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King Saud University
كلية الطب
مركز البحوث - وحدة دعم أبحاث الطلاب والأطباء تحت التدريب

المجلس الطلابي

RESEARCH SUMMER SCHOOL

Bases of Research

RSS 2024 Booklet

Credits

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Overview of the Research Process

What is research?

Research is often viewed as the corner stone of scientific progress. It is a systematic process based on scientific method that consists of testing hypotheses, careful observation and measurement, systematic evaluation of data, and drawing valid conclusions.

There are different research methods which are used in research, all with specific advantages and disadvantages. The main two types of research designs used in medicine are:

- **Quantitative research design**, which generates numerical data or information that can be converted into numbers.
- **Qualitative research design** generates non-numerical data that provides a complete description of the research topic.

Qualitative research	Quantitative research
◯ Inductive reasoning- formulate an idea/ theory	◯ Deductive reasoning- draw on or test a known theory
◯ Interpretivist paradigm- subjectivity	◯ Positivist paradigm- objectivity
◯ Textual data- language	◯ Numerical data, quantifiable variables

How to Read a Research

Efficient Reading Strategies:

- **Skimming:** Reading for the gist.
- **Scanning:** Looking for specific information.

For quick evaluation of large volumes of literature and identifying key papers and sources, there are AI tools to facilitate the process, find them at "Artificial Intelligence" chapter .

Steps in conducting research

1- Identification of research problem:

It is the first statement made in any research. An example of a research problem, which may be of a local concern for the community is, violence among children. This is the problem to be investigated. At this stage, the identified problem is still too broad in scope. Therefore, the scope of the study needs to be narrowed down, which can only be done after a thorough literature review.

2- Carrying out a literature review:

Literature review is the process of searching for information related to the research topic, across multiple databases and information resources; reading, evaluating and analyzing them to help you understand a research topic, to establish the importance of a topic, and to help develop your own ideas. A good literature review will help in finding gap(s), asking a good question, and accurately defining a problem, evaluating feasibility and relevance, as well as identifying a proper methodology. After doing a thorough literature review, the focus can be narrowed down into violence among children who watch TV Programs which needs parental guidance.

3- Formulating the research question / research objective:

The next step in the research process after refining the objective through a literature review involves translating that research idea into an answerable question. The most important part of the question is to be researchable and answerable using established scientific methods and procedures.

4- Proposal writing:

The main purpose of writing a research proposal is to obtain ethical approval, as well as funding. It is a summary of the suggested process to be used to answer the research question. It is done through gathering information, reading, integrating, organizing ideas, and planning. There is no common or specific format of the proposal. Each research center has their specific format.

5- Institutional Review Board (IRB) approval and ethical consideration:

IRB is specific human-subjects committees that review and determine the ethicality of research. The main purpose of the IRB is to assure that appropriate steps are taken to protect the rights and welfare of participating as subjects in a research study. Finally, once the IRB approved, you can start conducting the research.

6- Data collection:

Data collection is the process of collecting the information that will be used to answer the research question. The development of the data collection form is a time consuming process, and it should be given enough attention to ensure it is clear, valid and reliable. It has to be piloted on a small sample of subjects to guarantee applicability, as well as identify any potential problems in the tool. Finally, once the necessary fine-tuning has been carried-out, data collection can be done through surveys, questionnaires, interviews, observations, data abstraction, etc.

7- Data entry, cleaning, and management:

It is the process of entering the information (data) into the computer. There are many computer programs used for this purpose. The most widely used is the Statistical Package for Social Sciences (SPSS). Most of the time **data entry** is done manually. After finalizing data entry, a **data cleaning** process is carried out to check for any data errors or outliers. Once data is clean, **data management** starts which includes creating new variables from the existing ones based on pre-defined criteria.

8- Data analyses:

Data analysis is the process of analyzing data using statistical techniques in order to draw conclusions that support or reject the hypothesis, or answer the research question.

9- Research dissemination:

Data analyses results should be organized into tables and figures which serves multiple purposes such as: understanding the results, identifying missing analyses, comparing easily with other published articles, and preparing results for presentation. Publishing the research project is the final step of the research process, which entails summarizing the whole research findings in different forms, such as an abstract, presentation, report, or a manuscript published in a journal.

"Research is to see what everybody else has seen and to think what nobody else has thought"
- Albert Szent-Gyorgi

Research Question, hypothesis & objectives

What is a research question?

A research question is the fundamental core of research project. Usually starts as a general question and develops into a specific, researchable one. Well-defined and specific research question is the key for making decisions about study design and population and subsequently what type of data will be collected and analyzed.

Criteria of a good research question

There are different criteria that define a good research question. A good research question should be:

- **F**easible (can be done)
- **I**nteresting (to the investigator)
- **N**ovel (Confirms, refutes or extends previous findings)
- **E**thical
- **R**elevant (has and implication).

These criteria have been collectively called **F.I.N.E.R**

Sources of research questions

The researcher formulates a research question through different means. Personal interest /experience, research literature identifies the areas that need further study. Also clinical observation and experts insights. Other methods include previous research, journal clubs, social issues and conferences.

Elements of a research question

Research question should include four elements; referred to as PICOTS that identifies the key elements of a research question that need to be addressed. The PICOTS concept is providing search terms, and saving time in literature search.

PICOTS stands for:

Patient or **p**opulation: It describes patients" characteristics, such as age, gender, disease status, or any other patient-related characteristic.

Intervention to be tested: It is important to identify the exposure intended to be studied in the research project. This may include the use of a specific diagnostic test, treatment, adjunctive therapy, medication, etc. (what you plan to do for you patients?)

Comparison: The comparison component is the only optional one in the PICO question, since the researcher might study the intervention alone because either due to no interest in comparison or the lack of a comparable group. (What is the main alternative to compare with intervention like stander care or placebo?)

Outcome: is considered as result of intervention. This may include cure or level of control of a disease, efficacy of a medication or a diagnostic test, etc. (what you hope to accomplish , measure ,and improve effects)
T: time frame
S; setting

The categories of Research Question

Clinical questions can be divided into two categories:
foreground questions: these arw anout decesions that need to be made regarding a patients management
background questions: these look for general knowledge on a condition or an aspect of health status

Criteria for a bad research question

There are different criteria that define a bad research question summarized below. Too vague or ambiguous of the research question, too broad to reach conclusive results, and other criteria such as the time needed to carry out the study, high cost with limited funding, limited resources such as availability of expertise. Research question might be limited by ethical considerations or requirement of authorities' approval.

Example of a research question

Topic of interest: Men health

Narrowed topic: Men and cancer

Focused topic: Men smokers and colorectal cancer

PICO: **P** = Men (age more than 35) ,**I** = Cigarette smoking, **C** = No smoking, **O** = Colorectal cancer
Research question: Does smoking among men older than 35 years affect colorectal cancer risk compared to non-smokers?

Research Question, hypothesis & objectives

Hypothesis

Definition: a hypothesis is a statement that introduces a research question and propose expected result

general considerations:

-make sure the hypothesis clearly defines the topic and the focus of the experiment
-should be testable
-try to write the hypothesis as correlation-effect statement. as a statement of relationship between variables
-write the null hypothesis
-factually or theoretically based

example of a Hypothesis

is consuming an apple a day, will decrease the number of doctor visits?

is it clearly/ focused to the research ? No, it should be focused for age or group e.g. adults
is it testable? yes
can it be written as correlation-effect statement? Yes, daily apple consumption for adult population will decrease doctor visits
can it be written as a null hypothesis? Yes, the daily consumption of apple has no effect of decreasing doctor visits
was it based on fact or theory? Yes

Formulating Objectives

Objectives are the goals a researcher set out to attain in his / her study.

The main difference between the research question and objectives is the way of writing them. Objectives transform the research questions into behavioral aims by using action – oriented words as “to find out”.

The objectives may also be written as;

◯ Main Objectives(primary) ◯ Sub – objectives(secondary)

SMART objectives stands for: Specific, Measurable, Achievable. Relevant, Time related

Conducting an Effective Literature Review

Definition of a literature review

A literature review is a descriptive, analytic summary of the existing material relating to a particular topic or area of study. The literature review process involves a systematic examination of prior scholarly works to understand the current status, find out any reached gridlock, impasse, or controversy.

The aim of a literature review

Literature review is a very important step in planning a research project. The reasons for doing a literature review are listed and summarized below:

- Provide a context for the research and justify the research
- Show where the research fits into the existing body of knowledge
- Ensure the research has been done before
- Outline gaps in previous research
- Illustrate how the subject has been studied previously

Characteristics of a good literature review

A good literature review is characterized by the author's efforts to search, evaluate, and critically analyze the relevant work in the field. A good researcher has to develop good searching expertise, which will allow him/her to efficiently search available resources through the different electronic engines. Once the relevant articles are identified, the researcher has to have enough expertise to assess the content of the article, in terms of relevance, validity, etc. Finally, the researcher has to be able to integrate the important and relevant work into his/her own research project, specifically from the methodology and results point of view.

A good review should have the following characteristics which make it of value:

- **Comprehensive:** Evidence should be gathered from all relevant sources
- **Referenced:** Providing full references for reviewed papers.
- **Selective:** Using appropriate search strategies to find the most important evidence.
- **Relevant:** Focusing on related studies.
- **Balanced:** Providing objective evidence from papers with different findings.
- **Critical:** Following valid scientific critical appraisal of the literature.
- **Analytical:** Developing new ideas and understandings from the evidence.

Steps of a literature review

The following steps provide a sense of how researchers should proceed in searching and reviewing the literature:

1- Develop a research question

The first step is to define a specific research question, which identifies the research or clinical problem the research is aiming to solve. Evidence based practice proponents advice using four elements in building the research question, specifically, the PICO (Patient, Intervention, Comparison, and Outcome).

2- Types of the sources used in a literature review

The term sources refers to material needed to conduct the literature review, which could be summarized in three types:

- **Primary source:** Is a direct description of a research study written by a researcher who conducted the study.
- **Secondary source:** Is a review of studies summarizing and providing new interpretations built from and often extending beyond the original study.
- **Tertiary source:** Include perceptions, conclusions, opinions, and interpretations that are informally shared.

3- Search engines used in a literature review

There are different search engines that might be used to locate relevant material to be used in the literature review, which are summarized in the table below:

Database	URL	Charcteristics
PubMed	www.pubmedcentral.nih.gov	▪ The National Library of Medicine's free search service. ▪ Available through the World Wide Web. ▪ Rapid updates of published material. ▪ Some free full text material.
MEDLINE	www.nlm.nih.gov	▪ Contains abstracts and references from 1966 to the present. ▪ Combines more than 3,900 medical and nursing journals into a single database. ▪ Includes Canadian Journal of Medical Radiation Technology, Radiography and Radiologic Technology.
CINAHL	www.cochrane.org	▪ The Cumulative Index to Nursing and Allied Health contains abstracts and references. ▪ As well as more than 1,700 journals, CINAHL provides access to health care books, selected conference proceedings, and educational software.

Evidence-Based Database	URL	Charcteristics
BMJ Clinical Evidence	www.clinicalevidence.bmj.com	The British Medical Journal's online decision support resource describing the best available evidence from systematic reviews randomized controlled trials, and observational studies.
Cochrane Database	www.cochrane.org	▪ Includes full text of the regularly updated systematic reviews of the effects of healthcare prepared by The Cochrane Collaboration. ▪ Free summaries are available; the full version is subscription only.

Establish the keywords and search strategy

To effectively conduct a search, keywords to be used in the search need to be identified, which are mainly the PICO elements. Moreover, a specific search Strategy using (AND, OR, and NOT) should be developed.

Example of PICO elements:

- P (Problem or Patient or Population): hospital acquired infection
- I (Intervention/Indicator): hand washing
- C (Comparison): no hand washing; other solution; masks
- O (Outcome of interest): reduced infection

Conducting the search:

The search could be carried out by the different search engines. PubMed is the primary database for researchers in the fields of biochemistry, molecular biology, and related life sciences. It was developed by the National Center for Biotechnology Information (NCBI) at the National Library of Medicine (NLM).

PubMed can be accessed at: http://pubmed.gov **OR** http://www.nlm.nih.gov

The main screens of PubMed
the most important features in PubMed which a researcher needs to be familiarized with are:

1- **The main page:** includes a database selection menu, a search box, and an advanced search link.
- On the PubMed's home page the database selection menu is displayed, where the researcher can choose between PubMed and other NCBI databases.
- A search box appears where keywords are entered.

Following are some top tips for focusing a search:

- Combine search terms with "AND" or "OR"
- Use "Limits" (Age group, Publication type, language, etc.)
- Search for your term as a word in the title [ti] or title or abstract [tiab]
- Try PubMed's Clinical Queries or Topic-Specific Queries https://www.ncbi.nlm.nih.gov/pubmed/clinical
- Use the Related Articles link, once you find a set of relevant citations

Example:
If you want to search about Prevalence of heart diseases among young age group. In addition I want the search limited to title and abstract only.
My keywords will be: Hearts diseases AND young age [tiab]

2- The results of the search are displayed in the Search Results Page (see below).
Use the Display Settings menu to change the display format, the number of citations per page and the sort order of your results.
To view selected citations: Click on the box found to the left of each item number of interest.

3- My NCBI is a feature of the NCBI databases that allows the user to save records and searches, and customize the results display with filters and other options. Moreover, updates on saved searches might be requested to be sent to a personal e-mail.

Choosing the material to be included in the literature review

The choice of the articles found in the literature search to be included in the literature review may seem confusing as the number might be overwhelmingly high. Thus, filtering the found articles is important to make sure that the most relevant ones to support the research will be chosen.
In narrowing the literature selection, more focused screening criteria are taken into consideration, such as:

- **Date of publication:** ex: only studies conducted between 2005 and 2012
- **Participants or subjects:** ex: children 6 to 12 years of age
- **Publication language:** ex: documents written in English
- **Research design:** ex: clinical trials
- **Authors:** ex: well-known author in a specific field
- **Journal:** ex: high impact journal, such as New England Journal of Medicine
- **Relevance:** ex: similar objectives addressed and methodologies adopted

Constructing a summary table of selected material will serve as a tool to organize a researcher's work.

Critically analyze and evaluate the information

Critical analyses of the chosen documents refer to the process of reading the introduction, methodology, results and discussion.

As for the critical evaluation of the document, it refers to assessing the validity of the methodology adopted, and relevance of the results reported.

Biases affecting each of the documents should be taken into consideration, and evaluated accordingly. Finally, integrate the reported results into the scope of the proposed research.

Cite literature properly

A researcher is supposed to protect the intellectual property of other researchers by acknowledging any work that has influenced the proposed research. This is done by citing other people's work by denoting the following:

- Names of the authors.
- The title of the paper.
- The journal where it is published.
- The year of publication.

There are four main reasons why it is important to cite literature properly:

- To acknowledge the author(s) of the work that the researcher used.
- To provide context to the research and demonstrate that the research is well-supported.
- To allow readers to find the original source and learn more about some aspects mentioned in the document.
- Avoid plagiarism, which occurs when a writer deliberately uses someone else's language, ideas, or other original material without acknowledging its source.

There are bibliographic management software programs that allow the researcher to search, collect and organize citations, and insert the citations into a word processing program in formatted bibliographic styles. Such available programs are: EndNote, Reference Manager, and ProCite.

Conclusion

At all stages of the process it is vital that the search process is evaluated. An effective review will increase likelihood of funding, generate new ideas and directions for investigation, and improve the quality (and likelihood) of peer-reviewed publication of primary research.

Managing References

Comparison Aspects	EndNote	Zotero	Mendeley
Storage space	Unlimited	300MB	2GB
Cost	**Not** free	Free- more price for storage	
Web / Desktop App	Both		
Web-browser Importer	**No**	Yes (chrome/Firefox/Safari)	
Compatibility with Mac/Win/Linux	**No** (Mac/win only)	Yes	
Litrature search	Yes	**No**	
Private groups	Yes		
Public groups	**No**	Yes	
Community network	**No**	Yes	
Does it work with word processing software?	Yes	Yes + Google doc.	Yes
Highlight and annotate	Yes		
Create tags	Yes (with color tags)	Yes	Yes (keywords)
Easy import of existing library	Yes	**No**	Yes
IOS app	Yes (created by the company)	Yes by ZotPad	Yes (created by the company)
Android app	**No**	Yes by Zandy	Yes (created by the company)
Strengths	Good search and storage capacity.	Good in pulling metadata from web recourses.	• Large social Components. • Automatic renaming of PDF files.

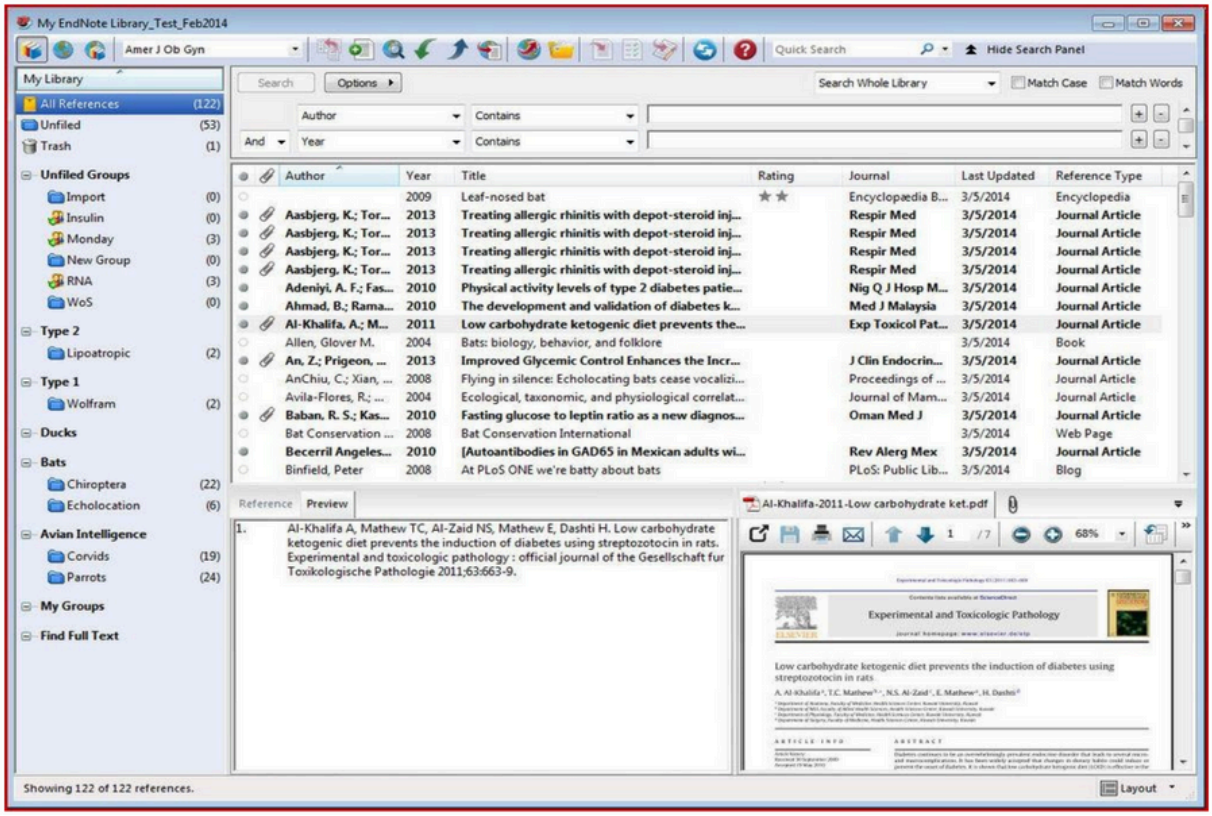
What is EndNote?

