

Evidence based practice: an introduction and application for radiation therapy practice

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Abstract Radiation therapists, as professionals, need to maintain personal knowledge and inform organisational best practice according to latest international research. Evidence based practice is well established in health care and has a defined methodological process for locating, appraising and applying the best available evidence to clinical practice. Conducting a comprehensive search of published research to find the best evidence requires the appropriate skills and resources, including time. Radiation therapists in clinical practice may be limited in one or more of these areas. Systematic reviews and evidence based clinical practice guidelines provide systematically developed recommendations for clinical practice and further research. Radiation therapists can retrieve this higher level evidence even with limited access to resources. This paper provides some practical tips for applying evidence based practice in radiation therapy.

Keywords: Clinical guidelines, evidence based practice, radiation therapy, research methods, systematic review.

Introduction

Evidence based practice (EBP) is a commonly used term in all areas of health care. The aim of this short communication is to clarify some of the terminology used in EBP and to describe the process of EBP as it may apply to radiation therapists whose primary role is clinical. Resources which are freely available are referred to throughout. Some of these provide educational materials on EBP, some access to evidence based resources and some are tools which aid the EBP process. The *What is...?* series^{1,2,3} and book *Practical tips in finding the evidence: an allied health primer*⁴ have been useful resources for writing this paper and would be good references for the practising radiation therapist.

Evidence based medicine and evidence based practice

In the early 1990s, the term evidence based medicine (EBM) first appeared in the medical literature⁵ and is defined as “the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients”. It involves “integrating individual clinical expertise with the best available external clinical evidence from systematic research”.⁶ EBM was initially applied to the practice of medicine and its undergraduate curriculum, but was soon integrated into other professions, including allied health.^{7,8,9} Given this, the term evidence based practice (EBP) was proposed “to reflect the benefits of entire healthcare teams and organisations adopting a shared evidence based approach”.¹⁰ Other terms used are evidence based healthcare (EBHC) and evidence based clinical practice (EBCP). Recent publications^{11,12,13} have discussed the need for adopting EBP methodologies within the medical radiation science professions.

EBP calls for us to apply the current best evidence and it may be that practice developed from basic principles, combined with radiation therapist clinical experience and a small in-house study is the best evidence available. We know there are many aspects of radiation therapist practice for which there is a paucity of research

evidence; however recent studies suggest this is changing.^{14,15} There has also been an increase in the number of peer reviewed journals specific to the medical radiation science profession, with a new *European Journal of Radiography*, launched in 2009. Also, due to the inter-disciplinary nature of some aspects of radiation therapy, relevant published research can be found in other discipline journals such as nursing, psycho-oncology, counselling and nutrition. With the ever increasing volume of published research literature relevant to the multi-faceted aspects of radiation therapy treatment, how do we, as radiation therapists, find the evidence, determine what is best and apply it to our practice?

Types of evidence

Hierarchies of evidence

Research methodologies are classified into hierarchies or levels. These are based on the likelihood that a type of research will produce valid, reliable results with minimal risk of bias. Well conducted randomised controlled trials (RCT) are high on the hierarchy as they fulfil these criteria. Radiation therapists are very familiar with this type of research as it is the method used in large clinical trials conducted in many radiotherapy centres. Highest in the hierarchy are systematic reviews of RCTs. Systematic reviews are discussed in more detail later in this article. At the bottom of the hierarchy, sits anecdotal evidence and non-appraised expert opinion.

The Australian National Health and Medical Research Council (NHMRC) evidence hierarchy¹⁶ designates levels of evidence according to the type of research question. The NHMRC hierarchy of evidence table for questions of interventions (the most likely in radiation therapy clinical practice) is shown in Table 1.

In radiation therapy, as in many areas of allied health and nursing, many research studies may be qualitative research or a mix of qualitative and quantitative methods. Qualitative research methods do not currently have a universally accepted hierarchy,

Table 1: Designation of National Health and Medical Research Council (NHMRC) Evidence Hierarchy for Interventions*.

