RESEARCH:
What, Why and How?

A Treatise from Researchers to Researchers

PM Kasi

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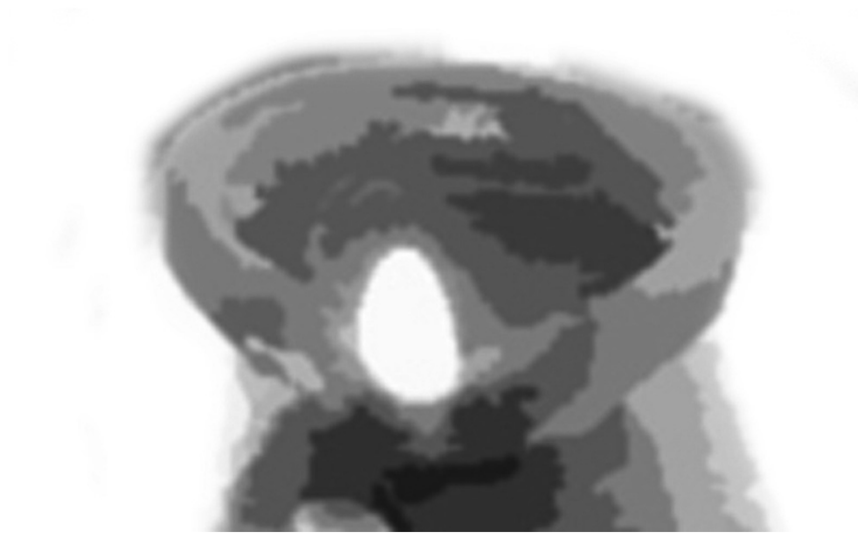
For Students, Trainees, Scientists, Scholars, Investigators and Researchers.

"The more I learn, the less I know"



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ABOUT THE BOOK:

Preface

For **students, trainees, scientists, scholars, investigators and researchers** at all levels.

"The more I learn, the less I know"

Purpose of the book:

This book is an effort to compile and answer some of the very basic fundamental questions regarding research. It is an outcome of collaboration between 43 researchers from 11 different countries (Pakistan, India, United States, Iran, United Kingdom, Nepal, Canada, Greece, Poland, Japan and Australia)

According to Descartes, when approaching a difficult problem,[1]

"Divide a problem into as many parts as necessary to attack it in the best way, and start an analysis by examining the simplest and most easily understood parts before ascending gradually to an understanding of the most complex."

Unconsciously, in writing this book about research, we have done just that. We have divided this vast topic of research into basic fundamental questions that come to the mind of a young student, researcher, scholar, investigator, trainee or scientist and have tried to answer those questions in the light of available knowledge and experience in a simple, straightforward and easy to understand way.

Although there is a lot of literature available to answer the queries that come to the mind of a young investigator, the language is often too complex and difficult to understand and thus, aversive. Some of these teaching materials sound more like experts talking to each other.

This book would act as a catalyst in providing useful reviews and guidance related to different aspects of research for students who need to be inducted and recognized as an integral part of the research community.

Who would benefit from this book?

This book is written for **students, trainees, scientists, scholars, investigators and researchers** at all levels. We all are students in this vast field of research and there is always something new to learn. Through this book we have tried to teach and learn side by side about core issues and fundamental topics like:

- What is Research?
- How to do Research?
- What are the principles of research?
- What are the different methods of data collection?
- What are the different search engines?
- How to search in search engines?
- What are the different softwares available for statistical analysis?
- How to write a scientific paper or case report?
- How to publish your findings?
- Why Open Access?
- Why Collaborate?
- Basic vs. Applied research: why the debate?
- How to translate research into practice?