EndNote is a software program that works with Microsoft Word to automatically format in-text citations and end-of-paper reference lists with your chosen style (APA, MLA, Chicago, etc.)

What can EndNote do?

- Automatically insert well-formatted citations into your paper.
- Automatically reformat citation style in one click.
- Search live within your EndNote library.
- Access and manage your research from your desktop, online, and your iPad.
- Find full text for your references in one click.

EndNote main screen



Managing References

Click here to download EndNote

Before proceeding to steps click here to watch a video

To create library

Open EndNote → Go to File → Select New → Name your Library → Add Citations to an EndNote Library

Entering references into a library

1. Type data by hand
2. Download Data from a database and import into your library. Most databases, for example PubMed, allow you to export records directly into EndNote.
3. Connect directly to and search a database from EndNote.

Inserting references and generating bibliographies in Microsoft Word

1. From the EndNote library, highlight the reference you want to insert into the document
2. Go to Word
3. Put the cursor in the text where it needs to be inserted
4. From the tools bar choose EndNote
5. Choose Insert Citation
6. Insert Selected Citation
7. Change citation style of paper (MLA to APA, etc.)
8. In your paper, choose Tools EndNote
9. Format Bibliography
10. Choose desired Output Style
11. All EndNote tools are gathered in the —EndNote X3 tab at the top.

Mendeley Reference management Research network Dataset

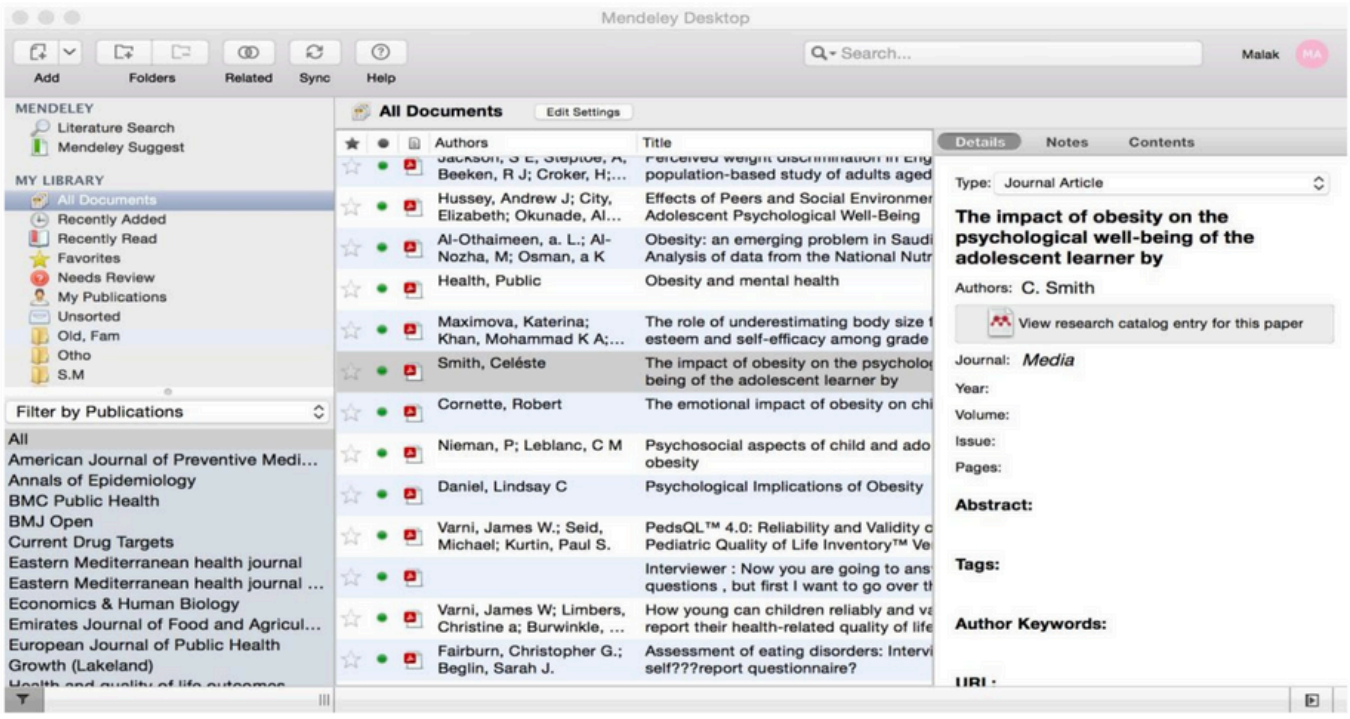
What is Mendeley?

It is free reference manager software that you can download to your desktop or use in-browser; it has an academic social network it helps researchers to organize their materials, to collaborate with others online by creating and joining groups and discovers the latest research in their field.

What can Mendeley do?

- Automatically generate bibliographies.
- Collaborate easily with other researchers online, creating or joining a group (private or public).
- Easily import papers from other research software, or from Pub-med database.
- Find relevant papers based on what you're reading.
- Access your papers from anywhere online, and having an online backup of your library.
- Read papers on the go, with IOS and Android apps.

Mendeley main screen



Click here to download Mendeley

Before proceeding to steps click here to watch a video

Importing files to Mendeley

- You can add a file by clicking File then add Files
- Or if you have full articles in a folder chose "add folder"
- Or if you have a library in other citation manger programs → click on "import" and chose the program formats that you have.

Other ways:

1. By literature search → by searching for the articles that you need → chose the article → click on –save reference
2. Via PubMed: click on –send to → chose citation manager → create file → drag the file from the downloads folder up to Mendeley.

Documents (PDF Files)

It has an excellent PDF metadata retrieval. Also, you can highlight any part of the article with lots of colors and add a note to the PDF file. **(Only if the full article is available).**

Citation plugin

First, activate it by clicking Install MS Word plugin from the Tools bar in Mendeley program then from the MS word via the View menu select the Mendeley option from the Toolbars list.

Note: in MS Word for Mac, the tool will appear as a separate panel which can be positioned wherever you like. While, in MS Word for Windows, the tool can be accessed via the References tab on the Ribbon. You should see a new set of tools for the "Mendeley Cite-o-Matic".

Managing References

Insert a Citation in MS Word

1. Put the cursor where you want to insert your first citation
2. Press the "Insert Citation" button on the toolbar.
3. The Mendeley Citation Editor Popup will appear.
4. Search your Mendeley library for the appropriate reference.
5. Enter a search term and choose the desired reference from the list of results.
6. Press Ok to insert a citation to the selected reference.

Another way:

1. Press the Go To Mendeley button to open Mendeley Desktop
2. Search for the specific reference you require using that interface.
3. Once you find your desired paper, press the "Cite" button, which temporarily appears in Mendeley Desktop.
4. To add your citation or press the "Cancel" button to return to your paper at any time.

Creating a bibliography

1. Put the cursor where you want the bibliography to appear
2. Press the "Insert Bibliography button on the plugin toolbar.
3. It'll style the list according to the Citation Style you have preferred.

Note: Your index will reorder and restructure itself every time you add or change an additional citation - there's no need to completely rebuild it.

Groups

You can create a group (private or public), or search via the website groups button for a Public group to join or follow up.

Click here for more video tutorials

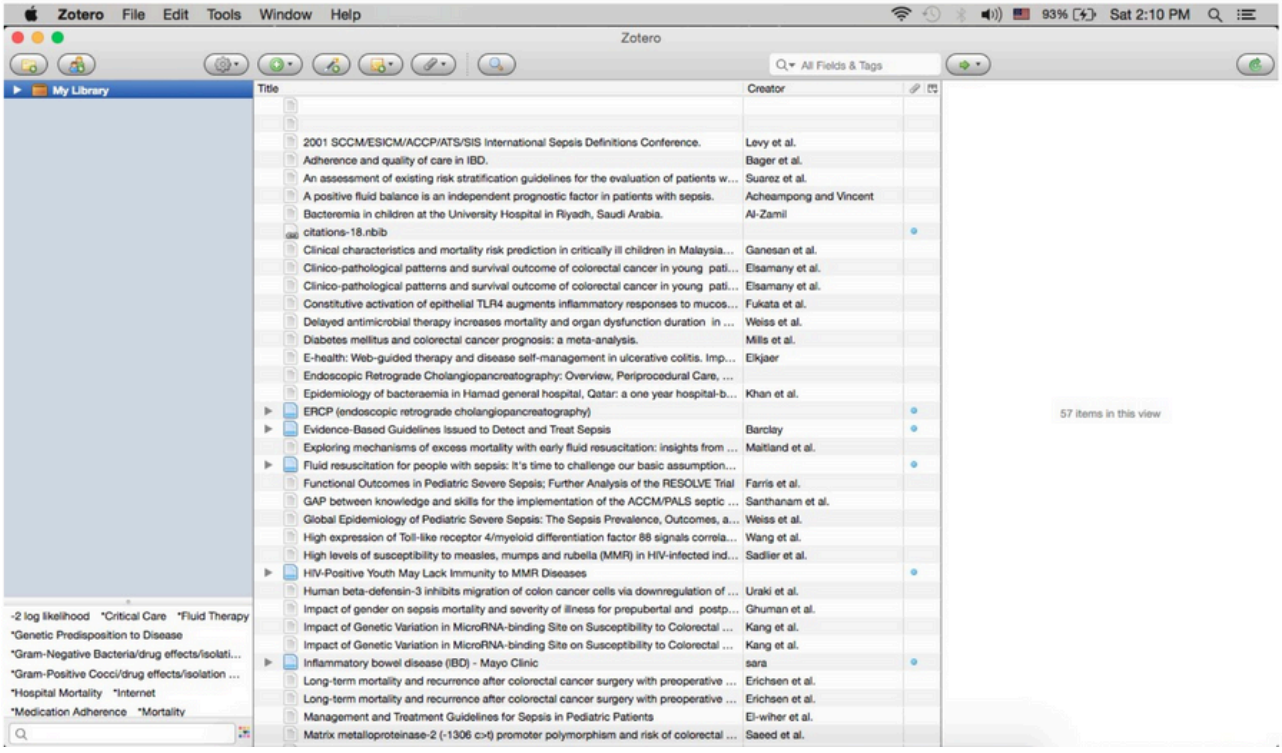
What is Zotero?

It is the most basic level, a reference manager. It is designed to store, manage, and cite bibliographic references, such as books and articles. In Zotero, each of these references constitutes an item.

What can Zotero do?

- **Organize:** collections, tags, Searches, saved searches.
- **Collect:** attachment, notes, files, links, snapshot, capturing items, web pages.
- **Cite:** many different bibliographic styles, word processor integration, automatic bibliographies and manual bibliographies.
- **Collaborate:** syncing, Zotero servers and groups.

Zotero main screen



Click here to download Zotero

Before proceeding to steps click here to watch a video

To create collection

Open Zotero → File → new collection.

Entering references into library

You can download data from journals or database then use one of the 3 ways:

- Drag the PDF\file and drop it into Zotero.
- File → Import
- File copies and file links can be created by clicking the New ( ) button at the top of the center column and selecting —Store Copy of File... or Link to File... , respectively. This creates standalone items.

Inserting references and generating bibliographic in Microsoft word

1. You can begin citing with Zotero by clicking the Add/Edit Citation ( ) button. Pressing the button brings up the citation dialog.
2. Start typing part of a title, the last names of one or more authors, and/or a year in the dialog box.
3. Select an item by clicking on it. The item will appear in the dialog box in a shaded field.
4. Clicking the Add/Edit Bibliography ( ) button inserts a bibliography at the cursor location.

Adding Files via the Browser

With Zotero for Firefox, you can right-click a link to a file in the browser (e.g. to a PDF) and select Zotero → Save Link as Zotero Item. This will save a copy of the file to your library as a standalone item.

You can also right-click an image in Firefox and select Zotero → Save Image as Zotero Item.

What is research proposal?

It is a summary of the suggested process to be used to answer the research question. It is done through gathering information, reading, integrating, organizing ideas, and planning.

There are main aims for research proposal:

1. Mapping a road for a research.
2. Gaining ethical approval by submitting it to the IRB committee.
3. For funding.

Sections for research proposal

The format of a research proposal depends on the institution at which the study will be carried out. In this guide, we are going to explain the specific format of King Saud University – Institutional Review Board (IRB) form.

Click here to view the form

Page Content	Details
Abstract	An abstract should concisely describe the background of the proposal, critically evaluate the rationale to carry out the study or the gap in knowledge, and it should highlight the objectives of the project. It also should briefly describe the methodology, data analysis, as well as the significance and relevance of the project. Not more than 1 page, and usually 200 words and less.
Research Problem & Significance	This section is referred to as rationale. It aims to convince the audience that the research is worth doing it. It should answer the question why the audience should want to read/fund/support the project. One way to do this is by describing how the results may be used.
Objectives	The purpose of the study should answer the research question by the proposed research. A research project should have one primary objective, and one or more secondary objectives which should all be detailed in this section. Your objectives should be **SMART**: **S**pecific, **M**easurable, **A**chievable, **R**elevant and **T**ime-bound

Page Content	Details
Literture Review	Explained in details in the previous pages
Research Methodology	It should be written in detail, because it is the main section that will be assessed by the reviewers.
References	Using standard methods of citing references, e.g. Vancouver style (New England Journal of Medicine)
Investigators information & their Roles	Usually the supervisor (faculty) is considered the principal investigator, unless agreed otherwise within the research group. Investigators' roles E.g. Review of literature, study design, data collection, data management and analysis, progress report, data analysis, final report and manuscript writing (as applies to each investigator).
Research Time Schedule	Expected time of processing till the finishing of the project.

Sample size Calculation

Is an important step carried out to calculate the number of subjects needed to be included in the research project. Different research questions require the use of different equations for the calculation of the sample size.

Typically, the following are the basic information needed for sample size calculation:

- Level of statistical significance (α), and is usually considered at 0.05 (5%).
- The value of the power desired (1-β), and it is usually considered at 0.8 (80%).
- An estimate of the expected prevalence or incidence rate in the control group (or unexposed), as well as the expected difference in response rates to be detected between the two groups. This could be achieved by considering the difference that would be clinically important in management of the specific patients, or from previous work carried out on the same topic.

This website can help to calculate the sample size (Click here)

Methodology Section	
Study Design	The type of study design to be used to answer the research question must be provided, such as cross-sectional, case-control, cohort, or interventional study. A valid justification should be provided for selecting the study design, as well as the reason behind ruling out other study designs.
Setting	The area or location where the study will be carried out is described in this section.
Time Period	It is important to set the time frame for the proposed work. The accomplishment of tasks or specific aims and the division of labor during that time-period must be clearly set and defined within time frames throughout the duration of the study.
Inclusion & Exclusion Criteria	• Inclusion criteria are characteristics that the subjects must have if they are to be included in the study. • Exclusion criteria are those characteristics that disqualify subjects from inclusion in the study e.g. age, gender, race, ethnicity, type and stage of disease etc.
Sampling technique	Sampling is the process or technique of selecting a sample of appropriate characteristics and adequate size.The most frequently used sampling technique is the random selection. Other sampling methods include convenient sampling, consecutive sampling, etc.
Data Collection Methods	E.g. questionnaires, data collection forms, online surveys, etc. Details of these forms should be specified in this section, as well as the validity and reliability of these tools. Moreover, the methods used for collecting the data should be specified.
Sample Size	Sample size should not be selected haphazardly by the investigator; rather it should be justified by proper statistical calculation.
Instruments	Any apparatus and/or instruments proposed to be used in the research study should be listed and described in this subsection. The following information should be included: a general description of the apparatus or instruments to be used, why they are used, variables measured by these instruments, and finally their reliability and validity.
Data Analysis	Statistical analyses to be carried out, which should address different levels of analyses (univariate, bivariate, and multivariate), as well as information about the program to be used for data

Data Collection, Entry, Cleaning and Management

The purpose of this section is to explain how to collect data as appropriate or the nature of your project, and what to do with them once they're collected to be ready for the statistical analysis.

Introduction

Before going through this section, you need to be familiar with some terminologies that are important in the process of data collection:

- **Variable:** A changeable piece of information (Can be changed), e.g. Heart rate is a variable that can be 90 BPM in one patient and 80 in another.
- **Types of variables (There are two main types):**

  1- Categorical: fixed (non-continuous) variables that can be grouped into categories. They're further subdivided into:

  A. Dichotomous: When the piece of information is one of two responses (either or), e.g. hypertensive vs non-hypertensive, Pass or fail and so on.
  B. Nominal: When the piece of information can be one of three or more responses, and the responses cannot be sequenced (ordered), e.g. blood groups (A, B, O, and AB).
  C. Ordinal: When the piece of information can be one of three or more responses, and the responses can be sequenced, e.g. the severity of any disease can be (mild, moderate or severe).

  2- Continuous: Variables that have the potential to be any value within a continuous range.
  Simply, Time for instance is a range of continuous values. E.g. when you are collecting data about time of admission, it can be 2:30 pm, 2:31 pm, 2:32 pm...etc. Other examples are: Age, Blood pressure, Height, Weight.

- **Coding:** During entering your data into the sheet, it's the process of giving numbers (Codes) for non-numerical data. E.g. 1 for males, 2 for females. **Why don't we keep letters in our sheet?** Because Statistical analyzing programs (e.g. SSPS) won't accept letters to do their job.

Data collection

- **What is Data?** Data is the facts (Pieces of information) collected and not yet interpreted, organized or processed by any means. So "Data collection" is a symmetric gathering of data for a particular purpose.
- **How data can be collected?** Many methods used to collect data depending of the nature and the need of the study, including questionnaire, interviews, observation, records and files. Basically, any paper or electronic form used to collect data is accepted as long as contains the data of interest.

E.g. the figure below is an example of a data collection form gathering their information from patients' records.

Patient's file number	Added information	Parameter	Result(s) of Parameter
		Gender	Male ( ) Female ( )
		Age	
		Year of admission	
		Section of Admission	
Patient's telephone number (Optional)		Diagnosis	1. 2. 3. 4. 5. 6. 7. 8.
DVT		Isolated microorganism	
Present ( ) Information :		Gram stain	P ( ) N ( )
		Type of catheter	
		Side of insertion	R ( ) L ( )
		Vein of insertion	
		Number of lumen	
		Date of insertion	
		Date of infection development	
		Date of removal	
		Location of insertion	
		Temperature (C)	
		Outcome of catheter insertion	
		Type of infection	CLABSI ( )
			LCBSI ( )

Database Structure

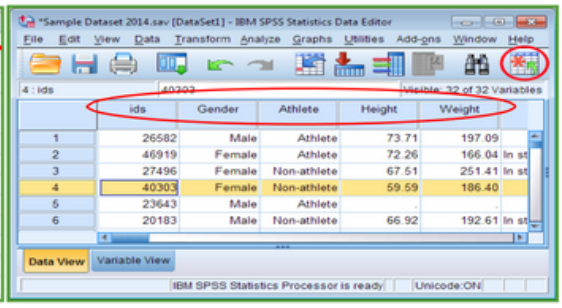
What is database?

