

I. Description of Levels of Evidence, Grades and Recommendations

Introduction

Recently, the buzzwords ‘evidence-based,’ ‘evidence-based medicine’ (EBM), and ‘evidence-based practice’ (EBP) have appeared in clinical practice protocols. EBP is defined as clinical decision-making based on (1), sound external research evidence combined with *individual clinical expertise* and (2), *the needs of the individual patient*.^{1,2} (emphasis added) The goal of EBP is to improve patient outcomes, quality of care, and provide some standardization of treatment. EBP protocols have recently been written for several conditions.²⁻⁹

One of the issues being debated is ‘what does and what does not provide evidence in EBM.’¹⁰⁻¹² Understanding the relevance and weight of evidence is an important topic when creating evidence based guidelines. The current guidelines seek to draw on the research and evidence in relation to the chiropractic utilisation of x-rays. Hence while some considerations will be to look at general evidence from across the health care and radiation science spectrum, specific evidence in relationship to chiropractic x-ray utilisation will be a primary consideration.

When reviewing a volume of evidence on a particular topic, it is importance to understand there are different levels of evidence, i.e. that not all forms of evidence can be considered of equal value. However, of equal importance, it also needs to be stated that all levels of evidence are important and have their respective value. It is widely accepted in the scientific and health care community that there are four levels of clinical treatment evidence. Depending on which organisation’s guideline we look at, there are subtle variations however the basic categorisations are the same:

- **Level 1.** *Randomized controlled trials*—includes quasi-randomized processes such as alternate allocation.
- **Level 2.** *Non-randomized controlled trial*—a prospective (pre-planned) study, with predetermined eligibility criteria and outcome measures.
- **Level 3.** *Observational studies with controls*—includes retrospective, interrupted time series (a change in trend attributable to the intervention), case-control studies, cohort studies with controls, and health services research that includes adjustment for likely confounding variables.
- **Level 4.** *Observational studies without controls* (e.g., cohort studies without controls, case series without controls, and case studies without controls)

(Source: the United States Department of Health and Human services <http://www.ahrq.gov/>)

Or

- **Level I:** Randomized controlled trials. This is generally accepted as the most reliable evidence of whether a treatment is effective.
- **Level II (a):** Good studies with a non-randomized control group (case/control or cohort). Prospective data or case notes, similar groups, correcting for confounding in the analysis,
- **Level II (b):** Poor studies with a non-randomized control group (case/control or cohort). Data gathered after the event, poorly matched groups, no attempt to correct for confounding
- **Level III:** Studies with no control group. Case series, anecdote, and testimonial.

(**Source:** Department of Public Health Sciences King's College London
<http://phs.kcl.ac.uk/teaching/ClinEpid/Evidence.htm>)

Or

- **Level I:** Evidence obtained from at least one properly designed randomized controlled trial.
- **Level II-1:** Evidence obtained from well-designed controlled trials without randomization.
- **Level II-2:** Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one centre or research group.
- **Level II-3:** Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials could also be regarded as this type of evidence.
- **Level III:** Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Discussion

When we consider the evidence from the chiropractic field we can not exclusively or even primarily restrict evidence to RCTs. As chiropractic is a clinical based science with few allied industries willing to invest into research, i.e. as pharmaceutical companies do in medicine. The most prevalent type of research in chiropractic is non-randomized clinical trials, case series, and case studies. The highest of these have control groups and there are a select few that also have randomized control groups. The main reasons for lack of RCTs in chiropractic research include labour intensiveness, cost, usually restricted to university research groups, and in the chiropractic field, there is not the tradition of research at a university level as there is in other health sciences.

