

**Journal Club Systematic Review
BEME Report**

**Are journal clubs effective in supporting evidence-based decision making? A
systematic review**

Dates

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Topic Review Group Membership

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Potential conflicts of interest

All authors declare they have no conflict of interest

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Abstract

Are journal clubs effective in supporting evidence-based decision making? A systematic review

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Background

Journal clubs are an increasingly popular way to promote the uptake of research evidence into practice. Despite several reviews investigating the effectiveness of evidence based teaching and learning, the benefits of journal clubs have not been established. This systematic review aimed to determine whether the journal club is an effective intervention in supporting decision making in terms of learner reaction, change in attitudes, change in knowledge, change in skills, change in behaviour, or patient outcomes.

Methods

The search strategy identified journal club interventions that included education, teaching, tutoring, or training, which were evaluated for effectiveness in achieving the above outcomes. We included quantitative and qualitative journal clubs occurring in undergraduate, postgraduate and practice settings that appeared to meet regularly, aiming to discuss the quality of research in current medical journals. We excluded studies if they evaluated video/internet meetings or single meetings, or if they lacked evaluation of learner reaction, knowledge, skills, attitudes, behaviour or patient outcomes. Data was independently extracted by three reviewers using criterion suggested by Reed et al. (2005)

Results

We included 18 studies from eight different settings and specialties – community medicine, emergency medicine, internal medicine, obstetrics and gynaecology, ophthalmology, psychiatry, surgery, multidisciplinary and multidisciplinary student. The size of journal clubs varied from 7 to 43 members; descriptions of the intervention were too heterogeneous to allow pooling. There were no studies reporting on patient outcomes and only 61% of studies reported whether the journal club discussed the applicability of research into practice. Several studies reported improvements in reading behaviour (N= 5/11), increased confidence in critical appraisal (N=7/7), improved test scores on critical appraisal (N = 5/7), and increased ability to use findings in clinical practice (N= 5/7). Four studies used validated tests and 16 self-report measures; however triangulation was not used to strengthen the methods and the actual reliability and validity of validated tests was not reported in any studies.

The 'active educational ingredients' within journal clubs included mentoring, providing brief training to help health professionals to judge the quality of research, and using a structured critical appraisal instrument. The use of adult-learning principles, the adoption of a multifaceted teaching approach, the use of patient scenarios, and the integration of the journal club with other clinical and academic activities were also described.

Conclusion

Journal clubs are a common valuable source of interaction and education in health care. However, from the current review it is not clear whether journal clubs are effective in supporting evidence based decision making and studies lack the detail needed to suggest that one format of journal club is superior to another. A mixed methods approach is needed in order to contribute valuable additional understanding for the journal club as a complex intervention to support evidence-based practice (EBP). Based on the findings of this review, those interested in running a journal club should consider clearly at the outset the aims of the club, the appropriate ways to promote and facilitate these aims, and valid approaches for assessing that the aims are being met.

Keywords: journal club; evidence based teaching

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Non-scientific executive summary

Are journal clubs effective in supporting evidence-based decision making? A systematic review

A journal club is a group of individuals who meet regularly to discuss the clinical applicability of articles in current medical journals' (Linzer, 1987). They are an increasingly popular way to promote the uptake of research evidence into practice. Although several reviews have investigated the effectiveness of evidence based teaching and learning, the benefits of journal clubs have not been established.

This systematic review aimed to determine whether journal clubs promote positive attitudes toward keeping updated by reading research, and whether they are an effective educational strategy for enabling practitioners to critically use research to improve patient outcomes. We reviewed studies of journal clubs that included health professionals from undergraduate, postgraduate and practice settings. Studies were included if they evaluated learner reaction, knowledge, skills, attitudes, behaviour or patient outcomes. Three reviewers selected abstracts. Data was independently extracted using criterion suggested by Reed et al. (2005). Realist synthesis was used to identify the active ingredients that promote use of research in practice as well as the factors that limit the success of journal clubs. Variations in the success of journal clubs were considered by the type of participants and the different settings for the clubs.

Some studies reported improvements in reading behaviour (N= 5/11), increased confidence in critical appraisal (N=7/7), improved test scores on critical appraisal (N = 5/7), and. increased ability to use findings in clinical practice (N= 5/7). The 'active educational ingredients' within journal clubs in our review included mentoring, providing brief training to help health professionals judge the quality of research, and using a structured critical appraisal instrument. Using the principles of adult learning, adopting a multifaceted approach to teaching and integrating the journal club with other clinical and academic activities were also described.

These results need to be considered in terms of the quality of research on journal club effectiveness. Studies were unable to explain some of the positive and negative learning experiences, indicating that more information is needed on the learning process that takes place during participation in the club. Sixteen of the 18 studies assessed the impact of journal clubs by asking participants to rate their own improvements in reading habits and appraisal skills. Two of these studies compared self-reported improvements with objective tests of knowledge, and noted that people can rate their improvement both higher or lower than the actual improvements shown by their test results - indicating that studies need to routinely compare self-reports with objective tests to obtain a more accurate picture of improvement. The quality of objective tests also needs to be considered; only four studies used validated knowledge tests and the actual reliability and validity of validated tests was not reported in any studies.

Conclusions

Journal clubs are a common valuable source of interaction and education in health care. However, from the current review it is not clear whether journal clubs are effective in supporting evidence based decision making and studies lack the detail needed to suggest that one format of journal club is superior to another. Analysis of the various elements contained in journal clubs produced a cluster of elements that may contribute to the overall effect. These were termed 'active ingredients', and included mentoring, didactic support, use of structured review instruments, adhering to principles of adult learning, using multifaceted approaches to learning, and integrating learning with other academic and clinical activities. Due to incomplete reporting some clubs may have actually had far more of the potentially active ingredients than reported. In order to facilitate our understanding of the active ingredients in the learning environment, studies need to provide adequate information on the journal club intervention.

A mixed methods approach is needed in order to contribute valuable additional understanding for the journal club as a complex intervention to support evidence-based practice (EBP). Based on the findings of this review, those interested in running a journal club should consider clearly at the outset the aims of the club, the

appropriate ways to promote and facilitate these aims, and valid approaches for assessing that the aims are being met.

Key messages

Among medical residents, fellows and faculty, it is possible that participation in journal clubs may

- improve reading behaviour
- increase confidence in critically appraising research
- improve critical appraisal skills
- promote ability to use research findings into clinical practice

The elements in successful journal clubs which may contribute to changes in knowledge, skills and behaviour are:

- mentoring
- didactic support such as teaching clinical epidemiology and critical appraisal skills
- use of structured learning materials such as critical appraisal checklists
- designing a club which uses principles of adult learning such as opportunistic review of research relevant to actual patient cases
- integrating journal club topics and activities with other material in academic training and practice
- using a multifaceted approach to teaching and learning

Research into journal clubs could be optimised by

- Encouraging researchers to adopt a standard terminology that describes each component of journal club interventions
- Requiring the use of educational models or conceptual frameworks that illustrate the teaching and learning principles underpinning the intervention
- Formulating a clear statement of educational objectives and measurable learning outcomes at the outset
- Promoting more consistent reporting of details of the intervention
- Basing journal club design and evaluation on the findings of past research
- Developing valid and reliable evaluation tools
- Considering the context of the educational intervention

- Evaluating the relative success of elements of the intervention in terms of the level of the learner – medical student, intern, research fellow, faculty, practitioner

1. Introduction

Research into the uptake of health care evidence shows that passive approaches to disseminating evidence, such as lectures, conferences, mailings, and printed materials are less likely to promote changes in practice than more interactive approaches (Davis et al., 1995). Systematic reviews indicate that academic detailing, outreach visits, opinion leaders, audit and feedback, and practice based reminders promote practice change to a greater or lesser degree (O'Brien et al., 2007 ; Jamtvedt et al., 2009). Randomised controlled trials, however, have not been able to identify the 'active ingredients' which would explain why more interactive approaches are effective (Forsetlund et al., 2009).

To date educational approaches have been based on the assumption that knowledge acquisition changes clinician behaviour. But it is important to consider the type of knowledge, how it is delivered, and who is receiving it. Within the immediate learning context, two way interaction is demonstrated to be important, as is delivery of the education by locally respected health professionals (Cauffman et al., 2003).

Once knowledge is acquired, people need to consider whether they can – and should - use it in their health care setting. Evidence-based behaviour change is a complex phenomenon, which occurs in response to a number of individual and organizational elements (Iles & Sutherland, 2001). Factors that support the use of knowledge include the organisational context, attitudes of influential professionals toward the evidence (opinion leaders), the quality of the evidence, and patients' preferences and values (Greenhalgh et al., 2004). There is no definitive research on the best way to promote uptake of research to improve health care practice, but we do know that opportunities to discuss and make sense of new knowledge is a critical component in transferring and applying knowledge in the workplace (Eraut & Hirsh, 2007).

One interactive technique for making sense of evidence is the journal club. A journal club is 'a group of individuals who meet regularly to discuss the clinical applicability of articles in current medical journals' (Linzer, 1987). Journal clubs have been established as an educational activity in many postgraduate training programmes, and are used across a number of countries in both medicine and other health professions.

There are several assumptions behind the belief that journal clubs may be effective in promoting evidence based care, which are supported by educational theory.

First, educational research tells us that positive attitudes toward the learning experience can influence the acquisition of knowledge, and development of skills (Eraut, 1998). Second, education and training targeted to the needs of adult learners is considered to be more effective than traditional didactic lectures. Adult learning uses a more facilitative and interactive approach with a focus on opportunistic learning, addressing the issues and problems of the participants and allowing learners to direct the process (Rogers, 1969). Third, finding the 'teachable moment' and providing relevant learning materials can lead to a change in clinical behaviour and, consequently, improved patient outcomes (Schon, 1987). Finally, there is growing interest in the concept that 'communities of practice' which foster interaction and discussion help people to negotiate meaning and decide upon the relevance and utility of knowledge (Wenger, 1998), with some research indicating that social learning promotes evidence based decision making (Fairhurst & Huby, 1998). These constructs form an attractive causal pathway, implying that if environments are tailored to adult learners then they will promote positive attitudes about evidence, and that if they also provide opportunities for people to discuss the quality and application of evidence, then we will achieve more evidence based practice and consequently better patient outcomes.

Several systematic reviews have reviewed elements that are part of journal club interventions, but they have focussed on the effectiveness of teaching critical appraisal and EB skills across a range of settings such as one-session workshops and short courses (Parkes, 2001; Taylor, 2000; Coomarasamy et al., 2003; Coomarasamy & Kahn, 2004). Only one review has focused on journal clubs as an educational intervention (Powell, 2004). The Powell review examined the ability of journal clubs to promote critical appraisal skills. Although this may be an essential component of the 'evidence into practice' pathway, it stops short of examining whether the interactive journal club environment promotes knowledge transfer to the clinical setting.

Researchers in the field of evidence based education agree that studies need to be conducted that focus on the relationship between providing education in EBP and facilitating the use of evidence in practice (Hopayian et al., 2007). These studies are difficult to conduct because they are interventions with a number of educational components, and the causal pathway from teaching and learning to using knowledge and skills in the workplace is longer. Ideally, each stage of the pathway should be evaluated in order to assess the relative effectiveness of each component. Five elements can usefully be considered when delivering an educational intervention to promote behaviour change. (Box 1).

Box 1: Educational interventions to promote evidence based practice

1. Design: length of educational sessions, number of sessions, duration of training, content of sessions
2. Training: how educators were trained and their expertise in teaching and facilitating during the sessions
3. Delivery: How the educational intervention was actually delivered and whether it was delivered according to plan
4. Receipt: participants' comprehension of the material, their ability to perform the skills that were taught, strategies to improve performance of skills during the training period
5. Enactment: performance of the skills that were taught in settings where they might be applied

Modified from Borelli et al. 2005

In EB teaching research, we have information primarily on the design of the training and the receipt, but little information on how EB skills are enacted in the work setting (Hopayian et al., 2007). The ability of journal clubs as a complex intervention encompassing all five elements (Box 1) needs evaluation.