It is all the data collected and organized but not yet interpreted. It can be easily reached and updated. Databases can be structured in many computer programs such as Microsoft Excel, Microsoft access, SPSS. Each of these can be used for data entry, archiving, and for analysis too. However, what is done usually by researchers is entering and archiving their database in Microsoft excel till it's complete and ready, at this step it's transferred to SPSS for the statistical analysis.

Generally, SPSS is more superior than Microsoft excel and preferred by researchers and statisticians for the following reasons:

1 - First horizontal line is usually used in excel for the names of the variables (Age, Sex ...etc.), while in SPSS, variables are defined already and the first line is saved for data as shown in the next two figure.

	A	B	C	D	E	F	G
1	OrderDate	Region	Rep	Item	Units	Unit Cost	Total
2	1/6/10	East	Jones	Pencil	95	1.99	189.05
3	1/23/10	Central	Kivell	Binder	50	19.99	999.50
4	2/9/10	Central	Jardine	Pencil	36	4.99	179.64
5	2/26/10	Central	Gill	Pen	27	19.99	539.73
6	3/15/10	West	Sorvino	Pencil	56	2.99	167.44
7	4/1/10	East	Jones	Binder	60	4.99	299.40
8	4/18/10	Central	Andrews	Pencil	75	1.99	149.25
9	5/5/10	Central	Jardine	Pencil	90	4.99	449.10
10	5/22/10	West	Thompson	Pencil	32	1.99	63.68
11	6/8/10	East	Jones	Binder	60	8.99	539.40
12	6/25/10	Central	Morgan	Pencil	90	4.99	449.10
13	7/12/10	East	Howard	Binder	29	1.99	57.71



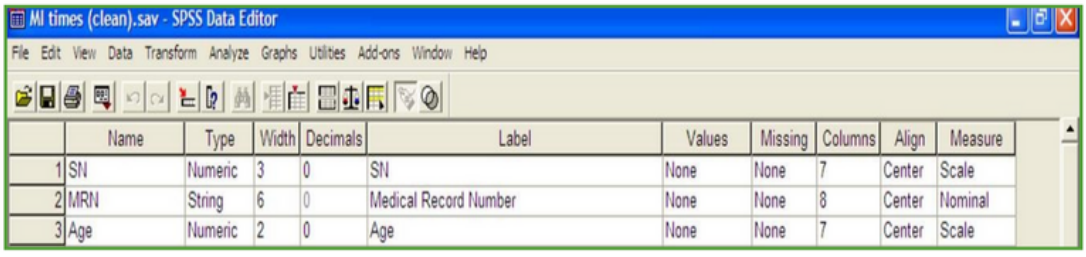
2 - SPSS provides an easy way to define the codes given for each variable, while excel requires much time and effort to give codes.

3 - Finally, excel is much harder and needs an expert to perform data analysis.

In SPSS and other programs, for each variable in the database, 6 things need to be defined:

Name	It is the short name of the variable that should not include any spaces.
Type	It specifies the format of the variable, such as: • Numeric: anything that type includes only numbers. • Dates: anything where date is involved. • String: where a combination of letters, numbers or symbols are included.
Width	Number of digits allowed for numeric variables e.g. for 999, width is 3
Decimals	Number of decimals needed for numeric variables e.g. 1.25, decimals are 2
Label	It is a place where the full definition of the variable could be provided.
Values	It is where the coding of the variable is specified.

(This figure shows an example from SPSS)



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	SN	Numeric	3	0	SN	None	None	7	Center	Scale
2	MRN	String	6	0	Medical Record Number	None	None	8	Center	Nominal
3	Age	Numeric	2	0	Age	None	None	7	Center	Scale

To fully understand the point, let's have an example: Abdullah is conducting a research in order to identify the risk factors of STEMI vs Non-STEMI in King Khaled University Hospital; he collected data about age, family history, cholesterol level, smoking status ...etc.

Before entering the data in SPSS, he has to specify 6 things for each variable he has. Let's apply this on Family history which is is a categorical dichotomous variable.

NAME	TYPE	WIDTH	DECIMALS	LABEL	VALUES
FH	Numeric (1,2)	1	0	Family history	1 = "Yes" 2 = "No"

Data Entry

It is the process of typing the data you got into a computer program. It can be single (entered into one computer) or double (entered into two computers, then the two databases are compared and any discrepancy will be resolved by computer). Double data entry is used to avoid or reduce errors in data entry.

Data Cleaning

Data cleaning is a process where the data is checked for entry errors or extreme values in the database. It's a very important point as errors may occur no matter how the person is cautious.

- There are 2 steps of data cleaning:
1-Identifying the errors: There are many methods to do that.
2-Correcting the errors: Once errors are identified, they are corrected through going back to the data collection form and finding the correct information.

Data Management

It is a crucial step just before data analysis. The goal is to create new variables based on the available ones. There are 3 types of data management:

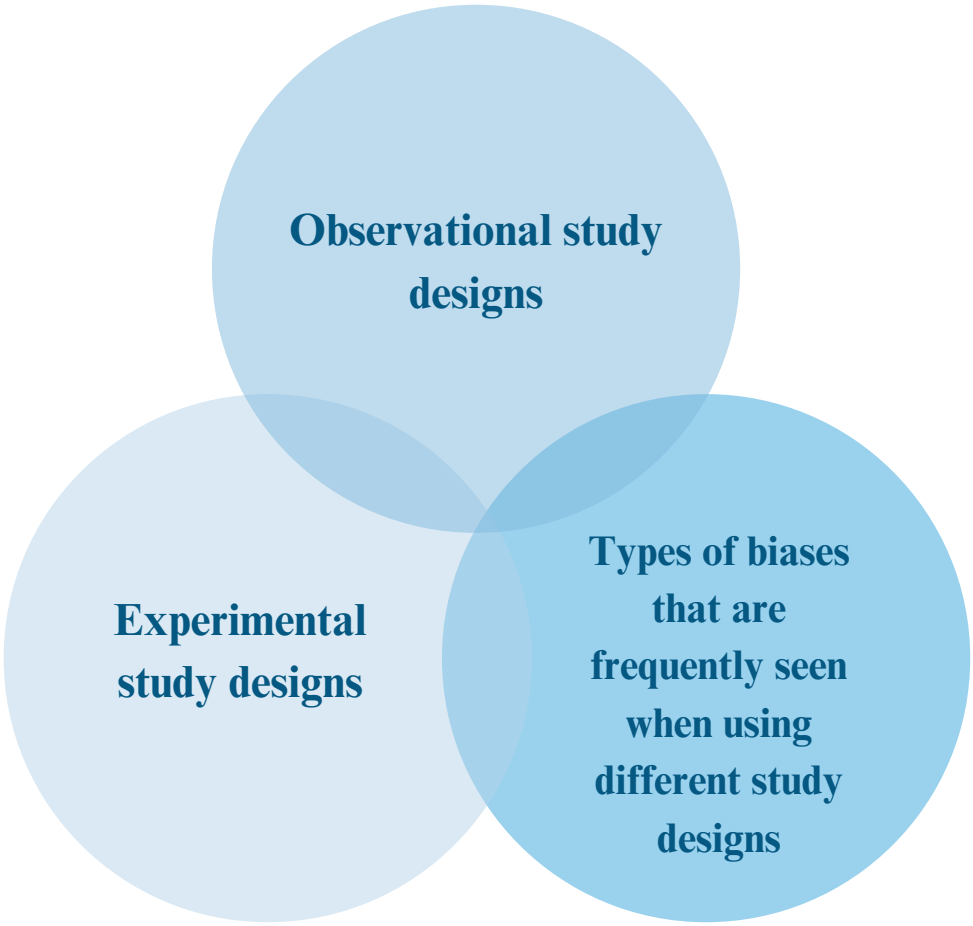
1- Recoding: creating new variables from the already coded variables, e.g. when you gathered information about smoking status and you got (0=non-smoker) (1=ex-smoker) (2=smoker), if you're further interested in having a new variable of (smoker vs non-smoker) only, you can merge non-smokers and ex-smokers as (non-smokers=0, in the new variable), while smokers remains the same with a new code=1.

2- Categorization: When one "continuous" variable is divided into more, e.g. SBP is divided into hypotensive, normotensive and hypertensive.

3- Computation: is having a new variable from doing mathematical equations of more than 1 variable, e.g. calculating BMI from weight and height.

Overview of Study Designs

This chapter is going to provide you with a brief overview on the different types of study designs, and how to choose the right study design for your research project. It will cover:



Generally, all study designs have similar components from the PICO formulation.
All study designs have a defined population (P), outcome (O). The intervention (I) and comparison (C) may or may not be present in all study designs **(We have them in experimental and analytic observational study designs).**

Overview of Study Designs

The first distinction is whether the study is analytic or non-analytic.

A Non-analytic Study	It does not try to quantify the relationship but tries to give us a picture of what is happening in a population, E.g., the prevalence, incidence, or experience of a group.
Descriptive Studies	Include case reports, case-series, qualitative studies and surveys (cross-sectional) studies, which measure the Frequency of several factors, and hence the size of the problem. Some may include analytic work.
An Analytic Study	It attempts to quantify the relationship between two factors, that is, the effect of an intervention (I) or exposure (E) on an outcome (O). To quantify the effect, we will need to know the rate of outcomes in a comparison (C) group as well as the intervention or exposed group.
Experimental Studies, or Randomized Controlled Trials (RCTs)	That is, subjects are allocated to two or more groups to receive an intervention or exposure and then followed up under carefully controlled conditions. Such studies controlled trials, particularly if randomized and blinded, have the potential to control for most of the biases that can occur in scientific studies.
Analytic Observational Studies	The researcher simply measures the exposure or treatments of the groups. Analytical observational studies include case control studies, cohort studies and some population (cross-sectional) studies. These studies all include matched groups of subjects an assess of associations between exposures and outcomes.
Observational Studies	It investigates and record exposures (such as interventions or ris factors) and observe outcomes (such as disease) as they occur. Such studies may be purely descriptive or more analytical.

- **Prevalence:** is an indication of how frequent a specific outcome or disease is present in a specified population. It is calculated by dividing the number of subjects with a particular outcome or disease in a given population by the total number of people in that population at a specific point in time. It is represented as a fraction, proportion, or a percentage. For example, the prevalence of diabetes in the Kingdom of Saudi Arabia was estimated to be 30%, calculated by dividing the number of diabetic patients (1,792 patients) over the total number of subjects included in the study (6,024 subjects).

- **Incidence:** Is an indication of how fast the outcome or disease is growing in a specific community. It is calculated by dividing the number of newly diagnosed subjects with a specific outcome or disease by the total number of people in that population over a specific period of time. For example, the incidence of intrauterine fetal deaths after 26 weeks of gestation was found to be 6.1 per 1,000 total births, which was calculated by dividing the number of deaths (103 cases) by total number of pregnancies (16,882).

- **Exposure and outcome:** two terms that researchers use when they carry out clinical research. An exposure might also be called a risk factor or an independent variable, and they all reflect the variable one is interested in seeing; the effect of on a certain outcome, also called disease or dependent variable. As an example, a researcher might be interested in studying the effect of physical activity (exposure) on obesity (outcome), but another researcher might be interested in studying the effect of obesity (exposure) on diabetes (outcome).

- **Contingency table (two by two table or cross tabulation):** Is a method used to display the frequency distribution of two variables across each other, for the purpose of assessing the association between these two variables. It is a method used in the different study designs, but what differs is the measure of association calculated, which is dependent on the type of study carried out.

Biases in Research

Bias is any deviation of results or inferences from the truth, or processes leading to such deviation. Bias can result from several sources: one- sided or systematic variations in measurement from the true value (systematic error); flaws in study design; deviation of inferences, interpretations, or analyses based on flawed data or data collection; etc. There is no sense of prejudice or subjectivity implied in the assessment of bias under these conditions.

Selection Bias:	• Occurs when the selection of subjects into a sample or their allocation to a treatment group produces a sample that is not representative of the population, or treatment groups that are systematically different. • prevented by random selection and random allocation.
Detection Bias:	• Occurs when observations in one group are not sought as diligently as in the other. • prevented by observer blinding.
Observer Bias:	• Occurs when the observer is able to be subjective about the outcome. • prevented by observer blinding and outcome measure design.
Recall Bias:	• Occurs when patients know which group they have been allocated to, which influences the way they report past history and symptoms. • i.e. If patient knows the are in the placebo group they may exaggerate their untreated symptoms. • prevented by patient blinding.
Response Bias:	• Occurs when patients who enroll in a trial may not represent those of the population as a whole. • -i.e. The obese patients who enroll in a weight loss. Medication trial may be more motivated than those in the general population. • Prevented by random sampling from population.
Publication Bias:	• Occurs because negative studies less likely to be submitted and/or published than positive ones • Prevented by clinical trials registries and ensuring all well conducted studies are submitted and published (should be mandatory) • In meta-analysis, the possibility of absent negative studies should be sought for by funnel plot analysis.

Observational Study Designs

In **observational studies**, the researcher observes and systematically collects information, but does not try to change the people (or animals, or reagents) being observed. In an observational study there is no intervention.

Examples of observational studies:

- A survey of drinking habits among students;
- A researcher who joins a biker gang to study their lifestyle.
- Taking blood samples to measure blood alcohol levels during Monday morning lectures.

- **Types of observational study designs**: Many, but the main ones are:

1– Cross–Sectional surveys

Example: What is the prevalence of diabetes in this community?
Here, you draw a random sample of people and record information about their health in a systematic manner.
You can also compare people with, and without, diabetes in terms of characteristics (such as being overweight).
The problem is that you cannot be sure which came first. We say that there is an inability to discern temporality or that there is a lack of a temporal relationship (i.e. which came first, the hen or the chicken?)

2– Systemic Review

A summary of the clinical literature.
A systematic review is a critical assessment and evaluation of all research studies that address a particular clinical issue.
The researchers use an organized method of locating, assembling, and evaluating a body of literature on a particular topic using a set of specific criteria.
A systematic review typically includes a description of the findings of the collection of research studies.

3– Cohort, or 'longitudinal', or 'prospective' studies

These are like surveys, but extend over time. This allows you to study changes and to establish the time-sequence in which things occur. Therefore, you can use this to study causes.
For example, you want to see whether using a cell phone leads to brain cancer. So, collect information on how many minutes each student uses his or her phone each week, and collect this information over a long time, and then eventually collect information on who gets brain cancer. In technical terms, you record the incidence of cancer among those who use their phones more than a pre-determined amount and compare this to the incidence in the non-users. You could calculate the relative risk.
• The advantages: it can establish that the phone usage predates the cancer, andit allows for accurate collection of exposure information.
• The disadvantages: Brain cancer is rare, so you will need a very large cohort of students; you will also need to keep in contact with them for a very long time and you will probably get very bored waiting for the results.

4– Case–Control

It is a "retrospective" study. This you begin at the end, with the disease, and then work backwards. In our example, you could identify a group of patients with brain cancer (these would be the cases in "case-control"). Then identify a control group who do not have brain cancer. Then, collect information on their previous use of cell phones, dating back as far as you can manage. The hypothesis would be that phone usage would be significantly higher in the cancer group than the control group.
• The advantages are that a case-control study is faster and more cheaply than a cohort study.
• The disadvantages, may be difficult to collect the information you require on past exposures, and there may be other ways in which the cases and controls differ, not just the cell phone use, which could also be causing the cancer. Sometimes you also have difficulty in being sure which came first: the disease or the exposure.

5– Meta–Analysis

A way of combining data from many different research studies. A meta- analysis is a statistical process that combines the findings from individual studies. It is the most broad and most accurate type of research

6– Case Reports & Series

A report on a series of patients with an outcome of interest. No control group is involved.

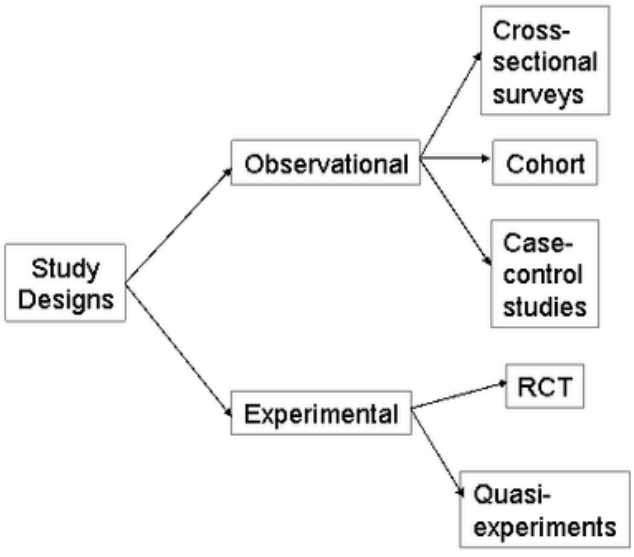
In an ***experiment***, when compared to observational studies, the researcher intervenes to change something (e.g., gives some patients a drug) and then observes what happens.

- **Example:** Warning one group of students that you are going to take blood alcohol levels next Monday to test for alcohol, and comparing their levels to another group that you did not warn.

How to conduct

- A sample of patients with the condition, and who meet other selection criteria, is randomly allocated to receive either the experimental treatment, or the control treatment.
- Occasionally, a placebo or sham treatment will be used in the control group, but where there is already an accepted treatment, it is unlikely to be ethical to use a placebo.
- The experimental and control groups are then followed for a set time, and relevant measurements are taken to indicate the results (or 'outcomes') in each group.

Summary of advantages and disadvantages of the most common study designs



Advantages	Disadvantages
Quick; can cover whole population, giving representative information whether or not people are seeking care	Based mainly on self-report (biases?); diagnostic information usually inaccurate; can't establish causal sequence
Prospective, so can establish causal sequence; can estimate incidence	Time-consuming; costly; attrition of cohort?
Relatively cheap way of focusing on causal factors	Requires recall of past events (inaccurate?); controls not equivalent to cases
Controls for all main forms of bias; good for both etiological and evaluative research	Ethical concerns in etiological applications; Often uses selected populations: issue of generalizability?
May be more practical than RCT: can use "natural experiments"	Allocation bias often significant (exp'tal and control groups not equivalent)

Case reports Study Design

Introduction

- case report is a detailed report of the symptoms, signs, diagnosis, treatment, and follow-up of an individual patient. usually describe a rare or novel occurrence.
- it importance lies in documenting history, findings, management and reactions.
- the structure of case reports includes:Introduction, Methods, Results, Discussion and Conclusions.

Criteria for case reports

- **incomplete list of:** Unique, Different, or Rare, or Unexpected, or recurring Pattern with an intervention or a medication.
- **Care checklist:** is a standardized tool used to ensure the completeness and transparency of case reports.

click here for CARE checklist

1–Title

- The words “case report” (or “case study”) should appear in the title along with phenomenon of greatest interest (eg, symptom, diagnosis, test, intervention)

- **CARE compliant** : A case report of increased movability and flexibility following a radioactive spider bite in a Caucasian male.
- **Not CARE compliant:** A spider bite made a young man into a SPIDER MAN.

2–Keywords

- The key elements of this case in 2-5 words.
- (words that can be searched and indexed. Not common, Unique, easy to think of for non-native speakers).