In order to create a guideline that is truly evidenced based but still relevant to the chiropractic profession, all levels of evidence need to be considered. In some cases, chiropractic guideline developers have excluded specific types or levels of evidence for unknown reasons.¹³

In 2001, Bolton¹ discussed the reliance on RCT's in EBP protocols. Although the first few published RCTs on spinal manipulative therapy (SMT) were important for the chiropractic profession, RCTs are many times narrow in methodology as to not be useful in clinical chiropractic practice.^{1,14} Although the RCT is unarguably the best research design for investigating a specific intervention compared to a known intervention or a placebo, "randomization and controlled conditions play no part in everyday clinical practice"¹ and thus, evidence for effectiveness in that arena cannot be solely collected by RCTs. The strengths and limitations of the RCT have been discussed elsewhere.¹⁵

Given the limitations of the RCT in evaluating chiropractic treatment,¹⁴ it has been stated that it does not make sense to exclusively pursue the RCT in the future.¹⁶ Other research designs such as qualitative and outcomes research are now being recognized as very meaningful ways of providing the evidence in EBP.¹ Additionally, it is known today that well-done case studies most often demonstrate findings consistent with that of the RCT.¹⁷⁻²⁰ For examples:

1. Benson and Hartz¹⁸ stated, "We found little evidence that estimates of treatment effects in observational studies reported after 1984 are either consistently larger than or qualitatively different from those obtained in randomized, controlled trials." And
2. Rosner¹⁹ stated, "From this discussion, it is apparent that a well crafted cohort study or case series may be of greater informative value than a flawed or corrupted RCT." And,

3. Concato et al²⁰ stated, “*The results of well-designed observational studies (with either a cohort or a case-control design) do not systematically overestimate the magnitude of the effects of treatment as compared with those in randomized, controlled trials on the same topic.*” And, “*The popular belief that only randomized, controlled trials produce trustworthy results and that all observational studies are misleading does a disservice to patient care, clinical investigation, and the education of health care professionals.*”

The above review delineating the relevance of observational studies has significance to the chiropractic profession in as much that the ‘birth’ of the chiropractic profession was based on a case report by Daniel David Palmer.²¹ In other words, if not for the case report, the chiropractic profession might not exist as we know it today.

Levels of Evidence for The Current Document

There are many different types of clinical studies, which may be used to obtain evidence that a certain procedure or set of procedures is effective. We have listed some of the common clinical studies in order of their importance, i.e., item #1 is lower evidence than item #2, etc. It is noted that the Non-randomized Clinical Control Trial (#9) and the Randomized Clinical Control Trial (#10) are the highest forms of clinical evidence. Definitions for these types of clinical studies can be found on the internet and the majority of these definitions are provided at the end of this section.²² The current PCCRP Guidelines for clinical chiropractic practice, will consider all of the following types of clinical studies as evidence:

1. Cost-Benefit or Cost-Effectiveness Analysis,
2. Case Study (Single Subject Experimental Design),
3. Case-Control Study (Case-Referent or Case-Comparison Study),
4. Case Series,
5. Cohort,
6. Inception Cohort,
7. Cohort Analytic Study,
8. Crossover Trial,
9. Nonrandomized Control Trial,
10. Randomized Control Trial,

With the background information presented above, it is obviously important to include all types of evidence. However, it is often forgotten that clinical studies are not the only types or categories of evidence. Some of these other categories of evidence are (but not limited to):

1. Basic Science studies, including but not limited to:
 - a. Spinal modeling
 - b. Evaluations of loads, Stresses, & Strains
 - c. Normal & abnormal anatomy
 - d. Physiology
 - e. Pathological processes,
2. Spinal alignment & Health studies (e.g., correlation studies),
3. Mechanical evaluations of medical/surgical devices,
4. Reliability and validity studies on clinical devices/procedures;
5. Professional Surveys.

Classifications & Ratings of Evidence

Sackett is generally referred to as the father of evidence-based medicine.^{2,9} The goal of “Evidence-Based Medicine” (EBM) or “Evidence-Based Practice” (EBP) is to improve patient outcomes, quality of care, and provide some standardization of treatment. Sackett defined “evidence-based practice” (EBP) as, “The conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients.”⁹ He also stated that EBP “is not restricted to randomized trials and meta-analyses. It involves tracking down the best external evidence with which to answer our clinical questions.”⁹

For clinical treatments, the 10 types of clinical studies were previously defined. To determine the “best evidence”, systematic reviews of available published evidence are required. The value of these literature reviews, however, depends on the quality of the review (selection bias by those doing the review), the quality of the publications, and how these are rated by any committee commissioned to evaluate the “evidence”.²³ Often, EBM and EBP guidelines only use evidence from controlled trials, which is not what Sackett^{2,9} proposed.

