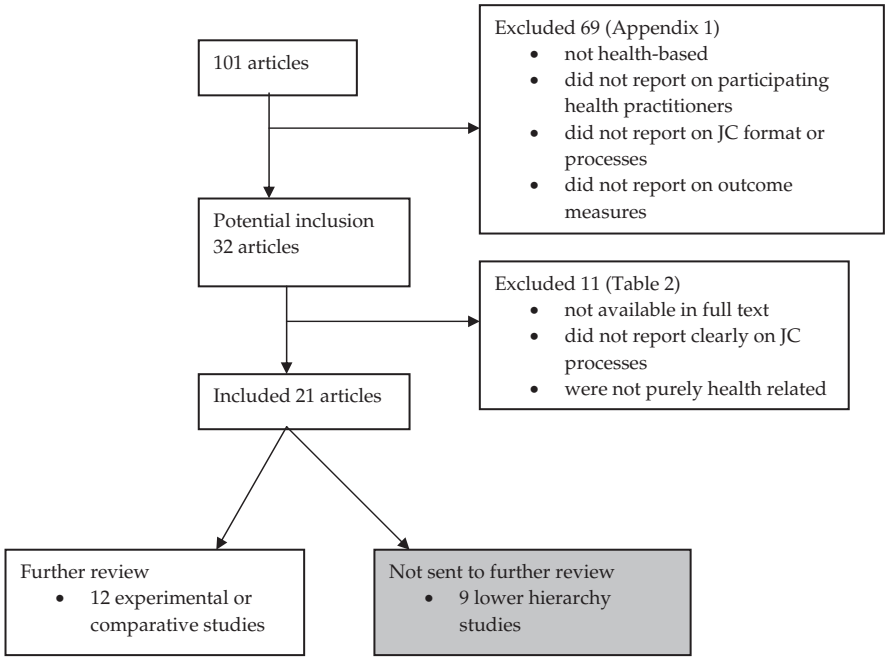

Figure 1 Systematic review consort diagram.

Table 3 Included papers, hierarchy of evidence in chronological order, and critical appraisal scores of included articles

Author (year)	Type of paper/study design	Level of evidence	Critical appraisal
Woods & Winkel (1982)*	Report	level 5	
Joorabchi (1984)*	Report	level 5	
Linzer & Hupart (1987) [13]	Randomized trial	level 2b	9
Linzer *et al.* (1988) [10]	Randomized, controlled educational intervention trial	level 1b	12
Thurnau & Fishburne (1989)*	Report	level 5	
Markert (1989)*	Cohort study	level 4	
Seelig (1991) [14]	Curriculum report	level 2b	7
Langkamp *et al.* (1992) [15]	Controlled prospective trial	level 1b	7
Kitching (1992)*	Report	level 5	
Burstein *et al.* (1996) [16]	Unblinded interventional study	level 1b	7
Sandifer *et al.* (1996)*	Cohort study	level 4	
Spillane & Crowe (1998) [17]	Review of journal club conducted for surgical trainees	level 2b	4
Bazarian *et al.* (1999) [18]	Prospective case controlled trial	level 2b	8
Khan *et al.* (1999) [12]	Feasibility study – prospective	level 1b	9
Fu *et al.* (1999)*	Experimental trial	Level 4	
Letterie & Morgenstern (2000) [9]	Curriculum report	level 2b	4
Owen *et al.* (2001)*	Report	level 5	
Mazuryk *et al.* (2002)*	personal experience based on JC conducted in a tertiary Palliative care unit	level 5	
Macrae *et al.* (2004) [11]	RCT	level 1b	12
Struck *et al.* (2005) [19]	Curriculum-based study	level 2b	7
Mukherjee *et al.* (2006) [20]	Pilot study	level 2b	7

JC, Journal club; RCT, randomized controlled trial
*See separate reference list after main references at the end of this paper.

approximated 56% of the total quality criteria (mean 8; SD 2.4). There was no significant difference between the methodological quality scores for levels 1b and 2b articles, as determined by independent *t*-tests ($P > 0.05$). Table 3 includes the type of research design and the hierarchy of evidence of each paper and the critical appraisal scores for the included articles.

Aims of the included papers

All included papers had similar site-specific or participant-specific aims. The most frequent improvement sought from journal club intervention was in knowledge of biostatistics and/or epidemiology, or critical appraisal skills. All but one of the

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

papers was explicitly curriculum (training)-based [11]. Overall, the included papers reported journal club objectives which aimed to improve participants' reading habits, skills in critical appraisal skills, knowledge of current medical literature, research methods and statistics. None of the papers reported that the journal clubs aimed to directly translate research evidence into clinical practice. Two papers [11,12] made use of computers or the internet to modify the traditional journal club meeting approach. Use of computers provided a permanent storage tool and also an opportunity to readily access research information. Mac Rae [11] reported that the journal club articles were emailed to participants (surgeons) prior to the journal club. This assisted organizers to contact busy surgeons in different parts of Canada quickly and effectively. The primary aims of the included papers comprised:

Linzer & Hupart (1987) [13]
- determine whether a journal club process improved understanding of biostatistical and epidemiological principles;
- establish the impact of journal club on house staff members' reading behaviours

Linzer *et al.* (1988) [10]
- determine whether a journal club improves medical house-staff reading habits, knowledge of epidemiology and biostatistics and critical appraisal skills

Seelig (1991) [14]
- investigate whether a limited adult education intervention could change staff residents' attitudes, behaviours and knowledge of critical appraisal

Langkamp *et al.* (1992) [15]
- improve paediatric residents' knowledge of clinical epidemiology, biostatistics and critical appraisal

Burstein *et al.* (1996) [16]
- improve overall satisfaction with journal club activities in a group of emergency medicine residents

Spillane & Crowe (1998) [17]
- determine the success of a journal club activity in developing critical appraisal skills of registrars, relating to recent important articles in surgical literature;
- provide a convivial social gathering to support the previous aim

Bazarian *et al.* (1999) [18]
- compare the performance of an evidence-based medicine approach and a traditional approach to teaching critical appraisal skills to emergency medicine residents

Khan *et al.* (1999) [12]
- assess the feasibility of a new educational programme to teach critical appraisal of medical literature to postgraduate trainees

Letterie & Morgenstern (2000) [9]
- develop a curriculum in epidemiology and biostatistics for instruction of medical residents, and assess participants' response to this format

Mac Rae *et al.* (2004) [11]
- evaluate whether an internet-based intervention would lead to enhanced critical appraisal skills in practicing surgeons

Struck *et al.* (2005) [19]
- assess the impact of a mandatory 4-week geriatric medicine clerkship on third year students in three areas: knowledge, skills and attitude using a pre- and post knowledge test, student satisfaction survey and written comments

Mukherjee *et al.* (2006) [20]
- evaluate a modified journal club format developed in an academic department of a medical school, combining critical appraisal of qualitative and quantitative literature.

