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Teaching Methods for Evidence-based Practice in Optometry

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Introduction

Evidence-based practice (EBP) is clinical decision-making based on the best available (most reliable) research evidence, the practitioner's expertise and the patient's circumstances and preferences (Satterfield et al, 2009). The concept was introduced to medicine in the late 20th century, and it has since been largely embraced by health disciplines as a means of ensuring the best outcomes for the patient. Research demonstrates that, indeed, when EBP is used, patient health outcomes are better than when clinical decisions do not use the best available research evidence (Emparanza et al, 2015).

The aim of teaching this subject is to ensure that the learner becomes an evidence-based practitioner, so knowledge and skills are not enough. In other words, we can teach what EBP is and how to practice it, but this does not automatically lead to its uptake. In addition, a positive attitude towards EBP should be developed too, so that the practitioner understands the need and advantages of EBP and is more likely to use this approach to clinical decision-making.[1]

As for any subject, evidence-based practice (EBP) can be taught/learned using a range of methods such a lectures, tutorials, workshops and clinical settings. A body of research exists on the effectiveness of EBP teaching methods. Systematic reviews of this research indicate that multifaceted teaching (combining more than one teaching approach) and clinically integrated teaching is more effective than the use of a single approach, or teaching that is separate from the clinical environment (Young et al, 2014). Prior to clinical teaching, the learner needs to know the concept and the process, for which lectures or tutorials may be useful, and needs to be able to use the process, for which interactive tutorials or workshops may be appropriate.

This manual describes some approaches that may be used to teach EBP. They are based on EBP teachers' experience as well as research on the effectiveness of teaching methods in this area.

Where does EBP fit in Health Care Education?

As outlined above, EBP has become part of health care, at least to some extent, since the late 20th and early 21st century. While the professions have been changing to incorporate EBP into practice, educational institutions have worked to fit EBP into the curriculum so that new graduates are equipped to practice in this way. As with the introduction of any concept, this has meant that practitioners who graduated before this period have no EBP knowledge or skills and do not necessarily understand its significance in clinical decision-making. Others, graduating with these skills, knowledge and (ideally) attitude enter the workplace and work alongside those with a different approach. Postgraduate and continuing education is always important but in this situation it has a particularly important place in developing EBP knowledge, skills and attitude among practitioners who may have received no undergraduate training is this area.

Now that EBP is accepted as an important aspect of clinical training, it has become part of many undergraduate curricula and is being introduced into many others. In some cases, it is an isolated module (or course, or unit, depending on terminology used in the programme) and in others it is threaded through the curriculum, being present within modules on a range of clinical and non-clinical subjects. In the former case, the subject is very visible in the curriculum since there is a component specifically labelled as 'Evidence-based Practice', but depending on the format of the

[1] Though it seems likely that a positive attitude toward the use of EBP (an understanding of its importance in healthcare) would increase its uptake among practitioners, at the time of writing this manual no research evidence could be found addressing this question specifically.

module it may be difficult for students to appreciate its clinical applications and to develop an understanding of its importance in clinical decision-making (i.e. a positive attitude toward EBP). For example, if delivered as an isolated module, EBP may be viewed by students as a subject that literally stands alone and is not an integral part of clinical practice. On the other hand, when EBP is taught within a range of subjects in the curriculum it may become part of the student's approach in a range of clinical and non-clinical areas.

Some may consider EBP to be relevant only in the later stages of the programme, when students are seeing patients in a clinic setting. However, EBP involves critical thinking and questioning (e.g. Jenicek et al, 2011), and it would seem unrealistic to introduce these concepts at a late stage if earlier in the programme the student has been expected to receive and not question information. In addition, as outlined previously it is important that students understand the concept and the process before they are expected to apply it. Therefore knowledge and skills in EBP should be learned early in the programme, prior to their application at a later stage.

