Revised by
Deema . Fatima . Talal . Ahmed . Mohammed
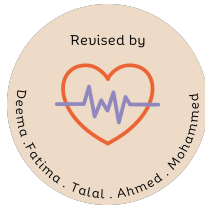
Selecting a research topic, objectives, and hypotheses

Lecture No. 5

Objectives:

1. Formulate research question
2. State and describe research hypotheses
3. Define specific research objectives

~ This lectures was totally made from 438, **Don't forget to study from the slides**
~ This lecture was presented by Dr. **Leena Baghdadi**
~ It is included in the **Midterm Exam**
~ We highly recommended reading the **Ayah** in the first page
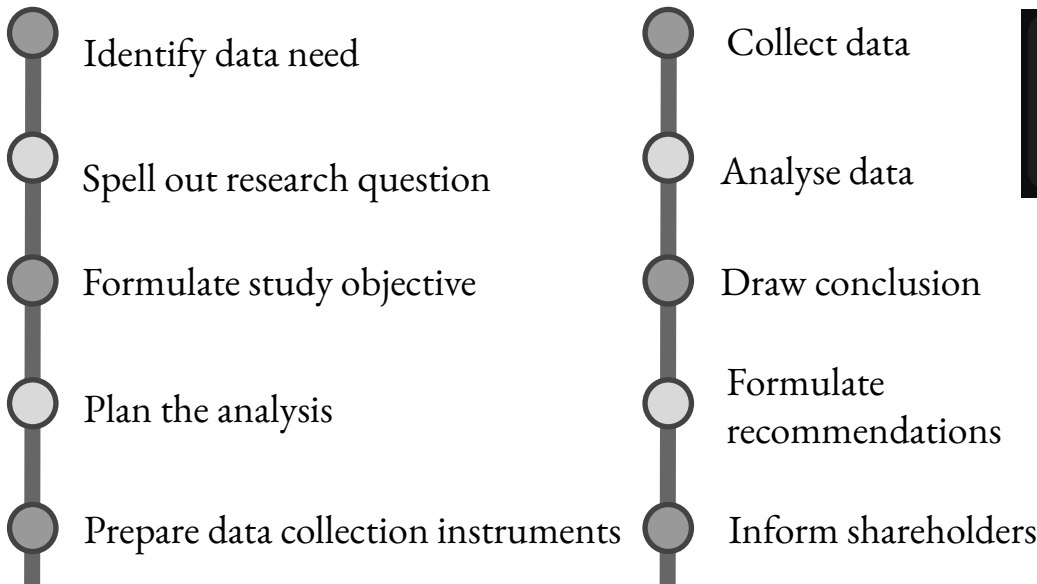
Slides

Color code

Original text
Dr. Notes
Important
Golden note 🎁
Extra

Editing file

- Identify data need
- Spell out research question
- Formulate study objective
- Plan the analysis
- Prepare data collection instruments
- Collect data
- Analyse data
- Draw conclusion
- Formulate recommendations
- Inform shareholders

قال ﷺ: «أقرَبُ ما يَكونُ الرّبُّ مِنَ العَبدِ في جَوفِ اللَّيلِ الآخِرِ؛ فإن اسْتَطَعتَ أن تَكونَ مِمَّن يَذكُرُ اللَّهَ في تِلكَ السّاعَةِ؛ فَكُن»

What Is A Research Question

- **Definition: Uncertainty about something** in the population that the investigator wants to resolve by measurements in the population.
- **Uncertainty = Data needs**
- **Clear research question facilitates:**
  - Choosing the optimal **study design**
  - Identify **who** should be included, **what** outcomes to measure and **when** to measure

It must be:

Direct and focused

How To Translate Uncertainty to Research Questions

- Frames problem in specific terms (clinical, public health, etc)
- Focuses on one issue
- Written in everyday language
- Links to a potential action once the question is answered
- **Is stated as a question**

What are the **sources** of research questions

- New ideas, technologies, and innovation
- Mentors/Guides
- Careful observations
- Literature Review [1]

[1] 438:

