

Evidence Based Clinical Practice Course Overview: Narrative Review

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Abstract

Introduction: In this narrative review, the author introduced Evidence Based Clinical Practice (EBCP) regarding definitions, basics, origins, benefits, necessity, and barriers. The suggested content of a Chiropractic EBCP course is detailed and modifications to the material are expounded. A proposed method of course outcome derivation is suggested for the curriculum to enhance cohesiveness: topic coverage, planned repetition, shifting overlap between course outcomes, and smooth Bloom's progression. This will provide a resource for those beginning or overhauling an EBCP course and curriculum.

Methods: Literature review was based on content used in the course and those necessary to provide context. Instructor's experience was used as evidence for resultant deliverables. This evidence was based upon not only the current structure of the course and position in the curriculum but perceived necessary modifications.

Results: Deliverables included an EBCP course outline with the following content modifications diagramed and explained: balance of evidence, tilted EBCP pyramid by design. Depth levels were delineated by Bloom's verb and a suggested curriculum sequence of outcomes was proposed.

Discussion: Potential problems were revealed and considered such as: subjectivity of Bloom's verbs, level of depth within Bloom's verbs, structural analysis, and quantitative analysis. Future and concurrent study plans included analysis of the design and outcomes.

Conclusion: This overview of an EBCP course could be used as a template for other chiropractic institutions and modified for other professions.

Keywords: *Evidence Based Medicine; EBM; EBCP; Curriculum; Education*

Introduction

Purpose

The purpose of this narrative review was to introduce Evidence Based Clinical Practice (EBCP) regarding definitions, basics, origins, benefits, necessity, and barriers. This was used to establish what EBCP is and why it was important to be integrated throughout a chiropractic curriculum. The suggested content of a Chiropractic EBCP course was detailed and modifications to the material are suggested.

Proposed method of course outcome derivation was suggested for the curriculum to enhance cohesiveness by using the following features: topic coverage, planned repetition, shifting overlap between course outcomes, and smooth verb progression. This would provide a resource for those beginning or overhauling an EBCP course and curriculum.

Definitions in Evidence Based Clinical Practice (EBCP) are confused by overlapping terms and multiple definitions. There are many synonyms for EBCP such as Evidence Based Medicine (EBM), Evidence Based Practice (EBP) as well as numerous other terms [1]. Evidence Informed Practice (EIP) often decries a nuance that EBCP does not follow rigidly from randomized control trial (RCT) based meta-analysis; rather it is very dependent upon clinician experience. The term Value Based Practice (VBP) focuses on outcome assessments more than comparison to placebo or natural history. Sackett defined EBCP as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients integrating individual clinical expertise with the best available external clinical evidence from systematic research” [2,3]. This definition is supported by 95% of medical college survey respondents [4]. Bolton, *et al.* offers this alternate definition: “clinical decision-making based on sound external research evidence combined with individual clinical expertise and the needs of the individual patient” [5]. The 3 lines of acceptable evidence listed by Sackett’s and Bolton’s definitions (research, doctor, patient) are sometimes referred to as the three-legged stool or the three pillars of EBCP. Evidence from these three pillars is considered important and must be kept in balance as noted in table 1 [3,6,7]. Achieving proximity to this difficult goal requires the practitioner to have learned EBCP basics. These basics include how to implement EBCP (5 A’s) and weigh the evidence for quality and applicability.

	Research	Doctor	Patient
Research over		Some people are not “average” and a treatment might or might not work for them despite what research says.	Researchers may be biased due to conflicts of interest that are not disclosed and put money over patient outcomes.
Doctor over	Doctors may recommend treatments that show benefit only because of natural history or placebo; “Snake Oil” charlatans		Doctor can do services for money that do not help patient; “the latest thing”. Or the doctor may persuade the patient in a time of vulnerability to do something against the patient’s values.
Patient over	Patient may demand treatments that hurt themselves (opioids abuse, antibiotic resistance)	Patient may want pain relief without necessary rehabilitation.	

Table 1: Balance of evidence is necessary to avoid the events in the blocks that result from placing the row evidence above the column evidence.

As per table 1, if one places the “Patient over” the “Doctor” then the “Patient may want pain relief without necessary rehabilitation”. This table reveals that abuses that can occur when these evidences are not in balance. The grey boxes are thought of as nonsensical; yet further consideration may find value. Such as, how would one weigh the experiences of two doctors that disagree? Would the quantity of experience, celebrity status or wealth be considered in this calculus? Do we weigh their adherence to higher levels of research, persuasiveness, logic? This truly requires more consideration.