Participants

The number of study participants ranged from 12 to 135. Most participants were students enrolled in university courses or post-graduation medical programmes run in training hospitals. Undergraduates, graduates undertaking clinical training and clinicians were involved. Also reported were studies involving post-graduation participants (general surgeons or staff in public health medicine departments).

Preparation for journal club

There was considerable variability in the expected preparation for journal clubs, from compulsory reading, compulsory training and attendance, through to voluntary attendance and no preparation. Although most articles mentioned attendance of journal club members and the requirement of pre-preparation of articles, only Burstein [16] mentioned measuring compliance with pre-preparation and attendance.

The processes of preparation for journal club differed widely. Variations included the presenter seeking group input for article selection, articles chosen for relevance to current programmes of clinical study, clinical cases and provision of structured work sheet to help with data extraction and critical appraisal. Preparation time for those who attended the journal club varied. In some articles this was not mentioned at all. In others, although preparation was mentioned, the articles did not mention the amount of preparation time or when the article was distributed to the participants prior to journal club meeting. Evaluation of journal club processes also varied, and included evaluation of the actual process of the club, through to evaluation of the learning from journal club.

Effectiveness of journal club

Of the 12 experimental or comparative papers included in the review, 10 reported significant differences in a number of learning outcomes (83% papers), indicating that journal club activities made a significant impact on at least one outcome measure when compared with a control activity (such as lectures or general reading) or before and after the journal club activity. Significant improvements were reported in knowledge of biostatistics and research design or in critical appraisal skills. Of the two papers which did not report significant findings, one did not report on statistical tests [18], although it reported benchmark information on the amount of reading and critical thinking which could be produced by a journal club intervention. The other reported no significant difference in outcomes between journal club and a control educational group [15]. A range of outcome measures were reported papers, many of which were purpose-built. Few mentioned the psychometric properties of the instruments/assessment methods for the outcome measures used to test the effectiveness of journal club. Table 4 reports on the key outcomes reported in the included papers, and indicate the papers which reported significant differences in these outcomes (compared with a control group, or compared pre–post within the

 © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Table 4 Outcomes reported from the comparative studies

Linzer & Hupart (1987) [13]	Sig	Perceived reading habits of JC members significantly improved, with increased number of articles read/month
Linzer *et al.* (1988) [10]	Sig	86% of JC reported improved reading behaviour, and 80% reported improved ability to critically read
Seelig (1991) [14]	Sig	Improved ability to appraise original research articles critically ($P = 0.01$), improved critical appraisal knowledge ($P = 0.02$)
Langkamp *et al.* (1992) [15]	Non-sig	No significant change in any educational outcomes
Burstein *et al.* (1996) [16]	Sig	Overall satisfaction $P = 0.04$, critical appraisal skills $P = 0.22$, clinical education skills $P = 0.05$
Spillane & Crowe (1998) [17]	Sig	22/ 28 respondents rated good to very good for review of recent surgical literature. 26/28 reported good to excellent on developing critical appraisal skills. All reported good to excellent at achieving a convivial social forum.
Bazarian *et al.* (1999) [18]	No statistical reporting	Journal reading habits improved of all participants: read > 2 journal articles per week; read journal articles primarily for patient care; find journal articles very useful in clinical practice; spend >30 min/day reading
Khan *et al.* (1999) [12]	Sig	Reading time improved from 2.0 hours to 3.5 hours ($P = 0.026$) and knowledge and critical appraisal scores improved from 50.8 to 62.9 ($P = 0.003$).
Letterie & Morgenstern (2000) [9]	Sig	85% participants expressed interest in continuing the format without a major change.
Macrae *et al.* (2004) [11]	Sig	Participants performed better in test of critical appraisal skills than control group (mean score 58% +/– 8 vs. 50% +/– 8) with a large effect size of 1.06 SD units.
Struck *et al.* (2005) [19]	Sig	Comparing pre–post knowledge test scores showed improvement ($P < 0.001$). On self-report, 50% agreed or strongly agreed that journal club experience assisted them in improving clinical skills
Mukherjee *et al.* (2006) [20]	Sig	The largest changes were seen in those with the least initial experience of reading and appraising qualitative papers. A significant level of change in confidence was noted ($P = 0.012$)

same group of participants). Further details of the outcomes assessed in the studies are provided in Appendix 2. Table 5 reports on the elements of the assessment processes used to determine the significance of impact of journal club, and highlight the salient features of instrument development and construction.

Using the criteria outlined in Table 1, the critical evaluation of the journal club processes reported in the included papers is outlined in Table 6. The highest scoring paper regarding description of journal club processes was Burstein [16], with 15/19 criteria reported, and the lowest scoring paper was Letterie [19], with only 8/19 criteria reported. There was moderate correlation between the scores from the process evaluation and the critical appraisal of methodological quality (Pearson $r = 0.51$). Letterie (2000) [19] scored lowest on both methodological quality and process reporting. Langkamp [15], the only paper not reporting a significant effect of a journal club intervention, had similar methodological critical appraisal scores and process reporting scores (7 and 12 respectively) compared with the other 11 papers, and thus it was unlikely that the non-significant findings were related to either methodological quality or reported journal club processes.

Journal club processes

The journal club processes which were reported by all included papers were field of health of participants, the setting in which journal club took place, the structured evaluation processes of journal club and description of outcomes which were evaluated. Having a clear journal club leader and a nominated supervisor of the journal club activities was reported in 11 papers (92%), and statistical significance of the comparisons between outcomes, and the number of participants involved in the journal club studies was reported in 10 papers (83%). The frequency of journal club meetings was reported in nine papers [9–13,15–18] (75%) as weekly or monthly (with monthly predominating), and eight papers reported on who initiated the choice of papers, the actual processes by which journal clubs were conducted and specific evaluation/comparison results (66.7%). The initiator of choice of papers was mostly the facilitator who generally held a respected leadership role in the group (consultant, academic leader or author of the paper under discussion). Journal club peers were reported as being involved in choosing papers for discussion in only two articles [13,19]. Six papers [10,12,13,16–18] (50%) reported chosen papers for the journal club having a direct clinical focus with only one paper reporting on presentations directly linked to clinical cases. In all other cases the chosen papers were for methodological or research design reasons. Five papers [10,11,13,15,16] (42%) reported on journal clubs having pre-reading sent out at variable (and mostly unnoted) times, which could be up to 10 days prior to the meeting. Two papers [11,12] reported on mandatory attendance or use of the internet (17.7%) and one paper [17] reported on the availability of food to increase the conviviality of the learning experience (8%). The timing of journal club was only reported explicitly in three papers – lunchtime [12,15] and evening [17].