As rightly pointed out by Angela Brew in her book on 'Research and Teaching' [2],

> '*Students need to be **fully inducted** into the culture and community of researchers. They need to develop a **knowledge** of what it is to engage in the subject in a research-based way, to understand the **key issues and debates** in the subject area and **know what researchers in the subject do**, in general and specifically. They need to engage in activities which mirror the research processes that their teachers are engaged in. They need to learn **methods and techniques** used in research in the subject and have opportunities to practice such methods and techniques. This all implies that during their studies they should engage in **building knowledge** just like researchers."*

Nothing else could have summarized the goals and purpose of this book than the paragraph quoted above. This book indeed is an effort to build on the existing knowledge of students, trainees, scholars, researchers, investigators and scientists, so that they could easily be inducted into this culture of true, original, genuine, useful and ethical research. It not only tries to teach the methods and techniques used in research but also gives them an opportunity to ponder on key issues and debates in the subject area.

Through this book, we have actively tried to follow the concept of ***'fully inducting students into the culture and community of researchers'.*** Contributions from students were invited and encouraged. Their work critiqued, given due appraisal and guidance provided at every step of the way. In some cases the tone and the simplicity has been maintained so as to give students a voice to communicate with other young scientists and investigators worldwide and share with them their concepts, ideas and/or problems.

Finally, the collection of essays and debates in the last section from researchers and faculty from around the world allows us to focus on global as well as regional perspectives regarding research along with highlighting the key issues and debates in this area. The definitions of key terms that are provided especially related to research, statistics and epidemiology along with explanation of important concepts would help address the gap in knowledge and thus would aid researchers understand other books and literature pertaining to research methods better.

The Road Ahead

As pointed out earlier, we ***actively need to induct students fully into the culture and community of researchers.*** This book is an effort in the same direction.

When I was a medical student, I came across a very nice poem in my student's companion to Stryer's biochemistry. It read:

"The Woods are lovely, dark and deep,

But I have promises to keep,

And miles to go before I sleep,

And miles to go before I sleep."

Robert Frost[3]

Thus, a lot of learning still needs to be done and the job of a researcher will always remain unfinished.

For the students, I would like to reiterate what Santiago Ramon Cajal (1852-1934), one of the fascinating personalities in Science said.

According to Cajal:

The traits that are needed especially by young investigators and researchers are "Hard Work, ambition, patience, humility, seriousness, and passion for work, family, and country." But above all, master technique and produce original data the rest will follow."[1]

We would welcome comments, critique, suggestions and guidance on existing chapters as well as contributions for future chapters for the book as we would like this learning and teaching exercise to continue. A supportive culture needs to be encouraged and we all need to share our knowledge with each other. Please feel free to contact us with guidance, critique or contributions:

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[1] Santiago Ramon y Cajal. Advice for a Young Investigator. Bradford Books The MIT Press; 1999.

[2] Angela Brew. Chapter 1. In: Research and Teaching: Beyond the Divide. Palgrave Macmillan; 2006. p15.

[3]Poem by Robert Frost. Available online: http://quotations.about.com/cs/poemlyrics/a/Stopping_ByWood.htm Accessed 19th May, 2009.

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Pashtoon Murtaza Kasi is a graduate of Aga Khan University (AKU), a prestigious international university spread over 8 countries, where he completed his five year program leading to the Bachelor of Medicine and Bachelor of Surgery Degree in 2006. Currently he is a Surgical Intern at the University Of Texas Health Science Center at San Antonio (UTHSCSA), San Antonio, Texas, United States.

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This book is dedicated to my first teachers: My Parents; and to my Alma Mater: The Aga Khan University.

Acknowledgements/Copyrights:

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- *Angela Brew, Research and Teaching: Beyond the Divide.2006, Houndmills, Basingstoke, Hampshire and 175 fifth avenue New York, NY; PALGRAVE Study Guides.*
- *Coombs Hilary.Research Using IT, 2001, T. Houndmills, Basingstoke, Hampshire and 175 fifth avenue New York, NY; PALGRAVE Study Guides.*
- *Wisker, Gina. The Postgraduate Research Handbook: Second Edition, 2008. Houndmills,*

Basingstoke, Hampshire and 175 fifth avenue New York, NY: PALGRAVE MACMILLAN, PALGRAVE Study Guides.