Basics

The 5 A’s (Ask, Acquire/Access, Appraise, Apply, Assess) [1] which has been adapted from Sackett [7] is the established construct used in EBCP. This article will use this construct to provide an outline for topics to be discussed in a graduate level EBCP course. This construct is used in multiple forms in other sources [8-10].

Ask involves developing a succinct clinical question. It uses the PICO acrostic to concisely define the Problem (Diagnosis), Intervention (Treatment, Diagnostic test), Comparison (Placebo, natural history, reigning comparator), and Outcome (Pain, Disability). An example of this would be the following: P-Low back pain, I-Chiropractic, C-Medicine. Notice that all of the parts of PICO do not have to be used. Other acrostics are available such as "PICO-D Man" [3].

Acquire uses the PICO terms to generate search terms and utilizes these terms to discover articles at the highest levels of the EBCP Tilted Pyramid for pre-appraised literature, including clinical practice guidelines, meta-analyses, systematic reviews, and narrative reviews, before moving toward more biased and possibly less clinically applicable evidence such as case studies, editorial opinion, and animal studies. Although, these later study designs are important for the discovery of new adverse events or treatments for higher level studies.

Regarding the significantly modified EBCP Tilted Pyramid, please refer to figure 1-3 which seems to be originally from Glover [11]. Haneline had a similar diagram in his EBCP textbook for chiropractic [12]. It has been significantly altered and placed in this paper as diagrams 1-3 depending upon the type of clinical question theme: diagnostics, treatment or prevention. diagnostics (subjective and objective to form an assessment/diagnosis), prevention (plan to address future diagnosis), treatment (plan to address present diagnosis). Notice this follows the SOAP format which is used as a basic template for each visit's health record.

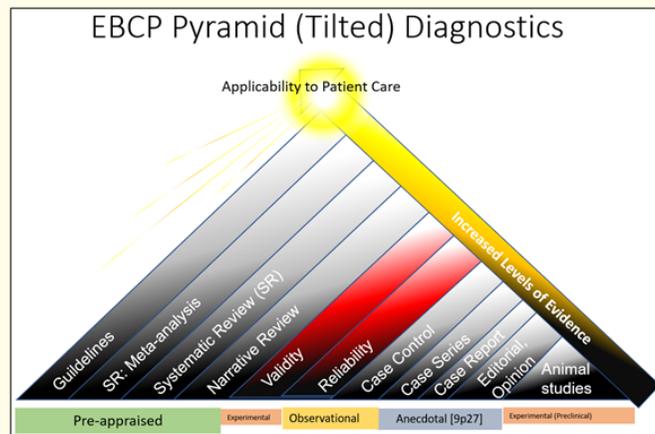


Figure 1: EBCP pyramid (Tilted) for diagnostics.

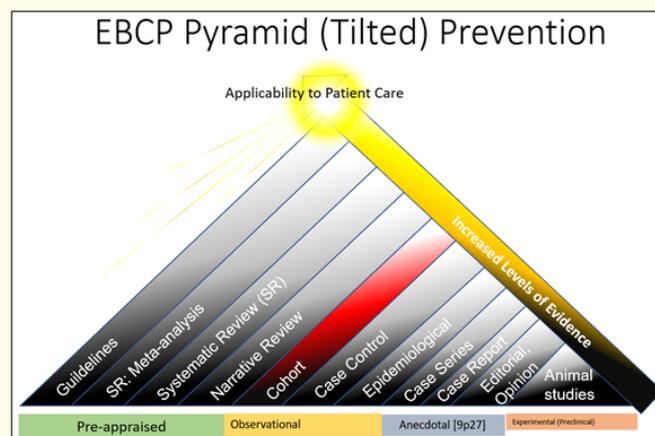


Figure 2: EBCP pyramid (Tilted) for prevention.