It is important to note that EBP, or any new concept, may be introduced to the curriculum, but could similarly be removed from the curriculum at a later stage. Since the need for EBP in clinical decision-making has been demonstrated, it is important to ensure that it is maintained as part of the curriculum. If mechanisms are in place to achieve this, we might say that it is 'embedded' into the curriculum. This is challenging, since there are limited ways in which we can protect the curriculum from significant change in the future, and in fact complete protection is not possible. If the profession appreciates the need for EBP, there may be support from professional organisations and regulators to ensure the curriculum includes EBP teaching. For example, in 2015 the Optometry Board of Australia published revised competency standards for the profession which included specifically evidence-based practice, including the search and appraisal of relevant research evidence (Kiely and Slater 2015). This means that optometry curricula in Australia must include this subject, and ensures that EBP will be part of the curriculum in the long term.

Teaching methods

To date, two 'Sicily statements' have been made on EBP teaching by the delegates of conferences of Evidence-based Health Care Teachers and Developers (which meets biennially in Sicily, hence the name). The first of these (Dawes et al, 2005) states that *'It is a minimum requirement that all practitioners understand the principles of EBP, implement evidence-based policies, and have a critical attitude to their own practice and to evidence. Without these skills and attitudes, health care professionals will find it difficult to provide best practice*'. The statement points out that health care curricula tend to include components in which students are required to critically appraise, and recommends that they should also include all of the five steps of EBP, as shown in the table below:

EBP step	**Description**
Frame a question based on a clinical scenario	The student is taught how to word a question that encompasses the clinical situation and includes the important, key words that can be used to find relevant evidence. Ultimately, with this skill, the practitioner will be able to decide on these words without formally framing a question, but this step helps to develop this skill.
Find relevant research evidence	The student uses the key words found in step 1 to look for research evidence, using internet databases and search filters that help to ensure relevant research is found, and that high level (e.g. systematic review) research is found if available.
Appraise the evidence	The student is taught how to determine the reliability of research. This is a significant skill – the student needs to develop the confidence

	needed to question work that has been peer reviewed and published. Critical appraisal tools (CATs) may be introduced. These present a set of questions to ask while reading research evidence, to help determine its reliability. CATs are available for a range of study designs (e.g. randomised controlled trial, or case study) so the student also needs to know study designs before using these tools. Ultimately, the practitioner should have these questions in mind, without needing physical tools, when reading research or hearing about it continuing education, for example.
Apply the best available evidence	At this stage, the student learns how to bring the best available research evidence (found via the above processes) together with any experience (perhaps the supervisor's) and to consider the patient's circumstances and preferences, to make a clinical decision.
Reflect on this practice	Finally, the student learns to make a habit of reviewing the EBP process, to consider whether it worked well for the patient, whether it was limited by factors in or outside of the practice, and what could be done better next time.

The second Sicily statement (Tilson et al, 2011) provides guidance on the development of assessment tools for EBP teaching. This will be discussed later (see Assessment of EBP Knowledge, Skills and Attitude) but at this point it is relevant that the statement indicates a need to assess seven indicators of EBP teaching and learning: the learner's experience, their attitude toward EBP, confidence in using EBP, knowledge of EBP, skills in EBP, behaviour as an evidence-based practitioner, and patient outcomes of EBP. The teaching methods discussed below each address one or more of the steps and indicators shown above, individually or combined within one method.

Lectures

Lectures with large or small groups of students provide opportunities to help students to understand what EBP is, including the general concept and process. They can be used to introduce the idea and to show the principles of EBP. In addition, it may be possible to include interactive components. For example, the students may be asked to read a paper in advance of a lecture in which the lecturer demonstrates appraisal of the paper using a critical appraisal tool (e.g. www.casp-uk.net).