Look for gaps in the literature review in your field of interest.
Why do we need literature review?
1- To get up-to-date info.
2- For your hypothesis
3- To get validated tools for data collection eg. questionnaires
4- For frameworks (Tools to communicate your findings with stakeholders)
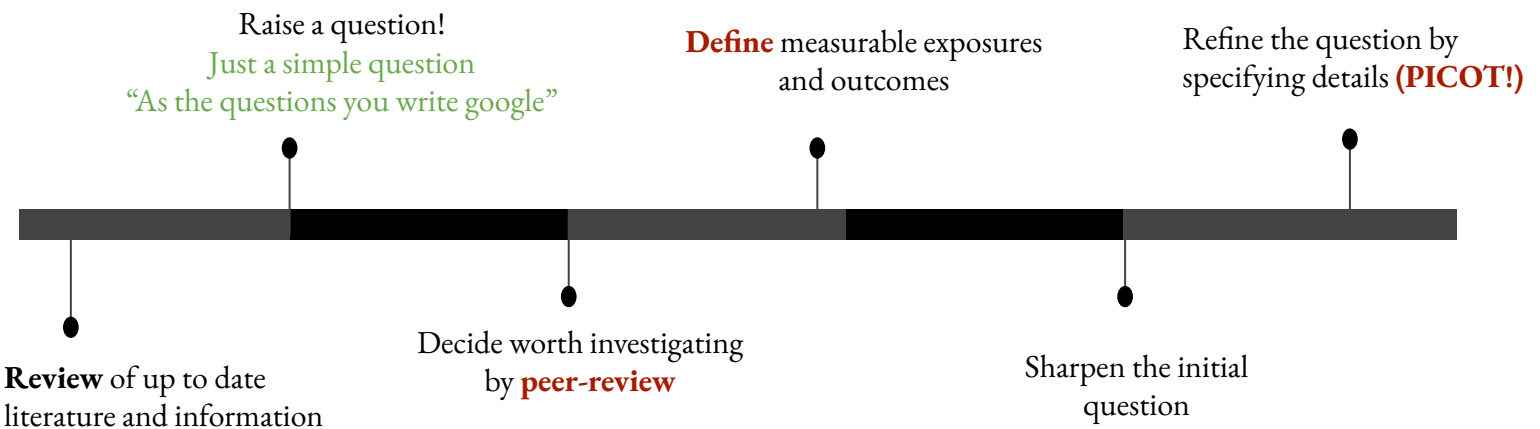
Two Categories of Research Questions:

Descriptive Questions

- Involve **observations to measure quantity**
- No comparison groups / Interventions

Analytical Questions

- Involve comparisons / interventions to **test hypothesis**

Steps in Conceiving (to imagine) a Research Question

Raise a question!
Just a simple question
"As the questions you write google"

Define measurable exposures and outcomes

Refine the question by specifying details **(PICOT!)**

Review of up to date literature and information

Decide worth investigating by **peer-review**

Sharpen the initial question

1. Review of up to date literature and information:

Example: is vaping bad?

- E-cigarettes have the potential to benefit adult smokers who are not pregnant if used as a complete substitute for regular cigarettes and other smoked tobacco products.
- E-cigarettes are not safe for youth, young adults, pregnant women, or adults who do not currently use tobacco products.
- While e-cigarettes have the potential to benefit some people and harm others, scientists still have a lot to learn about whether e-cigarettes are effective for quitting smoking.
- If you've never smoked or used other tobacco products or e-cigarettes, don't start.
- Additional research can help understand long-term health effects.

2. Raise a question

- Can vaping help in quitting smoking?
- Vague question, need to define: "vaping" and "quitting smoking"

3. Decide worth investigating by peer-review

- What is the optimal type of vaping, frequency, and duration?
- What is the rate of quitting smoking? [How many cigarettes smoked? Length of quitting (days, weeks, moths)]
- What are the risks? What are the other benefits?

4. Define measurable exposures and outcomes

Exposure	Vaping

Outcome	Quitting Smoking

- Smoking vapors produced from electronic nicotine delivery systems
- Daily for the past 30 days

- Discontinuing the habit of smoking cigarettes

5. Sharpen the initial question

Initial question	Now
Can vaping help in quitting smoking?	Among cigarette smokers, does vaping daily for at least 30 days increase the chance of smoking abstinence?

6. Refine the question by specifying details (PICOT)

PICOT criteria			
P	**P**opulation / **P**atients	Who are the relevant patients? Think about age, sex, geographic location, or specific characteristics that would be important to your question.	3rd year medical students at KSU who smoke cigarettes in the last 12 months
I	**I**ntervention / **I**ndicator	What is the treatment, diagnostic test, or exposure that you are interested in?	E-cigarettes
C	**C**omparison / **C**ontrol	Is there a control or alternative treatment you would like to compare to the intervention or indicator?	Nicotine gum
O	**O**utcome	What do you intend to accomplish, measure, improve or affect?	Smoking abstinence
T	**T**ime	What is the appropriate follow-up time to assess outcome?	30 days

Population: that will help write a good question and literature review

Comparison/ exposure: not always available

Novel: new idea or using a new method (good justification)

Ethical: avoid vulnerable people like prisoners or HIV patients

Results

- Among 3rd year medical students at KSU who smoke cigarettes in the last 12 months, does vaping daily for 30 days increase the chance of smoking abstinence in comparison to daily nicotine gums?