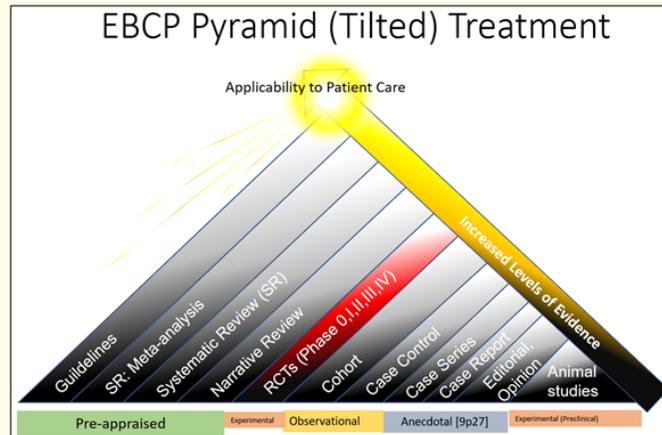


Figure 2: EBCP pyramid (Tilted) for prevention.

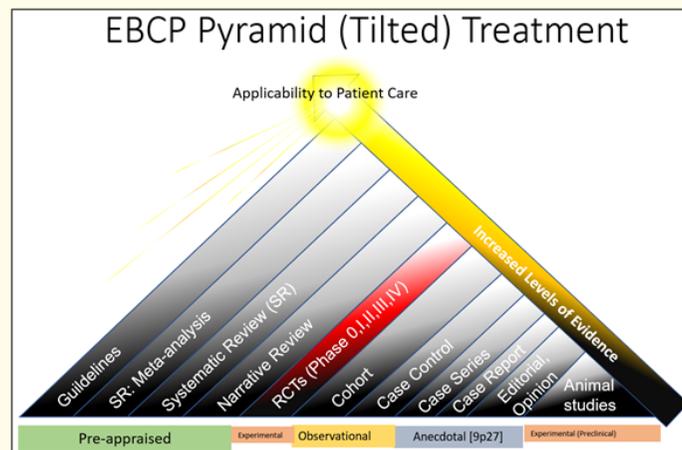


Figure 3: EBCP pyramid (Tilted) for treatment.

Note that the typical EBCP pyramid has been tilted in these diagrams to reflect that all levels have different grades of applicability to the patient depending upon demographic similarity, generalizability and quality. Poor quality studies of any type are not applicable. The relative quality is on a continuum based upon an appraisal.

Appraisal can be done at multiple levels as indicated below:

- Level 1:** This level involves understanding the EBCP Pyramid for each main study theme: treatment, prevention, and/or diagnostics as per diagram 1-3. Therefore, a cohort study would be considered at a higher level than a case-control study regardless of the quality. Level 1 appraisal has limitation that are progressively fixed in higher levels.

- **Level 2:** This level uses a tool called ABCD FIX (Allocation, Blinding, Comparable, Dropouts, Follow up, Intention to treat, X-tra factors) that compares the study to the randomized control trial (RCT) [13,14]; RCT's are often considered the pinnacle of study types especially for treatment. Triano describes some of the challenges in applying RCTs and meta-analysis-based evidence to individual patients [15]. Related to the inflated view of RCTs, cardiopulmonary resuscitation (CPR) is an example of a treatment that could not be tested by RCT since the people would have to be put in cardiac arrest before administration of a randomized treatment. ABCD FIX remains a higher-level appraisal than the EBCP Pyramid that can be used "on the fly".
- **Level 3:** This level utilizes specific appraisal tools designed for specific study types. These appraisal tools can be found at www.equator-network.org/. There are over 300 tools for many different study designs and sub-types [16].

Apply requires using a validated outcome assessment tool (OAT) before applying the intervention. Reliable and valid diagnostic tools should be used to determine the diagnosis. Then, statistical significance is determined by comparing the combined effect size (diamond on a Forest Plot) to the line of no effect; overlap leans toward insignificance. Heterogeneity and publication bias (Funnel Plot) are also considerations. The practitioner must determine from the evidence if the treatment effect size is clinically significant and weigh the benefits versus harm. Clinical significance is determined to exist if the combined effect size is greater than the minimally clinically important difference (MCID), the demographics between the patient and study subjects are similar, and the benefits outweigh the harms.

Assess involves re-evaluating the patient at intervals using the same OAT after the application of the treatment or prevention measure. If the intervention does not produce results greater than the MCID then the following should be considered: is the diagnosis correct, is there a better intervention and what may be causing deficits in patient adherence.