In any healthcare discipline, to have RCTs as evidence on all treatment methods is impossible.²⁴ Because of the limited number and selectiveness of available RCTs, there has been much criticism of the abuses of EBM and EBPs.²⁴⁻²⁷ In 1997, Kahn et al²⁵ stated that, for evidence-based practice guidelines (EBGs) to be useful, they need to consider all the best evidence, including that from controlled trials, case series, and case reports, and they must allow for clinical experience and judgment. We reiterate that well-done case studies and series most often demonstrate findings consistent with that of the RCT.¹⁷⁻²⁰

In fact, Latov²⁶ stated that EBM represents a convergence of financial interests, including Managed Care Organizations (MCOs), which want practice guidelines to control costs and maximize profits. He stated that there is a “diminishing role of practicing physicians in shaping medical policies.”²⁶

Since MCOs use EBGs to decide coverages,²⁶ Latov went on to state that it is foolish to think that EBP guidelines do not restrict options.²⁶ “Behind the facade of EBGs, MCOs can determine medical policy with impunity.”²⁶

PCCRP Guidelines Classification of Evidence

In order to classify levels of evidence for the different categories listed above, it was necessary to derive the following table of “Classifications of Evidence”. To use these Classes of Evidence, one must identify the Type of study, and then classify it according to the following table, e.g., Type = Reliability, Classification = Class 1-2. All types of studies were considered in developing the PCCRP Guidelines and none were excluded.

Table 1.

Classification of Evidence used in the current guidelines. Clinical Studies Levels I-V adapted from: the United States Department of Health and Human services <http://www.ahrq.gov/> .

Type	Class 1	Class 2	Class 3	Class 4	Class 5
Clinical Studies					
Level I	X				
Level II		X			
Level III			X		
Level IV				X	
Expert Opinion					X
Population Studies					
Longitudinal Design with control group	X				
Longitudinal Design without control group			X		
Cross-Section Design with control group		X			
Cross-Sectional Design Without control group				X	
Basic Science	X				
Reliability Studies					
≥ 30 subjects	X				
≤ 30 subjects		X			
Validity	X				
Professional Surveys	X				

PCCRP Guidelines Ratings of Evidence

The Center for Evidenced Based Medicine (CEBM) describes “Levels of Evidence” as having essentially originated when Suzanne Fletcher and Dave Sackett were working for the Canadian Task Force on the Periodic Health Examination in the late 1970’s.²⁸ They introduced "levels of evidence" for ranking the validity of “evidence”. They then submitted "grades of recommendations" (A-D) to the advice given in the report, based upon the extent of evidence

reviewed. The PCCRP Guidelines will use the “grades of recommendation” put forth by Phillips et al,²⁹ but will slightly modify these to fit the non-clinical levels of evidence. See Table 2.

In the Grades of recommendations in Table 2, it is possible to classify all the clinical and scientific publications that the PCCRP panel sought as possible evidence for our PCCRP Guidelines. Thus, all types and levels of evidence were considered, not just the RCT.

Table 2.
Grades of Recommendation from Phillips et al.²⁹

Type of Study	Grades A-D	Grades a-d
Clinical Level I	A = Consistent Level I Studies or A Systematic Review (SR) or Meta-Analysis (MA)	
Clinical Level II	B = Consistent Level II Studies or A Single Level I Study	
Clinical Level III	B = Consistent Level III Studies	
Clinical Level IV	C = Consistent Level IV Studies or Extrapolations from Level II or III	
Expert Opinion V	D = Level V Evidence or Inconsistent Studies of Levels I-IV	
Population Study		a = Consistent Class I Studies, b = A single Class I Study or Consistent Class II and III Studies, c = Consistent Class IV Studies, d = Inconclusive Evidence
Basic Science, Biomechanics, Validity Study, Professional Surveys		a = Consistent Studies b = A Single Positive Study d = Inconclusive Studies
Reliability Study		a = Consistent Class I Studies, b = A single Class I Study or Consistent Class II Studies, c = A Single Class II Study d = Inconclusive Evidence

