

Research Methodology in Dentistry

Prashanth Kumar Katta

Abstract

Research in any field is very important so that we can deliver the latest information. In the dental specialty research helps in shedding more light on more modern, conservative and treatment that is more acceptable. But research is only a first step in this direction. With so much of research going across the globe, the validity of research is a question, with regard to so many factors, that include whether the research personnel have stuck to the protocol while doing the research, the sample size, etc. hence systematic review of various articles helps un in understanding research of one particular topic in a more detailed way with short time. Meta analysis of systematic review gives it a statistical benefit and evidence based practice delivers what the patient expects from the doctor and the treatment is based on doctor's experience also.

Keywords: Research Methodology; Meta Analysis; Systematic Review; and Evidence Based Dentistry.

Introduction

Dental specialty is rapidly transforming and new materials, treatment techniques and concepts are emerging but before we adopt any new technique or treatment modality we have to know to what extent the new approach is valid and whether there is any scientific basis for it. It is imperative to know since how long the product is available and how much of research has been done pertaining to its validity. The research done should be in line with the strict protocol and in a systematic way. The research which has been done all together is tested for the significance of the technique. This approach is called systematic review. The systematic review is then subjected to statistical tests. This is called meta-analysis. In this review article we will know from research methodology to systematic review in a step by step manner and chronologically [1,2].

Different types of Research [3]

Exploratory	Descriptive	Analytical	Predictive
Exploratory research is done when few or no relevant Studies were done in the past. The goal is to search for patterns, hypotheses or ideas which can be tested and will form the basis for research in future. Typical research techniques might include case studies, observation and reviews of past related studies and data.	Descriptive research can be conducted to recognize and classify the elements or characteristics of the subject, e.g. pass percentage of students after change in the teacher. Quantitative techniques are commonly done to collect, analyze and summarize data.	Analytical research usually is continuation of the descriptive approach to suggest or determine why or how something is occurring, e.g. underlying causes of change in teacher. An important feature of this type of research is in locating and identifying the various factors (or variables) involved.	The goal of Predictive research is to predict intelligently on future possibilities, based on in depth analysis of current evidence of cause and effect, e.g. predicting when and where future changes in teachers might take place

Author's Affiliation: *Assistant Professor, Department of Restorative Dentistry Sciences, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia.

Reprints Requests: Prashanth Kumar Katta, Assistant Professor, Department of Restorative Dentistry Sciences College of dentistry King Khalid University Abha, Kingdom of Saudi Arabia.
E-mail: drprashanthkumar@yahoo.com

Research Methodology

What is Research?

The Purpose Of Research Is To...

- Review or synthesize existing knowledge
- Investigate existing situations or problems
- Provide solutions to problems
- Explore and analyse more general issues
- Construct or create new procedures or systems
- Explain new phenomenon
- Generate new knowledge
- & or a combination of any of the above!

(Collis & Hussey, 2003)