The 5 As should be taught to improve EBCP utilization to enhance benefits to patients. Healthcare providers should learn to employ these critical thinking constructs to champion our patient's welfare despite "unproven and heavily marketed therapeutic claims" [17].

Origin

For many healthcare education programs David Sackett's 1997 textbook has been the gold standard for informing the creation of an EBCP curriculum [7,10,18]. A learning strategy developed at the Michael G. DeGroot School of Medicine at McMaster University has been the gold standard for training healthcare providers and educators in EBCP [10]. In 2004, an interdisciplinary panel convened by the Institute of Medicine (IOM) recommended that all health care trainees and professionals practice EBM [4]. Chiropractic programs in North America began to implement the concepts of teaching and learning EBCP in the early 2000's [6]. A rather extensive list of learning outcomes (L.O.s) was developed by LeFebvre, *et al* [14].

Sackett noted that many healthcare programs are still in the early stages of adopting EBCP into the learning outcomes of their curricula, "evidence-based medicine remains a relatively young discipline whose positive impacts are just beginning to be validated and it will continue to evolve. Levels of adoption and sophistication will have to be developed. This evolution will be enhanced as several undergraduate, postgraduate, and continuing medical education programs adopt and adapt it to their learners' needs" [7].

Benefits and necessities of EBCP education

EBCP has many benefits to the following stakeholders: patients, students, clinicians, government, insurance companies and the public. Moreover, EBCP provides a common ground between professionals who want critically appraised methods to diagnosis and treat patients. Accreditors have become increasingly interested in the incorporation of EBCP into healthcare curricula. Patient outcomes will be considered first since it should be the focus of the healthcare system. In a 2004 review by Fernandez, *et al*. five RCTs and 1 controlled educational trial indicated improved patient outcomes after evidence-based medical education [10]. Equivocal findings were noted by

Bussieres in 2016 with “one pragmatic RCT comparing an evidence-based treatment protocol with the usual care for acute non-specific LBP and found no important difference in outcomes”. Bussieres also found that EBCP protocol generated results more rapidly than usual care and with fewer treatments [19].

Students support EBCP for growth and validation of chiropractic [20] which also mirrors some clinicians’ perspectives. A 2013 survey by Walker, *et al.* of Australian chiropractors revealed that “most Australian chiropractors viewed EBP as an essential component of chiropractic practice”. Respondents also thought that “research literature was useful in day-to-day practice and indicated that EBP improved the quality of their patient care and assists in decision making” [21].

The government, insurance companies and public continue to be alarmed by the overwhelming costs of healthcare. This should lead to a more equitable system of healthcare that pays based upon evidence supported results. However, the complexities are staggering and there is a cacophony of stakeholders. This system would have to be robust enough to handle a plethora of issues including effectors of research funding (capacity, grant allocation), treatment delivery (scope) and patient response (deconditioning, preexisting, adherence, relapse rates).

Other researchers have also commented on how the adoption of EBCP by the chiropractic profession would further strengthen interdisciplinary collaboration by providing common ground. As noted by Passmore in 2010, “the chiropractic profession needs to remodel its’ present approach to clinical education and research to remain relevant in an era of evidence-based practice” [22]. In 2011, Lefebvre commented that “although health care models, language, and attitudes may differ, an appreciation of evidence-based outcomes and EBP literacy offers the best common ground to help cement this burgeoning cooperation” [14]. Relevance is established by providing evidence that a clinician’s skills result in improved patient outcomes. Evidence is the common ground.

In addition to improved patient outcomes, assistance in clinical decision making and providing common ground between professions, there are other compelling reasons that require including EBCP into a D.C. program curriculum. As part of the 2018 accreditation standards, the Council on Chiropractic Education requires that students need to be information and technology literate (Meta-competency 6). As stated in the Curricular Objective “the program prepares students to locate, critically appraise and use relevant scientific literature and other evidence” [23]. Just as the U.S. Medical Licensing Examination has supported EBCP inclusion [10], the plans of the NBCE (National Board of Chiropractic Examiners) who administer the D.C. licensing exams will also necessitate the delivery of education regarding EBCP in the D.C. program.

Barriers

Even with all the benefits of EBCP, significant barriers still exist to the implementation of EBCP into the D.C. program curriculum, into the practice of EBCP in clinical training settings, and into eventual practice. The following issues and opinions have been found to be prominent themes in the literature: time constraints, confidence, a lack of adequately trained faculty, clinical challenges, and negative attitudes towards EBCP, including that it might degenerate into “cook-book” of clinical practice.