Lectures can also be used to introduce students to the PICO process. This is used as a framework to help write a question based on a clinical scenario, and includes the components **P**atient, **P**opulation or **P**roblem (what disease and/or type of patient is relevant in this scenario?); **I**ntervention (what treatment is relevant?); **C**omparison (what treatment are you comparing with, if any?); and **O**utcome (what do you expect to improve with treatment?). This works quite well with clinical scenarios that involve treatments, such as dietary supplements, but is less helpful for many questions that may involve diagnostic methods, prognosis or aetiology. In such cases the framework has to be adapted, and so it is important to teach not only PICO but also how to modify this when necessary. Ultimately the student should be able to decide on key words without using PICO, but this or a modified framework is helpful during training.

While lectures are useful for introduction of concepts and to begin the development of knowledge, other formats are more likely to be effective in the development of skills. To be able to carry out the EBP process, students need to actually go through this process themselves, repeatedly. By practicing this process the student should develop several abilities, including the ability to select words that

should be used in a search for evidence in a given clinical situation, to make a clinical decision with or without research evidence, to ask all of the important questions to determine reliability when appraising evidence, and to take the patient's situation and preferences into account when making clinical decisions or recommendations.

Tutorials

Small-group tutorials may be used to reinforce understanding of EBP and to begin the development of attitude, with discussions on real consequences of the lack of an evidence-based approach to clinical decision-making. As well as clinical examples, students could discuss situations in which research papers have been peer reviewed and published in reputable journals, but subsequently found to be flawed (demonstrating the importance of critical appraisal), or in which the teacher has found flaws and allows the students to also find these using critical appraisal tools (CATs). CATs are checklists which remind the practitioner/student to look for particular factors that may affect the quality of the study. Many critical appraisal tools are available free of charge online, and the Critical Appraisal Skills Program (CASP) has developed several CATs, each of which is aimed at a particular study design. So, there is a CASP CAT for a randomised controlled trial, a systematic review, a cohort study, a case-control study, etc. This is useful because it demonstrates to the student that a different set of questions is needed for different study designs. The use of CATs in appraisal develops the students' ability to use these checklists and develops their confidence as someone with the skills and ability to critique respected research evidence. This process can also reduce students' respect for research evidence, and it is important to demonstrate that high quality, reliable research evidence is available for many clinical questions, and that it is the evidence-based practitioner's role to find the best available, via critical appraisal.

Workshops

Following the use of methods such as lectures or tutorials which develop knowledge, some level of attitude and perhaps seed abilities, skills can be developed further within workshops or in clinical settings. One workshop method could include the development of knowledge, skills and attitude in more than one of the five EBP steps. For example, this method has been used in the first year of an optometry undergraduate programme taking place over two workshops, in the first year of a three-year programme (note that the effectiveness of this method has not been tested and there is no published evidence; it is offered only as an example). Students are asked in the first workshop to think of a health-related situation in which they have a question they would like to answer. Note that the situation does not have to be discipline-specific, and it could be any health-related question they would like to address. The idea is that the student should focus on something he or she really wants to know during this process. During this workshop, the student's chosen situation is used as a basis for framing a question (EBP step 1). The student learns about the nature of an answerable question, and the need to ensure that the question is specific to the chosen clinical situation proving a sound basis for step 2. In the second workshop, the students use an online database to use key words from their question to search for relevant research evidence (step 2). The Pubmed database (www.pubmed.com) was chosen for this purpose because it includes a simple tutorial and teachers considered it to be an intuitive tool, but of course other databases could be used. During this workshop, students search for evidence and learn how to narrow or broaden their search, and that not all evidence is available to everyone (some research papers are only available via subscription, while others are open access). A third workshop in which the 3rd EBP step was carried out (appraisal of the available evidence) was also included initially, but was later moved from the programme's first year to the second year, to spread EBP teaching to a larger number of modules within the programme. A set of example instructions for part of this series of workshops (a workshop on

formulating a clinical questions) is shown in appendix A, and can be adapted to suit other programmes.

