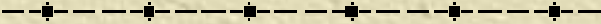




# *STUDY DESIGN*

Jerrilyn A. Cambron, DC, PhD  
Department of Research



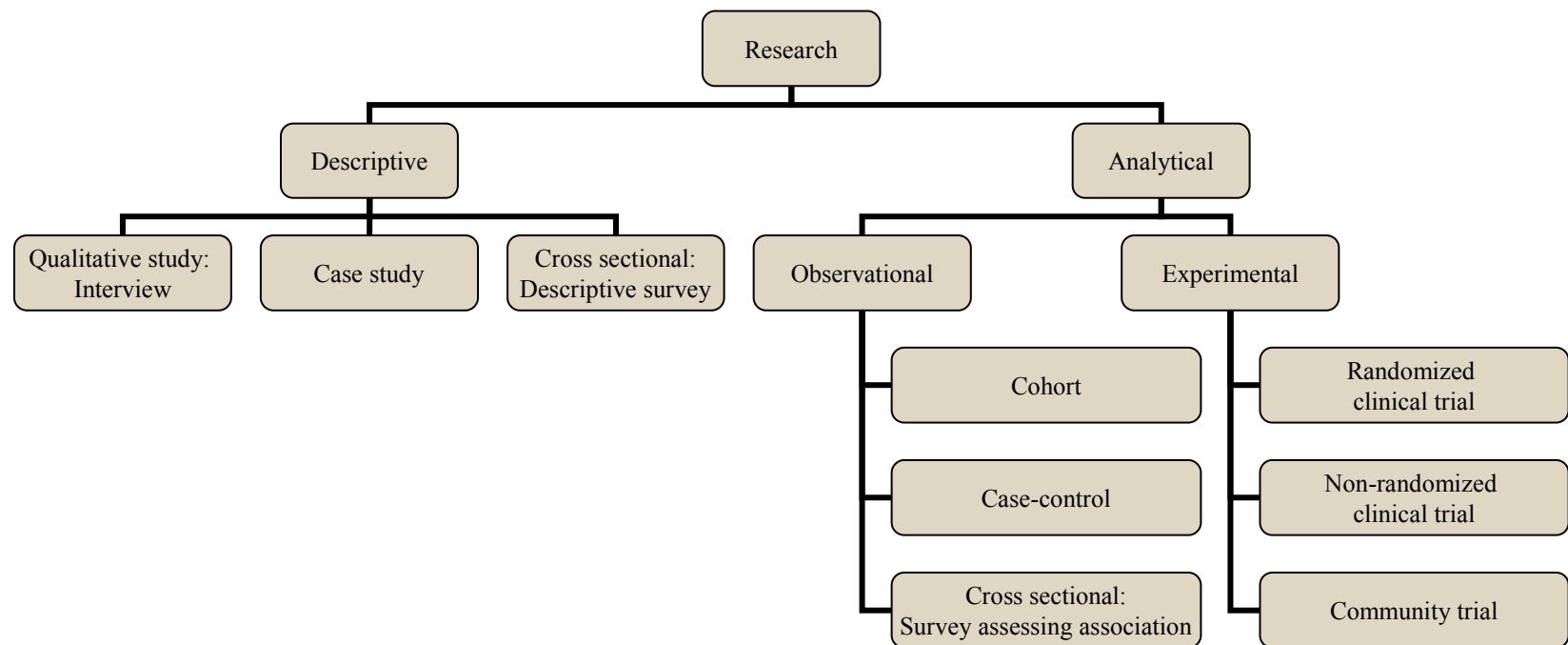
RE6002: Week 2



National  
University of Health Sciences

EBP@NUHS Essential Evidence Based Practice Study Guide Critical Appraisal Study Design Cohort Studies © J. Cambron 2008

# *Let's look at the big picture...*



# *Types of Research*

## ✦ Descriptive

1. Qualitative study: Interview
2. Cross sectional: Descriptive survey
3. Case study

## ✦ Analytical

1. Observational
2. Experimental



# *1. Qualitative study*

- ✦ An interview with one or more people asking open-ended question.
  - How does low back pain affect you in your daily life?
- ✦ Subjects are allowed to take discussion in any direction. Researcher looks for common themes in responses.



## *2. Cross sectional study*

- ✦ A survey with questions used to describe a population
  - Do you take vitamins?
  
- ✦ A survey with questions used to assess an association between two or more factors
  - Do you take vitamins?
  - Do you have diabetes?