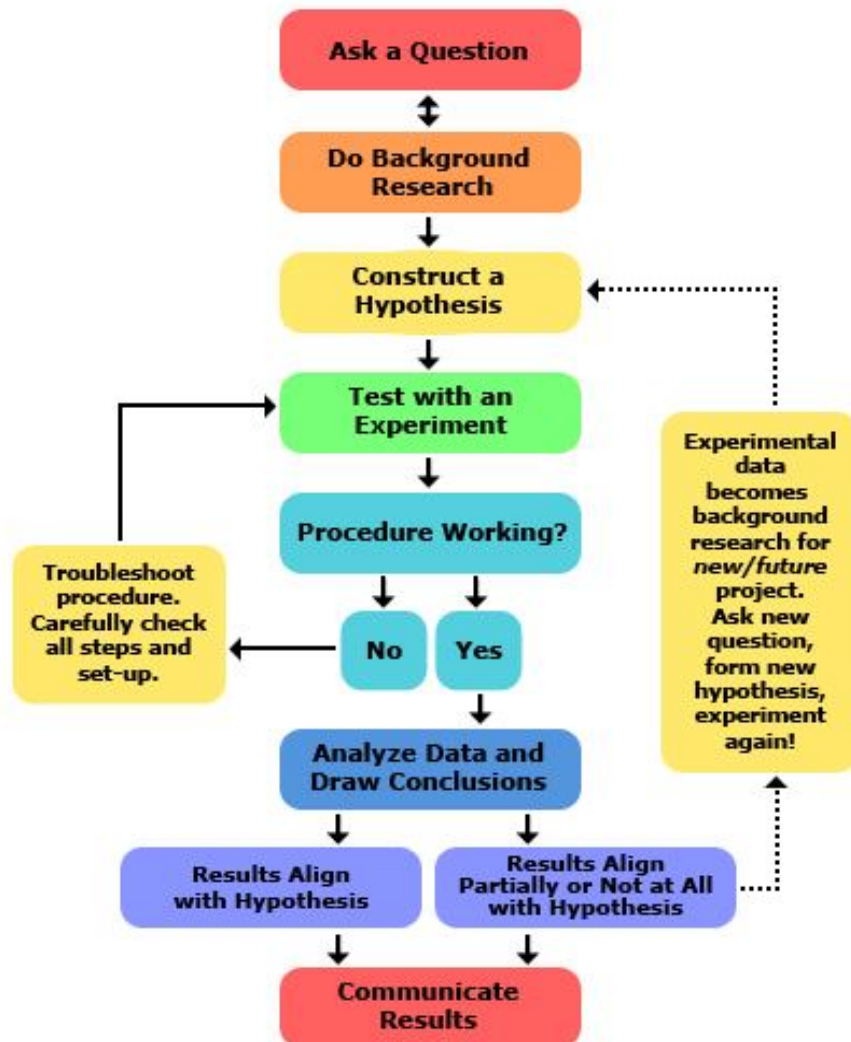
Design of Analytic Study [4]

Quantitative/Qualitative Research [5]