Presumed Knowledge

It is important to bear in mind that the student needs relevant knowledge before skills can be developed. For example, when the student is asked to frame a clinical question, they will need to know how to do this and should be introduced to the concept of an answerable question and to a framework such as PICO. They should also know that PICO is not always applicable, and often needs to be modified considerably for certain clinical situations. Similarly, if they are asked to use a critical appraisal tool to appraise a research paper, they need to know what CAT would be suitable for the research, and for this they need to know what kind of questions would be appropriate. The questions to ask when reading a review would be quite different than those for a clinical trial, and different again for a cohort study. If students are not given this knowledge and awareness they will not know what to do and will not develop ability, and will of course not develop their confidence in this ability. In addition, they are unlikely to develop a positive attitude toward EBP since they may be unable to see how it works and how it could be anything but obstructive to clinical practice. So, adequate knowledge is an important basis to skills development, and some skills (e.g. identifying study designs) may be needed in order for others (e.g. use of critical appraisal tools) to be developed.

Teaching Attitude

As indicated above, students should develop knowledge, skills, and attitude. They may know EBP very well, and they may have acquired the relevant skills, but it would be easier to make a clinical decision without looking for research evidence, so if the need for EBP is not apparent they may not practice in this way. Attitude is therefore as important as knowledge or skills. but the teacher's role in developing students' attitude may not be immediately clear. One way to demonstrate the importance of EBP is to discuss examples of situations in health care in which the best available evidence has not been used, and highlighting the negative outcomes for the patient. Similarly, students could be given a task to find such situations and discuss them. In medicine, one example is the history of the measles, mumps and rubella (MMR) vaccine, in which a 1997 research paper published in a respected journal suggested a link between this vaccine and autism in children. This led to a significant reduction in use of the vaccine, with consequences such as an increase in childhood disease and disability, until the research was discredited and the paper withdrawn. An evidence-based approach by peer reviewers and by practitioners could have limited or even avoided these major negative outcomes. Important outcomes are not always directly related to health, but to other aspects of well-being. For example, blue light-blocking spectacle lenses (to reduce the transmission of blue light to the eye for purported benefits including eye health) have been heavily (and in some cases misleadingly) marketed by some retailers and optometry chains (https://www.aop.org.uk/ot/industry/high-street/2017/05/26/boots-opticians-fined-40000-over-misleading-blue-light-advertising). The filters were made available to patients without good evidence of their effectiveness (Lawrenson et al, 2017). Their widespread availability without evidence has had cost implications for patients and is likely to have created some degree of distrust of optometrists among the public and other practitioners.

Interactivity

All teaching methods can include student interaction to some extent. Lectures can involve students discussing with neighbours and responding to questions, for example. Tutorials and workshops can

involve students working in small groups, discussing and questioning. This allows doubts to be aired and helps to develop understanding and attitude. In clinical settings, students confer with the patient and at times with the supervisor, and these situations can be used to develop the student's confidence in questioning authority and skills in applying evidence in the clinical context.

Journal clubs have been found to have some success in developing EBP skills. These could take place in a range of formats, but would usually be focused on critical appraisal of a piece of research. One possible format would include a small group of students who are given a research paper to critique and then asked to present this to a larger group for discussion. Alternatively, the group of students could each be given the same paper to critique independently, then to discuss as a group. Different students may identify different limitations and strengths of the research, encouraging discussion. Yet another format might include a number of EBP steps, with the students given a clinical situation, asked to formulate a question, find relevant research and critique it, either individually or as a group, with discussion.