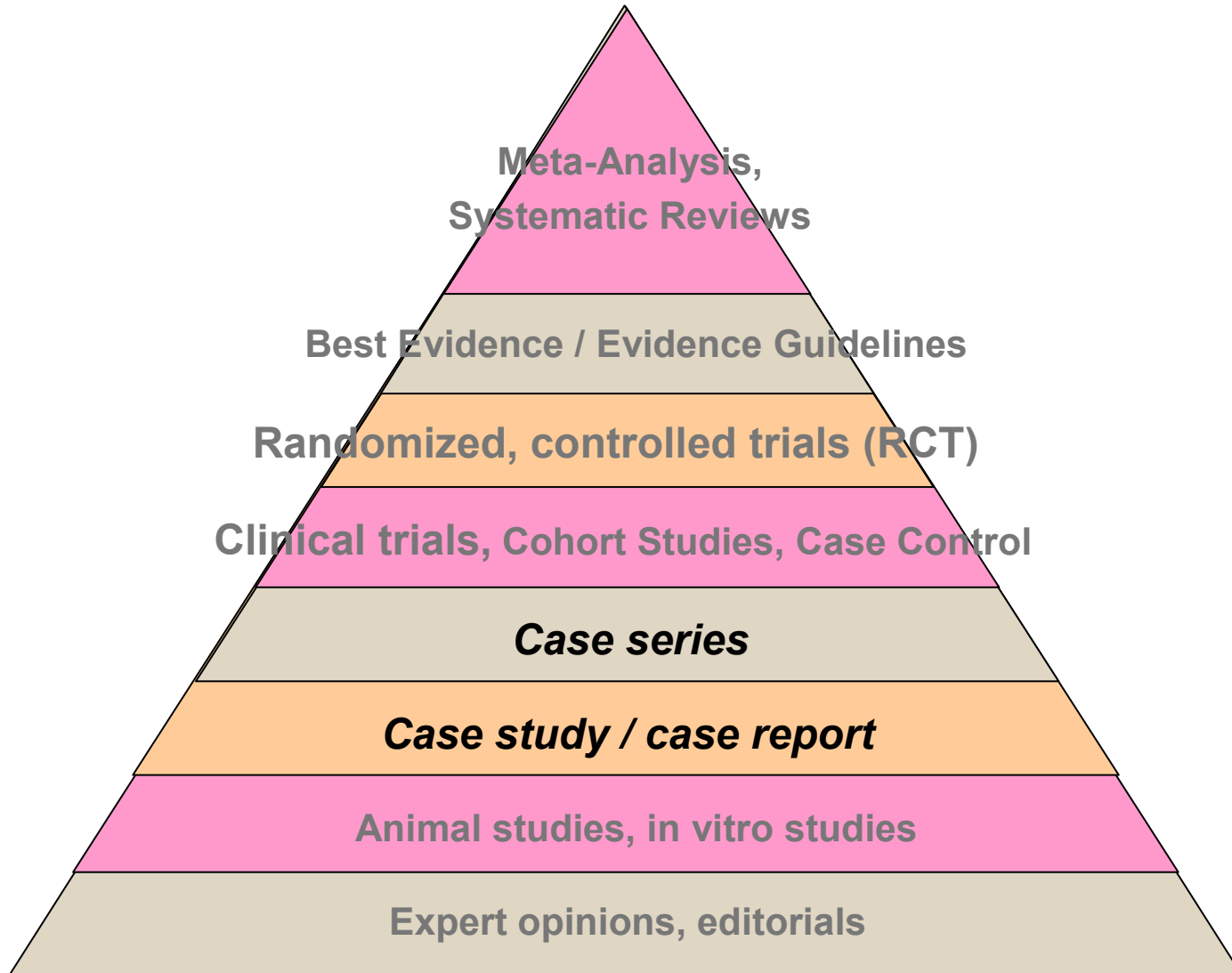


### 3. *Case study*

- ✦ A case study (case report) is a method of descriptive research that documents a practitioner's experiences, thoughts, or observations related to the care of a single client.
- ✦ A case series combines the observations from a group of similar clients



# *Hierarchy of Evidence: strength of study design*



## *Case studies usually feature:*

- ✦ New disease or condition
- ✦ Rare or sparsely reported condition
- ✦ Unusual presentation of a common disease
- ✦ Impact of one disease process on another
- ✦ Unexpected event in the course of observing or treating a patient
- ✦ Impact of a treatment regime of one condition on another condition
- ✦ Unexpected complication of treatment or procedure
- ✦ New and unique treatment