Level of Evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III-1	Evidence obtained from well designed pseudo randomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case control studies or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test/post-test

* The complete NHMRC evidence hierarchy table can be viewed at: www.nhmrc.gov.au/guidelines/developers.htm

Table 2: International Centre for Allied Health Evidence (iCAHE) Guideline Checklist*.

Questions	Comments	Score
Availability		
Is the guideline available in full text?		(1)
Does the guideline provide a complete reference list?		(1)
Does the guideline provide a summary of its recommendations?		(1)
Dates		
Is there a date of completion available?		(1)
Does the guideline provide an anticipated review date?		(1)
Does the guideline provide dates for when literature was included?		(1)
Underlying evidence		
Does the guideline provide an outline of the strategy used to find underlying evidence?		(1)
Does the guideline use a hierarchy to rank the quality of the underlying evidence?		(1)
Does the guideline appraise the quality of the evidence that underpins its recommendations?		(1)
Does the guideline link the hierarchy and the quality of underlying evidence to each recommendation?		(1)
Guideline developers		
Are the developers of the guideline clearly stated?		(1)
Do the qualifications and expertise of the guideline developer(s) link with the purpose of the guideline and its end users?		(1)
Guideline purpose and users		
Are the purpose and target users of the guideline stated?		(1)
Ease of use		
Is the guideline readable and easy to navigate?		(1)

*A pdf version of the checklist is available from the iCAHE website: www.unisa.edu.au/cahe/AHGDlines/ica guidelinechecklist.asp

but are recognised as taking an important role in health research. Being aware of the hierarchy, research should be designed to sit as high as possible, while ensuring the most appropriate methodology is used to answer the research question.

Systematic reviews

Systematic reviews are a synthesis of data from more than one study which were designed to answer the same or similar questions. Good quality systematic reviews develop a protocol which includes the search strategy (where and how to search), inclusion/exclusion criteria (what research methodologies, publication languages and dates will be included) and methods for critically appraising the literature. The search protocol, which is often peer reviewed, allows the review to be replicated. All the research evidence is then combined; either using meta-analysis (for homogeneous quantitative data) or meta-synthesis (for qualitative data

or data which are not homogeneous), to arrive at the best available evidence in an unbiased manner.

A well conducted systematic recent review can provide the best evidence currently available. This differs from a traditional literature review which is at risk of selection bias, reporting research evidence that supports the viewpoint of the author. This form of literature review is useful for providing background information, but does not inform us of the best available evidence.

Clinical practice guidelines

Evidence based clinical practice guidelines are produced using a well defined systematic method for developing the review question, retrieving, reviewing, interpreting and reporting the evidence.¹⁷ In this type of guideline, an extensive consultation process is undertaken with experts and stakeholders, including patients. The strength of the evidence upon which recommendations

are made is explicitly stated, linking evidence to recommendations. The evidence from this type of guideline can be used as the basis for locally produced protocols and processes.

Clinical guidelines, produced by specialist guideline developers, are often stored on websites called clearing houses. Clinical practice guidelines for a range of cancers can be viewed on the NHMRC clearing house at <http://www.nhmrc.gov.au/publications/subjects/cancer.htm>. While these are not specific to radiation therapy, aspects of the guidelines may be relevant to radiation therapists. These include psycho-social issues and care, complementary and alternative therapies, communication strategies and the patient perspective, areas for which Australian radiation therapists are seeking evidence.¹⁸ These guidelines have been rigorously developed and provide evidence summaries, linking recommendations to levels of evidence.

Consensus guidelines are another form of clinical guideline that may be developed when the systematic process does not lead to clear recommendations or where there is a lack of published evidence. A group of experts examine the available evidence (including opinion) to meet consensus. To reduce bias, a recognised formal consensus development technique, such as the Delphi method may be used.¹⁹ The recommendations in this case may be termed “practice points” and the process taken to reach consensus should be transparent and clearly stated.

Sometimes, consensus guidelines are developed by a group of experts, based on a non systematic literature review. While these may provide a useful source of information, it is important that the different types of guidelines are recognised.