Teachers' EBP Skills, Knowledge and Attitude

In some modules, it may be that critical appraisal is taught, and in this case generic critical thinking skills may be all that is needed to teach this component. However, if EBP is taught as a concept and process with specific aspects such as critical appraisal tools or the use of the PICO framework, it is important that teachers have the relevant knowledge and skills. EBP teaching and learning needs to continue throughout the programme in the clinical modules in which supervision is often provided by visiting clinicians. At this point, supervisors, as discussed earlier, may not have been taught about EBP, and there is the potential for the student to be aware that EBP is not continued from the classroom to real clinical situations with patients. It is therefore important that supervisors are given training to develop the relevant skills and knowledge, and an understanding of the need for EBP. The Centre for Evidence-based Medicine in Oxford, UK, offers a course for teachers of evidence-based medicine (http://www.cebm.net/teaching-evidence-based-medicine). An online course by the EU-EBM Unity project (http://ebm-unity.pc.unicatt.it/index.html) was at the time of writing under development, and a face-to-face course is offered by McMaster University in Canada (http://ebm.mcmaster.ca/). In general, however, health care educational institutions need to provide this education for their teachers. A one-day workshop for clinical teachers was provided in optometry at the University of New South Wales (Suttle et al, 2015) and a similar day has been provided at City, University of London, Chitkara University, Manipal University and the University of Hyderabad, India (unpublished). The format used by Suttle et al (2015) may be useful, but it is important to note that the time period (one day) did not allow skills development. A modified 2-day version was used at a later stage with more discussion and tasks for participants to undertake. Whatever format is used, training of teachers or supervisors is important to ensure EBP is taught throughout the programme.

Continuity of EBP teaching throughout the program can be encouraged by teaching staff in a range of clinical modules to use EBP during case based learning for example. Anecdotally, student feedback of learning through case studies tends to be very positive, and by encouraging students to use tools such as the CASP CATs, EBP for the management of ocular conditions becomes second nature.

A draft format for a one-day workshop is shown in Appendix B, based on a workshop for optometry educators at City, University of London. This can be used as a basis for modification and expansion (see above) as appropriate.

An overview of the effectiveness of EBP teaching methods

As part of the OCULUS project, an overview of systematic reviews was conducted to investigate which type of teaching methods are most effective for teaching EBP. Systematic reviews were considered eligible if they included randomised or non-randomised controlled trials (RCT), or before and after studies. They were considered to be a systematic review if they had predetermined objectives and criteria for eligibility and had searched appropriate literature via at least two search engines. They were eligible if they evaluated any educational intervention to teach any component of EBP for undergraduate or post graduate education, and if the teaching was aimed at health professionals.

A search for systematic reviews was conducted using a variety of electronic sources including The Cochrane library, MEDLINE and the Educational Resource Information Center (ERIC) on the 3rd May 2017, including publications from January 1996 to May 2017. No language restrictions were used. Search terms included the following: "systematic review" or "overview" *and* "healthcare" or "optometry" or "medicine" *and* "evidence based practice" or "evidence based medicine" or "evidence based healthcare" *and* "teaching methods" or "learning methods"

Our electronic searches identified 600 articles. After the initial screening of titles, we retrieved 23 abstracts for formal eligibility assessment. Of these we excluded 12 articles that did not meet the eligibility criteria (5 not systematic reviews, 6 not focusing on EBM, 1 a protocol with no results), leaving 11 systematic reviews included in this overview.

The main finding from this overview systematic reviews was that clinically integrated methods of teaching evidence based medicine are much more likely to improve attitudes, skills, behaviour and knowledge in EBP and therefore more likely to train a clinician into implementing evidence based medicine into their practice and to encourage other individuals in their work place to do the same.

Barriers to Evidence-based Practice

If graduates from our undergraduate or postgraduate programmes are to use evidence-based practice, it is important that they are prepared for the barriers they will face. Research on barriers to EBP in health care areas such as nursing and medicine indicates that there are several factors that limit practitioners' uptake of EBP, including a lack of incentives, skills, autonomy, time, motivation, limited availability of clinical research, and poor organisational support (DeBruyn et al, 2014; Baatiema et al, 2017; Solomons and Spross, 2011).

It is important that the curriculum acknowledges and introduces the student to these barriers, and particularly teaches how they can be overcome. For example, students should be made aware that internet access is not always available in the practice and even if so, there is not always time to use it. Strategies to overcome this can be discussed with students, and might including addressing common and/or anticipated clinical questions at times when patients are not present. For example, when the public and practitioner are made aware, via marketing, continuing education and other avenues, of a new treatment for a common health disorder, the practitioner should search for and appraise relevant evidence in preparation for related clinical situations in which advice is needed.