# *Case study example*

✦ Four previously healthy homosexual men contracted pneumocystis carinii pneumonia, extensive mucosal candidiasis, and multiple viral infections. In three of the patients these infections followed prolonged fevers of unknown origin. In all four cytomegalovirus (CMV) was recovered from secretions. Kaposi's sarcoma developed in one patient eight months after he presented with esophageal candidiasis.... The inversion of the T/ helper to suppressor/cytotoxic ratio suggested that CMV infection was an important factor in the pathogenesis of the immunodeficient state. A high level of exposure of male homosexuals to CMV-infected secretions may account for the occurrence of this immune deficiency.



# *Applications of case studies*

- ✦ Convey detailed information that might be lost in a clinical trial
- ✦ Document actual events and interventions in clinical practice
- ✦ Alert the reader to rare or unusual conditions or circumstances
- ✦ Alert readers quickly to potentially dangerous or life-threatening reactions to interventions
- ✦ Are faster and less expensive to complete than clinical trials
- ✦ Provide a rationale for further investigation



# *Vertebral osteomyelitis: a **case report** of a patient presenting with acute low back pain*

✦ Ursprung WM, Kettner NW, Boesch R. J  
Manipulative Physiol Ther. 2005;28(9):713-8.

OBJECTIVE: To report and discuss a case of vertebral osteomyelitis presenting to a chiropractic clinic.

CLINICAL FEATURES: **A 65-year-old man presented to a chiropractic clinic with acute low back**

**pain...** CONCLUSIONS: This case report presents a typical clinical presentation of vertebral osteomyelitis and reviews the diagnostic imaging, pathophysiology of spontaneous vertebral osteomyelitis, and treatment options in the management of this condition.



## *Case series*

- ✦ Cervical radiculopathy treated with chiropractic flexion distraction manipulation: A retrospective study in a private practice setting. *J Manipulative Physiol Ther* 2003;26:e19.
- ✦ Jason Schliesser, DC, MPH; Ralph Kruse, DC; L. Fleming Fallon, MD, DrPH



# *Analytical Research*

1. Observational (non-experimental) research: Researchers collect data without making changes to patient's lives or introducing treatments. Researchers 'observe' only.
2. Experimental research: Researchers actively introduce a risk factor, intervention, or treatment. Offers the greatest control. Researchers 'do experiments' by introducing new variables.