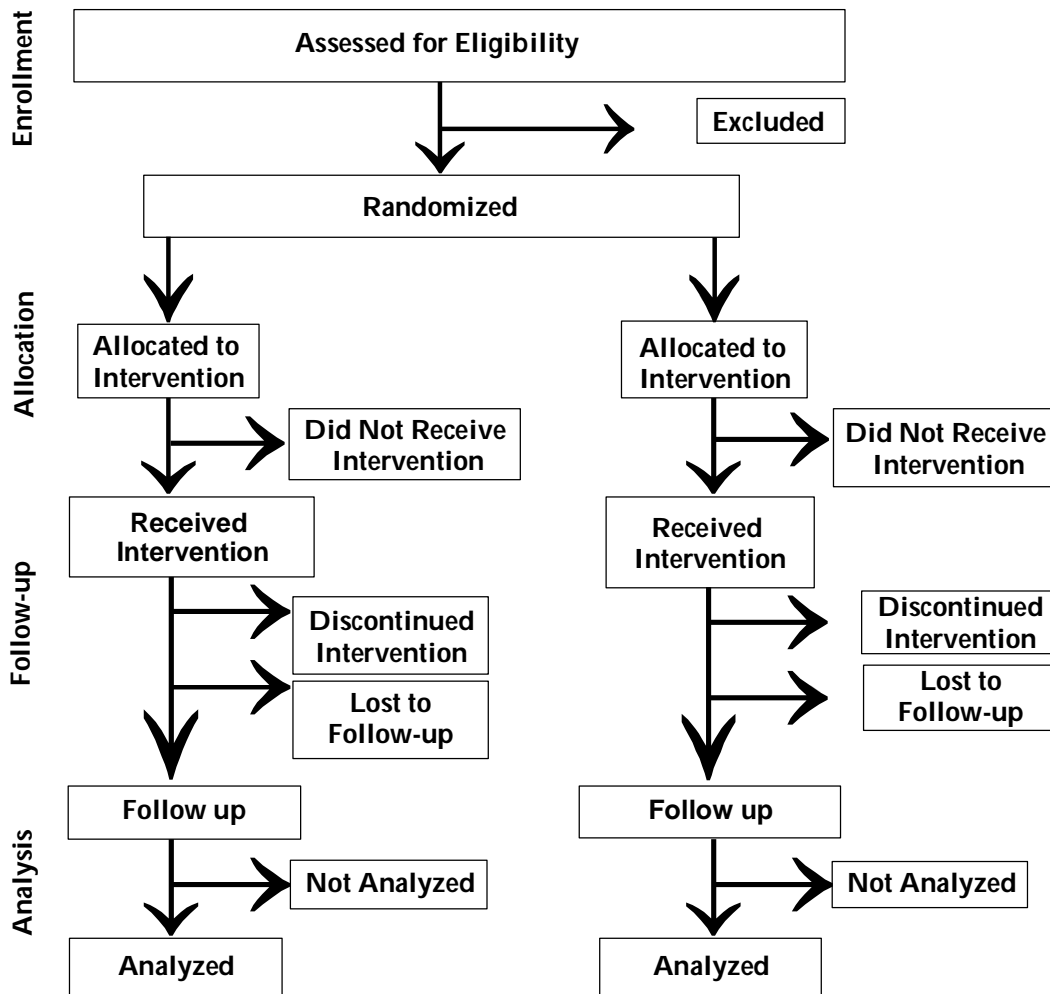
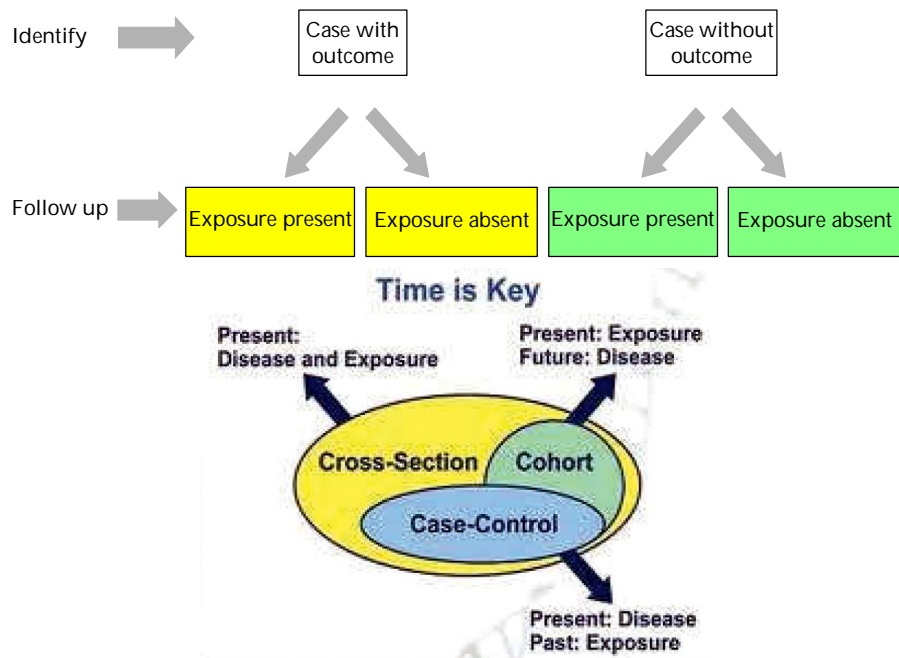
Quantitative	Qualitative
The aim of Quantitative research is on collecting and analyzing numerical data; it concentrates on measuring the scale, range, frequency etc. of phenomena.	Qualitative research is more subjective in nature than Quantitative research and includes examining and reflecting on the less tangible aspects of a research subject, e.g. values, attitudes, perceptions.
This kind of research, even though difficult to design initially, is usually very detailed and structured and results can be easily collated and presented statistically.	Although this type of research can be easier to start, it can be usually difficult to interpret and present the findings; the findings can also be questioned more easily.

Differences between Experimental and Descriptive Study [6]

Experimental study	Descriptive study
Measurements are taken before and after intervention Establishes causality	Measurements recorded only once Establishes only correlations between variables
May need only tens of subjects especially when a crossover design is adopted. The estimate of the relationship is less likely to be biased with a high participation rate in a sample selected randomly from a population when subjects are randomly designated to particular treatments there is less chance for bias, moreover when both subjects and researchers are blind to (unaware of) the identity of the treatments(double blinded)	needs comparatively larger sample size to establish a precise estimate of the relationship among the variables No effort is made to change behaviour or conditions. Measurements are recorded to describe the prevailing situation



Design of a Case Control Study [7]



Systematic Review [8]

What is a Systematic Review?