2. Objectives

The objective for this systematic review was to determine whether the journal club is an effective intervention in supporting evidence-based decision making in health care

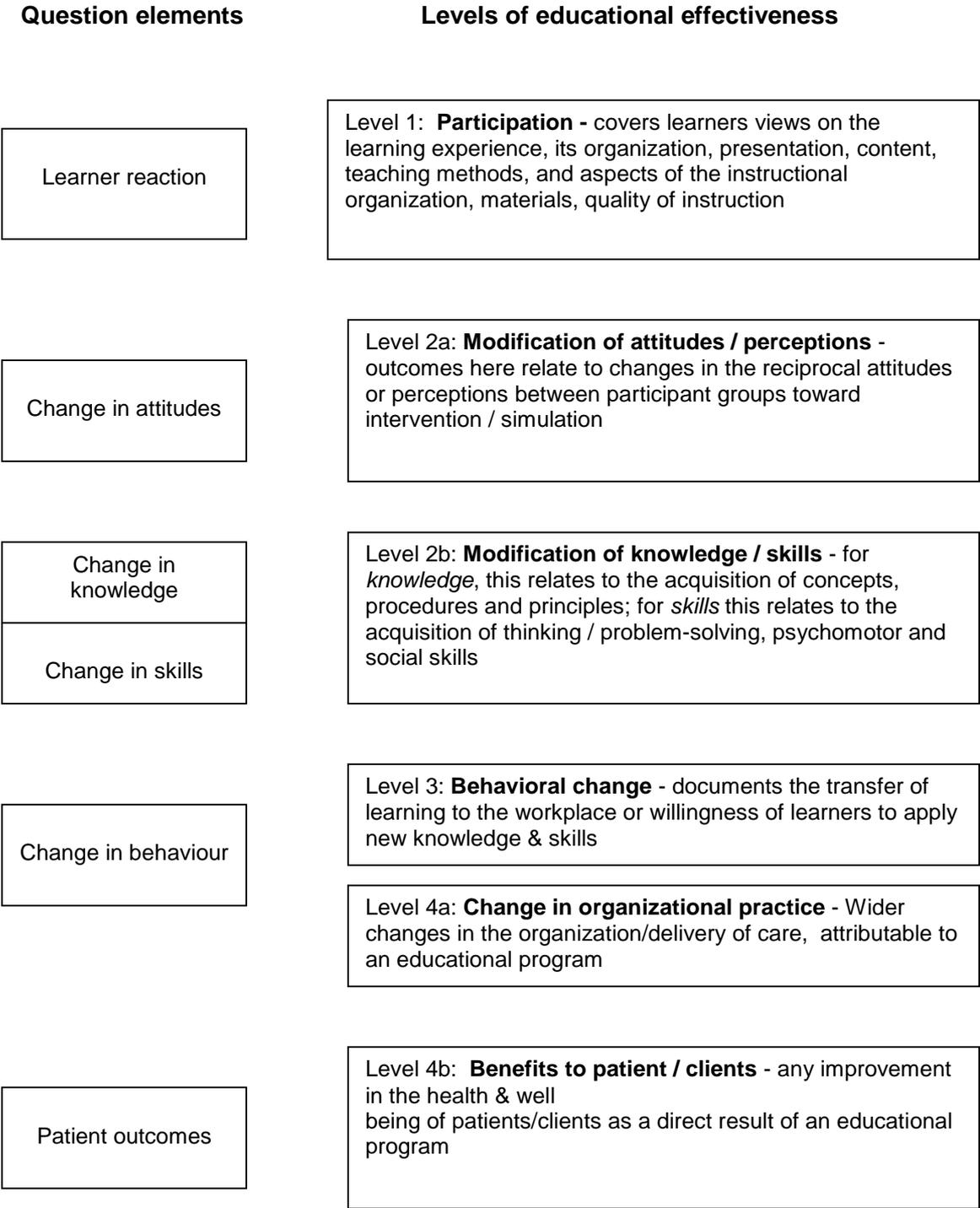
professionals, and to explore whether it is possible to determine which elements of a journal club contribute to effectiveness.

3. Review question

The question for this review is: Is the journal club effective in supporting evidence-based decision making?

Journal clubs are a complex intervention, which to be effective need to lead to a positive change at one or more stages of the intervention, including improvement in learner reaction, attitudes, knowledge, skills, clinical behaviour, and patient outcomes. This definition is based on Kirkpatrick's model for learning, as adapted by Freeth et al. (2002). The model implies a relationship between satisfaction with learning, positive attitudes to the experience, and the acquisition of new information that results in a modification of the existing knowledge base (Figure 1).

Figure 1: Mapping question elements to learning and service improvement



Adapted from Belfield et al. (2001); Freeth et al. (2002)

The presumed relationship can be presented as a logic model – a model that postulates relationships between a cause and an effect. Logic models are useful devices for assessing complex interventions, because they enable the assessment of each element of the intervention. They can also help to explain whether and how the final outcomes may be the result of an aggregation of smaller effects during the different stages of delivering the intervention (Pawson, 2006).

When this logic model is applied to journal clubs, we could make a number of theoretical assumptions, based on what is already known about adult learning, teaching evidence based practice, knowledge transfer, and strategies to promote clinical behaviour change (Table 1).

Table 1: A logic model for journal clubs

Design	Training	Delivery	Receipt	Enactment
Participation	Resources invested	Activities during sessions	Outcomes (short term)	Impact (longer term)
Length of meetings Duration of meetings Frequency of meetings Content of meetings Type of participants Attendance Size of group Level of participation/ interaction	Time Staff expertise: in searching, statistics, facilitating critical appraisal, facilitating discussion Money	Question formulation Searching Preparing for presentation Critical appraisal Discussion on clinical applicability	Ability to recognize uncertainty and question practice Skills to find relevant evidence efficiently Knowledge of clinical epidemiology Knowledge of critical appraisal concepts, procedures and principles Skills in summarizing evidence Skills in judging the quality of evidence Skills in using evidence to solve problems	Willingness to apply EB skills acquired in the journal club in the workplace Ability to use evidence to facilitate decision making Using evidence from JC to change organization/delivery of care Less harmful interventions for patients/ Improvement in health as a direct result of the journal club process
Outcomes assessed:		Learner reaction to participation - learners views on the learning experience, its organization,	Modification of knowledge / skills - for <i>knowledge</i> , this relates to the acquisition of concepts, procedures	Behavioral change - transfer of learning to the workplace or willingness of learners to apply new knowledge & skills

	<p>presentation, content, teaching methods, and aspects of the instructional organization, materials, quality of instruction</p> <p>Change in attitudes:of participant groups toward EBP</p>	<p>and principles; for <i>skills</i> this relates to the acquisition of thinking / problem-solving, psychomotor and social skills</p>	<p>Change in organizational practice - Wider changes in the organization/delivery of care, attributable to an educational program</p>
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We used the logic model in our review for the following reasons: to identify the elements that are present in journal clubs, and to look for single elements or clusters of elements that appear to be present in journal clubs which demonstrate effectiveness in any one of the domains of learner reaction, attitudes, knowledge, skills, or behaviour.

4. Review methodology

4.1 Inclusion/exclusion criteria for studies, participants, interventions, and outcomes

We used Linzer's definition of a journal club: 'A journal club is a group of individuals who meet regularly to discuss the clinical applicability of articles in current medical journals' (Linzer, 1987).

We were interested in searching for evaluations that link learning to positive learner reactions and attitudes, and improved knowledge and skills, with a corresponding change in clinical behaviour and improvement in health services. Individuals included people in any type of health care field currently training (undergraduate level) or practicing after completing their training (postgraduate). The effectiveness of educational interventions is likely to be different in undergraduate and postgraduate groups. Undergraduate groups include learners who are acquiring journal club skills, such as critical appraisal, within the context of an educational setting. Postgraduates may be working in academic environments, but they may also be health care practitioners who are acquiring skills in a work based context. The degree of

organisational support may be quite different across academic and practice environments. This variation is an important element of developing a theory for what works for whom in what circumstances (Pawson 2006).

Individuals needed to be in a position where the journal club could be used to inform clinical practice – librarians were therefore excluded. We limited studies to those where the club met regularly to discuss research articles. Video/internet and one-off clubs were excluded because they could contain less opportunities for interactive discussion and social learning. Studies needed to evaluate one or more of the outcomes listed in Table 2.

Table 2: Inclusion criteria for the review

	Inclusion criteria	Exclusion criteria
Population	Health care professionals	Librarians
Intervention	Regular meetings to discuss research articles in current medical journals	Video/internet meetings One off interventions
Outcomes	<ul style="list-style-type: none"> • Learner reaction • Change in attitudes • Change in knowledge • Change in skills • Change in behaviour • Patient outcomes 	No assessment of learner reaction, knowledge, skills, attitudes, behaviour or patient outcomes Reporting only on publication of a critically appraised topic
Study type	All quantitative and qualitative studies which evaluate any of the outcomes All languages	Surveys reporting on prevalence of journal clubs and journal club activities (unless data has also been collected from participants of the journal club) Opinion papers Articles with no abstract

All study types which evaluated any of the outcomes in table 2 were included. Research into EB teaching has noted the need for qualitative research and mixed methods approaches to capture important information about the learning environment and context where skills are applied (Straus et al., 2004; Jeffery et al., 2004). Both attitudes toward and experience of training, as well as the context in which EB knowledge is applied, may influence the impact of educational interventions such as journal clubs (Shuval et al., 2007a). Research designs such as case studies

and mixed method evaluations may contribute valuable additional understanding for the journal club as a complex intervention to support evidence-based practice (EBP). Including different types of studies is established practice in health areas that involve complex interventions (Armstrong et al., 2008; Pawson et al., 2005) and in the social sciences (Petticrew & Roberts, 2006) as well as in realist synthesis (Pawson, 2006).

4.2 Search strategy

The search strategy was developed using Medline (Table 3) and adapted for the requirements of other databases. The strategy included all study types, enabling the retrieval of qualitative research.

Table 3: Search strategy

Journal club	AND education	AND evaluation
Journal club	Educate or learn or teach or tutor or train	Evaluate or effect or react or outcome or assess or appraise or measure or trial or random or cohort or (case control) or qualitative or quantitative or test or exam or pre-test or post-test or feedback or explore or competence or change
	Exp Education/ Learning/ Teaching	Program-evaluation Evaluation Healthcare quality Clinical competence

4.3 Sources of papers including databases used

- Australian Education Index (1979 – February 2007)
- ACP Journal Club
- British Education Index (1975 – February 2007)
- Cochrane Library (2007, issue 1)
- Cinahl (1982 – February 2007)
- Embase (1980 to February 2007)
- Eric (1966 – February 2007)
- LISA (1969 – February 2007)
- MEDLINE (1950 to February 2007)
- metaRegister of Controlled Trials (mRCT) (February 2007)
- National Research Register (February 2007)
- Psychinfo (1967 – February 2007)
- REFER (February 2007)
- Sociological Abstracts (1952 – February 2007)

Web of Knowledge (1945 – February 2007)

Bibliographies of relevant publications and review articles were scanned and relevant references were retrieved. No language restrictions were applied.

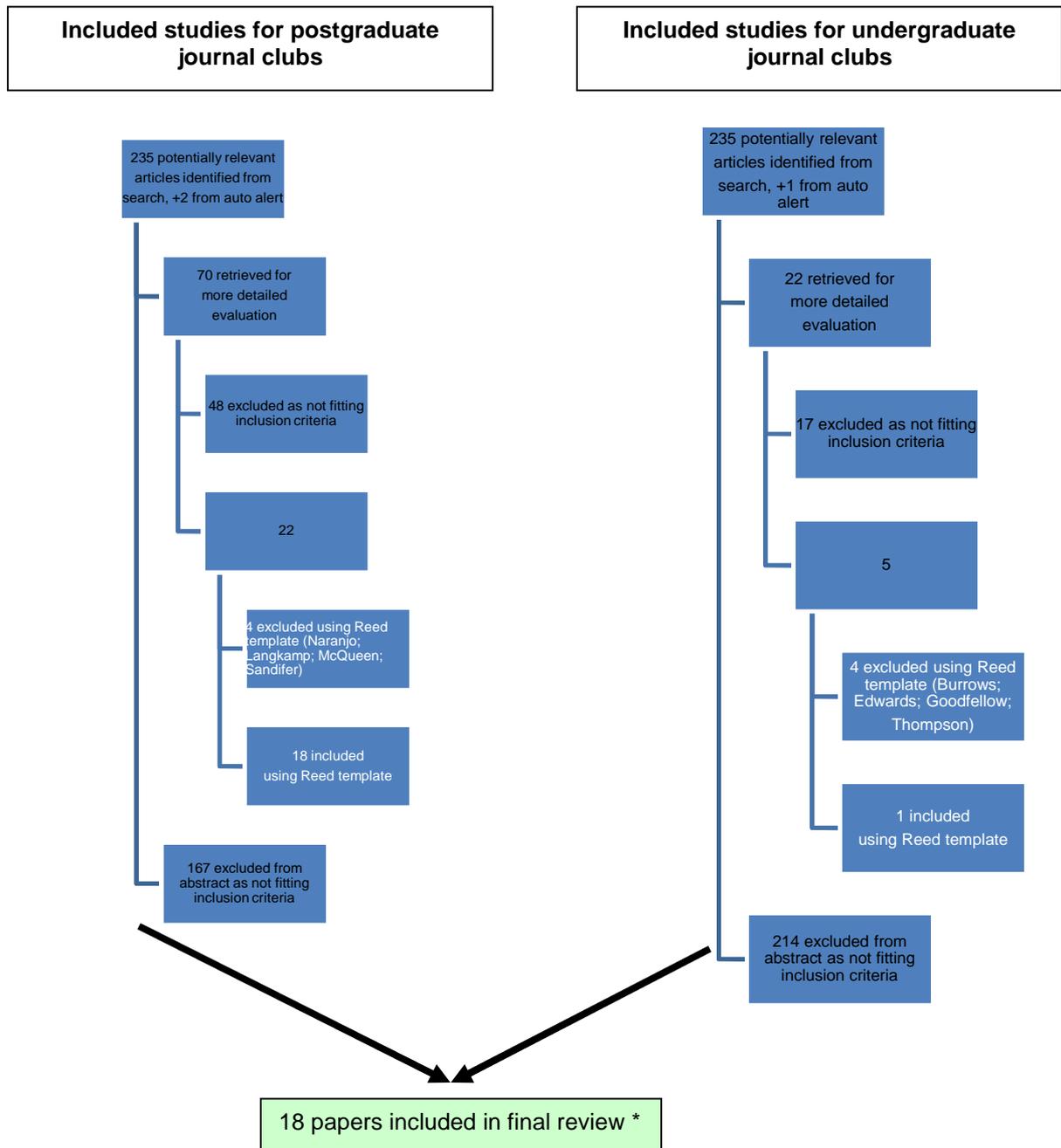
4.4 Selection methods and judgment of methodological quality

Three reviewers read the abstracts and compared them to the inclusion and exclusion criteria. Where the abstract did not contain enough information to exclude it, the entire study was retrieved. We divided the retrieved studies into subsets and randomly assigned two reviewers for each subset. The reviewers independently extracted data. Initially we used a modified BEME template, adding additional categories to include qualitative information that might contribute to journal club effectiveness, such as the type of participation in the club and the level of support provided during preparation and presentation of articles. However, the template did not enable us to collect detailed information on the evaluation methods, so we decided to use a modified version of the criterion suggested by Reed et al. (2005) for conducting a systematic review of educational research (Appendix 11.1). We divided the studies into subsets and randomly assigned two reviewers for each subset. The reviewers independently extracted the data. The entire set was then reviewed by one reviewer (JH) who documented disagreements which were resolved through group discussion.