BUT SO WHAT?!

FINER criteria for a good research question

F	**F**easible	- Adequate number of **subjects** - Adequate technical **expertise** - Affordable in **time and money** **Manageable** in scope
I	**I**nteresting	Getting the answer intrigues investigator, peers and community
N	**N**ovel	**Confirms, refutes or extends** previous findings
E	**E**thical	Amenable to a study that institutional review board will approve
R	**R**elevant	- To scientific knowledge - To clinical and health policy - To future research

Statement of Research Hypothesis

- Definition: a specific and measurable version of the research question.
- Hypothesis is important for two reasons:
  - Summarizes the 3 main elements of the study: sample, exposure and outcome
  - Establishes the basis for the statistical tests of significance.
- Hypotheses are only for Analytical Questions (Comparisons).
- Purely Descriptive Questions: No!

Characteristics of Good Hypothesis

- Simple
  - **One exposure**
  - **One outcome**
- Specific
  - Clear study **participants** and **variables**
- Stated in advance
  - Written at the start of the study
  - Focused on primary objective

Example: Vaping vs Nicotine Gum Hypothesis:

Among 3rd year medical students at KSU who smoke cigarettes in the last 12 months, vaping daily for 30 days increase the chance of smoking abstinence by 80% in comparison to daily nicotine gums.

Research objectives

- **Definition:** an active statement about how the study is going to answer the specific research question.
- **Objectives are important for two reasons:**
  - For the development of the **protocol and design of study**
  - For the **sample size calculations and determining the power of the study.**
- **Contrary to hypotheses, both descriptive and analytical questions require objectives.**
- Framed in scientific / epidemiological terms
- Use no more than one verb for each objective
- State primary and secondary objectives

Objectives for Descriptive vs Analytical Studies

Descriptive Studies

- Estimating a quantity
- **Use the verb "Estimate"**
- Example: To estimate the prevalence of vaping among medical students.

Analytical Studies

- Testing a hypothesis
- Use the verb "Determine"
- Example: To determine whether vaping increases the chance of smoking abstinence.

~You have to write a hypothesis for each objective you have

~Try to have 2-3 objectives

Example: Vaping vs. Nicotine Gum Objectives

- **Primary Objective:**
  - To determine whether vaping increases the chance of smoking abstinence in comparison to nicotine gums at 30 days.
- **Secondary Objectives:**
  - To determine whether vaping increases the chance of smoking abstinence in comparison to nicotine gums at 30 days in males and females subsets.
  - To evaluate withdrawal symptoms of vaping, relative to nicotine gums.

Tips

- Perform a literature review to increase knowledge and familiarity with the topic and to assist with research development.
- Learn about current trends and technological advances on the topic.
- Seek careful input from experts, mentors, colleagues and collaborators to refine your research question as this will aid in developing the research question and guide the research study.
- Use the FINER criteria in the development of the research question.
- Ensure that the research question follows PICOT format.
- Develop a research hypothesis from the research question.
- Develop clear and well-defined primary and secondary (if needed) objectives.
- Ensure that the research question and objectives are answerable, feasible and relevant.

الأعضاء :

عبدالله التَركِي   عبدالله المياح   رغد النظيف

محمد الزير   عبدالله النجرس   ريما الجربية

عثمان الدريهم   تركي العتيبي   شهد البخاري

عبدالعزيز القحطاني   عبدالله القرني   نوف الضلعان

ناصر الغيث   عامر الغامدي   أثير الاحمري

سعد السهلي   سعد الاحمري   وعد ابونخاع

رائد الماضي   معاذ آل صلام   ثراء الهويش

                      في الدوسري

سعود الشعلان   محمد الحصيني   منار الزهراني

MCQ:

Q1: What does **PICOT** stands for?
  A.   Publication, intervention, comparison, outcome, timeline
  B.   Population, exposure, communication, outcome, timeline
  C.   Population, exposure, comparison, outcome, timeline
  D.   Publication, information, comparison, outcome, timeline

Q2: Can a structured intensive diabetes education program help adult patients with Type 2 diabetes control their blood glucose levels, compared to patients receiving standard instructions. This is a?
  A.   Research objective
  B.   Research hypothesis
  C.   Literature review
  D.   Research question

Q3: Define **FINER**.
  A.   F: feasible, I: interesting, N: novel, E: ethical, R: relevant
  B.   F: fabulous, I: internal, N: novel, E: ethnic, R: reliable
  C.   F: finding, I: internal, N: novice, E: ethical, R: recognizable
  D.   F: functional, I: interesting, N: new, E: easy, R: realistic