Definitions of Methodological Terms²²

1. **Cost-Benefit & Cost-Effective Analysis:** A form of economic assessment, usually from society's perspective, in which the costs of medical care are compared with the economic benefits of the care, with both costs and benefits expressed in units of currency or cost per unit of clinical effect. The benefits typically include reduction in future health care costs and increased earnings due to the improved health of those receiving the care.
2. **Case Study (Single Subject Experimental Design):** The intensive study of individuals through experimental designs such as the ABA, multiple baseline, and alternating treatment designs. Study generally used to test possible causes of a disease or disorder, in an individual who has a designated disorder.
3. **Case-Control Study (Case-Referent or Case-Comparison Study):** Study generally used to test possible causes of a disease or disorder, in which individuals who have a designated disorder are compared with individuals who do not with respect to previous current exposure to a putative causal factor. For example, persons with hepatic cancer (cases) are compared with persons without hepatic cancer (controls) and history of hepatitis B is determined for the 2 groups. A Case-Control Study is often referred to as a Retrospective Study (even if patients are recruited prospectively) because the logic of the design leads from effect to cause.
4. **Case Series:** A series of patients with a defined disorder. The term usually describes a study reporting on a consecutive collection of patients treated in a similar manner, without a concurrent control group. For example, a surgeon may describe the characteristics of and outcomes for 100 consecutive patients with cerebral ischemia who received a revascularization procedure. *See also* Consecutive Sample.
5. **Cohort:** A group of persons with a common characteristic or set of characteristics. Typically, the group is followed for a specified period to determine the incidence of a disorder or complications of an established disorder (ie, prognosis), as in Cohort Study (prospective study). *See also* Inception Cohort.
6. **Inception Cohort:** A designated group of persons assembled at a common time early in the development of a specific clinical disorder (eg, at first exposure to the putative cause or at initial diagnosis), who are followed thereafter. *See also* Cohort.
7. **Cohort Analytic Study:** Prospective investigation of the factors that may cause a disorder by comparing a cohort of individuals who do not have evidence of an outcome of interest but who are exposed to the putative cause with a concurrent cohort who are also free of the outcome but not exposed to the putative cause. Both cohorts are then followed to compare the incidence of the outcome of interest.
8. **Crossover Trial:** A method of comparing 2 or more treatments or interventions in which subjects or patients, on completion of the course of a treatment, are switched to another. Typically, allocation to the first treatment is by random process. Participants' performance in a period is used to judge their performance in others, usually reducing variability. *See also* Before-

After Trial.

9. **Nonrandomized Control Trial:** Experiment in which assignment of patients to the intervention groups is at the convenience of the investigator or according to a preset plan that does not conform to the definition of random. *See also* Randomized Trial.

10. **Randomized Trial (Randomized Control Trial, Randomized Clinical Trial):** Experiment in which individuals are randomly allocated to receive or not receive an experimental preventive, therapeutic, or diagnostic procedure and then followed to determine the effect.