A systematic review is a rigorous way of summarizing the available scientific evidence that is derived from several individual clinical/non clinical studies on a specific treatment or method. It makes use of a set of well defined questions and methods to recognize and critically evaluate relevant research, followed by the procuring and analyzing the data from the studies that have been included in the review.

As the results of a one study is applicable only to a given type of patient or a particular clinical setting, a systematic review which is a conglomerate of several studies on the same topic, it can provide information that is more relevant to a wide range of patients under different clinical settings. Moreover, individual studies vary in sample sizes, thus opinion is inevitably subjected to bias in those studies. A systematic review minimizes bias while the reliability and accuracy of recommendations is increased because it clubs information obtained from individual studies and has an overall sample size that is significantly greater than that of any one study.

This results in increase in the quality of the review. In brief, a systematic review is presently believed to be the best, least biased and most rational way to

organize, gather, evaluate and integrate scientific evidence from the fast paced changes medical and healthcare literature.

Uses of Systematic Review

1. The vast amount of information available is condensed into one single part in a comprehensive way which can be easily understood and get a broader perspective of that particular topic.
2. This helps us in knowing the extent of consistency of results between various studies.
3. Its economical to do a systematic review than conduct a new study.
4. The time needed between results and implementation is reduced whne compare to validating the results of a new study.
5. This technique combines all the invidual studies done into one, as a result the results of systematic reviews are more significant than that of one sing study as the sample ize is more in systematic reviews than a single study.
6. As the sample size is larger, the precision o f the results is also more.
7. The bias is reduced in case of systematic reviews and the results are more reliable.

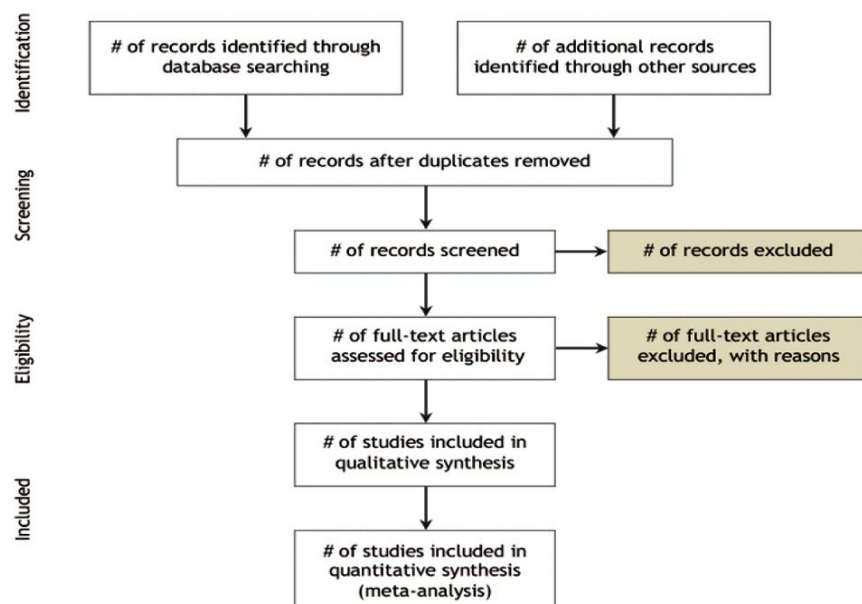


Fig. 1: Flow of information through the different phase of a systematic review

Systematic Review Steps [9]

Research Question
Research Protocol

Literature Search
Data Extraction
Quality Assessment
Data Analysis and Results

Interpret Results

Problems with Systematic Reviews:

- Important research studies are missing because of inadequate literature search.
- Too many biases creep in.
- The hypothesis or research questions are not clear.
- Review methodology is not clearly defined.
- The conclusion or statement to summarize the findings of the review are not clear

Meta Analysis

Definition

Meta-analysis is a statistical technique for merging the results of independent studies. The validity of the meta-analysis relies on the quality of the systematic review on which it is based[10].