Discussion

This review found a surprising number of experimental or comparative studies written over the past 25 years which described different journal club models across a range of health disciplines. This suggests that participation in journal clubs is a well-accepted

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Table 5 Elements of outcome measures

	Assessment instrument						Elements being assessed				
	Validity	Reliability	five-point scale	Likert scale	Delphi method	Written feedback/essay	Critical reading skills	Reading habits	Satisfaction	Knowledge	Instructional
Linzer & Hupart (1987) [13]	✓		✓				✓	✓		✓	
Linzer *et al.* (1988) [10]	✓	✓			✓		✓	✓		✓	
Seelig (1991) [14]				✓			✓	✓		✓	
Langkamp *et al.* (1992) [15]							✓			✓	
Burstein *et al.* (1996) [16]				✓			✓		✓	✓	
Spillane & Crowe (1998) [17]			✓				✓		✓		
Bazarian *et al.* (1999) [18]		✓				✓	✓	✓			
Khan *et al.* (1999) [12]	✓	✓					✓	✓		✓	
Letterie & Morgenstern (2000) [9]									✓		✓
Macrae *et al.* (2004) [11]	✓	✓		✓			✓				
Struck *et al.* (2005) [19]				✓		✓	✓	✓	✓	✓	
Mukherjee *et al.* (2006) [20]				✓			✓	✓			

Table 6 Processes of journal club reported in the included papers

		Linzer & Hupart (1987) [13]	Linzer *et al.* (1988) [10]	Seelig (1991) [14]	Langkamp *et al.* (1992) [15]	Burstein *et al.* (1996) [16]	Spillane & Crowe (1998) [17]	Bazarian *et al.* (1999) [18]	Khan *et al.* (1999) [12]	Letterie & Morgenstern (2000) [9]	Macrae *et al.* (2004) [11]	Struck *et al.* (2005) [19]	Mukherjee *et al.* (2006) [20]
Participants	Number of participants	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
	Field of health of participants	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Intervention	Clear leader	✓	✓	✓	✓	✓	✓	✓	✓ (peer)	✓	✓		✓
	Preparation (pre-reading)	✓	✓		✓	✓					✓		
	Frequency of meeting	✓	✓		✓	✓	✓	✓	✓	✓	✓		
	Setting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mandatory attendance			✓		✓							
	Who initiated article choice	✓	✓		✓	✓	✓	✓	✓			✓	
	Clinical focus	✓	✓			✓	✓	✓	✓				
Format	Case-based format							✓					
	Structured evaluation processes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nominated supervisor	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Internet-based								✓		✓		
	Time of day noted				✓		✓		✓				
	Formal process	✓	✓	✓		✓		✓		✓		✓	✓
	Food provided						✓						
Results	Specific results reported	✓	✓	✓		✓			✓		✓	✓	✓
	Description of outcomes tested	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Statistical significance reported	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
Total		14	14	11	12	15	12	13	13	8	12	9	10

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

mechanism for demonstrating commitment to evidence-based practice; however, there is little information on the most effective way of conducting a journal club to gain the most educational benefit from it. There is no standard method for conducting journal clubs, evaluating knowledge uptake as a result of participation in journal clubs or tracking knowledge uptake through to knowledge implementation.

Although there was consistent statistical evidence of the effectiveness of journal clubs in improving knowledge, there was little evidence of longevity of evidence-uptake or application. This would seem to be an area for further research, particularly in light of knowledge acquisition half-life, and the half-life of published research in different fields [13]. The common use of purpose-built, self-reported and non-validated outcome measures raises issues of the believability of the reported impact of journal club, and the generalizability of journal club formats to other journal club situations.

Struck [19] is the only paper which clearly mentioned additional educational interventions to the journal club. These researchers used a 4-week clerkship programme where students participated in interactive lectures, problem-based learning with a faculty facilitator in addition to the journal club sessions. The findings reported by Struck suggest that this barrage of learning opportunities increased participants' exposure to knowledge acquisition, and hence the likelihood of sustainability of learning.

Only three papers [12,18,19] mentioned the journal club format being based on learning related to clinical cases. This would appear to be an important component when bridging the gap between theory and practice of evidence, in order to assist the implementation of evidence into clinical practice [2]. Four articles only [13,16–18] described providing initial assistance for participants in choosing relevant articles for journal club, and supporting them to make their own choices as they gained more experience in conducting journal clubs. Article selection and its relevance to the attendees would appear to be a key element of a successful journal club in order to improve reading and critical appraisal skills and knowledge, and to encourage knowledge uptake to improve patient care [3].

Participant preparation appears to be a key factor to facilitate healthy and meaningful discussion during journal club sessions. Only one paper [16] followed through in evaluating this component until the end of the study. Distribution of the journal club reading to participants varied from up to 10 days prior to the meeting, to the start of journal club session. Compliance with being prepared for journal club was rarely reported, although this would appear to be critical to full participation in discussions and learning opportunities.

The optimum frequency of journal club meetings has not been established. Most articles mentioned that journal clubs were conducted monthly [9,11,15–18], noted that journal clubs, if conducted too often, diminished participant interest in attending. Based on the frequency with which monthly journal clubs were reported, it seems that this time period could be recommended.

Few articles reported on when journal club was best conducted, and with what incentives. Langkamp [15] discussed the relationship between the timing of the journal club, incentives to attend and the attendance rate. They suggested that journal club conducted during lunch time with no provision of food may be a reason for low attendance, and they suggest provision of food as one method to attract participants to attend journal club and contribute to discussions. Bazarian [18] concurred, reporting that informal sessions with food provision impacted significantly on attendance rates.