The number of studies excluded at each stage, by population group, is shown in Figure 2. Using the Reed template excluded 8 additional studies. Six were excluded because they lacked a description of the evaluation and conclusions were made without any supporting evaluation data (Burrows, Goodfellow, Langkamp, McQueen, Naranjo,, Thompson). Two studies evaluated submission of letters to the editor as a proxy for knowledge and skills (Edwards; Sandifer) and were therefore excluded because the outcomes differed from those in our review question.

We separated papers to allow analysis by journal clubs occurring at postgraduate level and at undergraduate level. Of the five undergraduate studies (Burrows, Edwards, Elnicki, Goodfellow, Thompson); however, only one was included in the final review (Elnicki).

Figure 2: Included studies



*One paper (Elnicki) included in both postgraduate and undergraduate

5. Data analysis and synthesis

At the first stage of analysis, we mapped the key characteristics of the included studies data using a template (Appendix 11.1). Data relating to the review question were then extracted using Excel spreadsheets. The extraction was checked by two reviewers (KK and JH). To determine whether the journal club is effective in supporting evidence-based decision making, we analysed whether whether studies were similar enough to be aggregated? Outcomes reported were improvement as (1) a self-reported change in reading behaviour, (2) a perceived change in confidence about critically appraising research, (3) an objectively tested increase in knowledge and critical appraisal skills, and (4) perceived ability to apply findings to clinical practice.

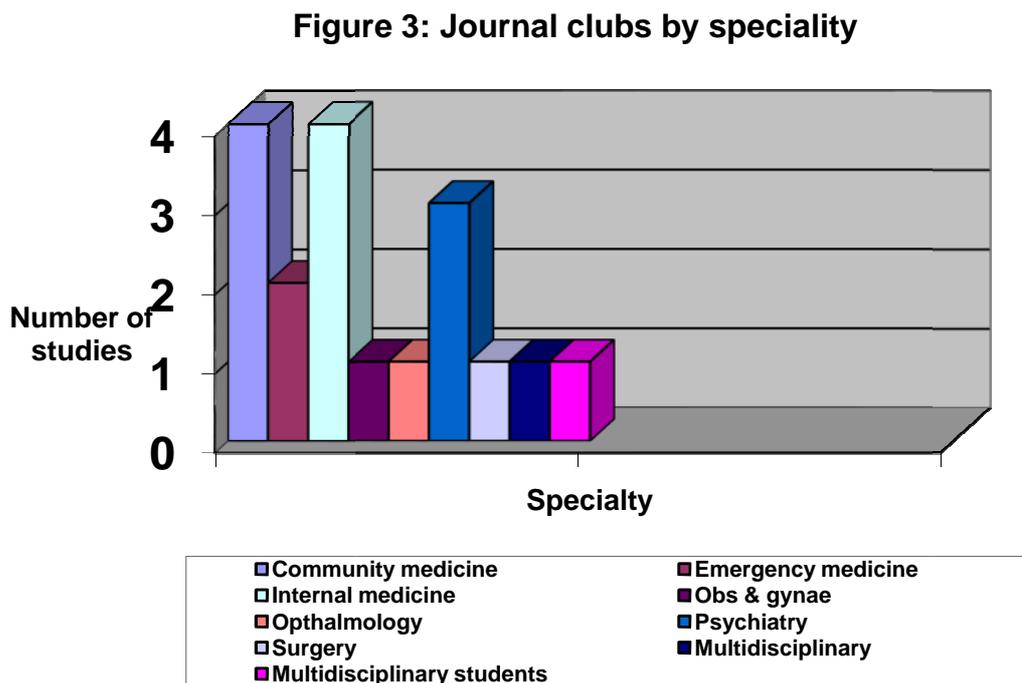
The populated template was then used to decide whether studies with similar approaches to journals clubs could be lumped together as a case, and to determine whether there was a core group of 'active ingredients' that contribute to successful journal clubs. These elements were systematically identified in each study (Appendices 11.3 – 11.7) and are discussed in section 7.

Finally we analysed whether effects occurring at different stages of the journal club influence the ability to apply research in clinical practice? Section 8 presents our conclusions on what type of journal clubs will work, for whom, in what circumstances? We compare our findings with other relevant education research, and make recommendations for improving research methods in future studies.

6. Findings

6.1 Overview of the studies included in the review

We found eighteen studies of which eleven were from the USA with the remainder conducted in Canada, England, Australia, and Pakistan. Eight different specialities all in the field of medicine were represented (Figure 3).



Eight studies were before-after (Bazarian, Cramer, Elnicki, Kellum, Khan, Lee, Seelig, Swift), six questionnaire surveys (Akhund, Heligman, Linzer 1987, Mazuryk, Spillane), and one each of observational (Mukherjee), case control (Bazarian), controlled trial (Fu) and randomised controlled trial (Linzer). No qualitative studies containing primary data were found, although several of the quantitative studies contained qualitative information obtained from interviews or from open ended response sections of surveys designed to assess self reported attitudes, knowledge and behaviour (Heligman, Mazuryk, Spillane).

6.2 Quality of reporting

Across studies the characteristics of journal clubs, such as the length of sessions, how often clubs met, duration and attendance were not reported consistently (Appendix 11.3). Only eight studies reported the average length of each session, while 14 reported how frequently sessions were held. Frequency and length may be key factors in terms of influencing educational experience, with clubs that are held more frequently enabling more reinforcement of learning, but this was not discussed. Mandatory attendance was reported for six studies but only three objectively counted attendances.

The resources available to support learning can have an effect on learner response, attitudes, change in knowledge and skills. These include help in selecting an article for critical appraisal, support in preparing the presentation, support during the presentation itself in terms of facilitating or chairing, and access to expertise to help with the appraisal and discussion of clinical applicability. The method of selecting articles may have some influence on perceived relevance of the material and learner reaction. Similarly, the amount of support that learners received while preparing their presentation (in the form of informal mentoring or faculty assistance), could influence not only learner reaction but also attitudes, knowledge, and skills development. Only seven studies reported whether learners received any support for preparation. This support covered one or more aspects of the preparation process, such as helping the learner select a topic, helping to develop literature search skills, checking the articles selected, checking the critical appraisal, and reviewing the plan for presenting the material.

Presentation as well as the ensuing discussion about the quality and applicability of the evidence can contribute to knowledge, skills development, behaviour change, and an improvement in patient outcomes. Twelve studies reported on the type of presentation that was made, but due to lack of descriptive detail it is not possible to assess the level of interaction. Eleven reported that the applicability of the evidence was covered, but only seven of these specifically mention that it was discussed during the sessions, while the other four include it only in the learner satisfaction evaluation without stating an intention to cover clinical applicability in the intervention.

It was therefore difficult to tell the depth or quality of the discussion regarding the feasibility of using evidence in practice.

6.3 Definition of the intervention

Many studies claimed to use Linzer's definition of a journal club as the basis for their intervention. However the elements of the definition may have led to confusion. For example: a journal club is 'a group of individuals', but what constitutes a group? The journal club group 'meets regularly' but what constitutes regular meetings and are regular meetings needed? The aim of a club is 'to discuss critically the clinical applicability of articles in current medical journals' but what constitutes a discussion of clinical applicability?

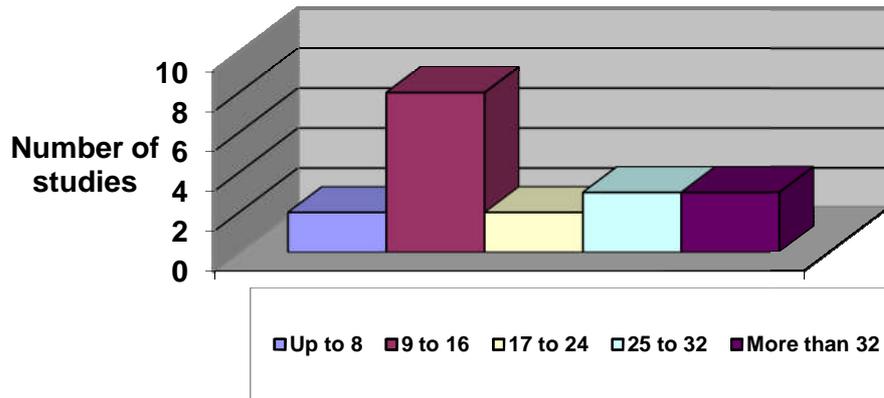
If the aim of a club is 'to discuss critically the clinical applicability of articles this implies that the group needs to be small enough for a discussion to take place. However it is not clear what is meant by clinical applicability nor what constitutes a discussion of it? Does regular meeting suggest a degree of bonding or the development of relationships within the group?

Optimal group size for group learning

The size of journal club groups ranged from 7 to 43 members. The variation in size of group was surprising, given that many studies adopted Linzer's definition of a club in which discussion was part of the process. Clearly in large groups discussion would be difficult if not impossible.

Perhaps surprisingly, in Linzer's studies, the groups were 22 and 43 participants respectively (Linzer et al., 1987; Linzer et al., 1988). Eight studies had between 9 and 16 participants. This may be small enough to promote learning and decision making through interaction, although it is argued that optimal group size is 8 participants (Elwyn et al., 2001).

Figure 4: Journal clubs by size of group



Six clubs had over 25 members. The similarity of interaction and opportunities to learn from each other across small groups and larger clubs needs to be explored.

Meeting regularly

Attendance was reported as mandatory in seven clubs, by invitation in two, unclear in seven and not reported in the remaining two (Table 3). Less than half of the studies reported on attendance, which would seem to be a key factor in assessing the effectiveness of journal clubs. Only 39% reported on length of sessions although 62% did report on frequency of sessions. The duration of the club (the period of time the club had been in existence) was reported for 83% of the sample.

Discussing clinical applicabilityIn terms of the process of the club, 56% reported on article selection, 39% discussed whether support was provided while preparing for the session, and 72% documented who did the presentation and/or chaired the meetings. Several factors may enable critical discussion to take place in journal clubs. These are (1) the amount of preparation before a meeting, (2) the way in which information is shared with the group, (3) the critical appraisal skills of the group, (4) the quality of facilitation during the process, (5) the level of interaction, and (6) a shared understanding of the clinical situation.

Only 7/11 clubs described clinical applicability explicitly as an aim of the club; although a further 4/11 reported a discussion of this in their evaluation, suggesting it may have been an implicit aim. In some cases, applicability was summarised by the attending coordinator and other faculty listing the lessons to be learned in terms of clinical practice (Burstein; Linzer 1988). Other clubs had a more interactive group discussion exploring applicability (Khan; Heligman). Two articles document the development of skills in deciding clinical applicability through use of case scenarios and post-test questions (Fu; Bazarian). The remaining five studies stated that clinical applicability was addressed but there is no further information on the process.

Only two clubs reported the criteria for selecting relevant articles (Bazarian; Khan). Given that six of the studies assessed learner reaction in terms of satisfaction (Burstein; Linzer 1988, Swift); interest (Heligman); clinical interest (Swift); perceived clinical value (Mazuryk); and perceived impact on work (Fu), the selection of the relevant question and subsequent article would seem to be important in determining the learners reaction.

Preparation for journal clubs can be done alone, in teams or with faculty advice or mentoring. In three clubs pre-session support appeared high, with faculty and resident jointly choosing the topic, reading and summarising literature (Bazarian; Burstein; Linzer 1988). Support may be a key factor in determining satisfaction, change in knowledge and skills. This is acknowledged by several authors (Spillane; Elnicki) but is not generally identified as a key variable across the studies.

Interaction during meetings was generally described as a presentation by the person responsible for finding articles, followed by a discussion. The articles described various levels of involvement. In eight clubs, the responsible resident presented the summary and/or chaired the discussion (Akhund; Bazarian; Burstein; Fu; Heligman; Kellum; Khan; Seelig). In four clubs it was a joint effort by mentor and presenter (Elnicki; Linzer 1988; O'Sullivan; Spillane) with varying levels of input from the faculty facilitator during or immediately after the presentation. One club used small group work to appraise and feed findings back to the larger group (Swift).

Participation needs to be considered in combination with the length of the sessions, the frequency of the sessions, and the duration of the club. Length of sessions was only reported in seven studies. Six of these met for 1 to 1.5 hours (Akhund; Fu; Heligman; Kellum; Khan; O'Sullivan) and the daily club (Mazuryk) met for 20 minutes each morning.

Frequency of sessions was reported by 14 studies ranging from daily to once a month. One club met daily before morning shift change (Mazuryk), one met twice a week (Elnicki, students), seven clubs met weekly (Akhund; Fu; Heligman; Khan, Linzer 1987 and 1988; O'Sullivan), one every two weeks (Seelig), and four met once a month (Bazarian; Burstein; Cramer; Elnicki, residents).