Meta analysis is sometimes called overview. In this method the results of individual studies of similar aim are combined and statistically tested to get a quantitative result of the effect of interest. Hence, a meta-analysis is thus a statistical analysis of a collection of statistical analyses from individual studies. As a result, the outcome of Meta analysis is of greater precision and power.

A meta-analysis combines the quantitative findings obtained from individual studies which are similar and gives a numerical estimate of the overall effect of interest.

The Results of Meta Analysis Can Have Bias in the Following Way:

1. A study in which the results are significant are called positive and negative if the results are not significant. While doing Meta analysis, the researcher must consider this so that the results of Meta analysis are not biased as studies with significant results are only published. The researcher must collect information from journals, texts, dissertations' to avoid bias.
2. Even though individual studies of similar type are taken they may vary regarding the inclusion and exclusion criteria, the variables, subjects, etc. while doing Meta analysis these factors should be considered.
3. Individual studies can be of either high or low quality and while a Meta analysis is being done it is necessary to include both high and low quality studies to avoid bias.
4. Sometimes same study might be published more

than once. Also, studies might be done under similar condition by different research person or different studies by same research person. All this factors must be considered while considering the results of such studies in Meta analysis.

Evidence Based Dentistry (EBD)[11]

It is a set of principles and methods intended to insure to the greatest extent possible, clinical decisions, guidelines and other types of policies are based on and consistent with good evidence of effectiveness and benefit. (Adapted from David M Eddy Health Affairs 2005)

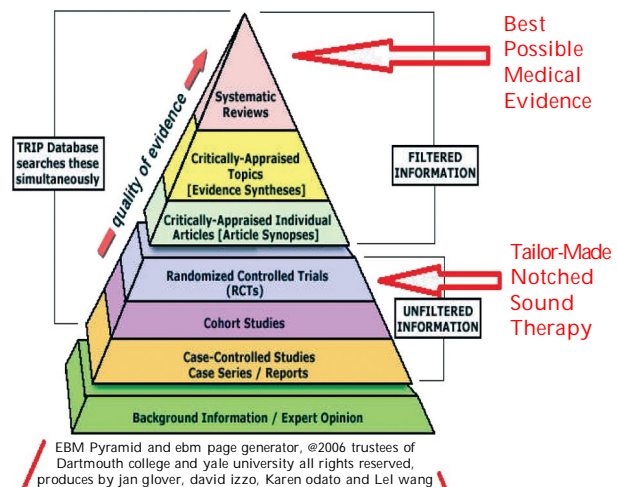
Practicing evidence based dentistry began in the early 90's.

The systematic reviews and Meta analysis are good research data for evidence based dental practice.

What is the need for EBD?

There are Numerous Reasons for Practicing EBD. These Include

1. The treating dentist must have relevant information regarding diagnosis, treatment and prognosis updated on daily basis
2. With EBD using systematic reviews and Meta analysis we can get a large amount of information with sound scientific basis.
3. With large number of new drugs, restorative materials, treatment techniques being introduced, it is imperative to have good research done before it is used in routine practice which comply with patients needs and clinical experience.



PICO Format[12,1]

P = Patient Problem or Population

The first part of the PICO question begins with the

following phrase: For a patient with... Inserting the patient's chief complaint or condition completes this phrase. For Mr. Brown, this phrase can be completed as follows:

"For a patient having tooth discoloration due to coffee and beetle nut chewing".

I = Intervention

The main intervention that is considered is Crest Whitestrips™, so the question now reads:

"For a patient with tooth discoloration due to coffee and beetle nut chewing, will Crest Whitestrips" is effective?

C = Comparison

The comparison phrase is stated "as compared to" the chief alternative, which in this case is custom trays for use with an at-home whitening/bleaching system. The question now reads:

"For a patient with tooth discoloration due to coffee and beetle nut chewing, will Crest Whitestrips, as compared to custom trays for use with an at-home whitening bleaching system".

O = Outcome(s)

Mr. Brown's prime concern is the discoloration of his teeth and having his teeth as white as they were when he was 24 years old within seven days. The outcome(s) is then phrased as, be as effective in whitening his teeth within 1 week. Based on these four parts, the complete PICO question can be stated as:

"For a patient with tooth discoloration due to coffee and beetle nut chewing, will Crest Whitestrips, as compared to custom trays for use with an at-home whitening bleaching system, be as effective in whitening his teeth within 1 week?"