3–Abstract

a) Introduction: What does this case add?

b) Case Presentation:

- The main symptoms of the patient
- The main clinical findings
- The main diagnoses and interventions
- The main outcomes

c) Conclusion: What were the main “take-away” lessons from this case?

4–Introduction & 5–patient information

Introduction: Brief background summary of this case referencing the relevant medical literature.

Patient Information:

1. Demographic information (eg, age, gender, ethnicity, occupation)
2. Main symptoms of the patient (his or her chief complaints)
3. Medical, family, and psychosocial history—including diet, lifestyle, and genetic information whenever possible, and details about relevant comorbidities including past interventions and their outcomes

6–Clinical Findings & 7–Timeline

- **Clinical Findings**: Describe the relevant physical examination (PE) findings (photos can be of extra value).

- **Timeline:** Depict important dates and times in this case (table or figure). This helps colleagues understands the presentation at a better and clearer rate.

8–Diagnostic Assessment & 9–Therapeutic Intervention

Diagnostic Assessment:

- a) Diagnostic methods (eg, PE, laboratory testing, imaging, questionnaires)
- b) Diagnostic challenges (eg, financial, language/cultural)
- c) Diagnostic reasoning including other diagnoses considered
- d) Prognostic characteristics (eg, staging) where applicable

Therapeutic Intervention:

- Types of intervention (eg, pharmacologic, surgical, preventive, self-care)
- Administration of intervention (eg, dosage, strength, duration)
- Changes in intervention (with rationale)

10– Follow–up & 11–Discussion

Follow-up and Outcomes

Summarize the clinical course of all follow-up visits including:

- Clinician and patient-assessed outcomes
- Important follow-up test results (positive or negative)
- Intervention adherence and tolerability (and how this was assessed)
- Adverse and unanticipated events

Discussion

a) The strengths and limitations of the management of this case

b) The relevant medical literature

c) The rationale for conclusions (including assessments of cause and effect)

d) The main "take-away" lessons of this case report

12–Patient Perspective & Informed Consent

- **Patient Perspective:** The patient should share his or her perspective or experience whenever possible
- **Informed Consent:** Did the patient give informed consent? Please provide if requested (Consent Form, Confidentiality and CV template for PI)

Considerations

General Consideration:

- Ask your department or programme director to have a channel or venue to discuss/present case reports.
- Submit the case reports to relevant meetings within and outside the institution.
- "Tweet" about it/ disseminate knowledge.

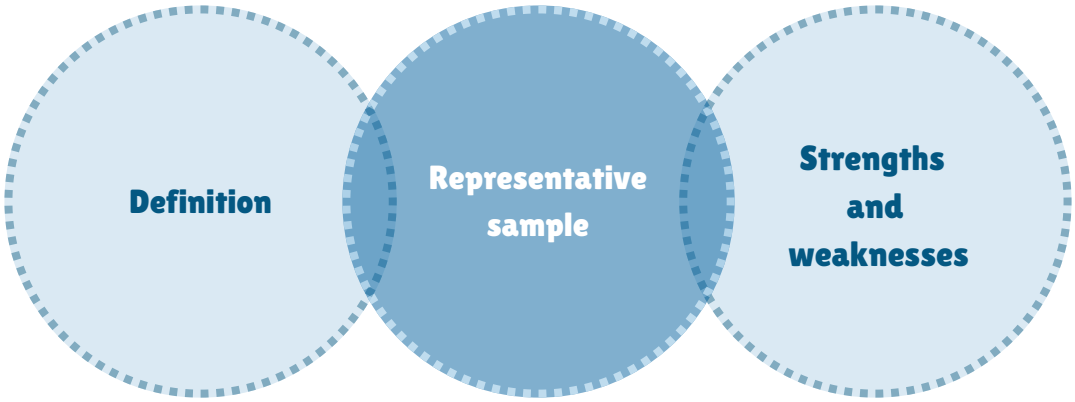
Consideration for Publications:

- Involve parties that was involved in the patient care.
- Be aware that some journals will have a limit on number of authors in case reports.
- Case reports are mostly not treated with the same reverence as classically peer-reviewed original articles.

Cross Sectional Study Design

This chapter will provide you with the most important elements when it comes to the **cross sectional study design**.

Hopefully, by the end of this chapter, you will learn the following:



Definition

- **A cross-sectional study** is an observational descriptive study, where the main objective is describing a particular status among a specific community. Such a study is observational since the researcher is not intervening in any way with the subjects, whereas the researcher is only observing the subjects and recording information on them.

- **A cross-sectional study** represents a snap shot about a particular status in a specific community, at a specific point in time (i.e. one time). This is where the cross-sectional aspect of the study comes from. Although the study might take few months to be conducted, the cross-sectional aspect is specific to each subject, where he/she will be assessed only once, and no follow-up is done.

- In other words, **in a cross-sectional study**, data are collected on the whole study population at a single point in time to examine the relationship between disease (or other health related state) and other variables of interest.

- **Cross-sectional studies** therefore provide a snapshot of the frequency of a disease or other health related characteristics in a population at a given point.

Note: Cross–sectional studies are sometimes carried out to investigate associations between risk factors and the outcome of interest. They are limited, however, by the fact that they are carried out at one time point and give no indication of the sequence of events

- **Whether exposure occurred before, after or during the onset of the disease outcome. This being so, it is impossible to infer causality.**

Types of cross–sectional studies

Descriptive	Analytical
A cross-sectional study may be purely descriptive and used to assess the frequency and distribution of a particular disease in a defined population. For example a random sample of schools across London may be used to assess the burden or prevalence of asthma among 12- 14 year olds.	Analytical cross-sectional studies may also be used to investigate the association between a putative risk factor and a health outcome. However, this type of study is limited in its ability to draw valid conclusions about any association or possible causality because the presence of risk factors and outcomes are measured simultaneously. It may therefore, be difficult to work out whether the disease or the exposure came first. The collection of information about risk factors is also retrospective, running the risk of recall bias

Choosing a representative sample

One of the most important challenges of a cross-sectional study is the selection of a representative sample. For instance, in a study assessing the prevalence of hypertension among Saudi adult population, the sample should include a random sample of all Saudi adult population; otherwise the results will not be valid because of selection bias.

Sampling methods

1- Probability Sampling: This is also known as random sampling. This method helps to utilize some form of random selection. In order to have a random selection method, you must set up some process or procedure that assures that the different units in your population have equal probabilities of being chosen.

Humans have long practiced various forms of random selection, such as picking a name out of a hat, or choosing the short straw. These days, we tend to use computers as the mechanism for generating random numbers as the basis for random selection.

Examples:

- Simple random sampling: size n is produced by a scheme which ensures that each subgroup of the population of size n has an equal probability of being chosen as the sample.
- Stratified random sampling: Divide the population into "strata". There can be any number of these. Then choose a simple random sample from each stratum.
- Simple random sampling: size n is produced by a scheme which ensures that each subgroup of the population of size n has an equal probability of being chosen as the sample.
- Stratified random sampling: Divide the population into "strata". There can be any number of these. Then choose a simple random sample from each stratum.
- Systemic random sampling: a method to select samples at a particular preset interval
- Cluster random sampling: divide the population into groups, obtain a simple random sample of so many clusters from all possible clusters, and obtain data on every sampling unit in each of the randomly selected clusters.

2- Non-Probability Sampling, or convenience sampling, Non- probability sampling is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

- Snowball Sampling: s usually done when there is a very small population size. In this type of sampling, the researcher asks the initial subject to identify another potential subject who also meets the criteria of the research.
- Judgmental Sampling: In this type of sampling, subjects are chosen to be part of the sample with a specific purpose in mind. The researcher believes that some subjects are fit for the research compared to other individuals.
- Convenience Sampling: the samples are selected because they are accessible to the researcher. Subjects are chosen simply because they are easy to recruit. This technique is considered easiest, cheapest and least time consuming.

Strengths and weaknesses

The few strengths and weaknesses of cross-sectional studies are:

	Description
Strengths	• Cheap and relatively easy to conduct, as the study methodology involves Identifying a group of subjects, collecting information about them, and analyzing the data. • It is a study that could be done over short periods of time, since there is no follow-up involved. • Data on all variables (exposure, outcome, and confounders) are only collected once. • Possibility of assessing prevalence for all factors being studied. • Multiple exposures and outcomes can be studied. • The prevalence of disease or other health related characteristics are important in public health for assessing the burden of disease in a specified population and in planning and allocating health resources. • Good for providing descriptive results and for generating hypotheses.
Weaknesses	• Time sequence of exposure and outcome is not implicated in this design, i.e. it is difficult to determine which one came first, the exposure or the outcome. (establishes association at most, not causality) • Not suitable for studying rare diseases, since very few subjects will be captured in the study, even if it includes a big number of participants. • The incidence of a disease cannot be calculated through this study design. • Susceptible to selection bias because of sampling and low response. • Susceptible to information bias because of recall. • Susceptible to confounding bias due to inability to collect information on all potential confounders.

Cross–sectional study vs. cohort study

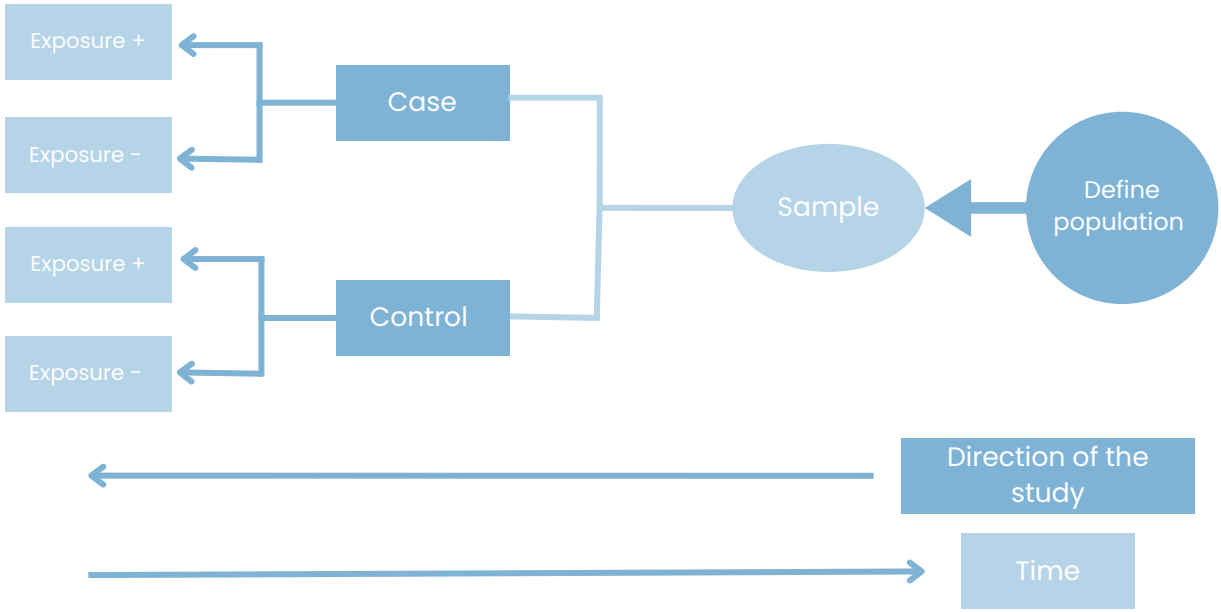
	Cohort study	Cross sectional study
Population at risk	Population at risk	Entire population (or sample)
Common measures	Risks and rates	Prevalence

Case control Study Design

Definition

A case control study is an epidemiological study where participants are selected based on their disease status. Two groups of subjects are included, cases (having the disease under research) and controls (Free of the disease). We study the exposure history and compare it between the cases and the controls to assess whether an association exists between the exposure and the outcome.

- In case control study both exposure and outcome already happened in the patients.



- **Graph explanation :**

  In case control, we have defined population so we take a sample from them to study it. This sample will be divided into cases (with the disease) and controls (without the disease), we'll study the history of exposure in each of them and come up with +ve exposure or -ve exposure.

Identifying cases and controls

If cases are a random sample of cases in the population, then controls should be a random sample of all non-cases in the population sampled at the same time. One general rule is that controls should be at risk of the disease. The controls should resemble the cases in all aspects like (age, gender,…etc.) except for the presence of disease.

Exposure assessment

Information about exposure history can be collected by questionnaires.

Strengths and limitations

The few strengths and limitations of case control studies are:

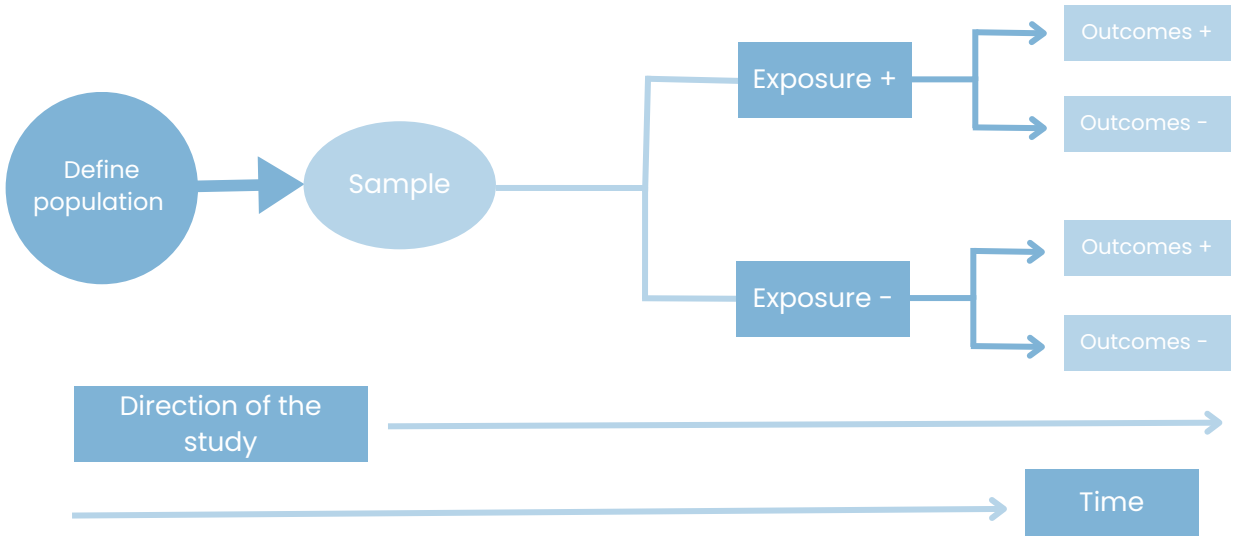
	Description
Strengths	• No follow up is needed, least time-consuming and low financial cost. • Useful for studying rare diseases, since patients are selected based on the outcome status. • Appropriate for assessing the association between different risk factors and one outcome.
Limitations	• Liable to selection bias. • Liable to Recall bias, since information collected has happened long in the past, and it might not be accurate (people with a condition will be more motivated to recall details about past exposures). • Not appropriate for studying rare exposures, since not enough subjects will be found to be exposed. • • selection of control groups is difficult

Cohort Study Design

Definition

A cohort study is a study where participants are selected based on their exposure status. Two groups of subjects are included in this type of study, exposed (having the exposure under research) and unexposed (not exposed to the factor under research). Both exposed and unexposed subjects are free of the disease under research, but they are at risk of developing it. Subjects are then followed prospectively over time to identify those who develop the disease.

Cohort studies could be either prospective (None of the subjects have developed any of the outcomes) or retrospective (All the events - exposure, latent period, and subsequent outcome - have already occurred in the past).(2,3) Important thing to know is that the investigator in retrospective cohort studies does not follow subjects as it is in the prospective cohort studies.



Strengths and limitations

The few strengths and limitations of the cohort studies are:

	Description
Strengths	• Easier and cheaper than experimental studies. • Establish a relation between exposure and outcome. So, you can build evidence for the causes, and the association between one exposure to different outcomes. • Appropriate for studying rare exposures, since patients are selected based on the exposure status. • A retrospective cohort study is fast to be carried out. • eligibility criteria and outcome assessments can be standardised
Limitations	• Expensive and takes a long time. (more if prospective). Thus, Loss to follow-up. • Could lead to bias if there is too many subject characteristics. • Not appropriate for studying rare outcomes or Diseases. • exposure may be linked to a hidden confounder

Narrative reviews

Definition

Narrative review is an umbrella term for a collection of review types in which the review process goes beyond an opinion or commentary. In a narrative review, researchers can pursue an extensive description and interpretation of previously published writing on a chosen topic. Narrative reviews provide a flexible and rigorous approach to analyzing and interpreting the literature. Researchers conducting narrative reviews usually follow chronological order in their description and organize the manuscript according to introduction, methods, results, and discussion.

Purpose

1. Summarize and describe what is known on a topic; providing a context for new research.
2. Provide a subjective examination and critique of the entire body of literature related to a topic.
3. Give recommendations on advancing the field and provide insight of future areas of research; outlining the gaps.

Steps

1. **Identifying a Research Question:** The first step in conducting a narrative review requires researchers to describe the rationale and justification for the review. Authors should also provide a rationale for why a narrative review method was chosen.
2. **Searching:** When conducting a narrative review, it is important for researchers to name the databases being searched. Although the search terms are not always known at the outset of a narrative review, researchers should provide as much information as possible about how they developed their search strategy and search terms with appropriate rationale for the decisions made along the way; these are often shared via appendices. The search itself may include diverse fields with a wide range of methods.
3. **Screening:** It helps to specify inclusion and exclusion criteria; however, as a narrative review is not designed to be a comprehensive review of the literature, offering the rationale for specific parameters is important. Researchers should clearly define key terms related to the topic and research question and any definitions used. Authors should elaborate why they chose a particular definition if others were available and they should be clear and explicit about the choices they made, how they conducted screening, and which team members were involved. Authors should also consider how they assessed the quality of articles included in the review.
4. **Sampling:** Narrative reviews include a non-comprehensive and non-exhaustive sample of the literature on a specific topic. Different researchers may take different approaches depending on the purpose of the review. Researchers can limit their sample to peer-reviewed journal articles or may choose to use reference lists and grey literature, such as meeting abstracts and presentations.
5. **Analysis:** The exact method of analysis may vary since several different categories of reviews fall under the narrative review umbrella. Authors must provide examples that justify their interpretations and coherently demonstrate how their interpretations have been used to inform their conclusions. In general, all types of narrative reviews must include some form of both descriptive and interpretive analysis.

Narrative reviews

Components

1. **Introduction:** Provides background, rationale, and objectives.
2. **Body:** Organizes literature by themes or chronology, including critical analysis.
3. **Conclusion:** Summarizes findings, discusses implications, and suggests future research.
4. **References:** Lists all sources cited in the review.

Types

There are several subtypes of narrative reviews with distinctive methodologies; each offers a unique way of approaching the research question and analyzing and interpreting the literature.

- **Critical review:** is a narrative synthesis of literature that brings an interpretative lens
- **State-of-the-art:** attempts to summarize the research concerning a specific topic along a timeline of significant changes in understanding or research orientations.
- **Meta-ethnographic:** involves choosing and interpreting qualitative research evidence about a specific topic. Working exclusively with qualitative data.
- **Meta-narrative review:** seeks to explore and make sense of contradictions and tensions within the literature.
- **Theory integration:** conduct an analysis of the available theories addressing a phenomenon, critically appraise those theories, and propose an advancement in the development of those theories.