Many practitioners report that there simply is not enough time to seek out and discover the “best evidence” [7] within the literature [2,4,10,19,24]. Bussieres and Fernandez have also indicated that low confidence levels in a clinician’s personal critical appraisal skills are also barriers to EBCP adoption [19].

There should be an emphasis placed on teaching critical thinking (including logic and 5 A’s - especially appraisal) to faculty, students and practitioners. Application of these skills will result in more efficient searches and therefore consume less time. As we create more confident and skilled consumers of evidence, we should be able to reduce the impact of time constraints as a barrier to EBCP implementation. As part of our R-25 training program, faculty were shown that higher level articles (meta-analyses, systematic reviews and RCTs) of

common diagnoses may be found in short order using the most popular electronic databases (Pubmed, Medline, Cochrane, etc.) utilizing a combination of keywords, limiters and filters. Google scholar can find many articles, yet it is important to check the publisher and journal in database lists of predatory sources.

EBCP faculty training availability has also been found to be a barrier to EBCP implementation. A 2014 systematic review by Blanco examined studies in both 2002 and 2006 that identified inadequately trained faculty in medical schools along with a lack of opportunities for faculty to learn EBCP skills as a barrier to EBCP adoption [4,24,25] it was also noted that there were inadequate EBCP teaching materials within the medical school curricula during this time [4]. Moreover, EBCP faculty should be taught EBCP methods of teaching such as team-based learning (TBL), problem based learning (PBL) and Critically Appraised Topics (CAT) [10,26-31] including relative strengths and weaknesses of these methods.

Clinical challenges in the application of EBCP principles with the training of primary healthcare providers including, the lack of clinician “role models” [19], the lack of pre-appraised clinical topics specific to chiropractic (such as Dynamed or UpToDate) [22], the lack of database access [19,32] and the lack of databases with full text access for a reasonable fee [1]. Regarding pre-appraised clinical topics, Triano remarks that around 85% of healthcare practices are evidence based [33]. Some chiropractors in solo practices have stated that their negative attitudes towards EBCP implementation may have come from the lack of “user-friendly processes and products” for clinical utility [18,32]. Evidence based Clinical practice guidelines (CPGs) have been developed. The Canadian Chiropractic Association’s CPG Initiative offers a free access, online site at <https://www.chiropractic.ca/guidelines-best-practice/practitioners/> which has CPGs for headaches, neck pain, mid back pain, upper and lower extremities and other conditions [34,35]. An associated barrier is the difficulties of updating professors’ content and testing material for these CPG guidelines while providing synchronicity with the board exams.

Negative attitudes towards EBCP have been noted in other studies [6,19,25]. The attitudes expressed were clinician concerns about detracting from patient care, a perception of a dichotomy between “traditional and caring” doctors and “research-oriented” doctors, along with misconceptions about evidence-based medicine that “it might degenerate into slavish cook-book” approaches to individual patient care [7]. Research-oriented protocols that incorporate the best evidence from all three pillars (experience, patient, and research) can be adapted to the specific patient situation by traditional doctors. Cookbooks could be beneficial; especially when the skilled practitioner can “salt to taste”.

Bloom’s verbs

Bloomian analysis is described by other sources [29,36]. This analysis began with the formation of course outcomes using verbs by Benjamin Bloom that signify levels of learning. The verbs begin with lower levels of learning such as gross memorization (list, choose, recall) and crescendo in evaluation (debate). The ability to analyze the structure and effectiveness of a curriculum on learning the material to a level of mastery is critical for doctoral programs.

Goals of the Study

The goals of this narrative review included determining the benefit versus barriers for EBCP and identifying deliverables for improving course administration and outcomes. The benefits of improved patient outcomes, feeling of success in understanding the literature, the requirements for accreditation compliance and successful licensure for graduates compelled the inclusion of an EBCP course into our chiropractic doctorate curriculum. Barriers have been discussed and solutions offered. Many of the barriers noted above may be overcome by training and providing progressive PowerPoints to be used as templates for each topic. The deliverables for this narrative review included an overview of EBCP course content with diagrams for balancing evidence and levels of evidence (Tilted EBCP Pyramid). Other results include a table for sequencing of EBCP outcomes in a curriculum.