Duration was defined in different ways. For instance, as duration of the journal club, duration of the intervention that was being introduced into an existing club, and duration of the academic programme which contained the journal club as one of many educational interventions. In some settings, journal clubs were deliberately introduced as an intervention with the plan of evaluating utility (Bazarian; Burstein; Elnicki; Fu; Kellum; Khan; Linzer 1988; Mazuryk). Spillane and O'Sullivan introduced evaluation into clubs that had been going for 5 and 15 years respectively. Akhund, Cramer and Khan introduced clubs into training programs for medical residents, using them to teach key principles in the curriculum. Duration varied considerably, from 3 months to 15 years, making direct comparisons impossible because duration of a learning group can have an effect on learning outcomes.

In summary, descriptions of the intervention were too heterogeneous to allow pooling and a meta-analysis. The next section of this review focuses on heterogeneity across definitions of outcomes.

6.4 Operationalizing variables

Across the studies, variables of learner reaction, attitudes, knowledge, skills and behaviour were operationalized in different ways. This contributed greatly to heterogeneity. Definitions of these concepts have been compiled from the studies, and compared to the definitions used in our theoretical model (Figure 1). A number of differences emerged, which are described below.

6.1 Learner reaction

In terms of educational effectiveness, learner reaction is defined as ‘Participants’ views of their learning experience, satisfaction with the programme, participation and/or completion’ (Figure 1). In the journal club evaluations, learner reaction included such diverse concepts as attitudes toward the timing of the club, interest in articles, and perceived value of the teaching in terms of learning critical appraisal skills and applying results to practice.

Table 4: Studies assessing Learner reaction (Level 1)
Participants’ views of their learning experience, satisfaction with the programme, participation and/or completion.

Definition of Learner reaction	Study
Satisfaction	Burstein; Swift
Interest; Clinical interest; Academic interest	Heligman; Swift
Enjoyment	Mukherjee; Swift
Collegiality; Social forum	Heligman; Spillane
Discussion of issues	Heligman
Perceived value of teaching appraisal	Burstein; Mazuryk
Perceived value of analysis for practice	Burstein
Preparation value	Mazuryk
Appropriate timing	Mazuryk
Effectiveness of teaching modality	Seelig; Spillane
Mentor system	Spillane
Teaching objectives met	Seelig
Attendance	Swift

Two studies (Heligman and Spillane) collected some qualitative data, but methods used by the other five to select important dimensions of learner reaction are not reported. The face validity of learner reaction variables is therefore questionable, as learner reaction variables selected by researchers may not really reflect what was important to participants.

6.2 Change in attitudes

In terms of educational effectiveness, attitudes are defined as ‘Changes in reciprocal attitudes or perceptions’ (Figure 1). Ten studies assessed change in attitudes, and seven of these operationalized attitudes as changes in attitudes toward medical literature, with 11 different definitions of a change in reading habits. One article defined attitudes as a change in perceived workload after adopting EBP, while three studies assessed changes in self reported confidence when reading papers. All of these studies therefore focused on a change in attitude toward the material and activities required by the journal club.

Table 5: Studies assessing modification of attitudes & perceptions (Level 2a)

Definition of Change in attitudes	Study
Attitudes toward medical literature	Heligman
Change in reading habits; Enhancement in reading habits	O’Sullivan; Akhund
Change in sources of knowledge used; Different journals read	Fu; Lee
Number of assigned articles that were read	Burstein
Time spent reading	Bazarian; Seelig
Number of journals read	Bazarian; Lee; Linzer 1988
Journals most frequently read	Seelig
Number articles read vs skimmed	Lee
Time taken to review an article	Bazarian
Workload	Burstein
Motivation to read or review a subject further	Akhund; Elnicki; Spillane
Confidence to critically evaluate papers	Akhund; Kellum; Mukherjee

6.3 Change in knowledge

Change in knowledge is defined as the ‘acquisition of new knowledge, concepts, procedures, principles or skills (Freeth et al., 2002). This definition provides a helpful dividing line between the passive acquisition of new information and the active use of new information in practice – which would be defined as a transfer of learning to practising skills in the clinical environment.

The distinction between knowledge and skills was not consistent in the journal club evaluations. What was called ‘change in knowledge’ in one study was termed ‘change in skill’ in another. For example, knowledge of clinical epidemiology and biostatistics was operationalized as ability to use critical appraisal skills. Conversely, skill in critical appraisal was operationalized as ability to answer knowledge questions in clinical epidemiology and biostatistics.

Table 6: Studies assessing change in knowledge (Level 2b)

Acquisition of knowledge/skills, concepts, procedures, principles and skills.

Definition of Change in knowledge	Study
Clinical epidemiology and biostatistics	Cramer; Khan; Lee; Spillane
Principles of EBM; knowledge of research methodology	Khan
Keeping up with current literature	Akhund
Expansion of knowledge base	Elnicki
Development of an area of expertise	O’Sullivan

6.4 Change in skills

In a hierarchy of learning and service improvement, skill is an active concept, where knowledge is translated by individuals into meaningful information that can be used to change professional practice. In the journal club evaluations, skills were conversely defined as academic, focusing on the first four steps of evidence based practice: question formulation, accessing literature, critically appraising literature, and determining the applicability of the evidence to the clinical scenario. Only one study adopted a definition of skills that was more closely related to learning transfer, assessing ability to use problem based learning approaches to resolve clinical questions (Lee).

Table 7: Studies assessing change in skills (Level 2b)

Individual transfer of learning to the practice setting and changed professional practice

Definition of Change in skills	Study
Formulate questions	Elnicki
Access literature	Elnicki
Understand literature	Elnicki
Analytic skills	O'Sullivan
Critical appraisal skills	Fu; Kellum; Lee; Linzer 1987; Linzer 1988; Seelig; Spillane
Apply reading to a clinical case scenario	Fu
Ability to determine clinical usefulness of a study	O'Sullivan
Presentation skills	O'Sullivan
Problem based learning skills	Lee

Most of the studies (7/9) focused on assessing whether journal clubs were able to improve critical appraisal skills.

6.5 Change in behaviour

Change in behaviour is defined as 'transfer of learning to the workplace or willingness of learners to apply new knowledge & skills in the hierarchy of learning and service improvement. In our review, we referred to this concept as the ability to determine whether evidence was clinically relevant to a patient scenario and the actual steps taken to use evidence in practice. Only one study (Linzer) reported that participants discussed the ways in which they now utilized the literature in their practice of medicine.

Clinical applicability was poorly defined and was not operationalised. Clinical applicability includes the process of discussing whether journal information is applicable to a clinical situation, and the ability to apply literature to clinical practice. Seven studies included clinical applicability as an aim of the journal club, a further 4 did not state it as an aim of the club but included it in the evaluation. Seven studies discussed applicability as part of the critical appraisal process. In one club, the attending coordinator and other faculty summarized the lessons to be learned both in terms of study design and clinical practice (Burstein). Other articles referred to clinical applicability as 'to appraise and assimilate evidence leading to improvement

in patient care (Lee)'; the 'ability to determine clinical usefulness of an article' (Cramer; Heligman; O'Sullivan), and 'evidence sufficient enough to influence practice]' (Kellum; Khan).

Changes in practice were self reported and include:

- An Improved ability to apply reading to patient care (Elnicki; Linzer 1987)
- A taught 'analysis of clinical practice' (Burstein)
- 'It provided me with information that I have been able to apply in my clinical practice' (Mazuryk)
- Self-reported change in utilising literature in practice (Linzer 1987)
- Self-reported alteration in clinical practice: 'It had an impact on my work' (Fu; Spillane)

6.6 Changes in organizational practice

Change in practice is defined as wider changes in the organizational/delivery of care, attributable to an educational program. None of the evaluations considered the relationship between individual behaviour change and improvements in delivery of care.

6.7 Patient outcomes

In the hierarchy of learning, improvements in health or well being of patients is the final step in linking journal club learning to actual service improvement. There were no studies reporting patient outcomes.

6.8 Weak levels of measurement

Self-reported measures were used in the majority of studies. Self report is commonly used in qualitative research to explore people's perceptions of a phenomenon, their attitudes about experiences, and their perceptions of behaviour. In qualitative research, self report data is used to determine what experiences and factors are important to participants. The information can then be used to design surveys or tests that ask questions on areas that learners believe to be important. In the journal club

review, seventeen quantitative studies used self report to assess a change in knowledge, skills and behaviour. The validity of self-report in these circumstances is questionable, for several reasons. First, quantitative instruments with rating scales were used, but there is no indication that the questions in the instruments are based on participants' opinions of important lines of enquiry. Second, for areas such as change in knowledge a knowledge test is a stronger method of measurement than perceived improvements in knowledge. Although this is a commonly accepted fact in educational research, four of the seven studies assessing knowledge used self reports. Perceptions of improved knowledge are open to bias, as demonstrated by Davis et al. (2006) have showed that estimates of improvement made by individual doctors are usually optimistic when compared to objective measures of performance,

Table 8: How variables were measured

Variables S = Self Reported O = Observation T = Test V= Validated tool	Learner reaction	Attitudes	Knowledge	Skills	Behaviour
Akhund			S		S
Bazarian		S		V	S
Burstein	S, O	S			S
Cramer			T		
Elnicki			S	S	
Fu	S	S		V	S
Heligman	S	S		T	
Kellum		S		S, V	
Khan		S	V		
Lee	S	S	T	S	S
Linzer 1987				S, T	S
Linzer 1988	S	S		S, V	S
Mazuryk	S				
Mukherjee	S	S		S	
O'Sullivan			S	S	S
Seelig	S	S			S
Spillane	S		S		
Swift	S O				

Objective tests were used in nine cases to measure knowledge and critical appraisal skills. Although authors reported using validated tests in 4 studies (Bazarian, Fu, Kellum, Linzer 1988), none of the studies used the validated tests described in a recent systematic review (Shaneyfelt et al., 2005) and the actual reliability and validity of validated tests was not reported in any studies. Observation was only used in two studies, to count attendance.

6.9 Time period for evaluation of the intervention

Evaluation occurred at different stages of club development. Some studies evaluated a long standing club in order to make decisions about changing the format (Heligman; Linzer 1987; O’Sullivan; Swift) while others chose to evaluate a new or modified club to determine the impact (Burstein; Cramer; Fu; Kellum; Khan; Lee; Linzer, 1988; Mukherjee; Seelig; Swift).

Table 9: Time period for evaluation

Time period for evaluation	Study *single measure
1 session	Lee; Linzer 1987*
3 months	Elnicki*; Fu
4 months	Khan; Seelig
6 months	Burstein; Mukherjee; Swift
9 months	Kellum; Linzer 1988
12 months	Bazarian; Cramer; Mazuryk*; O’Sullivan*
3 years prospective	Heligman*
5 years or more retrospective	Akhund; Spillane*

6.10 How do we aggregate the data?

In systematic reviews that focus on randomised controlled trials, studies are lumped together by population, intervention, and outcomes. Our first stage of data synthesis demonstrated that there was too much heterogeneity in journal club studies to take this approach to answering the question of whether journal clubs are effective in

promoting evidence based decision making. Our next step was to review the underlying assumptions of authors regarding the elements of journal clubs that would promote uptake of research evidence. Authors listed the following factors as important to successful journal clubs.

- Interest among residents
- Interest and support among faculty
- Collegial atmosphere where more experienced clinicians can mentor trainees
- Need to motivate clinicians to keep up to date with research evidence
- Selection of relevant articles
- Need for more structured, evidence based approaches to reviewing journals
- Need for didactic teaching on principles of clinical epidemiology and biostatistics
- Discussion of complex/controversial issues
- Need for educational interventions that are based on principles of adult learning and that are 'learner centred'

These are the authors' opinions on the 'active ingredients' that are needed to support evidence-based decision making. In the second stage of our review, data was extracted that described the context and inputs for each journal club. A common list of elements was derived from this review, and the proposed set of active ingredients identified during the realist synthesis is presented in section 7.

7. Findings from the realist synthesis

The elements commonly provided across journal clubs include

- mentoring where a more senior clinician provides advice and technical support to a less experienced clinician in preparing for a session
- providing brief didactic training in literature searching, critical appraisal, principles of clinical epidemiology, and/or biostatistics to give clinicians the knowledge needed to find and judge the quality of research; providing expert support from a statistician

- using a structured learning materials such as a critical appraisal review instrument to lift analysis and discussion from the informal to a more systematic approach
- using principles of adult learning such as identifying relevant clinical questions, applying the learning tasks to actual patient cases, answering questions in 'real time', promoting active learner participation, and providing timely and constructive feedback
- using multifaceted approaches to teaching and learning such as one-to-one mentoring/supervision, small group discussion, formal presentations, and interactive large group discussion
- Integrating and reinforcing journal club learning by choosing topics that are linked to clinical lectures and supported by academic modules with related content and skills

Although there was heterogeneity in terms of how variables were defined, we found that studies could be grouped together for four basic outcomes: (1) change in reading behaviour; (2) confidence in ability to critically appraise research; (3) demonstrated knowledge and critical appraisal skills; and (4) ability to apply findings to clinical practice. The common elements of journal clubs were mapped for each study by outcome as a first step in determining the active ingredients of successful clubs. These are summarized in Table 11 with more detailed synthesis in Appendices 11.3 – 11.7.