Strengths & Limitations

Strengths:

1. Flexible, rigorous and practical.
2. Provide a readable, relevant synthesis of a diverse literature.
3. Deliver a general overview, therefore, helpful in teaching or learning.
4. Useful for setting the stage for future research; they offer an interpretation of the literature, note gaps, and critique research to date.

Limitations:

1. It does not offer
   - Evidence-based synthesis for focused questions.
   - Definitive guideline statements.
2. Not often reproducible (can be addressed by being purposive, and transparent about the review process).

Tips for Effective Narrative Review Writing

1. **Clear Objective:** Define a clear purpose for the review, Avoid a broad or vague focus.
2. **Structured Outline:** Create a detailed outline to guide the writing process, tto ensure the review is well-structured and logically organized.
3. **Critical Perspective:** Maintain a critical and analytical approach throughout, rather than mere description.
4. **Consistent Style:** Ensure consistency in writing style and formatting.

Difference

between narrative review and systematic review

While a systematic review often focuses on a narrow question in a specific context with a prespecified method to synthesize findings from similar studies, a narrative review can include a wide variety of studies and provide an overall summary, with interpretation and critique.

Narrative	Systematic
Summary with interpretation and critique	**Narrow question in a specific context, an example of such a question would be what is the best course of treatment for strokes in elderly?**
can be conducted using a number of distinctive methodologies	**prespecified method to synthesize findings from similar studies.**
Wide variety of studies and sources.	**limits the dataset using explicit inclusion and exclusion criteria.**

click here for references

Overview

A systematic review summarizes the results of available carefully designed healthcare studies (controlled trials) and provides a high level of evidence on the effectiveness of healthcare interventions. Judgments may be made about the evidence and inform recommendations for healthcare.

The review plan

Review authors set about their task very methodically following, step by step, an advance plan called a protocol. The protocol describes the steps that will be followed when preparing a review. PRISMA and Cochrane are examples of widely used protocols.

The review questions

The purpose of the review is to assess the effects of [intervention or comparison] for [health problem] in [types of people, disease or problem], and healthcare setting if appropriate. The parts of the review question are often referred to as: PICO (Participants, Interventions, Comparisons and Outcomes).

The review data

The frame of searching and analyze the data depend on review protocol have been chosen. In general those steps are followed regardless type of protocol:

SEARCH FOR RELEVANT DATA	'EXTRACTION' OF RELEVANT DATA	ASSESS THE QUALITY OF THE DATA	ANALYZE AND COMBINE THE DATA
A search for relevant data from research that matches certain criteria. For example, only selecting research that is good quality and answers the defined question.	This can include how the research was done (often called the method or 'intervention'), who participated in the research (including how many people), how it was paid for (for example funding sources) and what happened (the outcomes).	Assess the quality of the data by judging it against criteria identified at the first stage	Analyse and combine the data (using complex statistical methods) which give an overall result from all of the data.

Titles of Cochrane reviews also have a set layout: Intervention for problem in a disease or population, and sometimes an outcome. An example is: Surgical excision margins for primary cutaneous melanoma. This is a statement of the types of population (participants in controlled clinical studies), types of interventions (and what they are compared to, even if it is no treatment), and the types of outcomes that are of interest.

You can find a full course for systematic reviews in the following link: Click here

Meta analysis

Definition

A meta-analysis is a statistical technique used to combine and summarize the results of multiple independent studies on the same subject to derive a more precise estimate of the effect size.
It aims to integrate the findings from various research studies to provide a comprehensive view of the evidence.

Components & Steps

1. Research Question Formulation: Clearly defined, often using the PICO framework (Population, Intervention, Comparison, Outcome).
2. Literature Search: Comprehensive and systematic search of multiple databases to identify relevant studies.
3. Screen Studies: Specific Inclusion and Exclusion criteria to determine which studies are selected for analysis.
4. Data Extraction: Systematic extraction of data and assessment of quality and risk of bias in the included studies.
5. Statistical Analysis: Combination of data using statistical methods to calculate overall effect size and assess heterogeneity.
6. Interpretation: Interpretation of results considering the quality and consistency of the included studies

Strength & Limitations

Strength	Limitations
• Combining data from multiple studies, meta-analyses increase the statistical power and precision of the estimates. • Provides a comprehensive summary of research findings on a specific topic. • Results can be more generalizable due to the inclusion of diverse populations and settings. • Helps to resolve uncertainties when individual studies show conflicting results.	• Variability in study designs, populations, interventions, and outcomes can complicate the analysis. • The tendency to publish positive results over negative or null results can skew the findings (Publication Bias) • The reliability of a meta-analysis is dependent on the quality of the included studies. • Conducting a meta-analysis requires advanced statistical skills and thorough understanding of the subject matter.

Example

A meta-analysis on the effectiveness of a new drug for reducing blood pressure would combine data from several clinical trials. It would evaluate the overall effect size, compare the results across different populations, and assess the consistency of the findings. The results would provide a more precise estimate of the drug's effectiveness and help guide clinical decision-making.

Differences between Meta–Analysis and Systematic Review

	Meta-Analysis	Systematic Review
Scope	Narrower scope, focusing on statistical combination and quantitative synthesis of data.	Broader scope, focusing on summarizing and appraising the entire body of evidence.
Methadology	Involves statistical techniques to combine data from multiple studies to produce a single effect size estimate.	Involves systematic literature search, study selection, data extraction, and qualitative synthesis.
Output	Quantitative synthesis, statistical estimates, and assessments of heterogeneity.	Narrative summary and qualitative synthesis.
Use Cases	Used to resolve discrepancies between study results, provide precise estimates of effects, and explore impact of moderators.	Used to provide a comprehensive overview of evidence, identify research gaps, and make recommendations.

click here for references

Randomized Controlled Trial (RCT)

Definition

A **randomized controlled trial (RCT)** is a type of scientific experiment that aims to reduce bias when testing the effectiveness of new treatments or interventions. RCTs are considered the gold standard in clinical research because they are designed to provide the most reliable evidence on the efficacy and safety of interventions

Key Characteristics of RCTs

Randomization:
Participants are randomly assigned to either the intervention group (receiving the treatment) or the control group (receiving a placebo or standard treatment). This random allocation helps to minimize selection bias and confounding factors, ensuring that the groups are comparable at the start of the trial.

Control Group:
The control group serves as a benchmark to compare the effects of the intervention. Controls can receive a placebo, no treatment, or the current standard of care.

Blinding:
Blinding (or masking) can be single-blind (where participants are unaware of their group assignment) or double-blind (where both participants and researchers are unaware). Blinding helps to prevent bias in the treatment administration and outcome assessment.

Outcome Measures:
RCTs have clearly defined primary and secondary outcomes to measure the effect of the intervention. These outcomes are decided before the trial begins.

Advantages of RCTs

Causal Inference: RCTs provide strong evidence for cause-and-effect relationships between the intervention and outcomes due to randomization and control.

Minimized Bias: Randomization and blinding reduce selection bias, performance bias (care), and detection bias.

Reproducibility: RCTs have a rigorous design that can be replicated in different settings or populations to verify results.

Limitations of RCTs

Cost and Time: RCTs can be expensive and time-consuming to conduct due to the need for large sample sizes, long follow-up periods, and extensive data collection.

Ethical Considerations: Ethical issues can arise, particularly when withholding potentially beneficial treatments from the control group or exposing participants to potential risks.

Generalizability: Results from RCTs may not always be generalizable to real-world settings due to strict inclusion and exclusion criteria.

Resources for Conducting RCTs

- **CONSORT Statement**: Guidelines for reporting RCTs. (http://www.consort-statement.org/)
- **ClinicalTrials.gov**: Register your trial and access resources for trial conduct. (https://clinicaltrials.gov/)
- **NIH Clinical Research Resources**: Tools and templates for conducting clinical research. (https://www.nih.gov/research-training/clinical-research-resources)

Finding the RCT idea

• **Replicate and Extend**: Consider replicating a previous study with a larger sample size, different population, or improved methodology.

• Extend previous work by exploring new variables, outcomes, or interventions that were not covered in earlier studies.

• **Networking and Conferences:** Attend conferences, workshops, and seminars to meet experienced researchers and clinicians. Networking can lead to collaborations and provide opportunities to discuss your ideas with a wider audience.

• **Collaborative Discussions:** Schedule regular meetings with your seniors to discuss your research ideas. Prepare a brief presentation or outline to facilitate focused and productive discussions.

Overview

A scientific manuscript is an original text of an author‘s work which is submitted to a publisher. The structure of a manuscript follows strict criteria by the scientific method. It includes different sections that provide the reader with the information needed to understand what was done and what results found, and it depends on the journal to which the article is being submitted.

Manuscript preparation

- Create a digital folder where you keep all the research-related work.
- Create Sub folders for results, papers, figures, manuscripts, archive (IRB).
- Share the folder with the authors.

The scientific manuscript is made up of the following sections: (see Appendix)

Title page

Abstract and key words

Introduction

Methods

Results

Discussion

Conclusion

Referances

Tables and Graphs

Title Page

Title of the manuscript
It should be simple, concise and informative.

Authors' names and institutional affiliations.

Contact information for corresponding author
The name, mailing address, telephone and e-mail address of the author responsible for all correspondence about the manuscript.

Source(s) of funding
It includes the sources from which funding was provided to carry out the study, if any.

Conflict–of–Interest
To prevent potential conflicts of interest from being overlooked or misplaced, this information needs to be part of the manuscript.

Abstract and key words

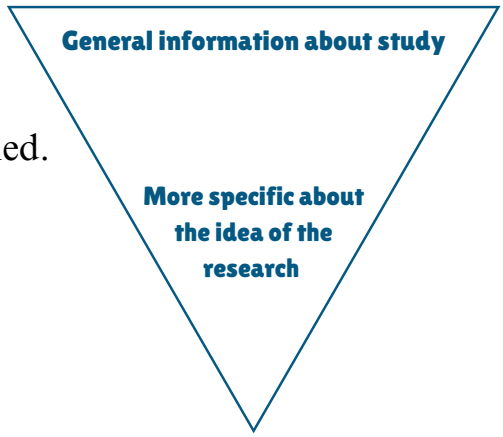
An abstract summarizes the major aspects of the entire research project. The length of the abstract should be kept between 200-300 words maximum (a typical standard length for journals.) Although there are various abstract forms, which depend on each journal; **generally, an abstract should include the following parts:**

- Objectives or study aims
- Methods, such as study design, sample size, inclusion/exclusion criteria, and data collected
- Results found which highlights the main findings of the study
- Conclusion which summarizes the main conclusion of the study

The abstract helps readers decide whether they want to read the rest of the paper, and it is may be the only part they can be obtained via electronic literature searches; therefore, Sufficient information need to be included to make it comprehensive by itself. It is usually the last part written to make sure that the information in it is in agreement with what is written in the paper.

Introduction

The introduction provides a context or **background for the study** (nature of the problem and its significance) supported by data from the available literature, the study objectives and questions that were answered by the study. The structure of the Introduction can be thought of as an **inverted triangle**: (Picture)



The broadest part at the top (early in the introduction) which represent the most **general information** and focusing down to narrow the context to the specific problem you studied.

Finally arriving at your statement of purpose and rational. It should be able to drive the readers to understand and agree that the idea of the study performed is necessary and reasonable.

Methods

In this section, the following should be explained:

- The study design
- Time and place of the study
- Inclusion and exclusion criteria
- Sampling technique (subject selection) and Sample Size
- Information collected throughout the study
- Informed-consent (if applicable)
- Statistical analyses used to reach the results

Results

The study results must be presented in a logical sequence in the text starting from the most high-level vantage point. Overview of the study sample should be provided , followed by results related to the objective of the study. **This section serves as a summary of the tables, but it should not replicate them, rather it should highlight the most important findings.**

Discussion

This section **emphasizes the new and important findings** in light of what is found in the literature. Results should not be repeated in this section, rather implications of the results should be addressed. **Specifically, this section should include possible mechanisms or explanations for the findings**, comparison of the results with other relevant studies, indication to the strengths and limitations of the study, as well as implications for future research and for clinical practice.

Conclusion

This section includes the take home message and summarizes the **potential significance of the paper and final implications on similar research or clinical practice** concluded from the study.

References

It is a list of published scientific material (papers, books, etc.) that were used in the manuscript.
Citations SHOULD NEVER be done manually.Get a reference manager from day 1.
There are different Citation and referencing styles, most common are AMA, NLM, Harvard, Chicago.

Tables and graphs

It is a list of published scientific material (papers, books, etc.) that were used in the manuscript.

Some tips after writing the manuscript

- Read it few times to make sure it flows well, and is free from typos, incomplete sentences, and grammatical errors.
- Give it to some colleagues for review and final comments.
- After the manuscript has been written according to the guideline provided by the journal, and once the researcher is comfortable with the manuscript as it stands, submission to a scientific journal is next.

Manuscript Submission

Choosing the appropriate journal for publishing your research papers is a tiresome process. Research paper should be submitted to a journal whose target audience and scope is relevant, otherwise the chance of the publication will be low.

Factors to be considered during journal selection

- If the journal is peer-reviewed or not
- Scope of the journal
- Does it publish original research or review papers
- Impact factor of the journal
- Average duration of review process
- Does it have online submission system?
- Cost of publication (page charges etc.)

Cover letter

A cover letter should be prepared and submitted along with the manuscript. It should include the following:

- A statement that the manuscript is original work of the author and has not been published before in another journal or other media
- Statements about any sponsor that potentially may cause any conflict of interest
- A statement that the manuscript has been read and approved by all the authors
- The name, address, and telephone number of the corresponding author, who is responsible for communicating with the journal

The next step is to submit the manuscript to the selected journal, following the step-by-step submission process, which varies from journal to journal. Most of the scientific journals nowadays accept electronic submission of manuscripts. Authors should consult the journal's Instructions for Authors for detailed description of the submission process. Many journals provide a pre-submission checklist to help the author ensure that all the components of the submission have been included.

Submission Response

The time between submission and receiving the response from the journal could be as short as a day and as long as few months.

There are three possible responses to the submission of the paper

Acceptance as it is	Indicates that the editorial office, **accepts the manuscript without any further modifications**, which is rarely the case. Accordingly, the next step is to finalize the process by signing the copyright transfer agreement that is specific to each journal.
Conditional acceptance	Indication that the manuscript has good chances of being accepted for publication. Usually, lists of comments are sent to the author. Some of these comments could be minor (such as typos) or major (such as further analyses). **The next step for the authors is to address each and every comment received with as much details as possible**, by either abiding by the suggestions or by not taking them into consideration. In either case, the authors should justify their action. At this point, the modified draft of the manuscript, along with a point by point letter addressing the comments should be sent to the journal, through the online system. It might take few rounds of revisions before the manuscript is accepted. **So, you will send two files for the journal: the edited manuscript and a sheet with the answers for their comments**
Rejection	Indicates that the manuscript is rejected for publication in that journal, for reasons that might be based on the topic, the quality, the conclusion, or just that it does not fall within the scope of the journal. At this point, the authors should look for another journal to which they should submit their manuscript. Although the publication process might be time and effort consuming, it is very important and it gets easier with time, as the researcher publishes more papers. One last thing to keep in mind is that most research projects are publishable in scientific journals, but the type and impact of the journal in which it will be published might differ.

Appendix: Manuscript Template

Title Page

Authors

Affiliations

Corresponding author

Conflict of interest:

Abstract

Background:

Objectives:

Methods:

Results:

Conclusion:

Keywords:

Introduction

1- Background information about the topic

2- What is known

3-Gap in knowledge

Conclude the Introduction section with a statement about the objective(s) of the study

Methods

Study design:

Setting:

Study population:

a. Inclusion criteria

b. Exclusion criteria

Sampling: (Selection of patients)

Appendix: Manuscript Template

Data collection:
1.Method of data collection
2.Data collected
I.Information
a. what
b. when
II.Questionnaire used

Endpoints:
Ethical considerations:
4- IRB approval
5- Consent forms
6- Confidentiality

Statistical analyses:
I. Program used
II. Data cleaning
III. Data management
IV. Data analyses

a. Univariate
b. Bivariate
c. Multivariate

Results

Overall description of participants (demographic characteristics and socioeconomic profile)
Summary of findings
Multivariate analyses

Discussion

Summary of study and findings

1. Overall methodology and objective

2. Overall finding

Comparison with literature (comparing results to similar studies) Strengths and limitations

Future recommendation

Conclusion (final statement about the overall study)

Tables and graphs

References

Introduction

A manuscript is a written, typed, or word-processed document submitted to a publisher by the researcher. And a well-written manuscript has the following components included: a clear title, abstract, introductory paragraph, methods and materials section, discussion of results, conclusion and a list of references. Manuscript submission is an organized, planned and a supervised process, which helps both the author and editor.

Process of Submitting a Manuscript

The manuscript submission process nowadays is online. Most publishers have their own electronic manuscript submission system. Some of the popular manuscript submission systems are ScholarOne used by SAGE and Nature Publishing Group, Editorial Manager used by Springer, Wiley and PLOS and Evise used by Elsevier. These systems are designed to simplify and speed up the journal submission process.

Most of this submissions systems are self-explanatory and the following common procedure is generally used:

The first step is to have a manuscript ready for publication. Ensure that it is prepared in accordance with the journal guidelines.

Next, you need to register or create an account that can be used even for your subsequent submissions to the journal. Usually this account should be created and maintained by the corresponding author of the manuscript as this would also serve as a communication interface between the author, editor and peer reviewers.

Once you have this account, **the next step** would be to fill in details about your manuscript such as the title of your paper, the list of authors, the affiliation of each of the authors, keywords, etc. Some journals may also ask for a list of preferred reviewers.

Once these details are filled in, you can proceed to uploading your manuscript to the submission system.

You may also be asked to upload supplementary information and a copyright transfer form if applicable.

Once all of the above mentioned information is entered, you will be prompted to review your details. Finally, you must carefully review the converted PDF file to make sure that all the equations, tables, and special characters are shown properly. Once approved and submitted, the converted file will be viewed by editors and referees.

Process of Submitting a Manuscript

These systems usually give you an option to fill in your details and save your work if you are not able to complete it at a single go. You can submit it later, once you complete the application. Also, if you do not complete the application in the stipulated time, they will send you a notification before they delete your incomplete application.

The Ethical Aspect

Ethical aspects in research publication are all the moral issues and problems raised by any behavioural misuse or abuse of the system for communicating scientific results and information within the international scientific community. Misuses or abuses include plagiarism, self-plagiarism, fraudulent and repetitive publication, unethical or fabricated data publication, censoring negative data, guest-, ghost-, and gift-authorship in multi authored papers, conflict of interests involving authors, editors, or referees, censoring and rejecting publications on biassed judgement, selective reporting, copyright breaches, confidentiality and informed consent infringements.

Research ethics matter for scientific integrity, human rights and dignity, and collaboration between science and society. These principles make sure that participation in studies is voluntary, informed, and safe for research subjects.