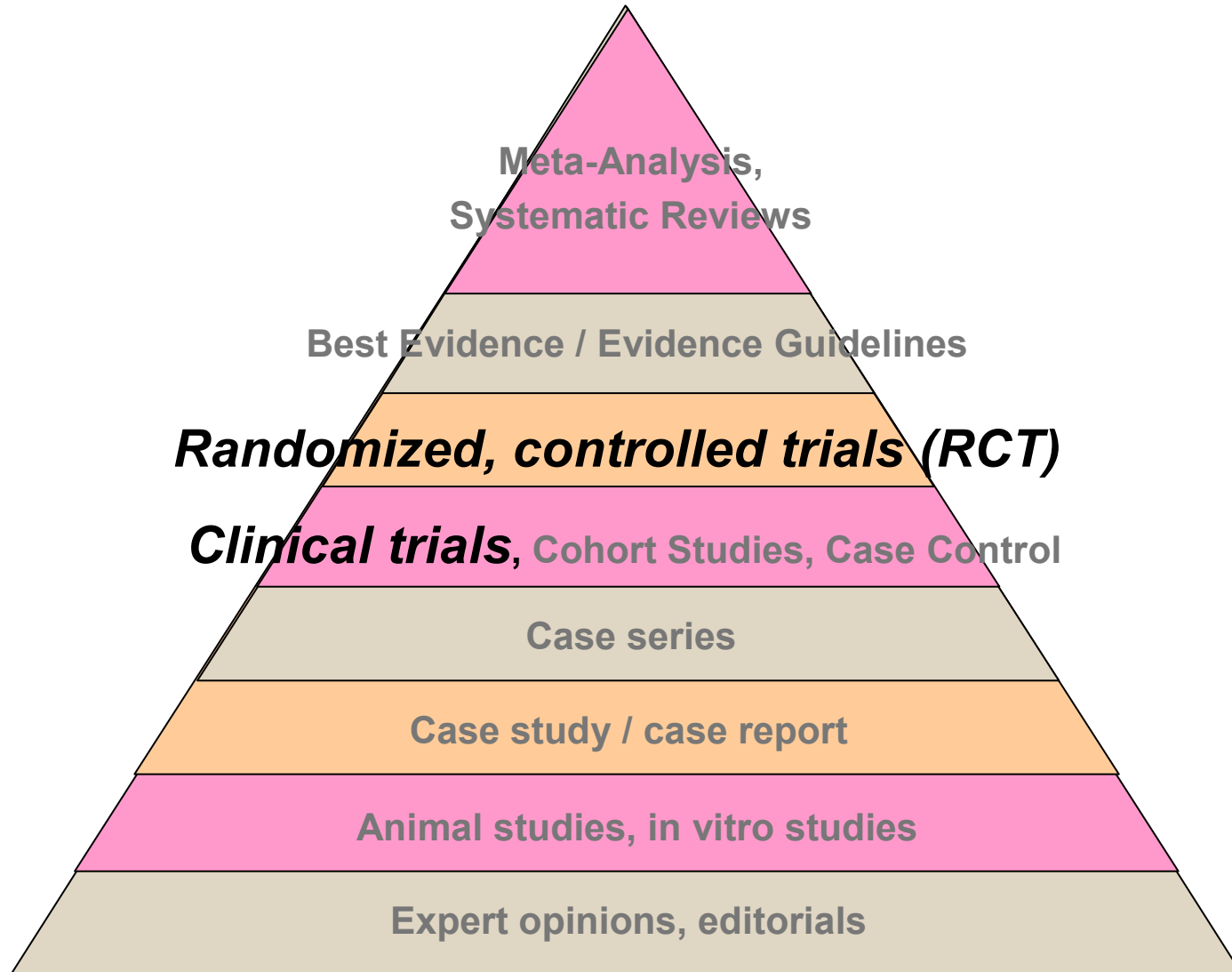


# *Experimental research*

- ✦ Randomized clinical trial
- ✦ Non-randomized clinical trial
- ✦ Community trial



# *Hierarchy of Evidence: strength of study design*



# *What is a trial?*

- ✦ Experimental study where the investigator decides who belongs in which group.
- ✦ Decision as to group allocation can be done by random or non-random methods.
- ✦ Study may or may not have control group.





# *What are the different types of trials?*

- ✦ Randomized controlled clinical trial
- ✦ Randomized clinical trial
- ✦ Controlled clinical trial
- ✦ Clinical trial



# *What does randomization do?*

1. Reduces selection bias by the investigator or the subject.
  2. Evenly allocates subjects on basis of known and unknown characteristics.
- ✦ Baseline characteristics are usually shown in Table 1 of any article so you can assess internal validity.



**Table 1.** *Characteristics of each group at the beginning of the study*

	Control group	Experimental group	<i>P</i>
No. of subjects	37	34	
Sex (male/female)	13/24	13/21	.7
Age (mean $\pm$ SD)	39 $\pm$ 10	35 $\pm$ 10	.2
Length of neck pain	4.5 $\pm$ 4.6	4 $\pm$ 3.4	.6
Neck pain at rest	5.5 $\pm$ 1.5	5.7 $\pm$ 1.5	.4
Cervical flexion	43 $\pm$ 9	45 $\pm$ 7	.2
Cervical extension	55 $\pm$ 7	57 $\pm$ 9	.2
Left lateral flexion	35 $\pm$ 7	37 $\pm$ 6	.2
Right lateral flexion	33 $\pm$ 6	34 $\pm$ 7	.4
Left rotation	56 $\pm$ 7	57 $\pm$ 10	.8
Right rotation	53 $\pm$ 6	55 $\pm$ 9	.3

Scores are expressed as means  $\pm$  SD.

# *Study validity*

- ✦ Internal validity: When the study groups are comparable in terms of demographics and clinical characteristics.
- ✦ External validity (generalizability): When the study groups are comparable to the target population such as the general public.



## *The term 'random'*

- ✦ 'Randomization' deals with group allocation
- ✦ 'Random selection' deals with sampling
- ✦ 'Randomization'  $\neq$  'random selection'
- ✦ Randomized clinical trials are called randomized because of 'randomization' which means the subjects are randomly allocated to groups.