Critical appraisal

The rationale and methodology for critical appraisal of quantitative and qualitative research studies has been described in a previous issue of this journal.²⁰ Systematic reviews and clinical practice guidelines also require critical appraisal to determine their quality and relevance to clinical practice. Quality of evidence refers to how the study was conducted and what methods were used to minimise bias.

The criteria used to assess risk of bias will vary depending on the research design. Many critical appraisal tools (CATs) have been developed which prompt the appraiser to look for certain information within the reported study. CATs are available for a range of research methodologies, systematic reviews and clinical guidelines. An easy to use clinical guideline CAT²¹ is reproduced (with permission) in Table 2.

For systematic reviews, the Critical Appraisal Skills Program (CASP)²² provides an easy to use 10 questions which aid in assessing the quality of reviews. The first two questions are screening questions, designed to provide a quick assessment of the relevance of this review to the clinical question. If it is judged relevant, the further eight questions, which include further prompting detail, are completed to determine the quality of the review. The complete tool can be downloaded from <http://www.phru.nhs.uk>.

Quality assessed abstracts of reviews are peer reviewed critical appraisals of systematic reviews. They provide a critical appraisal on the methodology and validity of the outcomes of the review and implications for research and practice. Examples of these can be found at the database of abstracts of reviews (DARE <http://www.crd.york.ac.uk/crdweb/>).

Further CAT resources can be found at: www.unisa.edu.au/cahe/CAHECATS/, www.cebm.net/index.aspx?o=1157, and www.sign.ac.uk/methodology/checklists.html.

Table 3: PICO method of asking clinical questions.

Population	External beam radiotherapy
Intervention	Skin care regime
Comparison	Any other skin care regimen
Outcomes	Reduced skin reaction, increased healing, patient satisfaction

Applying evidence based practice approaches to clinical radiation therapy practice

There are five well established steps in the EBP process, namely: identify a problem in clinical practice; search for the evidence; critically appraise the evidence; apply the evidence; assess the impact. Lack of time and skill are recognised barriers to undertaking EBP.⁹ Some practical tips on methods to undertake the steps in EBP are discussed.

Step 1: Identify a problem in clinical practice

Identifying a problem requires critical evaluation of our own practice. New information from a recent publication or conference presentation, questions from patients, carers or students on clinical rotation, or migration of staff between departments, may highlight areas of uncertainty regarding the “best available evidence” supporting practice.

Framing the problem in terms of specific, answerable questions, allows identification of the key words for searching for the evidence. This is achieved using the PICO method:²³

- The **P**opulation, **P**atient or **P**roblem in question (e.g. breast cancer or prostate cancer)
- The **I**ntervention given (e.g. skin care or information or immobilisation)
- The **C**omparison or **C**ontrol (e.g. standard care or another type of skin care, form of information provision or patient position)
- The **O**utcomes of interest (e.g. reduction in skin reaction, patient satisfaction, accuracy of treatment, cost).

For example, we wish to know whether there is any evidence on whether one type of skin care regimen is more effective than another in reducing and managing skin reactions in patients undergoing radiotherapy. Table 3 shows this question in PICO format.

Step 2: Search for the evidence

Once the question has been framed, the next step is to look for “high level” information. Searching for systematic reviews is a realistic prospect for radiation therapists in clinical practice. There are several databases that retrieve high level evidence with a few mouse clicks and simple search terms and many are freely available.

- PubMed (www.pubmed.org) is a free public access search engine for the National Library of Medicine’s MedLine. The PubMed tool, Clinical Queries, Systematic Reviews finds citations for systematic reviews, meta-analyses, reviews of clinical trials, evidence based medicine, consensus development conferences, and guidelines.
- The Cochrane Library is freely available to Australians through the Australian Cochrane Centre (www.cochrane.org.au). Searching the Cochrane library finds citations on systematic reviews, clinical trials, health technology assessments, methods studies and economic evaluations.
- The TRIP database (Turning Research into Practice, www.trip-database.com), a free clinical search engine, finds citations for systematic reviews, clinical guidelines, and a range of other resources.

Table 4: Results of search of freely available databases for high level evidence.