Only two articles [11,12] reported the use of the internet to support journal clubs. Both authors report positive findings. Given the dramatic increase in the use of the internet over even the past 5 years it is not surprising that there are few papers regarding this phenomenon. The use of the internet could significantly enhance traditional methods of journal club. Thus, we could expect future journal clubs to be conducted using electronic media.

Conclusion

This paper provides a synthesis of the scant published literature regarding the processes of conducting an effective journal club in a health setting. While the literature included in this review varied in terms of participants, processes of journal club interventions and evaluation processes, there were consistent findings regarding the effectiveness of journal clubs in health settings to improve knowledge and skills. The literature provides sound underpinnings from which to make recommendations about best practices when establishing a new health journal club. There are common elements that seem to be important when organizing and conducting a journal club that have the potential to significantly influence participants' attendance and uptake of new knowledge and skills. We recommend a number of broad questions that should be asked prior to establishing the journal club, and sub-questions that may assist in establishing an effective, sustainable journal club.

Journal club attendance

- Establish a journal club group of members of the same discipline, or similar interests within a clinical specialty.

Journal club purpose

- Have an established and agreed overarching goal for the long term journal club intervention. The overarching journal club purpose should be reviewed regularly, and agreed by participants
- Establish the purpose of each journal club meeting, and link this to the paper being read, or the skill acquisition being addressed.

Structure of an effective journal club

- Regular attendance should be expected and recorded. Attendance may be mandatory, particularly if the journal club has a curriculum-based format
- Conduct journal clubs at regular predictable intervals (suggest monthly)
- Conduct journal club at an appropriate times of the day for all participants
- Provide incentives to attend such as food (which is shown to increase attendance as well as the conviviality of the occasion).

Leading journal club

- Journal clubs appear to be more effective if they have a leader. The journal club leader should be responsible for identifying relevant articles for discussion, however the final choice needs to be decided by the journal club members

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

• Train the leader/facilitator of the journal club in relevant research design and/or statistical knowledge so as to appropriately direct group discussions and assist the group to work towards its goals
• The leader can change from meeting to meeting, however he/she needs to have the skills to present the paper under discussion and lead the group adequately. It is a fine balance between choosing a leader of high academic standing whose expertise may stifle discussion, or choosing a leader from peers who may not have the requisite understanding of the paper under discussion
• Provide access to a statistician to assist the leader in preparing for journal club, and to answer questions that may arise from the journal club discussion.

Choosing articles for discussion

• Choose relevant case-based or clinical articles for discussion. These papers should be of interest to all participants. Articles should be chosen in line with the overarching purpose of the journal club
• Identify one journal club member (either the designated leader or a member) who has the responsibility for identifying the literature to be discussed for each meeting. This person should also lead the discussion on the article at the journal club.

Circulating articles for discussion

• Provide all participants for each journal club (in addition to the leader) with pre-reading at a suitable time period prior to the journal club (may be up to a week prior). Participants should agree to the time frame for pre-reading. In some curriculum-based situations, assessment of whether pre-reading has occurred may be appropriate
• Use the internet as a means of distributing articles prior to the meeting, maintaining journal club resources and optimizing use of time and resources.

Efficiently running the journal club

• Use established critical appraisal approaches and structured worksheets during the journal club session, which leads to healthy and productive discussion
• Formally conclude each journal club by putting the article in context of clinical practice.

Journal club effectiveness

• Depending on the journal club purpose, it may be appropriate to evaluate knowledge uptake formally or informally
• Evaluation should specifically relate to the article(s) for discussion, critical appraisal, understanding of biostatistics reported in the paper and translating evidence into practice.

References

1. Milbrandt, E. B. & Vincent, J. (2004) Evidence-based medicine journal club. *Critical Care*, 8, 401–402.
2. Dirschl, D. R., Tornetta, P. & Bhandari, M. (2003) Designing, conducting and evaluating journal clubs in orthopaedic surgery. *Clinical Orthopaedics and Related Research*, 413, 146–157.
3. Forsen, J. W., Hartman, J. M. & Neely, J. G. (2003) Tutorials in clinical research Part VIII: creating a journal club. *Laryngoscope*, 113, 475–483.
4. Phillips, B., Ball, C., Sackett, D., Bedenoch, D., Straus, S., Haynes, B. & Dawes, M. (2001) Levels of evidence. Oxford Centre for Evidence-Based Medicine Levels of Evidence. Available from: http://www.mcw.edu/FileLibrary/User/fvastalo/Oxford_Levels.pdf (last accessed September 2008).
5. Law, M., Stewart, D., Pollock, N., Letts, L., Bosch, J. & Westmorland, M. (1998) *Critical review form-quantitative studies*. McMaster University. Available from: http://www.srsmcmaster.ca/Portals/20/pdf/ebp/quanreview_form1.doc (last accessed September 2008).
6. Alguire, P. C. (1998) A review of journal clubs in postgraduate medical education. *Journal of General Internal Medicine*, 13 (5), 347–353.
7. Brill, G., Falk, H. & Yarden, A. (2003) Teachers' journal club: bridging between the dynamics of biological discoveries and biology teachers. *Journal of Biological Education*, 37 (4), 168–170.
8. Pearce-Smith, N. (2006) A journal club is an effective tool for assisting librarians in the practice of evidence-based librarianship: a case study. *Health Information and Libraries Journal*, 23, 32–40.
9. Letterie, G. & Morgenstern, L. S. (2000) The journal club. Teaching critical evaluation of clinical literature in an evidence-based environment. *The Journal of Reproductive Medicine*, 45, 299–304.
10. Linzer, M. B. J., Frazier, L. M., DeLong, E. R. & Siegel, W. C. (1988) Impact of a medical journal club on house-staff reading habits, knowledge, and critical appraisal skills. A randomised controlled trial. *Journal of the American Medical Association*, 260 (17), 2537–2541.
11. Macrae, H. M., Regehr, G., McKenzie, M., *et al.* (2004) Teaching practicing surgeons critical appraisal skills with an internet-based journal club: a randomised controlled trial. *Surgery*, 136, 641–646.
12. Khan, K. D. L., Pakkal, M., Brace, V. & Awonuga, A. (1999) Postgraduate journal club as a means of promoting evidence-based obstetrics and gynaecology. *Journal of Obstetrics and Gynaecology*, 19 (3), 231–234.
13. Linzer, M. D. E. & Hupart, K. H. (1987) A comparison of two formats for teaching critical reading skills in a medical journal club. *Journal of Medical Education*, 62, 690–692.
14. Seelig, C. (1991) Affecting residents' literature reading attitudes, behaviors, and knowledge through a journal club intervention. *Journal of General Internal Medicine*, 6, 330–334.
15. Langkamp, D. L., Pascoe, J. M. & Nelson, D. B. (1992) The effect of a medical journal club on residents' knowledge of clinical epidemiology and biostatistics. *Family Medicine*, 24, 528.
16. Burstein, J., Hollander, J. E. & Barlas, D. (1996) Enhancing the value of journal club: use of a structured review instrument. *The American Journal of Emergency Medicine*, 14, 561–563.
17. Spillane, A. J. & Crowe, P. J. (1998) The role of the journal club in surgical training. *The Australian and NewZealand Journal of Surgery*, 68, 288–291.
18. Bazarian, J. J., Davis, C. O., Spillane, L. L., Blumstein, H. & Schneider, S. M. (1999) Teaching emergency medicine residents evidence-based critical appraisal skills: a controlled trial. *Annals of Emergency Medicine*, 34, 148.
19. Struck, B. D., Bernard, M. A. & Teasdale, T. A. (2005) Effect of a mandatoy geriatric medicine clerkship on third-year students. *Journal of American Geriatrics Society*, 53, 2007–2011.
20. Mukherjee, R. A. S., Owen, K. & Hollins, S. (2006) Evaluating qualitative papers in a multidisciplinary evidence-based journal club: pilot study. *Psychiatric Bulletin*, 30, 31–34.
21. Emerson, J. D. & Colditz, G. A. (1983) Uses of statistical analysis in the New England journal of medicine. *New England Journal of Medicine*, 309, 709–712.

 © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

22. Baxt, W. G., Waeckerie, J. F., Berlin, J. A. & Callaham, M. L. (1998) Who reviews the reviewers? Faesibility of using a factitious manuscript to evaluate peer reviewer performance. *Annals of Emergency Medicine*, 32, 310–317.
23. Mac Rae, H. M., Regehr, G., McKenzie, M., Brenneman, F. & McLoed, R. (2004) Assessment of critical appraisal skills. *The American Journal of Surgery*, 187, 120–123.
24. Pope, C. & Mays, N. (1999) Qualitative Research in Healthcare, 2nd edn. London: British Medical Journal Books.

Additional References relating to Table 3

Fu, C. H. Y., Hodges, B., Regehr, G., Goldbloom, D. S., Garfinkel, P. (1999) Is a journal club effective for teaching critical appraisal skills? *Academic Psychiatry*, 23(4), 205–209.

Joorabchi, B. (1984) A problem-based journal club. *Journal of Medical Education*, 59, 755–7.

Kitching, A. (1992) Resusicitating the cardiology journal club. *Canadian Journal of Cardiology*, 8, 520–2.

Markert, R. J. (1989) A research methods and statistics journal club for residents. *Academic Medicine*, 64, 233.

Mazuryk, M., Daeninck, P., Neumann, C. M. & Bruera, E. (2002) Daily journal club: an education tool in palliative care. *Palliative Medicine*, 16, 57–61.

Owen, S., Wheway, J. & Anderson, M. (2001) The use of a journal club and clinical seminars on a 4-year undergraduate, pre-registration mental-health nursing degree. *Nurse Education Today*, 21, 297–303.

Sandifer, Q., Lo, S. V. & Crompton, P. G. (1996) Evaluation of a journal club as a forum to practise critical appraisal skills. *The Journal of the Royal College of Physicians of London*, 30, 520–2.

Thurnau, G. R., Fishburne, J. (1989) Format of an obstetrics and gynaecology journal club and four years' experience. *American Journal of Obstetrics and Gynaecology*, 160, 313–316.

Woods, J. R., Winkel, C. E. (1982) Journal club format emphasising techniques of critical reading. *Journal of Medical Education* 57, 799–801.

Appendix 1: Excluded references

	Reference	Reason for Exclusion
1.	Burke, M.G. (2002) Journal club. *Contemporary Pediatrics*, 24 (3), 88.	didn't report the process of journal club
2.	Hughes, S. (2007) Journal club. *Mental Health Occupational Therapy,* 12 (1), 41–42.	didn't report the process of journal club
3.	Green, B. N. & Johnson, C. D. (2007) Use of a modified journal club and letters to editors to teach critical appraisal skills. *Journal of Allied Health*, 36(1), 47–51.	didn't report the process of journal club
4.	Burke, M.G. (2007) Journal club. School vaccination program reduces spread of influenza. *Contemporary Pediatrics*, 24 (2), 94.	a summary of a journal club meeting
5.	Parkes, J., Hyde, C., Deeks, J. & Milne, R. (2001) Teaching critical appraisal skills in health care settings. *Cochrane Database of Systematic Reviews*, issue 3.	didn't deal with journal club in particular
6.	Huber, C. (2006) Journal club. Sexuality and intimacy issues facing women with breast cancer. *Oncology Nursing Forum*, 33 (6), 1163–1167.	a summary of a journal club meeting
7.	Mayor, P., Boyle, P. & Price, L. (2004) How a research network developed a multidisciplinary journal club. *Professional Nurse,* 19(6), 308–309.	didn't report the process of journal club
8.	Grant, M.J. (2003) Journal clubs for continued professional development. *Health Information & Libraries Journal*, 20 (Suppl. 1), 72–73.	didn't report the process of journal club
9.	Doney, L. & Stanton, W. (2003) Facilitating evidence-based librarianship: a UK experience. *Health Information & Libraries Journal*, 20 (Suppl. 1), 76–88	non-health-related
10.	Palfreyman, S., Tod, A. & Doyle, J. (2003) An integrated approach to evidence based practice. *Developing Practice Improving Care*, 1 (9), 1–4.	didn't deal with journal club in particular
11.	Cutcliffe, J.J.R., Jones, J. & Jackson, A. (2002) Network for psychiatric nursing research journal club. *British Journal of Nursing*, 11 (3): 187–189	didn't deal with journal club in particular
12.	Cutcliffe, J.J.R., Jones, J. & Jackson, A. (2001) Network for psychiatric nursing research journal club. *British Journal of Nursing*, 10 (21), 1412–1413.	didn't report the process of journal club
13.	Network for psychiatric nursing research journal club commentary on Waite A, Carson J, Cullen D, Oliver N, Holloway F, Missenden K (1997) Case management: a week in the life of a clincial case management team. *Journal of Psychiatric and Mental Health Nursing*, 4, 287–294.	commentary
14.	Turner, P. & Mjolne, I. (2001) Journal provision and the prevalence of journal clubs: a survey of physiotherapy departments in England and Australia. *Physiotherapy Research International*, 6 (3), 157–169.	didn't report the process of journal club
15.	Wong, R.A. (2000) Evidence-based practice: a resource for physical therapists. *Issues on Aging*, 23(3), 19–26.	didn't report the process of journal club
16.	Cutcliffe, J.R. & Ward, M.F. (1999) Evaluating clinical supervision. *British Journal of Nursing*, 8 (15), 1010–1012.	didn't report the process of journal club
17.	Sierpina, V.S. (1999) The journal club: a forum for cultural change and the study of alternative and integrative medicine at a university health science center. *Integrative Medicine*, 2(1), 31–34.	didn't report the process of journal club
18.	Wall, A. (1999) Don't forget the Journal Club. *Professional Care of Mother & Child*, 9 (5), 115–116.	didn't report the process of journal club. More like a commentary