Table 11: Active ingredients by positive and negative outcomes

Author	Active ingredients	+ Positive change / No change			
		Reading habits	Confidence	Knowledge and skills	Ability to apply evidence
	Mentoring Didactic support Structured review instrument Adult learning Multifaceted Learning approach Integrated with other learning / clinical activities Patient scenario	N = 11 + = 5	N = 7 + = 7	N = 7 + = 5	N = 7 + = 5
Akhund	M;AL	/	+		
Bazarian	M; S; P	/		/	/
Burstein	D (statistics);S	/			
Cramer	D; I			+	
Fu	D	/		/	
Elnicki	M; AL;P	/	+		+
Heligman*	M;S				
Kellum	M; D; S; ML		+	+	
Khan	M; D; S; AL; ML;P	+		+	
Lee	S		+		+
Linzer 1987	D (facilitator experienced in topic versus experienced in EBMs)	/			/
Linzer 1988	M; S	+ habits /time		+ clin epi, stats /CA	+
Mazuryk*					
Mukherjee	D;S		+		
O'Sullivan	M; D; AL;ML;P	+	+		+
Seelig	D; S; AL; ML	+	+	+	
Spillane	M	+			+
Swift*	D (statistician)				

* Assessed attitudes, not perceived/actual change

7.1 Improvements in reading habits

Eleven of the eighteen studies assessed changes in reading habits (Appendix 11.4). Reading habits were not always defined (Linzer 1988; O'Sullivan) but three authors defined this as motivation to read or stimulation to review a subject further (Akhund; Elnicki; Spillane), or change in use of journals or textbooks (Fu). Researchers also used the number of articles read and time spent reading as a proxy outcome for testing the assumption that journal clubs lead to more positive attitudes toward reading and therefore inspire participants to keep updated. Reading patterns were defined as time spent reading (Bazarian; Khan; Seelig), the number of articles read per week or month (Burstein; Khan; Linzer 1987), and reading articles more

completely (Linzer, 1987). Five studies noted a self-reported improvement in reading patterns (Khan, Linzer 1988, O'Sullivan, Seelig, Spillane). It is worth noting that reading less articles per month was associated with reading more completely (Linzer 1987) and that improvement in critical reading habits is not necessarily associated with the amount of time spent reading (Linzer 1988). Seelig described this as an increase in perceptions of spending more 'useful' time reading.

Positive attitudes toward participation in journal clubs is not necessarily related to a change in reading behaviour. The Akhund study found that although 70% believed that the journal club provides stimulus to further reading, and 89% agreed that it was educationally valuable to prepare, only 44% associated participation with improved reading behaviour.

Of the seven studies using mentoring and assessing reading habits, four reported positive change in reading habits but three showed no difference. Where didactic support was used, three studies produced improved reading habits, but three did not. Three of five studies using adult learning showed improved reading. Of the five using a structured review instrument, three showed improved reading and two did not.

7.2 Increased confidence in ability to critically appraise the quality of research

The seven studies assessing confidence reported an overall increase in perceived ability to critically appraise (Akhund; Elnicki; Kellum; Lee; Mukherjee; O'Sullivan; Seelig).

One study noted that although confidence increased, perceptions of ability varied by the level of learner (Elnicki). Medical residents and faculty were more confident than students, and faculty noted that 'although some [students] enjoyed the sessions, others felt them to be a distraction from other tasks'. Faculty noted that the journal club was confusing for students and that beginners had problems with critical appraisal. The authors suggested that 'what we may be observing is variability in the students' capacity for independent study at this point in their medical education.' In

contrast, residents found that the JC experience was 'easily translated into patient care' and faculty found the club promoted 'useful skills, often overlooked in training'. Kellum also raised the point that a significant increase in perceived confidence did not correlate with actual performance on critical appraisal tests.

Four of the studies reporting positive change included mentoring, four used didactic support, four used adult learning and four used a structured review instrument.

7.3 Increased knowledge and skills in critical appraisal

Five of the seven studies that used objective tests of critical appraisal demonstrated an improvement. Two of these studies used validated knowledge tests (Khan; Linzer 1988), and three used unvalidated tests (Cramer; Kellum; Seelig). Although all five reported a statistically significant increase in knowledge, interestingly the Linzer study produced an increase in clinical epidemiology and statistics knowledge without a corresponding improvement in critical appraisal skills. Critical appraisal is a complex skill which includes but is not limited to knowledge of epidemiology and statistics. Participants attended a mean of 5 sessions over 9.5 months which may not be adequate for development of skills.

Two studies assessed both increased confidence to critically appraise and actual performance on tests of critical appraisal skills (Kellum; Seelig). Although both found improvements across confidence and test performance, Kellum noted that one fellow had increased confidence with no change in test score, while one had an increased test score with no change in confidence. The fellow with the largest increase in ability had no change in confidence. This indicates that self-report of increased knowledge and skills is a weak indicator of actual performance.

Three of the studies demonstrating improvement in knowledge and skills included mentoring in journal clubs, while four included didactic support and four used a structured review instrument.

7.4 Ability to apply evidence in clinical contexts

Seven of the eighteen studies looked at the ability of journal clubs to promote application of evidence in practice (Appendix 11.7) , and five found a self-reported positive relationship (Elnicki; Lee; Linzer 1988; O’Sullivan; Spillane). The Linzer study compared a control group that participated in a seminar series with an intervention group who participated in a journal club. Although there was no significant difference in critical appraisal knowledge scores between the two groups, the journal club group reported greater perceived ability to use information in practice. The active ingredients in this study were mentoring to promote understanding and group discussion to consider applicability. The O’Sullivan study contains the same active ingredients, noting that although both journal clubs included critical appraisal, the learner centered club which had interactive discussion was better at promoting ability to determine clinical utility.

Four of the studies reporting ability to use evidence in practice included mentoring,

What type of journal club works for whom in what circumstances?

The synthesis indicates that mentoring was present in some of the journal clubs where there were improvements in reading, confidence in critical appraisal, knowledge and skills, and ability to apply evidence. Didactic support was present in six of the studies that assessed improved reading and in half of these clubs reading actually improved. It was present in four of the five studies where knowledge and skills improved. Similarly, a structured review instrument appeared to be an active ingredient in four of the five studies where knowledge and skills improved. Adult learning was an ingredient in some studies across all areas, but the influence of adult learning is difficult to assess because it may have been underreported when the educational intervention was described. This may also be the case with multifaceted approaches to teaching and learning, as well as integration with other learning or clinical activities.

One of the key mediating factors in terms of journal club success may be whom the club is designed for. Although this review originally intended to analyse results by professional group and student group, this was not possible due to quality of studies and lack of multidisciplinary clubs. Similarly, O'Brien's review (2001), where the authors attempted to include type of health professional as an explanatory variable, were unable to do so due to a lack of studies including groups other than doctors.

We did, however, find within our population of doctors variation by level of training. For example, the Bazarian study, which contained a number of active ingredients, compared interactive case-based presentation and mentoring with a traditional journal club that did not have faculty support for preparation or systematic analysis. The authors posited that the lack of statistical significance may be due to the level of learners and number of sessions. Residents and interns participated in intervention and control groups for a total of 12 sessions over 12 months, with only one participant dropping out of each group. The authors noted that 'The important variable may not be the degree of structure in the teaching method but the total exposure time to the teaching method.' When the intervention group was exposed to a new activity – the journal club - some demonstrated remarkable improvement during the year while others regressed. This wide variation was not seen in controls, who were not exposed to a new way of learning. Bazarian hypothesized that unlearning may need to occur for residents before they can learn EBM.

The concept of unlearning is described by Eraut in relation to stages of learning that were originally outlined by Dreyfus & Dreyfus (1986). Introducing an EB journal club format into clinical learning may have different effects, depending on the stage of the learner. Novices and advanced beginners, for example, are at the stage where they are mastering content and learning rules (Figure 4). This may explain why Elnicki's medical students found critical appraisal more challenging than the residents and faculty in his study.

Residents will be at Dreyfus level four and fellows will be reaching level 5 (figure 4). This has implications for performance in journal clubs. For example, Kellum posits that fellows will be more knowledgeable than students or residents about the literature in their field. Lee notes that residents will also have proficiency in

assimilating evidence from journal articles. This knowledge may help in mastering critical appraisal techniques, because residents and fellows will not need to familiarize themselves with the content, just the skills. On a related point, O'Sullivan states that familiarity with the literature is crucial to the thorough review of an article. Less mature learners, therefore, will struggle more with critical appraisal, as was demonstrated in Elnicki's study, because they are more focused on mastering content than they are on critiquing it.

Figure 4: Summary of the Dreyfus Model of Progression

<p>Level 1 Novice Rigid adherence to taught rules or plans Little situational perception No discretionary judgement</p> <p>Level 2 Advanced Beginner Guidelines for action based on attributes or aspects (aspects are global characteristics of situations recognisable only after some prior experience) Situational perception still limited All attributes and aspects are treated separately and given equal importance</p> <p>Level 3 Competent Coping with crowdedness Now sees actions at least partially in terms of longer-term goals Conscious deliberate planning Standardised and routinised procedures</p> <p>Level 4 Proficient See situations holistically rather than in terms of aspects See what is most important in a situation Perceives deviations from the normal pattern Decision-making less laboured Uses maxims for guidance, whose meaning varies according to the situation</p> <p>Level 5 Expert No longer relies on rules, guidelines or maxims Intuitive grasp of situations based on deep tacit understanding Analytic approaches used only in novel situations, when problems occur or when justifying conclusions Vision of what is possible</p> <p>(Source: Eraut & Hirsh, 2007)</p>
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Mazuryk suggested that the focus of learning is different for residents and fellows. Residents are fulfilling a rotation in a limited time period, so their interest may be more clinically oriented, while fellows are focusing on a specialised area implying greater interest in the research topic and a more academically oriented approach.

The take away message here is that journal clubs need to consider the level of proficiency in the group, and educational research on the effectiveness of journal clubs needs to select assessment measures that will reflect the 'educationally important difference' by level of learner.

Other mediating factors that could influence success, particularly in relation to the level of learner, are the duration of the club and frequency of exposure. When questioning why clinical epidemiology and biostatistics knowledge improved but critical appraisal did not, Linzer noted that more prolonged exposure to the practice of EBM may be needed before a widespread improvement in critical appraisal can be demonstrated. He posited a 'dose-response' relationship, where proficiency increased over time. This is supported by Eraut's research, which points out that when more proficient practitioners are exposed to new ways of learning, they find themselves in a situation where they 'return to being a novice without the excuse of being a novice. Hence the need for more time and support is an order of magnitude greater than that normally provided' (Eraut 2004).

The overall message, across studies in the review, was that there is no ideal format for a journal club. Groups need to tailor the club according to learner needs and level of training (Alguire, 1998). There are, however, key ingredients that contribute to the success of journal clubs, and each of these potentially active ingredients needs to be considered when doing the tailoring (Table 12).

8. Conclusions

8.1 Using the review findings

The included studies reported improvements in reading behaviour (N= 5/11), increased confidence in critical appraisal (N=7/7), improved test scores on critical appraisal (N = 5/7), and. increased ability to use findings in clinical practice (N=5/7). Conclusions from the review need to be made in the context of the methodological quality of studies. There was a wide range of heterogeneity of the journal club intervention, as discussed in section 6, making it difficult to answer our effectiveness

question 'Is the journal club effective in supporting evidence-based decision making? We cannot conclude that journal clubs are effective in supporting evidence based decision making, because only seven studies attempted to measure this endpoint and they relied on self-report.

Methodological weaknesses in the studies

The first stage of review revealed some problems with research design, which have been noted by authors of reviews in related topic areas (Ebbert et al., 2001; Marinopoulos et al., 2007). First, the description of the interventions lacks attention to detail, preventing adequate replication. Second, there was a paucity of learner assessment and few validated tools were used for quantitative assessment. This finding is supported by a review conducted by Shaneyfelt et al. (2006) which found that only 53% of studies evaluating evidence based teaching used some form of validated assessment tool. Further, a recent systematic review of continuing medical education found that only 33% of the studies reported validity of evaluation tools (Marinopoulos et al., 2007). Qualitative assessment had corresponding problems with rigour, lacking descriptive data to support research conclusions. Third, the large variation in journal club design and delivery limits comparison. Heterogeneity was noted as an issue in Ebbert et al.'s review (2001), and is also pointed out in reviews of continuing medical education (Marinopoulos et al., 2007) and evidence based medicine teaching (Coomarasamy & Khan, 2004). Sources of variation include the size of the group, the frequency of meetings, the mode of presentation, the preparation required, the level of interaction, the level of facilitation and the skills and knowledge acquired.

One area of contention is the size of journal clubs. Perhaps there are two competing types of club: an interactive club which can be defined by a group size less than 16 and a more didactic club that has a number of participants greater than 16. Otherwise it would be hard to compare the level of interaction and learner reaction with two diverse group sizes. A second area of contention concerns the frequency of meetings. We would argue that relationships between group participants can only develop if the meeting is regular, and CME evidence indicates that multiple

exposures to learning are more effective in promoting and maintaining changes in practice over time (Marinopoulos et al., 2006).

Information on presentation, preparation, interaction and facilitation is missing in a number of articles, despite the fact that context is key to determining whether there is a basis for comparison across different clubs. Another problematic area concerns the lack of importance placed upon selection of relevant patient problems and articles relating to these problems. Thus we are unable to determine which of the components of the journal club are more important than others and likely to lead to improved outcomes.

In terms of change in attitudes these were mainly assessed with regard toward the material and activities required by the journal club. Knowledge and skills was not consistent throughout journal club evaluations. Only one study adopted a definition of skills that was more closely related to learning transfer, assessing ability to use problem based learning approaches to resolve clinical questions (Lee). Only one study (Linzer) reported that participants discussed the ways in which they now utilized the literature in their practice of medicine.