The Time Aspect

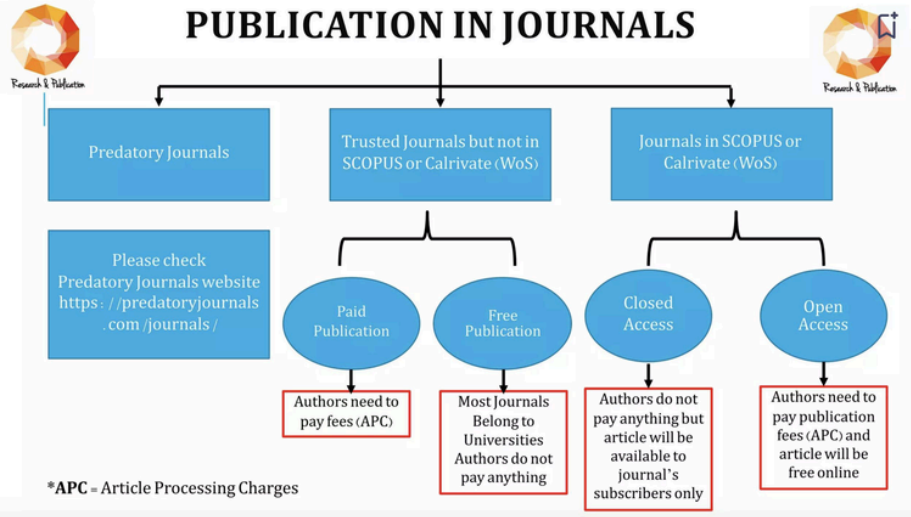
Generally speaking journals have multiple issues on some schedule from weekly to annually. A paper can be submitted at any time. The review process will then proceed and the paper may be revised on recommendation of reviewers. When the paper is ready for publication, an editor (managing editor) will schedule it for some future issue.

So, there is no real deadline for normal journal submission. However, there is no guarantee that a paper submitted right now will be published soon. The review process takes time and there can be delays. But earlier submission (of a well written paper) is preferred. Submitting a sloppy paper early and hoping for early publication is probably a bad idea. The review will take longer and rejection is possible.

Open vs Closed Access Journals

The main difference between open and closed access journals lies in the free availability and reusability of the former and in the way they are funded. In the case of traditional closed access (subscription-based) journals, the readers, or their institutions and scholarly libraries, pay high fees for access to the articles. Open access publications, by contrast, can be used free of charge.

Journals Types



Identifying predatory journals

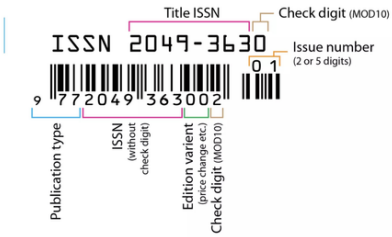
1-No standard identifiers, like ISSNs or DOIs

Publishers whose sole purpose is to scam people to make more money do not have standard identifiers, like DOIs or ISSNs.

Some who actually do, often do not know how to use them properly.
Spend some time googling the ISSN or journal title for a few minutes and carefully read through the results. You should be able to spot a scam pretty quickly.

Sometimes a quick google check of the email ID from which you received the message can also help find posts on forums where others have already mentioned about the scammer.

2-The scope of the journal is too wide



Scholarly peer-reviewed journals often focus on a particular niche under a broad discipline.

For example, Mediterranean Politics published by Taylor Francis focuses on research related to international relations and contemporary politics in the Mediterranean Sea and areas surrounding it

3-Poor online presence

Dead links, gruesome grammatical errors, unlicensed images, too many ads and misspellings are all indicators of a non-credible publisher website.

Identifying predatory journals

4-No transparency about article processing charges or APC

Many international journals now charge APS, especially when it is an open access journal.
But mostly the fee is payable when the journal has already gone through the entire process of getting your paper peer reviewed, copyedited, and typeset for free, and have been accepted for publication.
An important distinction to make here is that all reputed journals, even if they charge
APS, will reveal the chargeable amount beforehand on their website.
With predatory publishers however, even if they mention about APS beforehand, they mostly do not reveal the exact amount upfront.
Another malignant practice is for such publishers to charge PC and still require authors to transfer and retain the copyrights of their work to the journal. Some even ask for it at the time of submission of manuscripts.

5-The journal is not well-indexed

Reputed journals are well-indexed and have widespread coverage in the databases of library holdings, like Google Scholar searches, EBSCOHost and Ingenta and others since they are recommended by peer groups and are recognized for their good standing.
SCOPUS, Directory of Open Access Journals (DOAJ), the International Bibliography of the Social Sciences (IBSS), ISI (Web of Science), the Norwegian List, SSherpa-Romeo, WorldCAT, and ciELO (in South Africa) are all well-known indexes.
While a library or Google Scholar is not counted as a database, you can always check DOAJ. Some journals might list DOAJ index, but you must check the DOAJ list for the journal's name to confirm if their claim is true.

6-Officials of the journal use email addresses of a free email supplier like Gmail

Take this one with a pinch of salt. Only because an editor mailed you from a Gmail ID doesn't mean it is a bogus journal.
Sometimes good journals hire independent editors or the journal itself might not be housed under one university. In such cases, email providers, like Gmail or Yahoo prove to be a good alternative as you can avail great cloud storage at no cost.
Unless you notice some other red flags along with this one, use your discretion in how you want to proceed. A publisher with no online submission platform and only a gmail address to send submissions is another warning sign.

Click for BALL'S LIST OF PREDATORY JOURNALS AND PUBLISHERS

Selection of a target journal

1-Check how many issues per year

check journal issues per year if only twice that means they take long time to evaluate.

2-Choose journal with publisher and not a university

Publisher tend to be faster as they have people working in the editorial board so they process faster. Journals attached to University, editorial board usually lecturer and staff who got other jobs to do so the process is slow.

3-check similar titles published in which journals before

Can check using google scholar

journal finders websites

- http://journalfinder.elsevier.com
- https://www.springeropen.com/get-published/find-the-right-journal
- https://www.edanz.com/journal-selector

Designing a Questionnaire steps

State Objectives: Clearly state the primary and secondary objectives of your study.

Identify Variables: Identify and list the information/concepts needed in relation to these objectives.

Literature Review: Review relevant literature for already validated questionnaires aligned with your area of interest.

1st Draft: Draft an initial version of your questionnaire.

Revise: Revise the draft questionnaire based on feedback and effectiveness.

Finalize: Finalize the questionnaire by incorporating necessary changes and updates.

Variables to be collected

- Create a detailed list of information to be collected (Knowledge, Attitude, Practice (KAP), Needs, Risk factors, Behaviors, Demographics, etc.)
- Translate this information into measurable variables.
- Determine the role of each variable in statistical analysis: Predictor (independent), Outcome (dependent), or Confounder factor.

Examples of variables to be collected

Demographic Variables:

- Age (continuous)
- Gender (categorical: Male/Female/Other)
- Ethnicity (categorical: Hispanic/Latino, African American, Caucasian, Asian, Other)
- Socioeconomic Status (categorical: Low, Middle, High - based on factors such as income, education level, and occupation)

Vaping Related Variables:

- Vaping Frequency (ordinal: Never, Occasionally, Regularly, Daily)
- Type of Vaping Product Used (categorical: E-cigarettes, Vape Pens, Mods, Others)
- Duration of Vaping Habit (continuous: years/months of vaping)
- Cessation of Vaping (binary: Yes/No - If they have ever stopped vaping for a certain period)

Designing a Questionnaire

Examples of variables to be collected

Mental Health Related Variables:

- Presence of Anxiety Disorder (binary: Yes/No - based on a clinical diagnosis)
- Anxiety Disorder Severity (ordinal: Mild, Moderate, Severe - as rated by a clinician)
- Self-reported Stress Levels (continuous: Based on a validated stress scale like the Perceived Stress Scale (PSS))

Other Potential Confounding Variables:

- Physical Activity Levels (ordinal: Sedentary, Low, Moderate, High)
- Sleep Quality (ordinal: Poor, Fair, Good, Excellent - based on a validated sleep scale like the he Pittsburgh Sleep Quality Index (PSQI))
- Family History of Mental Health Disorders (binary: Yes/No)
- Other Substance Use (binary: Yes/No)

Literature Review

1. Review recent studies to identify surveys and data collection tools used for similar research objectives.
2. Look for validated questionnaires to save time and provide detailed items.
3. Compare your results with previous studies for validation and novelty.

Drafting the Questionnaire

Decide: Decide the mode of survey administration: face-to-face, self-administered, phone or email.

Draft: Draft more questions than the final version to ensure comprehensive coverage.

Prioritize: Prioritize important items in the first half of the questionnaire.

Ensure: ensure questions flow logically from one to the next.

At the top:
- Introduce yourself briefly - The purpose of the study - How the data will be used
- Instructions on how to fill out the questionnaire & how long will it take to fill it in Your policy on confidentiality

Finalizing the Questionnaire

- Group related questions under descriptive headings.
- Arrange questions logically and with the intent to provoke recall.
- Format questions to ensure unbiased and balanced results.
- Ensure the first half of the questionnaire includes the most important items. 5-Ensure logical flow between questions.

Avoid Leading Questions:

1. Do not suggest a particular answer within the question.
2. **Biased**: "How much do you agree that our service is excellent?"
3. **Unbiased:** "How would you rate our service?“

Use Simple and Clear Language:

4. Ensure that questions are easy to understand and free of complex terms.
5. **Complex**: "To what extent do you find the nutritional guidance provided by our dietary program efficacious?"
6. **Simple:** "How effective is our dietary program's nutritional guidance?"

Balanced Response Options

Provide Balanced Scales: Ensure response scales are balanced and offer a neutral option.
Biased: "How satisfied are you with our service? (Very satisfied, Satisfied, Dissatisfied)"
Unbiased: "How satisfied are you with our service? (Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)“

Include All Possible Options: Offer a full range of response options and consider an "Other" category for responses not covered.
Biased: "What is your primary source of news? (TV, Newspapers, Online)"
Unbiased: "What is your primary source of news? (TV, Newspapers, Online, Other)"

Avoid Double-Barreled Questions

Ask One Thing at a Time: Ensure each question addresses only one issue.

Biased: "How satisfied are you with the clarity and accuracy of the information?"
Unbiased: "How satisfied are you with the clarity of the information?" and "How satisfied are you with the accuracy of the information?

Testing

Testing the Survey Instruments:

Focus Group Discussions:

An interactive group setting where participants are guided to discuss the survey.

Cognitive Interviews:

Method to understand how participants perceive, understand, and respond to survey questions.

Field Pre-Testing:

A small-scale study where all conditions of the full-scale survey are simulated.

Field Pre-test:

- Field pre-testing involves mimicking the conditions of the full-scale survey in a smaller, controlled environment.
- Different survey modes can be tested in this stage.
- Interviewers can provide both oral debriefing and written reports on the pre-testing process.

Surveys vs Questionnaires

Aspect	Survveys	Questionnaires
Definintion	Broader method of data collection	Specific tool for data collection
Purpose	Gather information on a wide range of topics	Collect specific information on a topic
Format	Includes various question types and methods	Set of written questions with defined responses
Scope	Large sample, generalizations about population	Focused on specific data points or groups
Complexity	Comprehensive, multiple sections/themes	Varies from simple to complex, but focused
Examples	National health surveys, patient satisfaction surveys	Patient health questionnaires (e.g., PHQ-9)
Mwthodoligy	Multiple data collection methods	Typically paper-based or digital forms
Application	Understand broader trends and patterns	Target specific information

Questionnaire Validation

Introduction

Questionnaires are widely used in research and evaluation studies to collect data from individuals or groups. A well designed questionnaire can provide valuable information and insight into a particular topic or issue. With that being said, to ensure the accuracy and reliability of the collected data, it's of great need to validate the questionnaire first.

Questionnaire validation

Is the process of assessing the quality and effectiveness of a questionnaire to ensure that it precisely measures the phenomena of interest, that's implemented by evaluating questionnaire's reliability, validity, and usability to ensure that the data is representative of its population and meaningful to it too.

Psychometric assessment of a questionnaire

It involves evaluation of four main domains naming feasibility, reliability, validity and sensitivity to change. By which it ensures good quality data with significant comparability and credibility. Of them, the most important concerns of newly designed questionnaires are Reliability and validity.

Feasibility

The feasibility of a questionnaire is determined by a pilot study conducted on 30 subjects yet as the number of subjects. The points to consider in this domain are time taken to fill the questionnaire, simplicity of the format, clarity of the questionnaire, ease of scoring, and results interpretation

Feasibility Concerns	Explanation
Time taken to fill the questionnaire	5 min - 20 min
Simplicity	Using simple non complex words
Clarity	Not using misleading, heading descriptions
Ease of scoring	I.e. Likert scale (Strongly agree exc)
Results interpretation	Easily transition from quantitative to qualitative data

Reliability & sensitivity to change

Reliability is an indicator of precision of the questionnaire i.e. it evaluates if the questionnaire consistently determines what it intends to determine. A low reliability shows that the results of the questionnaire may vary greatly if the data is collected again with the same participants. For instance, if a participant scored 10 out of 50 on an HIV knowledge questionnaire yet scored 45 the next time, the questionnaire becomes unreliable.

Reliability is proved by pilot study measuring aspects of **stability**, **internal consistency** and **equivalence**.

	Test retest	Split half	Interrater
What it measures?	Stability over time	Equivalency of times	Agreement between raters
How it is accomplished?	Administer the same test to the same people at two different times. **Advantages**: • Easy and straight-forward approach • Useful for questionnaires, checklist, rating scales, etc... **Disadvantages:** • Practice effect (mainly for tests) > Inflating reliability • Too short intervals in between (effect of memory) • Some traits may change with time.	Correlate performance for group of people on two equivalent halves of same test.	Have multiple researchers measure same instrument and determine percentage of agreement between them.

Validity

A questionnaire can be reliable but invalid but a valid questionnaire is always reliable. Validity is the degree to which a questionnaire evaluates what it is intended to evaluate. Which resembles four types naming face validity, content validity, construct validity and criterion validity. To choose the suitable type of validity it mainly relies on the goals of the study.

Validity	Explanation
Fave validity	The degree to which a questionnaire 'appears' to evaluate what it was designed to evaluate
Content validity	The extent to which the questionnaire describes most of the dimensions of the concept under study
Constructed validity	The degree to which a questionnaire reflects the theory of the phenomena or concept of the designed study or relationship between questionnaire and underlying theory
Criterion validity	How well the questionnaire correlates with an existing 'gold standard' measure that can predict the disease outcome and is taken as a reference to evaluate validity. It is of two types: predicative validity and concurrent validity. • Predicative validity: for tests used to predict future performance. • Concurrent validity: for tests used to estimate present performance or a person's ability at the present time, not attempting to predict future outcome.

Introduction

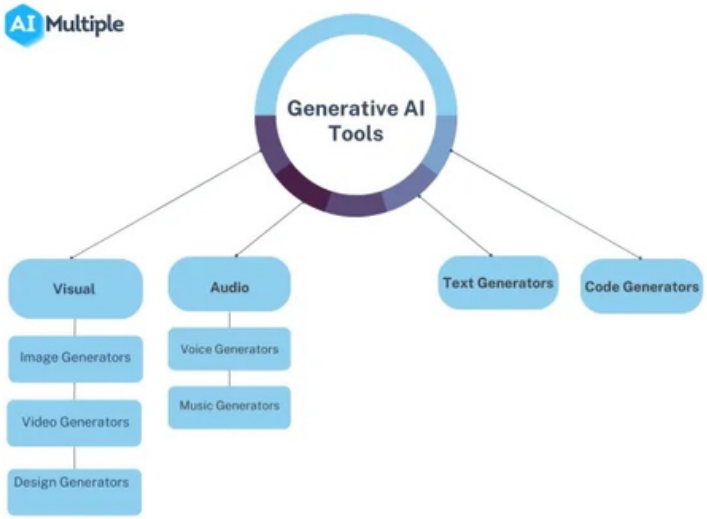
Academic writing is a fundamental component of research, characterized by structured expression of ideas and logical reasoning. Nevertheless , it poses obstacles such as handling vast amounts of information and complex ideas. The integration of Artificial Intelligence (AI) into academic writing has become increasingly important, offering solutions to these obstacles. As AI has become an invaluable tool in academic writing, it has also contributed to various steps in the research process, hence, these tools are not just helpful but central to improving the efficiency and the overall quality of research papers.

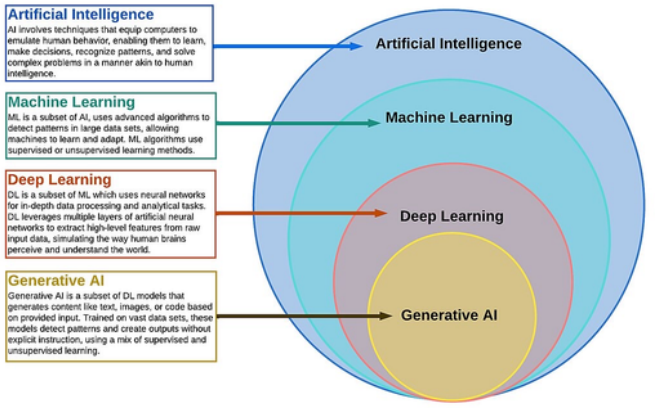
WHAT IS AI?

Artificial intelligence (AI) is the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns.

WHAT IS GENERATIVE AI?

Generative AI, or GenAI, is a subset of artificial intelligence technology that creates something new from a dataset of previous examples.





Unraveling AI Complexity - A Comparative View of AI, Machine Learning, Deep Learning, and Generative AI.

(Created by Dr. Lily Popova Zhuhadar, 07, 29, 2023)

ETHICAL CONSIDERATIONS IN AI TOOLS FOR RESEARCH

1. Bias and Discrimination: AI tools may perpetuate biases, leading to discriminatory outcomes. Validate content with reliable sources.

2. Plagiarism: AI-generated content can paraphrase from sources, raising plagiarism concerns. Be aware of tools detecting AI content.

3. Data Privacy and Legal Issues: Using AI with sensitive data types is prohibited and could lead to legal issues if data becomes public.

4. Data Misinformation: AI tools can generate inaccurate data. Cross-reference with reliable sources for accuracy in research.