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Appendix 1: *Continued*

	Reference	Reason for Exclusion
19.	Roberts, S.T. (1985) A journal club enhances professional development keeping abreast of current nursing literature on maternal–child health. *The American Journal of Maternal Child Nursing*, 10 (4), 271–172.	didn't report the process of journal club
20.	Grant, W.D. (2005) An Evidence-Based Journal Club for Dental Residents in a GPR Program. *Journal of Dental Education*, 69 (6), 681–686.	didn't report the process of journal club
21.	Norman, G.R. & Shannon, S.I. (1998) Effectiveness of instruction in critical appraisal (evidence-based medicine) skills: a critical appraisal. *Canadian Medical Association Journal*, 158,177–181.	didn't deal with journal club in particular
22.	Geddes, J., Reynolds, S. Streiner, D., Szalmari, P. & Haynes, B. (1998) Evidence-based practice in mental health. *Evidence Based Mental Health*, 1, 4–5.	didn't deal with journal club in particular
23.	Forsworth, J. & Campbell, D. (2002) Guidelines for journal club, University of Missouri-Kansas city school of medicine. Available from: http://www.med.umkc.edu/residency/intmed/rotation_curr/journalclub_curr.pdf (last accessed September 2008).	full text not available
24.	Alguire, P.C. (1998) A review of journal clubs in postgraduate medical education. *Journal of General Internal Medicine*,13 (5), 347–353.	didn't describe about journal club process
25.	Palmer, C.V. & Glattke, T. (2007) Efficacy of mandatory continuing education. *Seminars in hearing*, 28 (1), 46–54.	didn't deal with journal club in particular
26.	Grimmer-Somers, K. (2007) Incorporating research evidence into clinical practice decisions. *Physiotherapy Research International*, 12 (2), 55–58.	didn't describe about journal club process
27.	Poliakoff, M. (2007) Journal club. *Nature*, 448 (7155), 731.	didn't describe about journal club process
28.	Rajpal, S., Resnick, D.K. & Baskaya, M.K. (2007) The role of the journal club in neurosurgical training. *Neurosurgery*, 61 (2), 397–403.	didn't describe about journal club process
29.	Kearley, K. (2007) The 6 steps of evidence-based medicine: action plans and changing clinical practice through journal clubs. *Evidence Based Medicine*, 12 (4), 98–100.	didn't describe about journal club process
30.	Shuval, K., Berkovits, E., Netzer, D., Hekselman, I., Linn, S., Brezis, M. & Reis, S. (2007). Evaluating the impact of an evidence-based medicine educational intervention on primary care doctors' attitudes, knowledge and clinical behaviour: a controlled trial and before and after study. *Journal of Evaluation in Clinical Practice*, 13 (4), 581–598.	didn't deal with journal club in particular
31.	Petrozza, P.H. (2007) Journal Club. *Journal of Neurosurgical Anesthesiology*, 19 (3), 200–202.	didn't describe about journal club process
32.	Langer, R. (2007) Journal club. *Nature*, 447 (7146), 757.	didn't describe about journal club process
33.	Vratny, A. & Shriver, D. (2007) Conceptual model for growing evidence-based practice. *Nursing Administration Quarterly. The Perfect Storm: Ratios, Retirement, and Entry Into Practice*, 31 (2), 162–170.	didn't deal with journal club in particular
34.	Bailey, D.M., Bornstein, J. & Ryan, S.A. (2007) Case Report of evidence-based practice: from academia to clinic. *American Journal of Occupational Therapy*, 61 (1):85–91.	didn't deal with journal club in particular
35.	Compton, S.M. (2007) Achieving evidence-based practice: a handbook for practitioners. 2nd edn. *International Journal of Dental Hygiene*, 5 (1), 65–66.	didn't deal with journal club in particular
36.	Haynes, B. (2007) Of studies, syntheses, synopses, summaries, and systems: the '5S' evolution of information services for evidence-based healthcare decisions. *Evidence-Based Nursing*, 10 (1), 6–7.	didn't deal with journal club in particular
37.	Searle, N.S., Thompson, B.M. & Perkowski, L.C. (2006) Making it work: the evolution of a medical educational fellowship program. *Academic Medicine*, 81 (11): 984–989.	didn't deal with journal club in particular
38.	Frohna, A.Z., Hamstra, S. J., Mullan, P.B. & Gruppen, L. D. (2006) Teaching medical education principles and methods to faculty using an active learning approach: The University of Michigan Medical Education Scholars Program. *Academic Medicine*, 81 (11), 975–978.	didn't deal with journal club in particular
39.	Penz, K.L., & Bassendowski, S.L. (2006) Evidence-based nursing in clinical practice: implications for nurse educators. *Journal of Continuing Education in Nursing*, 37 (6), 250–254.	didn't deal with journal club in particular
40.	Shaneyfelt, T., Baum, K.D., Bell, D. Feldstein, D., Houston, T.K., Kaatz, S., Whelan, C. & Green, M. (2006) Instruments for evaluating education in evidence-based practice: a systematic review. *Journal of American Medical Association*, 296 (9), 1116–1127.	didn't describe in particular about journal club
41.	Kallen, A.J., Wilson, C.T., Russell, M.A., Larson, R.J., Davies, L., Sirovich, B.E., Schwartz, L.M., Woloshin, S. & Welch, H.G. (2006) Group writing of letters to the editor as the goal of journal club. *Journal of American Medical Association*, 296 (9)1053–1054.	letter