Self –reported assessment has its limitations and further evaluation should aim to use validated scales. Only two studies (Heligman and Spillane) collected some qualitative data, but methods used by the other five to select important dimensions of learner reaction were not reported. Perhaps the most we have to gain right now is through qualitative investigation of the components of a journal club that are most likely to lead to improved knowledge and skills and changes in practice, particularly with respect to direct patient problems.

Several systematic reviews have been conducted on topics related to journal clubs. These include reviews of the effectiveness of teaching critical appraisal skills (Parkes, 2001; Taylor, 2000), the effectiveness of teaching EB skills (Coomarasamy et al., 2003; Coomarasamy & Kahn, 2004), and the use of instruments to evaluate EB teaching (Flores-Mateo & Argimon, 2007). It is difficult to compare the findings of these reviews to the effectiveness question for our journal club review for two reasons. First, the outcomes of knowledge, attitudes, and skills were defined

differently. For example, Flores-Mateo and Argimon (2007) defined skills as 'the participant applying knowledge by performing EBP steps in some scenarios', where our BEME definition emphasizes transfer of skills to the workplace. Behavior is defined as actual performance of EBP in practice, where the BEME definition includes the dimension of organizational change. Across all of the reviews, definitions of knowledge and attitudes were assumed to be homogenous across individual studies. Our review found that on closer inspection these definitions were operationalised in different ways, and we therefore question whether data synthesis and meta-analysis can actually be performed. There may be important issues of heterogeneity in intervention design that warrant further investigation before conducting a meta-analysis. For example, the journal club interventions may be delivered differently than described in the study, presenting major issues with what Bellg et al. (2004) describe as 'treatment fidelity'.

8.2 Identifying active ingredients

Analysis of the various elements contained in journal clubs produced a cluster of elements that may contribute to the overall effect. These were termed active ingredients, and included mentoring, didactic support, use of structured review instruments, adhering to principles of adult learning, using multifaceted approaches to learning, and integrating learning with other academic and clinical activities. Due to incomplete reporting some clubs may have actually had far more of the potentially active ingredients than reported.

Definitions of 'positive' outcomes may also bias the findings of this review. We took a conservative approach, defining positive outcomes as those where authors either reported a substantial improvement in pre-and post-test surveys or a statistically significant difference. But some studies reported a positive trend which did not reach statistical significance (Burstein; Fu; Linzer 1987), while others reported internal variation with some individuals achieving much more substantial educationally important differences than others (Mukherjee; Bazarian). As study sizes were small, some were not adequately powered. Finally, some studies noted positive effects that were not systematically assessed, such as the fact that participants were actively

talking about and using EBM concepts more than they had previously, and felt that EB concepts were useful in designing and conducting their research projects (Bazarian). This indicates that participants' definitions of meaningful outcomes may differ from researchers' definitions.

Table 12 : What type of journal club works for whom in what circumstances?

Design	Training	Delivery	Receipt	Enactment
Participation	Resources invested	Activities during sessions	Outcomes (short term)	Impact (longer term)
Length, duration, frequency of meetings: Partially documented, not systematically analysed Content of meetings: Topics need to be relevant to learner needs and applicable to patient cases Type of participants: Level of learner (Student, intern, resident, fellow, faculty) was influential Attendance: Documented but not systematically analysed Size of group: Not identified as an active ingredient Level of participation/ interaction: Not described	Time: Not documented Staff expertise: in searching, statistics, facilitating critical appraisal, facilitating discussion: didactic support in the form of lectures, workshops or expert assistance before the club or during sessions Money: Not documented	Question formulation: Not documented Searching: Only documented in one study Preparing for presentation Critical appraisal Discussion on clinical applicability Supported by mentoring, structured materials/review instruments, adult learning, multifaceted approaches to teaching, integrated with other academic and clinical activities Tailored to level and needs of learner	Ability to recognize uncertainty and question practice: Not documented Skills to find relevant evidence efficiently: Problems finding relevant studies Skills in summarizing evidence; Ability to judge the quality of evidence: Positive results in clubs containing active ingredients Decision making regarding use of evidence: Positive results in clubs containing active ingredients	Willingness to apply EB skills in workplace Ability to transfer knowledge to practice Less harmful interventions for patients Improved patient care: Not documented

8.2 Implications for practice

Our review illustrates the principle that journal clubs are used widely across different sectors of the healthcare and used in a variety of different ways. Active ingredients are found at each stage of the educational intervention (Table 12).

It is not possible to determine whether one format of journal club is superior to another, but certain elements are linked to success and can be included at the stages of design, training, delivery, receipt and enactment. For example, if a journal club is being designed for residents, the content should be directly applicable to

patient cases they find problematic, enabling application of evidence in a real time setting; didactic support could be provided based on an educational needs assessment,(e.g. for statistical support). Critical appraisal and discussion of clinical applicability could be facilitated by senior clinicians who are in supervisory positions, enabling the transfer of discussion into practice. A journal club for students or interns may include the same ingredients, but in different proportions, with more emphasis on learning the 'rules' of critical appraisal and the topics of clinical epidemiology and biostatistics. The content of these clubs could mirror the topics that students are currently learning in the medical curriculum and on which they expect to be examined.

8.3 Implications for future evaluations

We have several recommendations for improving the research base for journal clubs which reiterate the recent systematic review of continuing medical education conducted by Davis et al. (2009). First, the study design should be based on pedagogical theory, for example using the principles of adult learning. This is in line with recommendations that research into the effectiveness of EB teaching needs to be more closely aligned with theory (Coverdale et al., 2008) particularly educational theories that support real time integration of education with clinical practice (Mascola, 2008) The findings from this realist synthesis suggest an emerging theory for effective journal clubs e.g. effective clubs will use a multifaceted approach providing mentoring, didactic support when needed, structured instruments for critical appraisal, and experts to facilitate interactive discussion of clinical applicability.

Second, the goals of the journal club need to be explicitly stated (Alguire, 1998). Future evaluations of journal clubs can only produce valid results if the elements of the complex educational intervention are explicitly described. Third, each element of the intervention needs to be operationalised with sufficient definition of the variables to facilitate comparison of the active ingredients within the delivery framework. Fourth, evaluation questions need to be matched to the goals of the intervention, to the effectiveness measures, and to the level of effect. In qualitative studies, evaluation questions need to match the methods for data collection and analysis. Where qualitative research is used, findings need to be underpinned with primary

data. Fifth, effectiveness measures, such as knowledge, attitudes and skills, require more consistent definitions to facilitate comparison across studies (Belfield, 2001). Tools for assessing effectiveness can be selected from the validated tools that currently exist (Shaneyfelt et al., 2006). Where this is not possible, tools can be internally validated and the degree of reliability and validity reported in the paper (Marinopoulos et al., 2007). Finally, systematic reviews in continuing medical education have identified studies that investigate the relationship between CME learning and performance in practice (Marinopoulos, 2007; Davis et al., 1995; Oxman et al., 1995). Lessons could be taken from these studies to explore the relationship between journal club learning, changes in clinical behaviour, and changes in organisational practice. Researchers have acknowledged that using a randomized controlled trial design presents challenges in educational research (Coomarasamy & Khan, 2004). More mixed method research need to be conducted, where randomised or before-after studies are supplemented with qualitative research to help explain levels of effect.

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11. Appendices

11.1 Coding sheets

Question	
Is the study purpose easily identified?	
Objectives	
Are objectives of the club clearly stated?	
Are objectives congruent with rationale, intervention, and evaluation?	
Study design	
Is study design appropriate for question?	
Is there a similar comparison group?	
Is there selection bias in group assignment?	
Are raters blinded to group assignment?	
Is study design described in sufficient detail to be replicated?	
Are long- and short-term effects assessed?	
Are confounding variables controlled for by design or analyses?	
Has power analyses been conducted to determine sample size?	
Intervention	
Are teaching methods and content described in enough detail to replicate?	
Is setting described?	
Are learner characteristics (e.g. level of training, profession, age) described?	
Are required resources described?	
Evaluation	
Do outcomes match learning objectives and question?	
Are reliability and validity of instruments reported?	

Were inter-rater and test-retest reliability and content and predictive validity considered?	
Are data collection methods described in enough detail to replicate?	
Are statistical tests described?	
Are statistical tests appropriate for design?	
Are p values and measures of dispersion reported?	
Results	
Is educational significance/effect size assessed?	
Are conclusions justified by results?	
Are strengths and limitations acknowledged?	
Is contribution to literature described?	

11.2 Assessing the methodological quality of the evaluation design

1. What is a journal club?
 - a. Demographics: Specialities and countries represented in papers
 - b. Size
 - c. Frequency and length of meetings
 - d. Duration
 - e. Choice of papers
 - f. Facilitation
 - g. Process: what actually happens in the club, in terms of training, support for preparation, presentation, discussion

2. Clinical applicability
 - a. Aims of the club – do they include clinical applicability?
 - i. Yes, definitely stated as an aim of the club
 - ii. Yes, to some extent (e.g. implied in the description of the club)
 - iii. No, no mention of clinical applicability anywhere in the paper

3. Does the evaluation method match the question?
 - a. Does the study design match the question?
 - i. No – discard the paper, poor evaluation design
 - ii. Yes – keep the paper
 - b. Was it a well conducted study? (Use Reid's criteria for evaluating an educational intervention)
 - i. No
 - ii. Yes
 - c. Was a validated instrument used to assess the educational intervention? (Use Shaneyfelt and Flores to decide)
 - i. No
 - ii. Yes
 - d. Did the tool match what they were trying to assess? (Content validity for the evaluation question)
 - i. No
 - ii. Yes
 - e. Did they evaluate clinical applicability?
 - i. No
 - ii. Yes

Appendix 11.3: Design of journal clubs

Author	Duration of club *Study period	Length of meetings	Frequency of meetings	Type of participants S = single group I = Intervention group C = Control group	Size of group	Attendance	Educational intervention Described participation/ interaction
1 Akhund	6 years	1 hour	Weekly	S = Community medicine residents. Faculty & students can attend.	N = 32 17 current participants, 15 former participants	Mandatory for community residents LR SRQ: 88.8% agree preparation and attendance at JC is educationally valuable,	EBM journal club, adult learning principles. Senior resident rotates as coordinator. Presentation by rotating resident then discussion. Presenter summarises search, describes burden of problem, critiques sections of article. Sometimes alumni are invited to share research they have conducted.
2 Bazarian	*12 months	Not stated	Monthly	I = Emergency medicine 8 interns, 8 second year residents from an academic urban emergency medicine residency program (no established journal club). C = Academic emergency residency program 8 interns and 8 second year residents, from a geographically distinct site (established club with set format).	I = 16 C = 16	I: mandatory C: voluntary. 2 residents dropped out (1 from each group). LR: The intervention group attended significantly more journal club conferences than the control group did (median 6 versus 2 sessions, P<.01).	I = EBM approach to critical appraisal with close mentoring and supervision, using structured review instrument and patient cases. C = Unstructured journal club
3 Burstein	Not stated	Not stated	Monthly	S = Emergency medicine residents, 1 faculty coordinator, 1 statistician	10 - 12 residents + other faculty	Mandatory. LR: Before-after attendance 92% vs 71%, P = .65	Structured EB review instrument. Resident chair selects a resident who to read each article and begin the discussion. Resident leader chairs the discussion and expands on group comments. Co-ordinator and statistician summarise key points for study design and clinical practice.
4 Cramer	1 academic year	Not stated		M = Family medicine residents, in their 2nd and 3rd year of university-based residency programme	>35	Not stated. Only those residents who were present for an entire year were included in analysis (35)	Evidence based medicine approach adopted including critical appraisal and clinical epidemiology. Participation not described
5 Elnicki	1 year *3 months	Not stated	Monthly: Faculty and residents: Twice weekly: Senior medical students:	M = School of Medicine 4th year students, residents, faculty; previous participation in journal clubs with a variety of formats	Group 1: 16 primary care faculty Group 2: 63 residents Group 3: 29 senior medical students	Faculty invited; unclear re mandatory attendance for students and residents. Some residents unable to attend due to clinical duties.	EBM structure based on questions from patient encounters, evaluating search for evidence and promoting application to patient care. Faculty and residents can attend each other's meetings. Senior medical students change rotations monthly, so group composition - and participation- may be affected. Motivating members to read

							articles was a problem. Wide range of ability can place some learners in 'a potentially embarrassing situation'. This implies some problems with facilitation.
6 Fu	I:12 weeks C: NoJC	1.5 hours	Weekly	IC = Psychiatry Residents postgraduate year 1-5. Matched intervention and control groups.	I = 12 C =12	Mean attendance 8.3+ 1.9SD. No loss to follow up. LR SRQ 5-point Likert: Motivation to attend JC I = 3.7 +- 1.0 C = 3.1 +- 0.5 Incomplete response rate	I: EB structure teaching critical appraisal skills and application of evidence to scenarios. C: No journal club or taught critical appraisal skills. Resident presents critical review including introduction, study design, biases, sample size, generalizability, statistical methods, results, discussion, conclusions, and other areas. Professor facilitates and elaborates. Residents encouraged to freely participate.
7 Heiligman	4 years 14 sessions/ yr *3 years	1 hour	Monthly approx	M = Family medicine residents	31 residents presented over the 3 years. (there were 11 faculty and 24 residents in the department).	Actual attendance averaged 50% of each group.	EB journal club using mentoring and structured review instrument. 31 different residents led the journal clubs, some residents presented twice, the first one was evaluated.
8 Kellum	Academic year	1 hour	Not stated	S = Internal medicine fellows from pulmonary medicine, surgery, and anaesthesiology	12	Attendance strongly encouraged but not mandatory , varied widely . .	EBM journal club requiring presentation of an article linked to other activities in the students' academic programme, followed by a written critique for assessment. Required active participation rather than mere attendance