Research steps in which AI helps– Summary

Research Step	How to Use AI Tools	Examples
Identifying a Research Topic	Brainstorming ideas, exploring trends and gaps	OpenAI ChatGPT, Googlr Gemini and Microsoft Bing Copilot
Conducting Literature Review	Searching and summarizing relevant academic papers	SciSpace, Litmap, Semantic Scholar, CHatPDF
Managing References and Citations	Organizing and formatting citations	Zotero, Mendeley, EndNote
Data Collection	Designing surveys/experiments, gathering data	Google Form and SurveyMonkey and Qualtrics
Data Analysis	Analyzing data, applying statistical/machine learning techniques	IBM Watson, RapidMiner, Orange GitHub Colilot, Google Colab AI Coding Tool
Writing and Reviewing the Paper	Drafting sections, Refining the draft	OpenAI ChatGPT, Grammarly
Checking for Plagiarism	Ensuring sources are properly cited, addressing plagiarism and Detecting AI Content	Grammarly, Originality.ai , ZeroGPT, Scispace, Scribbr, Copyleaks
Preparing Presentations	Creating and designing presentation slides	Smart Slides ChatGPT plugin

Using AI with the research process step by step

1) Research Idea Development

AI tool / Website	Picture	Description	Link
Miro		a visual collaboration tool used for research synthesis, ideation, and project planning. useful for: • Consolidating insights from multiple research tools onto a single board. • Finding connection points.	Miro Assist
Trello		project management website that provides AI tools to manage multiple projects, collaborate & communicate with global teams, and streamline their workflow.	Trello
Creately		organizing findings, creating flowcharts, mind maps, and diagrams to visualize data and concepts, and automating certain tasks to streamline the research process.	Creately
conceptboard			Conceptboard
Scisummary		assist in summarizing scientific articles quickly and efficiently.	SciSummary
Humata			humata

Using AI with the research process step by step

2) Hypothesis generation

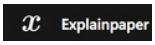
AI tool / Website	Picture	Description	Link
HyperWrite	HyperWrite	Assist in formulating clear and concise hypotheses based on the research topic and objectives provided.	HyperWrite

3) Literature Review

AI tool / Website	Picture	Description	Link
LATERAL	LATERAL	• Simplify literature reviews by automatically creating reference tables. • Act as an AI research assistant to suggest relevant content and help evaluate and draw connections between sources.	Lateral
SCISPACE	SCISPACE	• Simplifies and improves understanding of research papers • Identifies gaps in the literature • Expedites the research process	https://scispace.com/
Elicit	Elicit	Analyzing research papers at a rapid pace, allows search for research papers using natural language queries and provides one-sentence abstract summaries.	Elicit
Elephas		summarize research papers and organizing them in a centralized system	Elephas App
Scinapse	scinapse	• Identifying key trends in any research field. • Providing a comprehensive view of the latest research in their field of interest.	Scinapse

Using AI with the research process step by step

3) Literature Review

AI tool / Website	Picture	Description	Link
refseek		• narrowing down search results to academic and scientific resources. • helps locate relevant academic search results from web pages, books, encyclopedias, and journals	RefSeek
Science Open.com		uses AI to offer smart search capabilities, helping users find relevant articles quickly within an interactive interface.	ScienceOpe n
Consensus		It enables researchers to quickly find relevant studies	consensus
Research Rabbit		• suggestions of similar works and earlier studies. • simplifies the citation and reference management process, generating citations in various formats and organizing references for consistency and accuracy.	Research Rabbit App
Connected Papers		• Bibliography Creation: Researchers can start with key references for their bibliography and use Connected Papers to discover additional relevant papers.	Connected Papers
Explainpaper		• AI-generated explanations of papers	Explainpaper
Scholarcy		• summarize documents of various types, including PDFs, book chapters, articles, and even videos.	Scholarcy

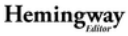
Using AI with the research process step by step

4) Writing and Drafting

AI tool / Website	Picture	Description	Link
ChatGPT	ChatGPT	Writing Assistance: helps enhance writing skills, and summarizes texts.	ChatGPT
WordTune	wordtune	Writing Assistance: helps enhance writing skills, and summarizes texts.	Wordtune
Gemini	Gemini	Writing Assistance: helps enhance writing skills, and summarizes texts.	Gemini
Copilot	Copilot	• Paper Explanation • Interactive Assistance	Copilot
Quillbot	QuillBot	• Paraphrasing • Summarizing • Citation Assistance. • Plagiarism Detection	QuillBot AI
Grammarly	grammarly		Grammarly
Paperpal	Paperpal	Online paraphrasing tools	Paperpal
SpinBot	SpinBot		spinbot
WordAI	WordAi		wordai
spellcheckplus	SpellCheckPlus		spellcheckplus
OutWrite	Outwrite		outwrite
DeepL	DeepL		deepl
paraphrase online	Paraphrase-Online		paraphrase online

Using AI with the research process step by step

4) Writing and Drafting

AI tool / Website	Picture	Description	Link
enago		Proofreading tools	enago
Hemingway editor			Hemingway editor
Sentence Stack			Sentence Stack

5) Study designs– systematic review

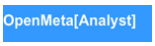
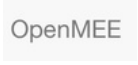
AI tool / Website	Picture	Description	Link
covidence		• employs machine learning to streamline the systematic review process in research. • automating the screening of titles and abstracts, thus saving time and improving the efficiency of conducting systematic reviews.	Covidence
cochrane		• automate and improve the efficiency of systematic review production. • This includes machine learning for identifying relevant studies and data extraction.	Cochrane
CADIMA		allow for offline data extraction	cadima

Using AI with the research process step by step

5) Study designs– systematic review

AI tool / Website	Picture	Description	Link
SRDR		Data extraction tools for better management, categorization, and refining data gathered from studies in systematic reviews.	srdrplus
DistillerSR			distillers
Rayyan			rayyan

5) Study designs– Meta analysis

AI tool / Website	Picture	Description	Link
The metafor Package		Support the meta-analysis process	The metafor Package
OpenMeta[Analyst]			open meta
OpenMEE			openmee
PredicTER			predicTER

Using AI with the research process step by step

6) Data collection

AI tool / Website	Picture	Description	Link
Microsoft Forms	Microsoft Forms	• assists users in creating surveys • streamlines process by generating draft content and suggestions	Microsoft Forms
Google Forms	Google Forms	• Create surveys to gather data, then use AI tools to analyze responses and extract meaningful patterns. • Implement AI scripts to automate tasks like sending thank-you emails to respondents and organizing data in spreadsheets.	google forms
Survey monkey	SurveyMonkey	• assists users in creating surveys • provides analysis tools such as cross-tabulation, filtering, and statistical significance testing to aid in data interpretation • Multiple users can collaborate on survey design and data analysis.	SurveyMon key
Red Cap	REDCap	• assists users in data collection • Assist in data management, particularly in clinical trials and longitudinal studies.	REDCap
surveyplanet	surveyplanet	• assists users in data collection	survey planet

7) Data Management and analysis

AI tool / Website	Picture	Description	Link
Prism	Prism	automating tasks such as literature reviews, data extraction, and analysis, and by identifying patterns and insights that may be difficult to identify manually.	Prism
infogram	infogram	particularly useful for presenting complex data in a visually appealing and easily understandable format (creating informative infographics, reports etc.).	Infogram
SPSS	IBM SPSS	It's a powerful software suite that allows to handle, analyze, and present data in various forms.	SPSS

Using AI with the research process step by step

7) Data Management and analysis

AI tool / Website	Picture	Description	Link
Stata		used in data management, statistical analysis, and graphical visualization.	Stata
JMP statistical discovery		provides a comprehensive set of statistical tools and techniques, ensuring validity of data analysis	JMP
Sas (Statistical Analysis System)		enables users to retrieve, report, and analyze statistical data.	SAS
R		for statistical computing and data visualization	R
Power BI		Data visualization tools	power bi
Tableau			tableau

8) Citation

AI tool / Website	Picture	Description	Link
Zotero		• designed to help researchers collect, organize, cite, and share research sources. • particularly useful for managing bibliographies and references.	zotero
Mendeley			mendeley
JabRef			jabref
EndNote			endnote

Using AI with the research process step by step

8) Citation

AI tool / Website	Picture	Description	Link
Cite this for me	Cite This For Me™ a Chegg service	Reference Management tools	citethisforme
ProQuest RefWorks	ProQuest RefWorks		proquest
RESOOMER	RESOOMER		resoomer

9) Journal selection and submission

AI tool / Website	Picture	Description	Link
PLAGIARISMA	PLAGIARISMA	plagiarism checkers before submissions	plagiarisma
PlagScan by Turnitin	PlagScan by Turnitin		PlagScan by Turnitin
iThenticate	iThenticate		iThenticate
Small SEO Tools	SmallSEOTools		Small SEO Tools
Researcher Life	Researcher.Life by Editage	• It provides comprehensive information about the journal's classification. • can determine open access journals only. • can determine a specific range of the impact factor. • it provides detailed information for each journal	Researcher Life

Using AI with the research process step by step

9) Journal selection and submission

AI tool / Website	Picture	Description	Link
Journal Finder	Journal Finder	Finds suitable journals for your Research paper	journal finder
JournalGuide	JournalGuide		journal guide
MDPI	MDPI		mdpi
SJR	SJR		SJR

10) Conference participation

AI tool / Website	Picture	Description	Link
Smart Slide		• **Real-time AI Chat:** Instant AI-powered chat support directly within presentation slides. • **Natural Language Processing:** Understands and responds to queries in natural language. • **Content Generation:** Assists in creating slide content based on user input. • **Interactive Q&A:** Facilitates interactive question-and-answer sessions during presentations. • **Integration:** Seamless integration with presentation software for enhanced functionality.	Smart slide
WikiCFP	WikiCFP A Wiki for Calls For Papers	Discover the top conferences in a given field.	wikicfp
All conference alerts	All Conference Alert		allconferencealert
Conal conference alerts	Conal CONFERENCE ALERTS		conferencealerts

click here for references

AI: Appendix

COMPARISON OF AI CHATBOTS

Features	OpenAI ChatGPT	Microsoft Bing Copilot	Google Gemini
Ease of Use	User-friendly interface	Seamless integration with Bing	Seamless integration with Google products
collaboration tools	Available via third-party integrations	Microsoft 365 integration	Google Workspace integration
cost	Free version + ChatGPT Plus at $20/month	Free version + Microsoft Copilot at $10/month integrated with Microsoft 365	Free version + Pro integrated into Google services
accuracy	Continuously improving, occasional misinformation	Precise responses with source information	Needs improvement
response length	Limited (Free), Unlimited (Paid)	Limited (5 per session – Free), Unlimited (Paid)	Unlimited
strength	Versatile use cases, strong community support	Accurate search results, integrated with Microsoft tools	Integration with Google services, user-friendly
weaknesses	Occasional misinformation, limited real-time web access	Limited responses in free version	Accuracy needs improvement

TECHNIQUES FOR BYPASSING AI DETECTION SYSTEMS

- Paraphrasing: Rewriting AI-generated text to make it more natural and human-like.
- Hybrid Approach: Combining AI-generated text with human writing to create a natural flow.
- Editing and Proofreading: Thoroughly editing AI-generated content to remove machine-like patterns.

PROMPT–ENGINEERING

Prompt–engineering involves techniques for crafting inputs to produce outputs that closely match the user's intent.

Characteristics of a good prompt for finding research gaps:

Specific and Clear: Clearly state the field or topic of interest.
Context Provided: Provide context or specific areas within the field that you are interested in.
Purpose-Oriented: Ask for identification of gaps or areas that need further exploration.

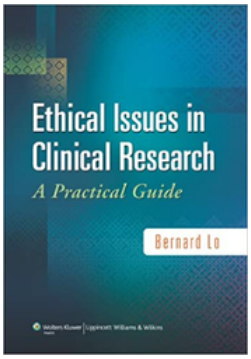
Example Prompts

• "Review the latest research on [specific topic] and identify any gaps in the existing literature."
• "Summarize the key findings from recent studies on [specific area] and suggest areas where further research is needed."

Research Ethics

Introduction

- **Session one:** How we got here; horrific violations inspired human subject protections.
- **Session two:** Human subject protections: why research and practice are not one and the same.
- **Session three:** Deep dive into some of the implications of research ethics guidelines- is it time to reconsider some of these protections?
- **Session four:** How ethics informs authorship, scholarship and publication.

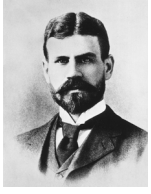


Edward Jenner and the Smallpox Vaccine

- (1796): Jenner wanted to test the theory that cowpox provides immunity from smallpox.
- Inserted pus from a cowpox pustule into an incision on the arm of an 8 year old boy.
- Experimented on several more children including his 11 month old son.
- Eventually was proven correct, developing the vaccine for smallpox.
- The term vaccine comes from Vacca, the Latin word for cow.

Self Experimentation

- Jesse Lazear (1900): took part in an experiment to study the transmission of Yellow Fever by allowing himself to be bitten by an infected mosquito.
- Werner Forssmann (1929): inserted a catheter into his own antecubital vein and passed into his right atrium and took an x-ray.
- Albert Hofmann (1943): ingested LSD to experience its hallucinogenic effects.
- Others: exposed themselves to various gases, infected blood, radioactive materials, and drugs.

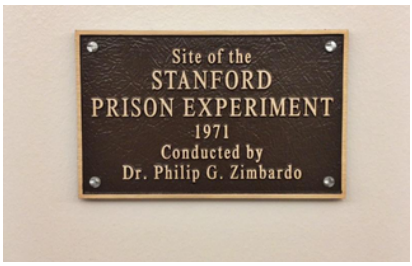


Tuskegee Syphilis Study

In 1932, the U.S Public Health Service began a forty-year clinical study aimed at observing the natural progression of untreated syphilis. The study subjects included more than 600 impoverished African American men who were given free medical care, meals, and burial insurance in return for their participation. The men were not informed of their diagnoses, instead they were told they were being treated for "bad blood." Participants were subjected to investigative and research-oriented tests but told they were therapeutic. After the discovery of Penicillin and its success in treating syphilis, none of the participants received treatment. In 1972, the study was deemed unethical and shut down, but researchers defended their actions by arguing that this population was uneducated, unlikely to care for itself or understand medical diagnosis or management, promiscuous and violent, and therefore a risk to white women.

Tuskegee Syphilis Study

In a study aimed at understanding the psychological effects of perceived power, researchers recruited 24 male participants for a two week immersive experiment. The participants were divided into 2 groups: prisoners and guards and conducted in a fake prison built inside Stanford University's psychology building. The "guards" were instructed not to physically harm the "prisoners" but were otherwise allowed to control, torture, threaten, and frighten them. As the study progressed, "guards" were observed to display significantly abusive behaviour. The study was not discontinued, even after several "prisoners" expressed a desire to be let out.

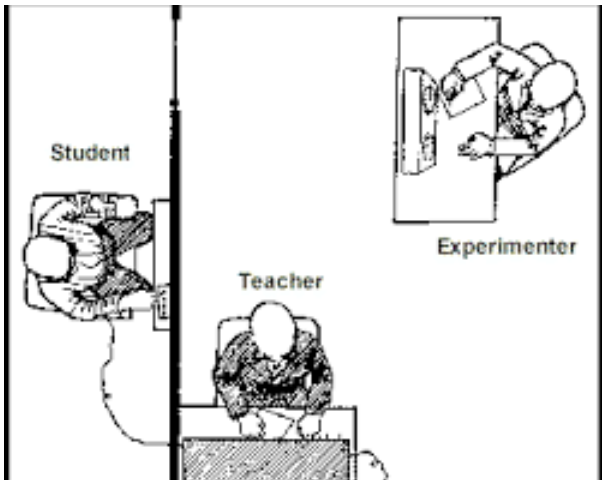


The Willowbrook School

In a study that lasted 14 years, researchers intentionally infected and allowed hepatitis A to spread at a school for intellectually impaired children. They withheld treatment and prevention to study immunization and mode of transmission. They also misled parents about the goals of the study and told them the only way their children may be admitted is through the hepatitis unit. Researchers justified their actions by claiming that the high rate of infection meant that all children will become infected anyway.

The Milgram Shock Experiment

At Yale university in 1963, Milgram and his team wanted to study obedience to authority. Participants were designated as "teachers" and paired with "learners" who unbeknownst to the participants were members of the research team. The learners were hooked up to an electrode. In a separate room, the teachers were given access to an electric shock generator. The learners were asked a series of questions, every time they fail, the teachers were supposed to shock them. If they refused, the experimenter would encourage them. Almost two thirds of participants used the highest voltage to shock the learners.



Sloan Kettering Cancer Experiments

In 1964, researchers at a major cancer centre injected live cancer cells into patients to study human immunity to cancer without their knowledge.

What is Ethics?

Ethics is a study of moral conduct, of right and wrong. It is inescapably normative:

- **Normative**: What should be the case in dilemmas. Ideas about how the world ought to be.
  - Although X is illegal, it shouldn't be because...
  - I believe X is wrong, but I can't tell people not to do it.

- **Descriptive**: empirical facts about beliefs, policy, the world as it is
  - X is against the law, Islamic doctrine prohibits X, Most Saudis believe X is wrong.

Examples: business ethics, bioethics, military ethics, etc.

Ethics vs. Law

	Ethics	Law
Meaning	A branch of moral philosophy	Systematic body of rules.
Oversight	Individual, legal and Professional norms.	Government
Violation	No punishment	Punishment
Objective	Determines the right course of action.	Maintains social order
Binding	Not binding	Binding

What is Research Ethics?

A field of study that examines and ensures the ethical conduction of research on human participants. **Two components:**

- Protecting participants (benefits> harms)
- Adequate informed Consent (autonomy)

Ethical issues arise from:

- Small number of participants, much wider benefits.
- Balance between community benefit and individual autonomy/good.

Components of Research Ethics

I. Protecting Human Research Participants:

Main aim of any study should be the safety of human participants:

- Researcher must identify all potential risks and means to minimize them.
- Continuous monitoring for adverse effects, stop study if risks occurs.
- Before any research on human subjects, clinical equipoise must be established.

A clinical trial is only ethical if there is **clinical equipoise.**

Clinical equipoise: the expert medical community is uncertain about the therapeutic benefit of experimental and control drugs.

*No patient will be randomized to a treatment known to be inferior.

Importance:

- Protects the right to best treatment.
- A way of protecting patients in clinical trials.

Ethical Requirements for Clinical Trials:

- Research aims at socially valuable, health related knowledge.
- Rigorous methods used to produce scientifically valid data.
- Subjects selected fairly.
- Favorable risk/benefit ratio based on: Benefit to research subject, and Value of knowledge gained.
- Protocols must gain IRB approval.
- Adequate informed consent.
- Participants must be treated with respect.

II. Adequate Informed Consent

Disclosure	Voluntariness	Comprehension
The information that should be provided to the participant about the study. This includes things like the nature and purpose of the study, the methods that will be used, the risks and benefits of participation, and how confidentiality will be maintained.	The participant must be free to decide whether or not to participate in the study without any pressure or coercion.	The participant must understand the information that has been provided to them. The information should be presented in a way that is easy to understand, using lay language and avoiding technical jargon. The participant should also have the opportunity to ask questions.

Components of Research Ethics

II. Adequate Informed Consent

Consent Forms: When applicable, participants must authorize their participation in the research study in writing.

Consent forms should include:

- Background to the research.
- Possible demands on participants.
- Details about participants consent.

Consent forms must not include:

- Exculpatory language by which the participant waives legal rights or releases the investigator from liability for negligence.

Role of the Institutional Review Board (IRB)

Administrative board: balances society's interest in medical research with the rights of human subjects.

Main task: The welfare of human participants.

- Informed consent.
- Risk benefit analysis.

IRBs should:

- Be sensitive to local values, expectations, concerns.
- Anticipate vulnerability (low literacy, difficulty understanding IC)
- Determine what levels of payment would be acceptable if any.
- Determine investigator competence and conscientiousness.

Procedure: varies by institution

- Review of protocol
- Periodic review, reporting.

Criteria for approval:

- Risks are minimized or reasonable in relation to anticipated benefits.
- Selection of participants is fair.
- Informed consent is adequate.
- Confidentiality is maintained.
- Data is adequately monitored.

Can we pay participants for research? Yes, but the reward should not be excessive. This is because undue influence can occur when the reward is too attractive, potentially impairing decision-making and causing participants to overlook potential risks. Additionally, excessive rewards can target those who are financially disadvantaged, thereby increasing inequality in research participation.