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Appendix 1: *Continued*

	Reference	Reason for Exclusion
42.	Hooper, B. (2006) Beyond active learning: a case study of teaching practices in an occupation-centered curriculum. *American Journal of Occupational Therapy*. 60 (5), 551–562.	didn't describe about journal club process
43.	Warner, D.S. (2006) Reviewer Journal Club. *Journal of Neurosurgical Anesthesiology*, 18 (3), 218–220.	didn't deal with journal club in particular
44.	Kitchens, J.M. (1989) Teaching residents to read the medical literature: a controlled trial of a curriculum in critical appraisal/clinical epidemiology. *Journal of general internal medicine*, 4, 384–387.	didn't deal with journal club in particular
45.	Doyle, C. (2006) Methods of Continuing Professional education Preferred by Irish Pediatric Nurses. *Journal for Specialists in Pediatric Nursing*, 11(2), 90-99.	didn't deal with journal club in particular
46.	Luby, M., Riley, J. K. & Towne, G. (2006) Nursing Research Journal Clubs: bridging the gap between practice and research. *MEDSURG Nursing*, 15 (2), 100–102.	didn't deal with journal club in particular
47.	Johnston, L. & Fineout-overholt, E. (2006) Teaching EBP: The Critical Step of Critically Appraising the Literature. *Worldviews on Evidence-Based Nursing*, 3 (1), 44–46.	didn't deal with journal club in particular
48.	Cahill, M., Smith, V. & Ballou, K. (2006) Infusing information on evidence based practice to staff nurses. *Nephrology Nursing Journal*, 33 (2), 135.	didn't deal with journal club in particular
49.	Vidyarthi, A.R., Katz, P.P., Wall, S.D., Wachter, R.M. & Auerbach, A.D. (2006) Impact of reduced duty hours on residents' educational satisfaction at the University of California, San Francisco. *Academic Medicine*, 81 (1), 76–81.	didn't deal with journal club in particular
50.	Boon, M.H. (2005) How well are we doing in supporting evidence-based health care? The 'Information Mastery' perspective. *Health Information & Libraries Journal*, 22 (4), 290–293.	didn't deal with journal club in particular
51.	Pierre, J. St. (2005) Changing nursing practice through a Nursing Journal Club. *MEDSURG Nursing*, 14 (6), 390–392.	didn't describe about journal club process
52.	Melnyk, B.M. (2005) Advancing evidence-based practice in clinical and academic settings. *Worldviews on Evidence-Based Nursing*, 2 (3), 161–165.	didn't describe about journal club process
53.	Akobeng, A.K. (2005) Evidence in practice. *Archives of Disease in Childhood*. 90 (8):849–852.	didn't deal with journal club in particular
54.	Than, M., Bidwell, S., Davison, C., Phibbs, R. & Walker, M. (2005) Evidence-based emergency medicine at the 'coal face'. *Emergency Medicine Australasia*, 17 (4):330–340.	didn't deal with journal club in particular
55.	Turkel, M.C., Reidinger, G., Ferket, K. & Reno, K. (2005) An essential component of the magnet journey: fostering an environment for evidence-based practice and nursing research. *Nursing Administration Quarterly*, 29 (3) 254–262.	didn't deal with journal club in particular
56.	Maher, A.B. (2005) Journal Club. *Orthopaedic Nursing*, 24 (3), 234–235.	didn't describe the process of journal club
57.	Markovitz, B.P., Kochanek, P.M. (2005) Show us the evidence? An evidence-based journal club linking pedsccm: the pediatric critical care web site and pediatric critical care medicine. *Pediatric Critical Care Medicine*, 6 (3), 25.	didn't describe the process of journal club
58.	Straus, S.E., Ball, C., Balcombe, N., Sheldon, J. & McAlister, F.A. (2005) Teaching evidence-based medicine skills can change practice in a community hospital. *Journal of General Internal Medicine*, 20 (4):340–343.	didn't deal with journal club in particular
59.	Debreczeny, S. & Perkins, J. (2005) A review of the reading preferences of primary care professionals. *Work Based Learning in Primary Care*, 3 (4), 312–324.	didn't deal with journal club in particular
60.	Stern, P.A. (2005) Holistic approach to teaching evidence-based practice. *American Journal of Occupational Therapy*, 59 (2), 157–164.	didn't deal with journal club in particular
61.	Zisook, S., Benjamin, S., Balon, R., Glick, Ira., Louie, A., Moutier, C., Moyer, T., Santos, C. & Servis, M. (2005) Alternate Methods of Teaching Psychopharmacology. *Academic Psychiatry*, 29 (2), 141–154.	didn't deal with journal club in particular
62.	Peraud, P.J. & Kulstad, E.B. (2005) Another resident perspective: resident education and the pharmaceutical industry. *Annals of Emergency Medicine*, 45 (1), 32–36.	didn't deal with journal club in particular
63.	Kent, B. (2004) Resources for evidence-based practice. *Worldviews on Evidence-Based Nursing*, 1 (4), 246–249.	didn't deal with journal club in particular
64.	Melchoir, J. M. (1998) The journal club and its role in hand surgery education. *The journal of hand surgery*, 23 (6), 972–976.	didn't describe the process of journal club
65.	Willson, P., Madary, A., Brown, J., Gomez, L., Martin, J. & Molina, T. (2004) Using the Forces of Magnetism to Bridge Nursing Research and Practice. *Journal of Nursing Administration*, 34 (9), 393–394.	didn't deal with journal club in particular

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

Appendix 1: *Continued*

	Reference	Reason for Exclusion
66.	Carmona, R.H. (2004) Members of the preventive cardiovascular nurses association: making a difference. *Journal of Cardiovascular Nursing*, 19 (5), 5A–8A.	didn't deal with journal club in particular
67.	Gelfand, D.V., Podnos, Y. D., Carmichael, J. C., Saltzman, D. J., Wilson, S. E. & Williams, R.A. (2004) Effect of the 80-hour workweek on resident burnout. Archives of Surgery, 139 (9), 933–940.	didn't deal with journal club in particular
68.	Breuer, S.K., Wallenstein, S, Kiprovski K., Calapa, A., Snow, B. & Pappagallo, M. (2006) Clinically significant placebo analgesic response in a pilot trial of botulinum B in patients with hand pain and carpal tunnel syndrome. *American Academy of Pain Medicine*, 7 (1), 16–24.	a summary of a journal club meeting
69.	Jones, S.R., Harrisson, M.M., Crawford, I.W.F., *et al.* (2002) Journal clubs in clinical medicine. *Emergency Medicine Journal*, 19, 184–185.	didn't describe the process of journal club