Author	Duration of club *Study period	Length of meetings	Frequency of meetings	Type of participants S = single group I = Intervention group C = Control group	Size of group	Attendance	Educational intervention Described participation/ interaction
9 Khan	*15 sessions/ 4 months	1 hour	Weekly	S = Obstetrics & gynaecology post graduates	8	Not stated	EBM journal club using structured review instrument. Small interactive groups, one-to-one tutoring during workshop to increase confidence in critical appraisal.
10 Lee	Pre-existing club	Not stated	1 meeting	M = Ophthalmology post graduate residents	29 total Group 1: 12 Group 2: 9 Group 3: 8	Mandatory	Existing traditional journal club adopting structured review instrument. Participation not described
11 Linzer 1987	Pre-existing club with members who had participated for 1-2 years	Not stated	Weekly	IC = Internal medicine 1st year residents	Team 1: 42 Team 2: 43 led by chief medical resident and subspecialist with interest in article under review	Team 1 attended 7 sessions (sd 5.1) vs team 2 12.9 (sd 8.8): significantly more attended team 2 p<0.02	Traditional journal club I: Led by general medicine faculty member with clinical epidemiology, statistics and critical appraisal training C: Led by chief medical resident and subspecialist with interest in article under review Meet weekly, select articles, and announce articles for discussion. Participation not described.
12 Linzer 1988	9 months	Not stated	Weekly during clinical rotations	Internal medicine interns I: Journal club group C: Conference series on ambulatory medicine, no emphasis on critical appraisal or clinical epidemiology	I = 22 C = 22	Attend average of 5 sessions I: Nearly 100% attendance	I: EB journal club using structured instrument. House staff presents, faculty emphasizes methodological points, then elaborates on epidemiological and statistical principles as they arise in discussion and showed how principles can be used in CA. Facilitators leads discussion of clinical applicability. C: Standard conference series with lectures. Critical appraisal, epidemiology or biostatistics not emphasized.

Author	Duration of club *Study period	Length of meetings	Frequency of meetings	Type of participants S = single group I = Intervention group C = Control group	Size of group	Attendance	Educational intervention Described participation/ interaction
13 Mazuryk	10 years	20 minutes	daily	S = 4 staff physicians, 2 family practice residents(2/52), 1 PC fellow(4/12+) visitors survey of residents and fellows only	Approximately 7-12	Mandatory.	Daily presentation of article before ward rounds. Regular presenters include 4 staff physicians, 1 fellow, 50% of presentations given by attending physician staff. Residents must do 1 presentation during their 2 week rotation. Some brief discussion.
14 Mukherjee	10 sessions	1 hour	monthly	S = Medical school doctors, psychologists, clinical and social science researchers, and multidisciplinary community team members	15	Not stated	Presentation and assessment of both qualitative and quantitative research papers on the same subject at the same session A different presenter was chosen for each session, a psychiatric specialist registrar for the quantitative section of the session and social science researcher for the qualitative section. The structure was modified based on comments received throughout the period of study.
15 O'Sullivan	>25 years	1 hour	I: 1 hour weekly C: 2 times per month	General internal medicine residents I: Situated within a 'Learner Centred' general internal medicine GIM programme C: Situated within a 'Traditional' internal medicine (IM) programme	I: 25-30 per week	I: Nurse practitioners, community physicians, GIM faculty and residents. C: Both IM and GIM residents I: Residents attend mean 24 sessions, presents at 6 C: Resident attends mean 9 sessions, presents at 2	I: Faculty member 'provides structure' & faculty-student team emphasize active audience involvement throughout. Discussion is very interactive. Participants often start with a case scenario and vote on choice of care. Feedback from co-presenters and program evaluator on presentation skills. Faculty present approximately 4 times a year, each resident twice a year. C: Led by chief resident. Emphasised critical appraisal. Minimal faculty participation.
16 Seelig	Existing club	Not stated	Every 2 weeks	S = Internal medicine residents years 1-3	14	Not stated	EB journal club incorporating principles of adult education and using structured review instrument. Adult learning teaching intervention including clearly presented learning objectives, explanation of relevance of journal club to immediate clinical needs and long term professional goals, and multifaceted teaching and learning format. 'learners' participation elicited on specific objective-related tasks'

Author	Duration of club *Study period	Length of meetings	Frequency of meetings	Type of participants S = single group I = Intervention group C = Control group	Size of group	Attendance	Educational intervention Described participation/ interaction
17 Spillane	5 years	Not stated	weekly	M = Surgery accredited registrars, non-accredited general surgical registrars and consultant surgeons.	30 current and 9 past members	Encouraged to attend but not compulsory Self reported attendance 21 respondents reported attending > or = 66% of meetings	Traditional journal club. An informal evening, with drinks and a meal. Evening concludes with coffee and informal discussion. 3-6 articles discussed each night.
18 Swift	Not stated	Not stated	weekly	S = Psychiatry doctors, consultants, post-Membership trainees involved in teaching and research, & pre-Membership trainees	10	Mandatory attendance. Before: 10 of 14 meetings cancelled over 3 months due to lack of preparation or trainees failing to attend. After: No cancelled meetings. Attendees increased from 10 to 15, including 2 who had previously declined due to lack of relevance and 2 from outside the department.	Presenter chairs discussion and uses statistician as a resource. Presenter prepares questions for each paper similar to structured checklist. Small groups discuss and present conclusions to larger group.

Appendix 11.4: Improvements in reading habits

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
<p>9 Khan Study type: Single group study before-after</p>	<p>Mentoring: 1 hour one.-to-one tutoring with mentor.</p> <p>Didactic support. One day workshop (6 hours) covering critical appraisal and searching skills.</p> <p>Topics were generated by questions that were raised by health care professionals or patients themselves in the clinical setting.</p> <p>Presenter receives relevant methodology papers to appraise.</p> <p>Adult learning – small interactive groups during workshop to increase confidence in critical appraisal.</p> <p>Multifaceted teaching and learning approaches.</p> <p>Structured review instruments Catmaker software used to record Critically Appraised Topic.</p>	<p>Participants: Obstetrics & gynaecology post graduates Group size: 8</p>	<p>Duration: Academic year Attendance : Not stated</p>	<p>Respondents: Not stated SRQ at baseline and 4 months Significant increase in reading time baseline median 2 hours (range 1-5) post-intervention 3.5 hours (range 2-8) (p=0.026).</p> <p>Number of articles read/week baseline median 1.5(1-5) post-intervention 2.5 (1-4) P=.096</p>

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
12. Linzer 1988 Study type:RCT	Mentoring: Faculty facilitator (1 hour preparation) helps presenter in selecting article. Structured review instrument: McMaster series used for CA.	Participants: Internal medicine interns I: Journal club group C: Conference series on ambulatory medicine, no emphasis on critical appraisal or clinical epidemiology Group size I = 22 C = 22	Duration: 9 months Attendance: Attend average of 5 sessions I: Nearly 100% attendance	Respondents: I: n/N 22/22 C : n/N19/22 Time: 9.5 months -mean time pre/post –test Assessment: Change in articles read/month I: -2.3, C: -2.0 P=.59 Change in journal subscriptions or completeness of reading NS. Change in reading habits as a result of participation I: 86%, C: 0% P=<.02.001 I: More skeptical of results and conclusions 86% I: Pay more attention to methods sections 77% Bottom line: JC improves critical reading habits but not time spent reading.
15. O'Sullivan Study type: Descriptive survey	Mentoring I: Randomly assigned resident-faculty pairs meet 1 month before session, as often as needed (usually about 3 times). About 16 hours preparation required. C: About 9 hours preparation required. Didactic support: . Initial 1 hour teaching session. All residents receive 6 1-hour sessions on critical appraisal skills, and clinical teaching skills sessions. Clinicians receive CE credit for attendance Adult learning 'learner centred' emphasizing active participation and interactive discussion throughout. Multifaceted learning: combining presentation with group discussion and other interactive exercises.	Participants: General internal medicine residents I: Situated within a 'Learner Centred' general internal medicine GIM programme C: Situated within a 'Traditional' internal medicine (IM) programme Group size: I + 25-30/week	Time Sessions I: 1 hour weekly C: 2 times per month Attendance: I: Residents attend mean 24 sessions, present at 6 C: Resident attends mean 9 sessions, presents at 2	Respondents: Distributed to current residents and those completing training within the past year Assessment: Survey 5 point Likert scale SRS: I group rated Impact on reading habits significantly higher P= .001 Bottom line: Learner centred journal clubs with weekly meetings, high levels of attendance, and clear expectations of collaboration are more positively perceived than 'traditional' JCs in terms of residents' perceptions of their reading habits.

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
16. Seelig Study type: Single group before-after	<p>Didactic support: Workshops or lectures designed to enhance understanding of structured approaches to appraising and understanding research</p> <p>Adult learning teaching intervention including clearly presented learning objectives, explanation of relevance of journal club to immediate clinical needs and long term professional goals</p> <p>Multifaceted teaching and learning format.</p>	<p>Participants: Internal medicine residents years 1-3</p> <p>Group size: 14</p>	<p>Duration: Existing club</p> <p>Sessions : Every 2 weeks</p> <p>Attendance : Unknown</p>	<p>Respondents: Not stated Assessment: SRQ Likert 6 point</p> <p>Reading time increase from 3.75 to 4.50 hours/week NS (P = 0.17) Perceptions of spending more useful time reading changed 4.08 on the scale Bottom line: A JC based on adult learning principles and structured support with clinical appraisal improves reading behaviours,</p>
17. Spillane Study type: Retrospective survey	<p>Mentoring: A nominated consultant acts as a mentor, guiding the registrar in the selection of a paper. The level of mentor assistance is variable. Once the paper is presented the mentor gives his/her opinion on the qualities of the paper and the presentation.</p>	<p>Participants: Registrars and consultant surgeons</p> <p>Group size: 30 current and 9 past members</p>	<p>Duration: 5 years</p> <p>Attendance 21 respondents reported attending ≥ 66% of meetings</p>	<p>Respondents: 19/28 Assessment: 19/28 were stimulated to further reading as a result of the journal club</p>

Appendix 11.5: Increased confidence in ability to critically appraise

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
1 Akhund Study type: Survey	Mentoring: Coordinator helps presenter in article selection, preparing presentations, organizing mock presentations, distributing selected article. Residency faculty supervises session and provides feedback	Participants: Community medicine residents. Faculty & students can attend. Group size: N = 32 17 current participants, 15 former participants	Duration: 6 years Attendance: Mandatory for community residents 88.8% agree preparation and attendance at JC is educationally valuable,	Respondents: 29/32 Assessment: Satisfaction with appraisal: 89% satisfied SR: Confidence in CA >85% increase
5. Elnicki Study type: Descriptive evaluation	Mentoring: Faculty helps with question definition, search and preparation of presentation. Adult learning: learner centred, self directed, relevant - topics arising from actual patient encounters. Patient scenarios: Topics arose from actual patient encounters.	Participants: Faculty, residents, and senior medical students Group size: 16 Faculty 63 Residents 29 Students	Duration: 1 year Sessions: Faculty and residents attend monthly: Senior medical students attend twice weekly Attendance: Not stated Students change rotatios monthly, so group composition – and participation – may be affected.	Respondents : Group 1: 16 /16 primary care faculty Group 2: 31/63 residents Group 3: 29/29 senior medical students Assessment: SR Questionnaire Likert 7 point scale D: Mentors felt underutilised despite the fact that students highly valued the contact. Discussion mentions that students 'dread' presenting because of the time commitment. Motivating members to read articles was a problem. Ongoing perceptions of inadequate critical appraisal skills, despite mentoring, SRQ =Perceptions of improved understanding of literature higher for residents and faculty Students 4.4 (1.4) Residents 5.3 (1.5) Faculty 5.6 (.73) SRQ= Faculty perceived most useful for Expanding knowledge base Stu 4.5 (1.3) Res 4.9 (1.5) Fac 5.1 (.81) Student perceptions of utility statistically lower p<.01

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
8. Kellum Study type: Single group before-after	<p>Mentoring: Faculty preceptor supports review and preparation</p> <p>Didactic support: Lectures by faculty two 1-hour sessions on principles of trial methodology and analysis, four 1-hour sessions on biostatistics.</p> <p>Structured review instruments: McMaster series used for CA</p> <p>Multifaceted learning: Lectures by faculty and interactive presentations by fellows.</p> <p>Integration of JC with a problem-based educational package which linked journal club topics to clinical lectures and biostatistics offered in other modules (reinforcement of learning coupled with opportunity to apply knowledge and skills)</p>	<p>Participants: Internal medicine fellows from pulmonary medicine, surgery, and anaesthesiology</p> <p>Group size: 12</p>	<p>Duration: 1 academic year</p> <p>Attendance: Strongly encouraged, but varied widely.</p>	<p>Respondents: 6/12 Sample size: Inadequately powered.</p> <p>SR Questionnaire: 5 point scale. Self-reported confidence in critical appraisal increased pre-test 2.5+/-0.5 vs. 3.9+/-0.7; p = .004 and post-test 2.6+/-0.5 vs. 3.9+/-0.6; p < .001</p> <p>Confidence in ability did not change in line with competence. Four residents had increased test scores and increased confidence; 1 had increased confidence with no change in test score; 1 had increased test score with no change in confidence. The fellow with the largest increase in ability (2.) had no change in self assessment of ability. Others tended to over estimate the degree to which their skills improved</p>
10. Lee SR Questionnaire 5 point scale	Structured checklist for reviewing research	<p>Participants: Ophthalmology post graduate residents</p> <p>Group size: 29 total Group 1: 12 Group 2: 9 Group 3: 8</p>	Duration: 1 session	<p>Percentage of those scoring 4 or higher increased substantially for</p> <p>A) ability to appraise and assimilate evidence pre-test 62% post-test 83%</p> <p>B) ability to read a journal article critically 28% to 86%</p> <p>C) ability to use a standardized and systematic checklist 21% to 66%</p> <p>Bottom line: Self reported scores for critical appraisal increased substantially.</p>