Students should be made aware of time-saving electronic databases such as TRIP (translating research into practice; https://www.tripdatabase.com/about). TRIP provides research evidence relevant to key words, in the same way as a database such as Pubmed, but also provides an indication of their evidence level. Level is an indirect indicator of reliability, or quality, of research evidence. For example, the highest level would be a systematic review, because this is a review using a set of standardised criteria to carry out a broad search and to decide what research is reliable, thus using an evidence-based approach. Low level would include a case study, with one or a small

number of participants, without the possibility of controls for effects such as placebo, and not applicable to the wider population. However, it is important to note that high level does not necessarily indicate high quality, since a systematic review or a randomised controlled trial (both high level) could be flawed, and in fact this is the point of appraisal, part of the EBP process. Thus, the TRIP database tells us about level, and this is a likely indicator of quality, but we still need to be aware that the research should be checked, at least minimally, for possible flaws.

The Cochrane database provides high quality systematic reviews on clinical questions, and includes discipline-specific groups such as the Eyes and Vision Group with a focus on questions of relevance to eye care practitioners. EBP teaching should include sessions in which students are introduced to databases such as these, and develop skills in searching them for given clinical scenarios. This would include formulating a question, using relevant key words, and accessing evidence. Cochrane systematic reviews (http://www.cochrane.org/) include careful quality controls which maximise reliability of their findings. Thus, these are important time-saving tools for students and practitioners since they provide a rapid means of addressing clinical questions, at least those for which a Cochrane review exists.

Students should be aware of evidence-based clinical guidelines relevant to their discipline, such as the National Institute for Health and Care Excellence (NICE) guidelines (https://www.nice.org.uk/). In optometry, the College of Optometrists provides guidelines on diagnosis and management of a range of eye conditions (https://www.college-optometrists.org/guidance/clinical-management-guidelines.html).

Clinical Settings

As outlined above, it is important that clinical teachers are equipped to teach EBP. Clinical settings provide opportunities for students to use and sharpen the knowledge and skills they have acquired, in a number of ways, including discussion with clinical teachers in which the teacher and student should be prepared to question and challenge existing ideas on case management.

Case discussions may be held, in which a group of students each have details of a clinical case they have handled recently. Each student is asked to outline the case from reason for visit to management, and the group is expected to ask about justification for clinical decisions including what evidence was used, and how the decision combined evidence, expertise and the patient's preferences. Students discuss whether the process could be improved upon and whether it is likely to be the best outcome for the patient. This helps students to discuss the whole process and to reflect on their evidence-based practice, the fifth EBP step.

Each clinical encounter also provides opportunities for students to apply EBP. It would be unrealistic and unnecessary to expect students to go through all five EBP steps in every clinical encounter. This would provide experience that will not reflect the clinical situation the graduate will face on leaving the programme, since barriers (outlined above) prevent this, and in many clinical cases it will be unnecessary to search for research evidence. For example, the patient attending for a routine eye examination with no symptoms and no significant personal or family history raises no clinical questions that need research evidence. However, in some cases it will be important to look for the best available evidence, and the student should be able (via chair-side internet access) to look for readily available, high quality evidence (via Cochrane or TRIP searches) to support decision making. Immediately after the clinical encounter, there should be a discussion between the student and supervisor on various aspects of the eye examination process, including EBP, with feedback. This again offers an opportunity for reflection (step 5 of the EBP process).

Assessment of EBP Knowledge, Skills and Attitude

Education research tells us that assessment is one of the main drivers for learning, so if we want our students to be evidence-based practitioners we need to assess their EBP knowledge, skills and attitudes. Knowledge can be assessed using similar methods as for any other subject, such as using questions that require short answer or descriptive essay-style answers, multiple-choice questions, or viva voce exams. Skills can also be assessed using conventional practical assessments or using written reports. Methods such as student presentation or online discussion, with clear criteria provided to the student, can also form part of assessment.