Methods

The author overhauled the EBCP class and has taught EBCP for 4 years for a total of 16 quarters. The course is part of an EBCP sub-curriculum spanning 13 quarters. Then a task force was created to integrate the topics through-out the curriculum. The resultant changes were approved by the Faculty/Admin level Curriculum Management Committee (CMC) after consultation with the Learning Outcomes Committee (LOC). Then the curricular changes were approved by the Administrative Committee. An article detailing this process is under review in another journal.

This article presents an overview of the course content for the purpose of providing resources for creating an enhanced EBCP course with specific recommendations on modifications that the author found helpful.

Results

Topics were determined by the faculty who taught EBCP and were approved by the Task Force and other administrative committees. These topics included those listed in table 2.

Topic Number	Topic Content
T01	Basics: Definitions, Pillars
T02	Critical Thinking: 5As, Logic, Creativity
T03	Scientific Method: Hypothesis test, Errors
T04	Ethics (Non-stat related)
T05	Reliability, Validity Basics
T06	Ask: Background vs Foreground Questions → PICO
T07	Access/Acquire: Pyramid, Databases (Pubmed: MeSH, Dynamed)
T08	Appraisal: General Stats: Data Types, Distributions, Measures of Central Tendency (Mean, Median, Mode), Dispersion (SD, z, %tiles)
T09	Appraisal: Stat Selection: Data Types, Parametrics (n, homogeneity, Skew, Kurtosis)
T10	Appraisal: Significance, Confidence Intervals (CIs) Alpha level, P-value, Statistical significance
T11	Appraisal: ABCDFix: Allocation (Randomization, concealment), Blinding, Comparison (Table 1), Drop-out, Follow-up, Intention to Treat, X-tra factors.
T12	Appraisal: Formal Tools
T13	Appraisal: Correlation, Regression
T14	Appraisal: Diagnostic Reliability: Kappa, ICC, MAD
T15	Appraisal: Diagnostic Validity: Sensitivity, Specificity, Likelihood ratio, PPV, NPV
T16	Appraisal: Treatment (Surrogate End Points, Effect size, Difference in Means Tests), Metaanalysis (Forrest Plot, Heterogeneity, Funnel plot)
T17	Appraisal: Risk/Prevention: OR, ARR, NNT
T18	Apply: Clinical significance, Effect size (Minimally Clinically Important Difference (MCID))
T19	Assess: OATs, Specific ADLs
T20	Ethics (Stat related)

Table 2: List of EBCP topics.

Creation of an EBCP curriculum may be performed with different levels of difficulty. College administrators could “press an easy button” and use what the author herein calls Stage 1 or they can use more rigorous methods: Stage 2 or 3.

Stage 1: This stage is an easier method. The numbers 1 - 6 (first column) in table 3 represent the Bloom’s verb level: 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation. These levels normally include many verbs; however, for a quick start and/or restart curriculum, the author would recommend the Bloom’s verbs in Stage 1. Start with the topic that has been listed in table 2 and tag the Bloom’s verb to the beginning of the topic; then refine as needed. Further refinement can be done by making the outcomes related to clinical approximation.

Blooms Level	Quick Start Blooms Verbs	101 Basics: Definitions, Pillars	Clinical Approximation Refinement		
			Course Outcome	Non-clinical: Starting to learn about the information	Semi-clinical: Applying to simulated patient case
1	Describe, Define	Describe the basics of EBCP including definitions and pillars.	Define EBCP by finding it in a list. Describe the 3 pillars by finding the 3 in a list.		
2	Apply	Apply the basics of EBCP including definitions and pillars.	Apply the EBCP definition to a scenario where the evidence may be in the grey zone. Apply the 3 pillars to a scenario where evidence is coming from other sources (advertisements)		
3	Interpret	Interpret the basics of EBCP including definitions and pillars.	Interpret results of studies and whether they included all 3 pillars of EBCP.	Interpret which part of the 5 As were not performed from a simulated patient case.	
4	Explain	Explain the basics of EBCP including definitions and pillars.	Explain the definition of EBCP. Explain the 3 pillars and the need for balance.	Explain how the 3 pillars related to the management of a simulated patient case.	
5	Integrate	Integrate the basics of EBCP including definitions and pillars.	Integrate multiple definitions of EBCP and create your own. Integrate the 3 pillars and how they complement each other.	Integrate evidence streams to form a plan for your simulated patient or scenario.	Integrate evidence streams to form a plan for your patient’s unique situation.
6	Defend	Defend the basics of EBCP including definitions and pillars.	Defend an alternate definition of EBCP. Defend the 5 A’s as a method of critical thinking. Defend the 3 pillars model and how one would determine if one is better evidence than the other in some instances.	Defend your use of evidence streams and how a clinician would determine if one stream is better evidence than the other in a simulated patient or scenario.	Defend your use of evidence streams and how a clinician would determine if one stream is better evidence than the other in your patient’s unique situation.