Significance of Biostatistics in A Study [13,14,5]

A Working Definition of Statistics is

The study of methods to first design an investigation, then to collect, classify and summarize data, and, finally, to analyze and make scientific inferences from such data in the light of the rigor of the laws of probability [14].

Descriptive Statistics

Inferential Statistics

Design

1. Study Type: Observational or Experimental

2. Population of Experimental Units → 3. Sampling → 4. Sample of Experimental Units

Accrual
10. Subject Matter Interference (Interpretation)

8. Laws of Probability

5. Data Collection Type of Variable

Analysis
9. Population of Observations (Parameters)

7. Statistical Inference

6. Sample of Observations (Statistics)

Fig. 1: overview of statistics in scientific studies

Conclusion

Research in the field of dental medicine is very essential to improve the health care to the patients. It should be done with at most precision whether it is clinical or non clinical trials. But due to various

constraints' like financial support, a competent guide or infrastructure flaws creep in individual studies and bias is unavoidable. To improve the results systematic reviews are need, but the systematic review does not follow strict statistical procedures. A meta analysis addresses this issue of statistical techniques and gives a reliable result. Evidence based dentistry

apart from considering the results of various studies, patients concerns and the practitioner's experience are included in giving the patient the best scientifically based treatment.

Conflict of Interest

Nil

References

1. Further statistics in dentistry part 1: research designs 1 a. Petrie¹ j. S. Bulman, and j. F. Osborn, British dental journal. October 12, 2002; 193(7): 377.
2. Further statistics in dentistry part 2: research designs 2, a. Petrie¹ j. S. Bulman, and j. F. Osborn, British dental journal. October 26, 2002; 193(8).
3. Overview, strengths, and limitations of systematic reviews and meta-analyses, Alfred a. Bartolucci and william b. Hillegass, f. Chiappelli et al. (eds.), evidence-based practice: toward optimizing clinical outcomes, 17 DOI: 10.1007/978-3-642-05025-1_2, © springer-verlag berlin heidelberg 2010.
4. Qualitative research in dentistry, k. Stewart,¹ p. Gill,² b. Chadwick³ and e. Treasure, British dental journal. Mar 8, 2008; 204(5).
5. Further statistics in dentistry part 9: bayesian statistics, a. Petrie J. S. Bulman, and j. F. Osborn, British dental journal. February 8, 2003; 194(3).
6. An introduction to research for primary dental care clinicians' part 2: stage 4. Planning the study, Andrewtoy, Kenneth a eaton and Ariasantini, primary dental care. 2011; 18(1): 36-40.
7. Further statistics in dentistry part 8: systematic reviews and meta-analyses, a. Petrie¹ j. S. Bulman, and j. F. Osborn, British dental journal. January 25, 2003; 194(2).
8. Evidence-based Dentistry: Part IV-Research Design and Levels of Evidence, Susan E. Sutherland, DDS, J Can Dent Assoc. 2001; 67: 375-8.
9. Using Research for Clinical Decision-Making: Evaluating a Research Report, Ann L. McCann, RDH, PhD; Emet D. Schneiderman, PhD, September 13, 2011.
10. Research methodology in Dentistry: Part I – The essentials and relevance of research, Jogikalmat Krithikadatta, Journal of Conservative Dentistry. Jan-Mar 2012; 15(1).
11. Research methodology in Dentistry: Part II – The essentials and relevance of research, Jogikalmat Krithikadatta, Journal of Conservative Dentistry. Jan-Mar 2012; 15(1).
12. Tools and Methods for Evidence-Based Research in Dental Practice: Preparing the Future, Francesco Chiappelli PhD, Neogita Neagos, MD, J Evid Base Dent Pract. 2004; 4: 16-23.
13. Analyzing and presenting qualitative data, P. Burnard, P. Gill, K. Stewart, British dental journal. April 26, 2008; 204(8).
14. Statistics by Zooth-A primer, M. Anthony schork, PhD., NYSDJ. August/September 2007.