In addition to these methods, tests have been developed and validated for the assessment of EBP knowledge and skills. The Fresno test was initially developed for family medicine but has since been developed and validated for some other health disciplines (Tilson, 2010). The test includes discipline-specific clinical scenarios, so adaptation includes a change in scenario. No test of this kind is yet available for optometry, but has been developed and is currently undergoing validation.

Assessment of attitude is less straightforward, but again tests have been developed for this purpose. The Evidence-based Practice Attitude Scale was developed for application in mental health care, and has been applied in a small group of optometry educators (Suttle et al 2015). However, the items and scoring may not provide a reliable indication of attitude toward EBP, as discussed by Suttle et al 2015. Another test, the Evidence-based Practice Inventory (Kaper et al, 2015) includes assessment of attitude toward EBP and has been validated in clinicians that adopt EBP, teachers and researchers in health disciplines. It is not discipline-specific so could be applied directly in optometry, and could be used as part of assessment within the undergraduate or postgraduate curriculum. At undergraduate level, it should be used at later stages when the student has direct clinical experience, since the questions refer to this.

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Appendix A: Workshop on Formulating an Answerable Question

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Formulating a Question as a Basis for Finding Evidence

In this workshop you will be formulating an answerable question. What do we mean by this? Surely all questions are answerable. Well, if I ask 'Is it worth using an umbrella on a sunny day?' there would be other questions to ask, to clarify, before answering the question. What do I hope to achieve by using the umbrella, for example? How sunny is it? What do we mean by 'worth' (how much benefit would be worthwhile). The same issues apply to clinical questions, so we need to frame our question carefully so that it asks specifically about what we want to know. This is important because the question forms the basis of a search for evidence. If the question is not directly relevant to the clinical scenario, the answer will not be useful.

Please spend only **up to 20 minutes** on each of these 4 stages:

1. Think of a health care-related situation where you would like to find an answer. Examples might include:
   - If I have knee pain, is it ok to run?
   - Does iridology work?
   - How can I avoid jet lag?
   - Does homeopathy work?
   - How does retinoscopy compare with full refraction results?

   You should talk your ideas through with your partner and supervisor, but your health-care situation should be your own.

2. Use the PICO or similar system to phrase your question.
   - PICO stands for Patient, Intervention, Comparison, Outcome. These terms can help you decide on a few words that should be part of your question. *Patient* prompts you to include one or more words that indicate what type of person or problem your question is about (e.g. knee pain); *Intervention* prompts you to include words on the type of treatment, if this is relevant to your question (e.g. melatonin); *Comparison* prompts you to add words indicating any comparison you are interested in (e.g. steroid or other cream that is recommended for dermatitis, Vs homeopathy); *Outcome* prompts the inclusion of one or more words describing how the result of treatment might be measured, such as refraction.

     Notice, though, that PICO only really applies when your question is about a treatment of some kind, and one of the example scenarios above is about diagnosis. In this case, we can include a test (diagnostic) method instead of an intervention (in this case, the test method would be iridology). Modified forms of PICO for different types of situations (diagnosis, prognosis) are explained at http://www.eboptometry.com/content/optometry/step-1-ask/practitioners-students-teachers/step-1-ask

3. Once you have some words from your 'PICO' procedure, you can form an answerable question. For example, 'Does iridology work' could become 'Is iridology effective in the diagnosis of [a disease]?' The difference between these questions is that the first one is very

vague and does not suggest specific terms that can be used to search for information. The second one is much more specific – it says exactly what you want to know and if you use this as a basis for a search you will be able to find research evidence because research tends to be specific, e.g., testing efficacy on a particular disease.

4. Use the question to decide on a set of key words.
    - Once you have a question, you can use this to decide on a few key words that you will use next week when you are searching for information. The key words are those that indicate the main points about the question, so they exclude generic words such as ‘the’ or ‘of’, and include specific words such as ‘jet lag’ and ‘melatonin’.