# *RCT ADVANTAGES*

- ✦ Randomization decreases bias
- ✦ Blinding (single or double) decreases bias
- ✦ Very structured therapy or intervention so investigator can accurately describe
- ✦ Strongest study design because so much control over the study



# *RCT DISADVANTAGES*

- ✦ Structure may change the results a clinician would get in private practice
- ✦ No variation from the therapy by the research clinician
- ✦ Takes many research personnel to complete and can be very expensive



# *Let's critically appraise an RCT*

*(using the CAT criteria from last semester)*

- ✦ Martinez-Segura R, Fernandez-de-las-Penas C, Ruiz-Saez M, Lopez-Jimenez C, Rodriguez-Blanco C. Immediate effects on neck pain and active range of motion after a single cervical high-velocity low-amplitude manipulation in subjects presenting with mechanical neck pain: A randomized controlled trial. *J Manipulative Physiol Ther* 2006;29:511-517.





# *Study objectives*

## ✦ Purpose, objectives, and hypothesis

- Were the objectives of the study clearly stated?
- Was there a study hypothesis?
- Was there a significant need for this study?  
Was the study justified?



# *Study design*

- ✦ Was the study design stated and adequately described?
- ✦ If appropriate, was ethical approval of the participants and institutional review board obtained?



# *Subjects*

- ✦ Who was included in the study? Who was excluded from the study?
- ✦ How were the subjects recruited?
- ✦ Was there any selection bias?
- ✦ Was the sample size adequate to support the measurement of outcomes and to analyze statistically?



# *Baseline differences*

- ✦ Were there any differences noted between groups at the beginning of the trial?
- ✦ Should any differences be considered as possible confounders?
- ✦ If differences are present, are they acknowledged and addressed?
- ✦ Are any differences discussed as limitations?



## *Control, Comparison, Randomization*

- ✦ Was there a control population or comparison group?
- ✦ Was there randomization?



# *Description of Intervention*

- ✦ What specific intervention or other maneuver was given?
- ✦ Is the intervention sufficiently described so that the reader (practitioner) could adequately deliver the same intervention?
- ✦ Were an adequate number of visits provided at appropriate intervals and frequency?
- ✦ Was the intervention similar to “real life” treatments?
- ✦ If a placebo or “sham” was utilized, was it realistic?



# *Blinding*

- ✦ Was the study population blind to the type of intervention (experimental, sham or placebo)?
- ✦ Were experimental and control groups treated equally?
- ✦ Were the clinicians and statisticians “blind” to what the patients were being given?



# *Follow-up / Accountability*

- ✦ Were all study participants or subjects accounted for at the end of the study?
- ✦ Are the reasons why patients withdraw from the clinical trial included in the follow-up information?





# *Outcomes, measurement, observation*

- ✦ What outcome was measured, and how?
- ✦ Are outcomes clear and logical?
- ✦ Are outcomes valid? Standard? Objective?
- ✦ Are there alternative measurements which are considered “gold standards” ?
- ✦ Is the endpoint measurement clinically relevant?
- ✦ Was the study of adequate length in terms of outcomes assessment (ex: follow-up)?



# *Key results*

- ✦ Are the basic data adequately described?
- ✦ Are results presented clearly, objectively, and in sufficient detail to enable the reader to draw their own conclusions?
- ✦ Are adverse effects adequately described and explained?



# *Analysis and Validity*



Is the analysis valid and sufficient?

- Are the methods used to analyze the outcome(s) appropriate, recognized or well-known, sufficiently described and sufficiently explained?
- Are any statistical methods or tools referenced and validated?
- Is this trial or experiment also being used to test new methods of measurement and analysis?



# *Statistical significance*

- ✦ Have "P values" been calculated and interpreted appropriately?
  - What level of difference between the groups, outcomes, or interventions constitutes a statistically significant effect?
  - Does the statistical significance match clinical significance?
- ✦ Have confidence intervals been calculated, and do the authors' conclusions reflect them?



# *Author's conclusions*

- ✦ Have the authors expressed the effects of an intervention in terms of the likely benefit or harm which an individual patient can expect?
- ✦ Do the authors overstate any of their conclusions?
- ✦ Do the authors discuss limitations of the study?



## *Statements of support/influence; Disclaimers*

- ✦ Did any of the authors have affiliations with companies or organizations that may have affected their ability to be objective?
- ✦ Did any financial support potentially lead the investigators to be biased?



# *Clinical impact statement*

- ✦ Does this new research add to the literature in any way?
- ✦ Does this research impact your clinical decision-making within your practice?



*Next week...*