Database	Citation		Evidence Level
Pubmed	Aistars J, 2006 ²⁶	The validity of skin care protocols followed by women with breast cancer receiving external radiation.	Systematic review of 11 studies with a range of study designs – detailed method reported
	McQuestion M, 2006 ²⁷	Evidence based skin care management in radiation therapy	Systematic review of 14 RCTs, 1 non-RCT – detailed method not reported
TRIP	NHS Quality Improvement Scotland, 2004 ²⁵	Best practice statement – skincare of patients receiving radiotherapy.	Score 8/14 Review methodology unclear, primarily expert consensus statement
	Bolderston, et al., 2005 ²⁸	The prevention and management of acute skin reactions related to radiation therapy	Score 13/14 Clinical practice guideline, systematically developed

Table 5: Databases that index radiation therapy professional journals.

Journal	Database
The Radiographer Australian Institute of Radiography	Informit Health Collection
Radiography UK College & Society of Radiographers	Embase, CINAHL, Scopus, ScienceDirect
Journal of Radiotherapy in Practice	Embase, Scopus
Journal of Medical Imaging and Radiation Sciences Canadian Society 2008 onwards, formerly Canadian Journal of Medical Radiation Technology	CINAHL, Scopus, ScienceDirect
Radiation Therapist American Society of Radiologic Technologists	CINAHL
European Journal of Radiography Euro-med Congress of Radiographers	Embase, Scopus, ScienceDirect

Using these databases to search for systematic reviews and clinical guidelines for a very simple term, radiotherapy AND “skin care”, yielded two results from Pubmed, none from Cochrane and two from TRIP. The results are shown in Table 4.

Most clinical guideline and best practice statements are freely available on the internet, while most systematic reviews require subscription to the relevant journals (Cochrane reviews are free to access as stated above). This highlights an issue for radiation therapists who rely entirely upon free databases for literature searches. Many journals containing research by radiation therapists are not indexed by free databases, and paid subscription is required. Table 5 provides some databases which access radiation therapy journals by paid subscription. A search of the database Embase found a citation for a recent relevant systematic review²⁴ which would have been missed if only free databases were searched. Where hospitals and radiation therapy clinics do not have access to these databases and journals, linking with centres or universities who do will help retrieve all the relevant evidence.

Step 3: Critically appraise the evidence

The results of the papers retrieved from the search can then be appraised using a relevant CAT for systematic reviews and clinical guidelines. The iCAHE Guideline checklist²¹ and CASP 10 questions²² can be applied to the guidelines and systematic reviews respectively. The evidence level is indicated in Table 4.

Step 4: Apply the evidence

In this example, all of the systematic reviews report no clear evidence for any one moisturising cream over another in reducing or healing of skin reactions; they indicate a need for further research in this area. As the studies reported in these reviews were all published prior to 2006, a further search for RCTs and other relevant research published since then would be the next step in the search for evidence on this point. Many other points of practice related to skin care for radiation therapy patients are raised by these reviews and may prompt discussion and a review of individual professional and organisational practice.

The EBP process includes adopting a patient centred approach, where patients are involved in the decisions regarding their management and care. Where high level evidence is lacking to support one practice over another (e.g. using a particular moisturising cream) patients’ psycho-social wellbeing may benefit if given a choice in which skin care regimen to adopt.

Step 5: Assess the impact

Where change in practice is made, it is important to assess the impact on change. This can be done in many ways, including audit of practice before and after the change. In this example, one of the guidelines²⁵ includes pro-formas for regular skin assessment to be conducted by radiation therapists while the patient is on the treatment couch. This provides a continuous written record of grade of skin reaction, the data for which are available for analysis against many factors such as radiation dose, body habitus and skin care products used. This provides a platform to add to the current evidence.

Summary

Well conducted systematic reviews and evidence based clinical practice guidelines provide critically appraised synthesis of available research with recommendations for clinical practice and further research. While carrying out a comprehensive systematic review of published research may not be a realistic option for many clinical radiation therapists, systematic reviews and clinical practice guidelines can often be accessed through freely available databases and guideline clearing houses.

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