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
14. Mukherjee SR survey	<p>Didactic support</p> <p>Structured checklist: used critical appraisal guidance for qualitative research</p>	<p>Participants: Doctors, psychologists, clinical and social science researchers, and community team members</p> <p>Group size: 15</p>	<p>Duration: 10 sessions Monthly</p>	<p>Change in perceived confidence to appraise qualitative papers</p> <p>D: Those who were more confident tended to be researchers already familiar with research methods. The largest changes were seen in those with the least initial experience of reading and appraising qualitative papers.</p>
15. O'Sullivan Descriptive survey	<p>Mentoring I: Randomly assigned resident-faculty pairs meet 1 month before session, as often as needed (usually about 3 times). About 16 hours preparation required. C: About 9 hours preparation required.</p> <p>Didactic support: . Initial 1 hour teaching session. All residents receive 6 1-hour sessions on critical appraisal skills, and clinical teaching skills sessions. Clinicians receive CE credit for attendance</p> <p>Adult learning 'learner centred' emphasizing active participation and interactive discussion throughout</p> <p>Multifaceted learning: combining presentation with group discussion and other interactive exercises.</p> <p>Patient scenarios.</p>	<p>Participants: Residents</p> <p>Group size: 25 - 30</p>	<p>Duration: >1 year</p> <p>Sessions: I: Weekly C: 2 times/month</p> <p>Attendance I: Residents attend mean 24 sessions, presents at 6 C: Residents attends mean 9 sessions, present at 2</p>	<p>SR Survey: I Learner-centred JC rated perceived impact of JC significantly higher than C group for Analytic skills: P=.001 Content expertise: P =.001 Bottom line: Self reported improvement in analytic skills and ability to understand content of articles was significantly higher in the learner centred JC.</p>

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
16. Seelig Survey	<p>Didactic support. Lecture presenting rationale for adopting structured McMaster approach in existing JC</p> <p>Adult learning teaching intervention including clearly presented learning objectives, explanation of relevance of journal club to immediate clinical needs and long term professional goals</p> <p>Multifaceted teaching and learning format.</p>	<p>Participants: Internal medicine residents years 1-3 Group size: 14</p>	<p>Duration: Existing club Sessions : Every 2 weeks Attendance: Unknown</p>	<p>Evaluation of effectiveness of teaching modalities for CA: Handout, lecture and written assignment rated more highly than practice in class SR Survey Significant increase in self-reported ability to appraise research articles (P = .01)</p>

Appendix 11.6: Increasing Knowledge and Skills in Critical Appraisal

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
4 Cramer Single group before and after	Didactic support: 1 session. Integrated – referred those with educational needs to their academic adviser for further support.	Residents in 2 nd and 3 rd year of university-based residency programme Group size: 35	Time: 1 academic year Sessions: Not stated Attendance: Not stated	Respondents: ?/35 Sample size assume adequately powered. Repeated measures by 'module' K T significant improvement in clinical epidemiology and critical appraisal Median group performance improved from 54.5 to 78.9 % A significant linear trend for Pre-test scores was shown (F 89.17, p < .001). Median Post-test results moved from 63.6 % to 81.6 % with a significant linear trend (F 85.84, p < .001). The overall Pre to Post-test difference reached significance (F 2.04, p = .046). Bottom line: Introduction of structured critical appraisal approach produced significantly better achievement of learning objectives.
8 Kellum Single group before-after	Mentoring: Faculty preceptor supported review and preparation Didactic support: Lectures by faculty included two 1-hour sessions on principles of trial methodology and analysis, four 1-hour sessions on biostatistics. Structured review instruments: McMaster series used for CA Multifaceted learning: Lectures by faculty and interactive presentations by fellows. Integrated with concurrently running biostatistics module and running concurrently which reinforced the statistical principles used in critical appraisal, as well as clinical lectures using same topics as those in JC articles...	Participants: Internal medicine fellows from pulmonary medicine, surgery, and anaesthesiology Group size: 12	Duration: 1 academic year Attendance: Strongly encouraged, but varied widely.	Respondents: 6/12 Sample size: Inadequately powered. K T CA articles: Pretest given after 3 months of fellowship training but before any lectures on EBM or biostatistics or JC exercises were started. Critical appraisal of 4 different therapeutic trial articles (2 before and 2 after intervention). Statistically significant increase in Mean scores both for the paired analysis (4.1+/-0.7 vs 5.1+/-0.5; p = .015) and for the unpaired analysis (4.3+/-0.6 vs. 5.0+/-0.5; p = .012). 1 fellow had no change in results although no fellow scored worse. SR survey Confidence in critical appraisal significantly increased on a 5 point scale pre-test 2.5+/-0.5 vs. 3.9+/-0.7; p = .004 and post-test 2.6+/-0.5 vs. 3.9+/-0.6; p < .001 Confidence and ability did not change in line with competence. Four residents had increased test scores and increased confidence; 1 had increased confidence with no change in test score; 1 had increased test score with no change in confidence. The fellow with the largest increase in ability had no change in self assessment of ability. Others tended to overestimate the degree to which their skills improved Bottom line: Critical appraisal integrated into the training of critical care medical fellows significantly improves confidence and ability to appraise. Training may be more effective because fellows are more knowledgeable about the literature in their field. D: Active participation across a range of academic activities was required, rather than merely JC attendance. Fellows had previous familiarity and knowledge with the topics in the JC.

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
9 Khan Single group study before- after	<p>Mentoring: 1 hour one.-to-one tutoring with mentor.</p> <p>Didactic support. One day workshop (6 hours) covering critical appraisal and searching skills.</p> <p>Adult learning – Topics were generated by questions that were raised by health care professionals or patients themselves in the clinical setting. Small interactive groups during workshop to increase confidence in critical appraisal.</p> <p>Multifaceted teaching and learning approaches.</p> <p>Structured review instruments Catmaker software used to record Critically Appraised Topic.</p>	<p>Participants: Obstetrics & gynaecology post graduates</p> <p>Group size: 8</p>	<p>Duration:4 months</p> <p>Sessions: 15</p> <p>Attendance: Not stated</p>	<p>Participants: Interns I 22 and C 22</p> <p>K V questionnaire at baseline and 4 months included 20 items covering different aspects of evidence-based medicine.</p> <p>Significant improvement in knowledge of critical appraisal baseline mean of 50.8 (3-9) post-intervention 62.9 (4-7) (P=0.003).</p> <p>Bottom line: Adopting an EB format for the JC improves trainees reading habits and knowledge of EBM</p>
12 Linzer 1988 RCT	<p>Mentoring: Faculty facilitator (1 hour preparation) helps presenter in selecting article.</p> <p>Structured review instrument: McMaster series used for CA.</p>	<p>Participants: Internal medicine interns</p> <p>I: Journal club group</p> <p>C: Conference series on ambulatory medicine, no emphasis on critical appraisal or clinical epidemiology</p> <p>Group size I = 22 C = 22</p>	<p>Time 9 months</p> <p>Attendance Attend average of 5 sessions</p> <p>I: Nearly 100% attendance</p>	<p>Respondents: I 21/22 and C 19/22. Sample size adequately powered.</p> <p>SR Questionnaire: skills I group reported improvement in CA skills</p> <p>KV: 15 questions re epidemiology and statistics. Test article used to assess CA skills and clinical utility</p> <p>Significant improvement in K of biostatistics and epidemiology P=.04</p> <p>I: 25% C: 0% P=-02</p> <p>No significant improvement for critical appraisal in either I or C groups</p> <p>D: Dose response relationship between number of sessions attended and Knowledge of clinical epidemiology and statistics</p> <p>Bottom line: JC improves knowledge of epidemiology and biostatistics but does not improve critical appraisal skills.</p>

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
16. Seelig SR Survey	Didactic support. Lecture presenting rationale for adopting structured McMaster approach in existing JC Structured review instrument	Participants: Internal medicine residents years 1-3 Group size: 14	Time Existing club Sessions Every 2 weeks Attendance Unknown	Evaluation of effectiveness of teaching modalities for CA: Handout, lecture and written assignment rated more highly than practice in class K T: 42% correct pre-test; 67% correct post test Significant improvement P 0 .02)

Appendix 11.7: Ability to apply evidence in clinical contexts

Author Study type	What works? Active ingredients	For whom?	In what circumstances?	Number of respondents Methods of measurement Findings
5. Elnicki Descriptive evaluation	<p>Mentoring: Faculty helps with question definition, search and preparation of presentation.</p> <p>Adult learning: learner centred, self directed, relevant - topics arising from actual patient encounters.</p> <p>Patient scenarios: Topics arose from actual patient encounters.</p>	<p>Participants: Faculty, residents, senior medical students</p> <p>Group size: 16 Faculty 63 Residents 29 Students</p>	<p>Duration: 1 year</p> <p>Attendance: Unclear</p>	<p>Respondents: 16/16 faculty; 31/63 residents; 29/29 senior medical students</p> <p>Assessment: SRQ Likert 7 point with open ended questions LR SRQ: Apply reading to patient care Likert 7 pt scale Stu 4.7 (1.6) Res 5.0 (1.7) Fac 5.3 (.86)</p> <p>All student means lower than those of faculty and residents Bottom line; More mature learners feel more able to apply reading to patients care</p>
10. Lee Single group before after	Structured checklist for reviewing research	<p>Participants: Ophthalmology post graduate residents</p> <p>Group size: 29 total Group 1: 12 Group 2: 9 Group 3: 8</p>	<p>Duration: 1 meeting</p>	<p>Respondents: 29</p> <p>Assessment: SR Questionnaire 5 point scale Those scoring 4 or higher for D) apply knowledge of study designs and statistical methods pre-test 21% post-test 76%</p> <p>Bottom line: Using a structured journal club checklist linked to formal learning assessment in residency programmes improves perceived ability to apply knowledge</p>
12. Linzer 1988 RCT	<p>Mentoring: Faculty facilitator (1 hour preparation) helps presenter in selecting article.</p> <p>Structured review instrument: McMaster series used for CA.</p>	<p>Participants: Residents</p> <p>Group size: I 22 C 22</p>	<p>Duration: 9 months</p> <p>Sessions: Average 5</p> <p>Attendance: Nearly 100%</p>	<p>Respondents: I 22/22 C: 19/22</p> <p>Assessment: SR Questionnaire Increased ability to incorporate medical literature into practice I: 80% C: 44% P= <.02</p> <p>Bottom line: Although there was no significant improvement in critical appraisal Knowledge scores between I and C groups, the I group reported a significantly greater perceived ability to incorporate medical literature into practice.</p>
15. O'Sullivan Descriptive survey	<p>Mentoring I: Randomly assigned resident-faculty pairs meet 1 month before session, as often as needed (usually about 3 times). About 16 hours preparation required. C: About 9 hours preparation required.</p> <p>Didactic support: . Initial 1 hour teaching session. All residents receive 6 1-hour sessions on critical appraisal skills, and clinical teaching skills sessions. Clinicians receive CE credit for attendance</p>	<p>Participants: Residents</p> <p>Group size: 25 - 30</p>	<p>Duration: >1 year</p> <p>Sessions I: Weekly C: 2 times/month</p> <p>Attendance I: Residents attend mean 24 sessions, presents at 6 C: Residents attends mean 9 sessions, present at 2</p>	<p>Respondents: Distributed to current residents and those completing training within the past year</p> <p>Assessment: Survey 5 point Likert scale</p> <p>Bottom line: Learner centred Journal clubs with weekly meetings, high levels of attendance, and clear expectations of collaboration are more positively perceived than 'traditional' JCs in terms of residents' perceptions of their ability to determine clinical utility and ability to develop content expertise.</p>

	<p>Adult learning 'learner centred' emphasizing active participation and interactive discussion throughout.</p> <p>Multifaceted learning: combining presentation with group discussion and other interactive exercises.</p>			
17. Spillane Retrospective survey	<p>Mentoring: A nominated consultant acts as a mentor, guiding the registrar in the selection of a paper. The level of mentor assistance is variable. Once the paper is presented the mentor gives his/her opinion on the qualities of the paper and the presentation.</p>	<p>Participants: Registrars and consultant surgeons</p> <p>Group size: 30 current and 9 past members</p>	<p>Duration: 5 years</p> <p>Attendance: 21 respondents reported attending $\geq 66\%$ of meetings</p>	<p>Respondents: 19/28</p> <p>Assessment: 19/28 reported that JC led to alteration of clinical practice</p> <p>Bottom line: Of the 72% who responded to the survey, over 95% rated the informal format as good to excellent. Despite comments that mentoring needed some improvement, and articles were not relevant to all members, 68% reported an alteration in clinical practice.</p>