Table 3: Example of progressive verbs for quick start of an EBCP curriculum (Stage 1) and further examples of Bloom’s verbs for specification (Stage 2). This example uses outcome T01 Basics: Definitions, 3 Pillars (lines of evidence, 3-legged stool).

Stage 2: This stage involves allowing other Bloom's verbs that are not represented in table 3. Furthermore, the outcome statements should follow pattern: Bloom's verb, topic, how assessed (exam, project), and clinical approximation. For example, a full outcome statement could be "Integrate evidence streams to form a written plan for your simulated patient or scenario". This outcome follows the pattern: Bloom's verb = integrate, Topic = Evidence streams, How assessed = written plan project, and Clinical approximation = simulated patient or scenario.

Stage 3: This stage of maturation of Bloom's verbs would involve addressing single outcomes after analysis. Analysis would include a deep dive into multiple factors: course level, topical, quantitative analysis of assessment performance (exams, quizzes); congruence of actual method of assessment with the method stated in the outcome (or is it even being assessed).

In retrospect, the author recommends a curricular structural design akin to table 4. The 1 - 6 represents the level(s) of Bloom's verb. The Bloom's verb level increases with some overlap as the student progresses through the curriculum. Notice the topic totals were similar while the term totals generally decreased with dedicated courses in quarter 1 and 7. The quarter 1 class would be more introductory while the quarter 7 course would be focused on patient simulations.

Discussion

Evidence Based Clinical Practice (EBCP) describes how evidence is obtained and used in clinical practice. Every part of patient management that is taught in a doctoral curriculum requires evidence to inform the doctor how to proceed. The benefits and barriers of EBCP have been discussed and solutions given. Forming a cohesive EBCP sub-curriculum is essential to help the doctor create protocols to help their patients. This EBCP sub-curriculum will have to adapt to the everchanging environment of healthcare. Ongoing analysis of this sub-curriculum will be helpful to determine if it meets the needs of stakeholders. Sub-curriculum analysis involves the successfulness of the integration of the EBCP sub-curriculum into the curriculum through-out the whole doctoral program. This analysis involves many aspects: structural analysis (gaps in the curriculum by Bloom's level or term, general progression of Bloom's verb which should be an upward trend), necessity of mid or higher levels of terminal Bloom's verbs; quantitative analysis (how well the students performed on those outcomes by grades on questions within tests); degree of repetition and scope of details and comparison with national board scores. EBCP is not taught at this time on national boards yet the author believes that it is only a matter of time since he heard that it is under discussion.

Another discussion should include the subjectivity of Bloom's verbs. An example would be that Bloom's verb "appraisal" (Level 6) can be done at a beginner level where the student will be able to "identify" (Level 1) whether the line items are represented in an article from an appraisal tool or at an expert level where they "criticize" (Level 6) an article because it uses Pearson's R for diagnostic reliability [37]. The subjectivity of the necessary depth is also a point of discussion. Unless the curriculum is intended for developing researchers, calculations seem unnecessary other than mean, median, and quartiles to understand a boxplot. Regarding "inferential stats", the depth of the content could be at many levels: 1. Define inferential stats; 2. Apply the correct inferential stat (difference of means test, regression, correlation) to given data without calculation; 3. Interpret inferential stat results. 4. Explain why absolute risk ratios (ARR) preferred prevention stats are. difference of means tests; 5. Integrate the information from a Forest plot including combined effect size, CI and heterogeneity to form a conclusion 6. Perform analysis using R (version 3.4.3; R Foundation for Statistical Computing; Vienna, Austria) which is a downloadable, free source statistics program. Another issue with Bloom's verb levels is that the level might not pertain to your topic given the context. It might not be necessary for a chiropractic clinician to debate the 5A's. Although, a debate on the 3-pillars might be profitable. These discussions are necessary to properly stage the outcomes.