Components of Research Ethics

II. Adequate Informed Consent

Research with Persons with Impaired Decision-making Capacity (DMC)

Informed consent can be obtained from **surrogate decision-maker, But still ethical issues:**

- Patients may not understand the research procedure and risks.
- Patients may be used as a means to advance research.

Research on Children

Children are afforded extra protections as research subjects because:

- Limited autonomy.
- Rely on proxy decision makers (parents, guardians).

All research conducted on children must **satisfy two conditions**:

- Must produce direct **benefit** to the child.
- Child's assent must be **documented**. Children who cannot read or write must still signal their willingness according to their developmental age.

Further protections to children include:

- Pediatric expertise on the IRB.
- Specific training requirements for researchers.

Minority Population

Ethical Issues:

- Exploitation
- Stigmatization and stereotyping.

What to do:

- Involve affected community directly in planning of research.
- Provide benefit to community.
- Use due care in presenting and publishing findings.
- Help disseminate findings to media.

Prisoners:

Ethical issues:

- Compromised voluntariness, subject to additional discipline, Poor access to care: may influence decision to participate. Compromised privacy and confidentiality. Most IRBs have no direct experience with prisons. Difficult to monitor adverse effects. and Vulnerability: poor education, mental health, substance abuse.

Protections for Prisoners:

- Benefits must not constitute undue influence or impair informed consent. Risks acceptable to non-prisoners. Fair selection procedures. Participation not a condition of release or less sentence. Adequate follow up care provided. Easy to understand consent forms. Compelling reason to use prison population.

Research with Biospecimens

Biospecimens: blood, urine, hair, tissue, DNA

Efficient, quick, valuable experience for junior researchers.

But: privacy and confidentiality concerns.

No informed consent is required for:

- De-identifiable data (no name, no ID number)
- Data that is publicly available (database)
- Specimens collected anonymously.
- Specimens coded so that investigator cannot identify them.

Ethical Justifications for Using Biospecimens Without Consent

- High benefit of research.
- Low risk of harm due to identification of biospecimens.
- Studies show that people would allow de-identified material to be used.

Research Misconduct

Fabrication: making up data or results.

Falsification: manipulating materials, process, or data.

Plagiarism: use of someone else's ideas, words, methods, results without proper citation.

Authorship:

- Authors included without their knowledge.
- Authors included without actual contributions.
- Authors excluded unfairly.

Research misconduct is ethically problematic:

- Compromises scientific knowledge.
- Rewards for cheaters
- Weakens public support for research.

How can misconduct be identified?

- Progress is much faster than expected.
- Enrollment in one site greater than others.
- Familiar wording.

Data:

- Too good to be true.
- Inconsistent.
- Cannot be validated or replicated.

Research Misconduct

Responding to Research Misconduct:

Inquiry: initial review, followed by full investigation. (Ensure no conflict of interest)

Protection:

- Complainant, witnesses, committee members.
- Reputation of those found innocent.
- Confidentiality of process.

Prevention:

- Educate investigators, staff.
- Data audits
- Close involvement of principal investigator.

Plagiarism:

Types:

- Direct: copying others work (exact, direct) Permitted only if used as "quote"- should be indicated and cited.
- Paraphrasing: changing a few words or sentence order- without reference.
- Self plagiarism: cite yourself!

Authorship: Being in a position to conduct medical research or author a scientific paper is a privilege and must treated as such:

- Authors must ensure the integrity of their work: objective, valid, non-fraudulent.
- Authors must accurately and fairly represent the work of others: must cite all sources.
- Authors must not take credit for work they did not participate in.
- Authors must be impartial and avoid or declare financial, professional, or personal conflict.
- Authors must respond to and engage with the differing views or comments in a respectable and professional manner.

Ethical issues in Authorship and Publication

Too many authors:

- Did not revise or review.
- Supplied materials or gave advice- acknowledgement section.

Ghost authors: Not listed, but did the work.

Failure to do work agreed upon.

Articles published that ought not be:

- Plagiarized, fabricated, falsified.
- Duplicate results or papers.

Failure to publish articles that should be published:

- Articles with negative findings.

Bioethics

Branch of study that addresses moral uncertainty arising in medical science and healthcare practice:

Public Health Ethics	Research Ethics	Medical (Clinical) Ethics
Ensures ethical public health action or intervention. E.g. vaccine mandates, disease reporting, quarantines.	Ensures ethical research on human participants. E.g. drug testing, genetic studies	Systematic body of rules.
Communities, institutions, populations	Small number of participants to achieve wider benefits.	Individual patients
Social good, community benefit.	Balance between community benefit and individual autonomy/ good.	Individual liberty, autonomy.

Why is Adhering to Ethical Norms Important in Research?

- **Promote the aims of research:**
  - Knowledge.
  - Avoidance of error.
- **Promote values essential to collaborative work:**
  - Trust (guidelines for authorship, subject-researcher relationship)
  - Confidentiality and data sharing.
- **Ensure researchers are held accountable to the public.**
- **Build public support for research.**
- **Promote moral and social values:**
  - Social responsibility
  - Animal welfare
  - Compliance with law
  - Public health and safety.

Evidence Based Medicine

Definiton

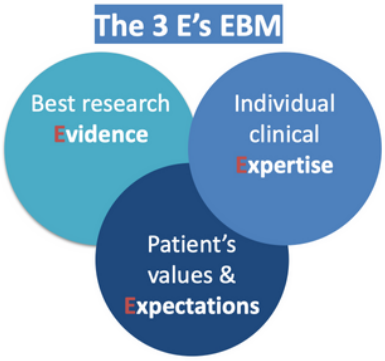
- is the use of current best evidence in making decisions about the care of individual patients.
- It involves integrating individual clinical expertise with the best available external clinical evidence from systematic research and considering patients' values and preferences.

Key Components of EBM:

• **Best Available Evidence:** Utilizing up-to-date, high-quality research to guide clinical decision-making.

• **Clinical Expertise:** Leveraging the skills and past experience of the healthcare provider to diagnose and treat patients.

• **Patient Values and Preferences:** Incorporating the patient's unique preferences, concerns, and expectations into clinical decisions.



Importance of EBM in Clinical Practice

• **Improved Patient Outcomes:** By applying the best available evidence, EBM helps in achieving better patient outcomes.

• **Informed Decision Making:** EBM provides a framework for making informed clinical decisions, enhancing the quality of care.

• **Consistency of Care:** Helps standardize care across different providers and settings, reducing variations in practice.

• **Cost-Effectiveness:** Promotes the use of interventions that are proven to be effective, potentially reducing unnecessary treatments and healthcare costs.

• **Lifelong Learning:** Encourages healthcare professionals to continually update their knowledge and skills in line with the latest research.

Evidence Based Medicine

Definiton

- is the use of current best evidence in making decisions about the care of individual patients.
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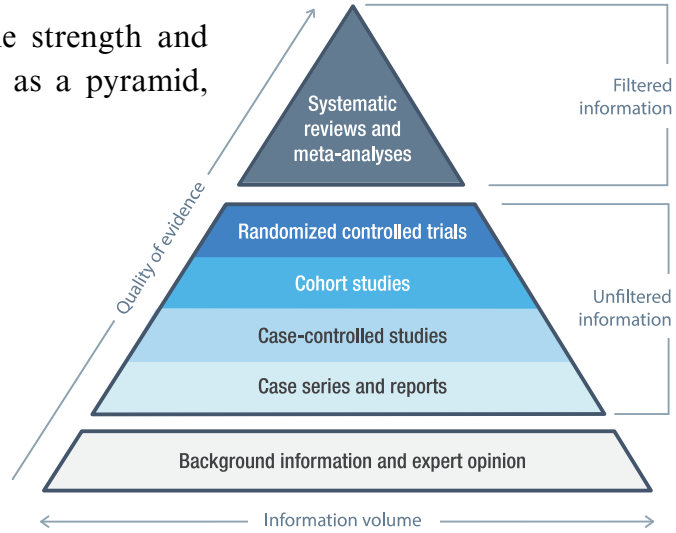
Hierarchy of Evidence

• The hierarchy of evidence is a system used to rank the strength and reliability of research evidence. It is typically represented as a pyramid, with the highest-quality evidence at the top.



Levels of Evidence

I- 1: A well done systematic review of 2 or more RCTs
I- 2: A RCT
II- 1: A cohort study
II- 2: A case-control study
II- 3: A dramatic uncontrolled experiment
III: Respected authorities, expert committees, etc.
IV: "Someone once told me"

Sources of Evidence

The 6S pyramid:	Description
Systems	Integrating information from the lower levels of the hierarchy with individual patient records, systems represent the ideal source of evidence for clinical decision-making.
Summaries	Regularly updated clinical guidelines or textbooks that integrate evidence-based information about specific clinical problems.
Synopses of syntheses	Summarize the information found in systematic reviews.
Syntheses	• Commonly referred to as a systematic review, a synthesis is a comprehensive summary of all the evidence surrounding a specific research question.
Synopses of single studies	Summarize evidence from high-quality studies.
Single studies	Represent unique research conducted to answer specific clinical questions.

Critical Appraisal

- The process of carefully and systematically assessing the outcome of scientific research (evidence) to judge its trustworthiness, value and relevance in a particular context.

- It is a systematic process used to identify the strengths and weaknesses of a research article in order to assess the usefulness and validity of research findings.

Components:

- Evaluation of the appropriateness of the study design for the research question.
- Careful assessment of the key methodological features of this design.
- Suitability of the statistical methods used and their subsequent interpretation.
- Potential conflicts of interest.
- Relevance of the research to one's own practice.

Importance:

- Combat information overload.

- Identify papers that are clinically relevant.

- Continuing professional development (CPD) - critical appraisal is a requirement for the evidence-based medicine component of many membership exams.

Critical appraisal is the systematic evaluation of clinical research papers in order to establish:

- Does question of this study address a clearly focused question?

- Did the study use valid methods to address this?

- Are the valid results of this study important?

- Are these valid, important results applicable to my patient or population?

If the answer to any of these questions is "no", you can save yourself the trouble of reading the rest of it.

Translational Research

Definition

Translational science: the process of turning observations in the laboratory, clinic and community (basic science) into interventions (clinical science) that improve the health of individuals and the public.

Role of Basic science research in translational medicine:

- Advancing our understanding of disease and their underling mechanism.
- Identifying potential targets for therapeutic interventions.
- Developing new diagnostic tools and techniques.
- Testing the safety and efficacy of new treatments.
- Improving patient outcomes and quality of life.

The impact on developing new therapies: basic science research provides the foundation for the development of new therapies by:

- Uncovering the molecular and cellular mechanisms involved in disease progression.
- Discovering novel drug targets and pathways.
- Designing and optimizing drug molecules.
- Conducting preclinical studies to assess safety and efficacy.
- Informing clinical trial design and patient selection.

Basic Science Research to Clinical Trials:

Basic science research: scientists conduct experiments and studies to gain a deeper understanding of biological processes, diseases, and potential treatment targets.

→

Preclinical studies: Once promising findings are obtained from basic science research, preclinical studies are conducted to evaluate the safety and efficacy of potential interventions in laboratory and animal models.

→

Clinical trials: If preclinical studies show positive results, clinical trials are initiated to test the safety and effectiveness of the intervention in human subjects. These trials are conducted in multiple phases and involve rigorous testing and data collection.

↓

Regulatory approval: After successful completion of clinical trials, regulatory approval from health authorities is required before the intervention can be used in clinical practice. This ensures that the intervention meets safety and efficacy standards.

←

Clinical application: Once regulatory approval is obtained, the intervention can be applied in clinical settings to diagnose, treat, or prevent diseases. This stage involves implementation, monitoring, and ongoing evaluation of the intervention's effectiveness.

Translating clinical research to real– world practice:

Process of translating clinical research:

1–Identification:

identify promising research findings that have the potential to improve patient outcomes or address unmet medical needs

2–Validation:

validate the research findings through additional studies, including clinical trials to ensure the safety and efficacy of the new treatment or intervention.

Valid scientific evidence:

- Is: well-controlled, well-documented, and provide evidence that the device works as intended.
- Is Not: Isolated case reports, anecdotal data, partially controlled studies, studies without matched controls, reports lacking sufficient details, and unsubstantiated opinions.

Safety: determined by valid scientific evidence that shows the benefits outweigh the risks. There should not be unreasonable risks.
Effectiveness: This is determined through valid scientific evidence that shows the device works as intended and provides clinically significant results.

3–Implementation:

develop strategies and guidelines for implementing the new treatment or intervention in real world settings, such as hospitals or clinics.

4–Adoption:

promote the adoption of the new treatment or intervention by healthcare providers and organization, and ensure that it becomes a s standard of care.

Patents & Innovation (Translation of Knowledge into Technology)

Introduction

Innovations are considered as the key to success. They are important in education, technology, science, healthcare industries and in all other fields [1]. Innovations in healthcare play an important role as the World Health Organization (WHO) says that health innovation raises healthcare's productivity, efficiency, reliability, sustainability, security, and cost.

Definitions

A simple way to define healthcare innovation is that it is any developments, simple or complex, that lead to improvements in health outcomes and patient experiences [3]. Innovations can be protected through patents. A patent is an exclusive right given for an invention. It gives the patent holder protection for his or her idea. The protection is only provided for a set amount of time, namely 20 years. Without the permission of the patent owner, the innovation cannot be commercially manufactured, utilised, distributed, or sold. When a patent expires, the protection ceases, and the innovation enters the public domain, which means that the owner no longer has exclusive rights to the creation, and it can be commercially exploited by anyone.

The difference between innovations and inventions in healthcare

Innovations and inventions do not have the same meaning. The table below shows the difference between innovations and inventions.

Invention	Innovation
• An object, process, or technique which displays an element of novelty. • Radical breakthrough in science or technology which extends the boundaries of human knowledge.	• The process of making improvements by introducing something new. • The process of translating new ideas into tangible societal impact. • Change that creates a new dimension of performance. • A creative idea that is realized.

Patents & Innovation (Translation of Knowledge into Technology)

Importance of innovation in healthcare

Healthcare innovation is valuable as it can lead to better patient care, improved population health, and lower healthcare costs.

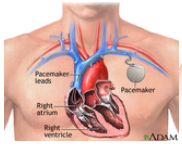
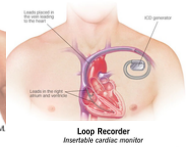
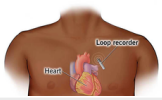
- Healthcare innovations can **improve patient outcomes** by providing new and better treatment options, making it easier for patients to access care, and improving care coordination.
- Innovation can also lead to **improvements in population health** by making it easier for people to live healthy lifestyles and by providing new tools to detect and prevent the early onset of diseases.

Finally, healthcare innovation can help to **lower healthcare costs** by improving the efficiency of care delivery and by providing new and less expensive treatment options .

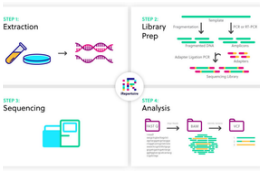
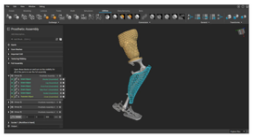
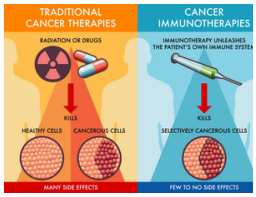
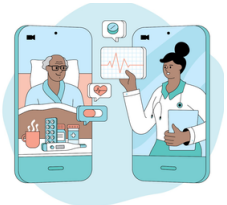
Innovation in Medical Technologies

Medical technology: is a broad discipline at the intersection between health care, medicine and technology. it is concerned with the development of solutions of prevention, monitoring diagnosis, treatment as well as maintenance of the quality of care

Medical devices impact our day-to-day lives with devices such as eyeglasses, contact lenses, and bandages. Medical devices that are needed only from time to time for most of us include diagnostics, monitoring, life support systems, surgery, and emergency care. The table below shows examples of innovation in medical technologies

Innovation in Medical Technologies	Pictures
Glucose monitoring and insulin delivery systems for diabetics	
Cardiac implantable electronic devices such as: **1- Pacemakers** **2- Implantable cardioverter defibrillators (ICD)** **3- Cardiac loop recorders**	  
Using a wristband for detecting electrical impulses: Researchers have developed a new wearable device that can detect heightened skin responsiveness that indicates stress and aids in spotting potentially lethal seizures, epilepsy, and other psychiatric and neurological conditions.	

Patents & Innovation (Translation of Knowledge into Technology)

Innovation in Medical Technologies	Pictures
Next-generation sequencing: Applications of genetic sequencing to identify at-risk populations or target therapies to patients who are likely to respond.	
3D-printed devices: Lower-cost and highly customised medical technology products that can be tailored to suit the physiological needs of individual patients.	
Immunotherapy: Treatments with the potential to significantly extend survival for cancer patients, without the negative side effects and related health care costs of traditional chemotherapy.	
Artificial intelligence: The ability of computers to think like and complete tasks currently performed by humans with greater speed, accuracy, and lower resource utilization.	
Virtual reality: Simulated environments that could accelerate behaviour change in patients in a way that is safer, more convenient, and more accessible.	
Biosensors and trackers: Technology-enabled activity trackers, monitors, and sensors incorporated into clothing, accessories, and devices that allow consumers and clinicians to easily monitor health.	
Telehealth: A more convenient way for consumers to access and increase self-care while potentially reducing office visits and travel time; may also prevent complications and emergency room visits.	

Patents

What does a patent do?

• A patent allows you to prevent others from making, selling, using or importing your claimed invention between the issue date and the end of the patent term.

• A patent does NOT give you the right to make, use, sell or import anything, even your own claimed invention

Body of patents:

The body of the patent include the figures and supporting text.

• Used as support for the claims and used to define the claim terms

• Sometimes referred to as the “specification” or “spec”

Claims:

numbered “sentences” at the back end of the patent and an output of a patentability analysis. Specifically describe what the applicant is protecting.

Claims must be novel and not obvious

Novel = no single prior art reference has all claim elements

Non-obvious = one having ordinary skill wouldn’t have combined multiple references to achieve all claim elements

Patentability vs. Freedom to Operate

Patentability	Freedom to Operate
Will our patents stop our competitors from making our product? • Is our product covered by our likely patent claims? • How will the prior art limit the claim scope? • How far-sighted is our specification? Patentability analysis = our claims vs. their disclosure (Patentability analysis is a comparison of your claims to all prior art)	• Will product infringe the claims of other (i.e., competitors') patents? • FTO Analysis = their claims vs. our product (FTO analysis is a comparison of your product to competitors' claims.)

There are several forms of telehealth that have been variably defined.

Telehealth: Use of technology to provide healthcare and/or health information remotely.

Telemedicine: Subset of telehealth in which clinical care is provided remotely.

Synchronous Telemedicine: Provision of patient care in real-time using various forms of live videoconferencing in lieu of in-person appointment.

Asynchronous Telemedicine: Provision of patient care that does not occur in real-time, but includes forwarded data, such as vital signs, images, and/or video clips sent to providers for future use. Data may be sent by the patient, another clinical team member, or by a technologic device.

Remote Patient Monitoring: Iterative off-site review of patient data as a part of clinical care (vital signs, blood glucose, cardiac rhythm).

Mobile Health: Use of technology by consumers to collect health information and/or support health (online health interest groups, wearables).

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المجلس الطلابي