Appendix B: Draft format for one-day workshop on EBP for health care educators

Duration	Session topic	Description
15 mins	Introductions	Welcome, introductions and overview. Form groups of 3 and 4.
45 mins	EBP: Meaning and significance	What does EBP mean to you, and what is its significance to optometry? One person from each group to briefly summarise. Think of a clinical decision you have made recently. What evidence did you use? Discussion to follow.
1 hour	Workshop 1: Finding and appraising research evidence	Scenario-based tutorial and workshop. E.g. child with bacterial conjunctivitis. Should chloramphenicol be prescribed in this case? 1. Lecture/tutorial on EBP, quality of evidence, searching for evidence. (30 minutes) 2. Relevant paper for participants to read (15 mins) 3. Appraisal using a CAT (whole group; 10 mins) 4. Clinical decision (apply; 5 mins)
Break		
1 hour	Workshop 2	Scenario-based workshop. E.g. 45 year old patient interested in using 'glasses off' technology to treat presbyopia. Is this likely to be effective? 1. Frame question (10 mins) 2. Find evidence (10 mins) 3. Relevant paper for participants to read (15 mins) 4. Appraisal using a CAT (small groups; 20 mins) 5. Clinical decision (apply; 5 mins) 6. Discussion on appraisal and decision (10 mins)
Lunch		
1 hour	Workshop 3	Scenario-based workshop. A child with learning difficulties has been told by a teacher that a coloured overlay may make reading easier. The child's parent would like your opinion.

		1. Find evidence (10 mins) 2. Relevant paper for participants to read (15 mins) 3. Appraisal using a CAT (small groups; 20 mins) 4. Clinical decision (apply; 5 mins) 5. Discussion on appraisal and decision (10 mins)
1 hour	Using EBP in practice (barriers and enablers)	How would this work in practice? Faced with such a scenario, would you actually go through this process? If not, why not? What can be done instead?
Break		
1 hour	Workshop 4:	Participants in each small group decide on a clinical question they would like to answer, and try to do this within their group. One participant from each group summarises any problems and the findings.
4.30	Summary and close	

Appendix C: Pilot format for Journal Club

The journal club has been found to be one of the most successful tools of teaching EBP competencies to health science students (Harris et al., 2011). A structured journal club activity can not only teach EBP competencies, but also helps to develop proficiency in the process of EBP. However, there is no single and standard format of journal club in health care education (Harris et al., 2011; Alguire, 1997). We have developed a journal club format which is currently being piloted at Manipal University, India.

Students work in small groups of 5 to 10 allowing discussion and peer/ team based learning. A minor role is assigned to each member of group to ensure involvement of each student in some way throughout the EBP journal club session. We have found this model to be feasible and engaging in our pilot study, but detailed study of its effectiveness is currently ongoing. Some of the roles (Deenadayalan et al., 2008) in this team based integrated journal club include:

1) Mentor- a teacher acts as mentor, to ensure appropriate outcomes of the entire session.
2) Captain- a student takes this role, giving direction to discussion, search, appraisal and other activities during the journal club.
3) Vice-captain- a student again supports or challenges decision making of the captain and also ensures active participation of each member in all steps of journal club.
4) Search navigators- Students use the formulated question and keywords tp search for the evidence in various databases, to find the most relevant articles to be included in the appraisal process.
5) Other student members actively participate in the critical appraisal process and discuss the application of evidence in a clinical scenario. Finally, all members can actively input to reflecting on the entire process and also can contribute to peer assessment.

As outlined above, this approach is at the time of writing being piloted so effectiveness is not yet known, but it may provide useful suggestions for adaptation by EBP teachers. In the above format, a typical journal club session may run for 3-4 hours but this may be shortened by completing some steps online. For example, formulation of a question and searching for evidence (the first two EBP steps) could be completed using an online discussion portal prior to meeting to complete the remaining steps as a group.