After each topic is staged, then the outcomes can be distributed through-out the entire curriculum. "In the traditional pre-clinical years cognition by students is mostly at the knowledge and comprehension levels. In the first clinical year it moves to the application and analysis levels with expansion of the knowledge base and reduction of comprehension time. By the final year, students should be function-

ing mostly at the analysis and synthesis levels with occasional evaluation level processing to effectively solve the clinical problems that they are likely to encounter” [38]. “Students believe that application of EBCP in the clinical context is of utmost importance and that the academic program should design opportunities for this to happen as often as possible” [39].

Regarding the proposed curriculum design in table 4, some modifications are worthy of note such as the following: integration, planned repetition, decrease of term totals, dedicated courses to EBCP, increasing trend and balance of Bloom’s level, balance of difficulty (from test stats), placement of diagnostic statistics. EBCP information should be integrated with the other courses in the curriculum: anatomy, physiology, pathology, diagnostic (vitals, ortho/neuros, physical exam) integrated with diagnostics stats (including epidemiology for pre-test probability); treatment (CMT, physiotherapy, rehabilitation) with treatment and prevention stats; clinic with all concepts focused on PICO, access, apply (MCID), assess. Term totals should show a decrease over time since students are expected to perform higher level tasks that are more clinically relevant. Projects will be more labor intensive for the faculty and may require less outcomes to assess. Dedicated courses should be placed in the curriculum to force reckoning with the material and to avoid students buffering grade with easier content from integrated courses. Some higher-level bloom’s verbs will take more student time and professor time. If the professor is overloaded, then the grades may show a ceiling affect due to grading fatigue. Some institutions may consider multiple instructors for these types of projects and a rubric.

Expansion of diagnostic statistics including sensitivity, specificity, and likelihood ratios (LR) should be placed after some diagnostics are learned (such as physical exam or orthopedic tests). The threshold of .90 for sensitivity and specificity can be taught with the concept of leaning versus being more dogmatic with the SLR (leaning to rule out with sensitivity of .80) and WLR (more dogmatic to rule in with specificity of .90). Showing that SLR is not good at ruling in and WLR is not good at ruling out is important point. The orthopedics test should be taught with a discussion of diagnostic statistics. Diagnostic stats can be taught with vitals, physical exam, laboratory tests (especially amylase/lipase).

The author describes an EBCP course within the context of a doctorate level chiropractic curriculum. Bussieres explains that “academic programs should incorporate EBCP content early in a program of study and “weave” it throughout the 4 - 5 years of professional education” [19]; others agree with this sentiment [4,14,40,41]. This course could be designed to be introductory or challenging depending upon the scope and depth. The intended scope and depth are dependent upon the intended results. Is the result of the curriculum the development of a clinician, researcher, or both?

Limitations of the Study

Limitations include lack of exhaustive literature search and grading of evidence.

Uniqueness and Summary of Discussion

This narrative review is unique since it integrates multiple factors: worth of EBCP, overview of content with modifications, and EBCP sub-curriculum sequencing. Content topics were converted to course outcomes and delineated. In addition, some concepts (evidence balancing, tilted EBCP pyramid) were shown in a nuanced fashion. Also, based upon the author’s experience, a suggested curriculum surrounding the course is detailed to provide planned repetition and Bloom’s verb graduation.

Future and Concurrent Planning

Specific structural analysis of the curriculum has been performed and is under review for publication. Quantitative analysis of the curriculum will require logistical modifications. Study is needed to determine what topics are necessary for students to understand before they can make reasonable application of EBCP.

Conclusion

This article introduced Evidence Based Clinical Practice (EBCP) regarding definitions, basics, origins, benefits, necessity and barriers. The suggested content of an EBCP course was detailed and modifications to the material are suggested. Proposed method of course outcome derivation was suggested for the curriculum. This narrative review provided a resource for those beginning or overhauling an EBCP course.

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Other Disclosures

The authors report no conflict of interest. The author is solely responsible for the content and writing of this original article.

Ethical Approval

Palmer College of Chiropractic Institutional Review Board determined this article does not constitute human subjects research pursuant to 45 CR 46. This research project was assigned IRB Tracking #: N2020-10-27-M in text of letter and file name with N2020-10-28-M on October 27, 2020.

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