References

1. Bolton JE. The evidence in evidence-based practice: what counts and what doesn't count? *J Manipulative Physiol Ther* 2001;24:362-366.
2. Sackett DL, Richardson WS, Rosenberg W, Haynes RB. Evidence-based medicine: How to practice and teach EBM. New York: Churchill-Livingstone, 1997.
3. Lipman G. Evidence-based pain management and palliative care. *J Pain Palliat Care Pharmacother* 2002;16:1-3.
4. Fishbain DA, Cutler RB, Rosomoff HL, Rosomoff RS. Can patients taking opioids drive safely? A structured evidence-based review. *J Pain Palliat Care Pharmacother* 2002;16:9-28.
5. Caramanica L, Cousino JA, Peterson S. Four elements of a successful quality program. alignment, collaboration, evidence-based practice, and excellence. *Nurs Adm Q* 2003;27:336-343.
6. Jordan KM, Arden NK, Doherty M, et al. EULAR recommendations 2003: an evidenced based approach to the management of knee osteoarthritis: Report of a task force of the standing committee for the International Clinical Studies Including Therapeutic Trials. *Ann Rheum Dis* 2003;62:1145-1155.
7. Wassem RA, Stillion-Allen KA. Evidence-based management of the fibromyalgia patient. In search of optimal functioning. *Adv Nurs Prac* 2003;11:34-38,41-43.
8. Hasenfeld R, Shekelle PG. Is the methodological quality of guidelines declining in the US? Comparison of the quality of US Agency for Health Care Policy and Research (AHCPR) guidelines with those published subsequently. *Qual Saf Health Care* 2003;12:428-434.
9. Sackett DL. Evidence-based medicine [editorial]. *Spine* 1998;23:1085-1086.
10. Miles A, Polychronis A, Grey J. Evidence-based medicine: Why all the fuss? This is why. *J Eval Clin Pract* 1997;3:83-86.
11. Fahey T. Applying the results of clinical trials to patients in general practice: perceived problems, strengths, assumptions, and challenges for the future. *Br J Gen Pract* 1998;1:1173-1178.
12. McKee M, Britton A, Black N, et al. Interpreting the evidence: choosing between randomized and non-randomized studies. *British Med J* 1999;319:312-315.
13. Triano JJ. CCGPP: Best Practice "The process to select relevant research". <http://www.ccgpp.org>.
14. Hawk C. Chiropractic clinic research: where are we looking for the key? *J Neuromusculoskeletal System* 1999;7:150-155.
15. Rosenfeld RM. Meaningful outcomes research. In: Isenberg SF, ed. *Managed care, outcomes and quality*. New York: Thieme, 1998:99-115.
16. Bolton JE. Whence the evidence from evidence-based practice? *Br J Chiropr* 2000;4:2-3.
17. Venning GR. Validity of anecdotal reports of suspected adverse drug reactions: The problem of false alarms. *BMJ* 1982;284:249-252.
18. Benson K, Hartz AJ. A comparison of observational studies and randomized controlled trials. *N Engl J Med* 2000;342:1878-1886.

19. Rosner A. Fables or Foibles: Inherent problems with RCT's. *J Manipulative Physiol Ther* 2003;26(7):460-467.
20. Concato J, Shah N, Horwitz RI. Randomized, controlled trials, observational studies, and the hierarchy of research designs. *New England J Medicine* 2000;342(25):1887-1892.
21. Lillard H. In: Palmer DD, Editor. *The Chiropractor* 1897;17:3.
22. Archives of Physical Medicine and Rehabilitation. Information to Authors. <http://www.archives-pmr.org/authorinfo>.
23. Davidson KW, Goldstein M, Kaplan RM. Evidence-based behavioral medicine: What is it and how do we achieve it? *Ann Behav Med* 2003;26:161-171.
24. Caplan LR. Editorial. Evidence based medicine: concerns of a clinical neurologist. *J Neurol Neurosurg Psychiat* 2001; 71:569-576.
25. Kahn DA, Docherty JP, Carpenter D, Frances A. Consensus methods in practice guideline development: a review and description of a new method. *Psychopharmacol Bull* 1997; 33:631-38.
26. Latov N. Evidence-Based Guidelines: Not Recommended. *J Amer Physicians Surgeons* 2005; 10(1):18-19.
27. AMA News in Brief. Michigan Blues introduce bonus program. *American Medical News* 2004; Dec:18.
28. Canadian Task Force on the Periodic Health Examination: The periodic health examination. *CMAJ* 1979;121:1193-1254.
29. Phillips B, Ball C, Sackett D, Badenoch D, Straus S, Haynes B, Dawes M. Levels of Evidence and Grades of Recommendation. http://www.cebm.net/levels_of_evidence.asp. Accessed July 10th, 2006.