Appendix 2

Detailed information on outcome measures used in the included studies

Linzer & Hupart (1987) [13]
Self-assessment questionnaire to assess critical reading, reading habits, educational value of journal club; and knowledge of epidemiology and biostatistics. Questionnaire consisted of 15 questions drawn from the 'question bank' used for examinations in clinical epidemiology and biostatistics for the first year medical students in the Department of Community Medicine of the Mount Sinai School of Medicine of the City University of New York. These questions were selected based upon the work of [21] who sorted the statistical methods used in 760 research articles in the New England Journal of Medicine and described the statistical and epidemiologic techniques with which physicians should be conversant in order to have 'statistical access' to the articles; Reading behaviour was assessed by asking about quantity (number of journals subscribed to and number of articles read per month) and quality (thoroughness) of reading. The questionnaire was validated by an expert in questionnaire design and two clinical epidemiologists.

Linzer *et al.* (1988) [10]
A test instrument improved by the Delphi method was administered before and after the journal club intervention. The instrument was valuated by an expert in questionnaire design and two clinical epidemiologists. Intra- and inter-rater observability was reported in the paper. The evaluation consisted of four parts – research background and other teaching received in critical appraisal, epidemiology and biostatistics; interns' reading habits; knowledge of the epidemiology and biostatistics – 15 questions drawn from the 'question bank' used for examinations in clinical epidemiology and biostatistics for the first year medical students in the department of community medicine of the Mount Sinai School of Medicine of the City University of New York; to measure the interns' critical appraisal skills.

Seelig (1991) [14]
Prior to the journal club intervention, a questionnaire was administered addressing the basic principles of critical appraisal stressed in the educational session. Four months after the pre-test, post test was administered. Contents of the pre- and post test were identical. Also, the participants were asked to report on the average number of hours per week spent reading medical journals and to list in rank order the five journals they most frequently read. A course evaluation (lectures, classroom exercises, written assignments, handouts, references) using a Likert scale, was completed at the end of 4-month period.

Langkamp *et al.* (1992) [15]
Intervention and control residents completed a pre-and post test on clinical epidemiology and biostatistics. Pre-test included 23 questions about clinical epidemiology and biostatistics selected from questions used in medical school courses at the University of North Carolina and the Medical college of Wisconsin. Pre- and post test questions were identical except that they asked the intervention residents about attendance at journal club meetings and their perceptions of club's usefulness.

Burstein *et al.* (1996) [16]
Evaluation survey consisting of five items assessing overall satisfaction with the journal club. Residents were not told that a change in the journal club format (SRI, structured review instrument) was being evaluated. Attendance was noted before and 6 months after the introduction of the SRI. The SRI was used to guide residents in critical reading and review of journal club articles.

Spillane & Crowe (1998) [17]
A questionnaire was used to assess how well journal club achieved its aims, overall value, educational effect, satisfaction with the format, attendance record of members and enthusiasm for the concept.

Bazarian *et al.* (1999) [18]
A 1-hour pre- and post test was administered by evaluating a fictitious article using an essay format. Residents were asked to answer one question 'After critically appraising this article, would you use intravenous propranolol for the treatment of migraine headache? Give at least five reasons to support this decision.' The article was originally used to test the editorial skills of reviewers of the Annals of Emergency medicine and was purposely created with 17 methodologic flaws. The errors in the fictitious article were first revealed by the study's author during a lecture given at the 1995 ACEP Scientific assembly, and subsequently published in a manuscript. [22] Inter-tester reliability was assessed between three test graders and reported within the study.

Khan *et al.* (1999) [12]
Knowledge was assessed by a questionnaire with 20 items covering different aspects of evidence-based medicine such as study

 © 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd

design, evaluation of bias, evaluating statistical tests/principles, assessment of the general value and clinical application of the article; educational performance of the trainees was assessed using self-administered structured questionnaire designed to evaluate knowledge. There were five control items that were not covered in the educational programme and were used to determine the stability and content validity of the questionnaire. The validity of the instrument was reported ($P = 0.11$), and test–retest reliability was reported ($r = 0.9$) within the study for repeated use of the knowledge questionnaire;

Letterie & Morgenstern (2000) [9]

A questionnaire was distributed at the conclusion of the journal club session to the residents and the staff. A pre-test or post test was given in keeping with the authors' intent to avoid a course-like atmosphere

Macrae *et al.* (2004) [11]

Several of the investigators in this study developed a 2-hour test of critical appraisal skills (Cronbach alpha = 0.77). This has been described elsewhere [23]. Two general surgeons with expertise in clinical epidemiology developed an answer key for the examination. The examinations were all marked by a single clinical epidemiologist; participants were also asked to complete an evaluation form after each month's journal club package. Inter-rater reliability of two physicians marking the examination was 0.93.

Struck *et al.* (2005) [19]

The impact of clerkship on students was assessed in three areas:

- Knowledge (33-question pre- and post test). Questions were randomly pulled from a question pool of 100 previously developed questions ref. Faculty developed the questions based on United States Medical Licensing Examination guidelines and underwent peer review to check item face-value relevance. Question content included geriatric assessment, preventive care, cognitive examination, hospice care, iatrogenic complications in hospitalization and other common geriatric syndromes.
- Skills (faculty observation and evaluation during patient encounters as well as self-assessment on Likert-scales regarding improvement of physical examination skills and patient assessment skills)
- Attitude (using answers on Likert-scale survey as well open-ended questions allowing students' written feedback) using a pre- and post knowledge test, student satisfaction survey and written comments.

Mukherjee *et al.* (2006) [20]

A list of questions used in quantitative appraisal was summarized from various sources and provided to the facilitators. For the qualitative papers a series of questions based upon the framework suggested by [24] were developed. Two short questionnaires composed of a mixture of open answer boxes as well as some five-point Likert scales were developed. The first questionnaire was used to obtain baseline options. The second distributed after four sessions over a 6-month period was used to assess any change in confidence when appraising qualitative papers and participants' enjoyment and the perceived usefulness of the new format.

© 2008 The Authors. Journal compilation © 2008 Blackwell Publishing Ltd