- *] Grix, Jonathan, The Foundations of Research, 2004. Houndmills, Basingstoke, Hampshire and 175 fifth avenue New York, NY: PALGRAVE MACMILLAN, PALGRAVE Study Skills.*

We would also like to mention the book on Biostatistics by Muhammad Ibrahim with whose permission the definitions related to statistics were reproduced and quoted. We highly appreciate his contribution to the statistics section of the book. He is a faculty in Biostatistics at School of Physiotherapy, Mayo Hospital, KEM University, Lahore, Pakistan.

- *Muhammad Ibrahim. BioStatistics and Research Methods. Published by Iqra Research Center, Anarkali Lahore.*

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Credit also goes to Mr. Abaseen Khan Afghan for not only his work for the book but also his creative suggestions/designs for the cover and illustrations.

Finally, I am grateful to all the researchers from around the world who trusted me and contributed to this endeavor. I have learnt a lot from all of you and hope that this learning exercise shall continue.

Of special note are the efforts and advice of some authors and the fact that they were always there to contribute, review or give expert opinion whenever needed. These include Dr. Haider A. Naqvi, Dr. Sajjad Ahmed Sherjeel, Prof Dr. Rakhshanda Rehman, Dr. Ahmed Ijaz Gilani, Dr. Haq Nawaz, Dr. Amina Ahmad, Prof. Dr. N.M. Butt, Farhad Shokraneh, Muhammad Ibrahim, Dr. Ravi Shankar, Masoom Kassi, Mahrukh Fatima, Abaseen Khan Afghan and Mahwash Kassi. This work could not have been completed if it weren't for them.

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A note on the Collaboration:

Recently in a keynote address, Former President Bill Clinton hailed the internet as,

> *"an inherently cooperative instrument and an inherently shared technology. The internet has the potential to put power through information and communication in the hands of ordinary people."*[1]

If I look back, this book would not have been possible without the internet; a tool with enormous potential. The entire write up and publication and all the communications between authors was through the internet.

The Internet is indeed a very powerful tool and it is because of the internet that a collaboration of this level between 43 researchers from 11 different countries (Pakistan, India, United States, Iran, United Kingdom, Nepal, Canada, Greece, Poland, Japan and Australia) was made possible. I have not even met some of the faculty who have contributed to this endeavor, but have learned a lot from everyone of them.

Along these lines we would like to iterate that collaboration is of paramount importance when it comes to a research inquiry. The sooner we are able to realize this the better it is; there are research issues at the interface of disciplines, which can never be solved unless one takes a multidisciplinary approach. Science has no boundaries, no drawing room clichés. It is ruthlessly honest, demanding integrity, collaboration and teamwork. . A supportive culture needs to be encouraged and we all need to share our knowledge with each other for the ultimate goal of promoting research and benefiting mankind.

References and Further Reading:

[1] Bill Clinton, China Linked via his foundation. Published in Los Angeles Times, April 13 2008. Available from: http://www.latimes.com/news/politics/la-na-clintonchina13apr13,0,499290.story

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This book is an outcome of collaboration between 43 researchers from 11 different countries (Pakistan, India, United States, Iran, United Kingdom, Nepal, Canada, Greece, Poland, Japan and Australia).

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List of Tables:

RESEARCH

What is Research?

Masoom Kassi, Abdul Malik Achakzai, Daniyal Ali

"What is research, but a blind date with knowledge."

William Henry

Research can be defined as:

> *"a detailed study of a subject, especially in order to discover (new) information or reach a (new) understanding"*
>
> *Cambridge Advanced Learner's Dictionary* [1]
>
> *"diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications, etc."*
>
> *Dictionary.reference.com* [2]
>
> *"Studious inquiry or examination; especially: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws."*
>
> *Merriam-Webster's Online Dictionary*[3]

It is derived from French: Middle French *recerche,* from *recercher* to go about seeking, from Old French *recerchier,* from *re-* + *cerchier, sercher* to search. [3]

Simply stated as by Coombes:

> *"Research is a tool for getting you from point A to point B. You wish to prove an idea – research it. You wish to disprove an idea – research it. You think that fact ABC is incorrect – research it, or that fact ABC is*

correct – research it. Research is simply a method for investigating and collecting information”. [4]

Or, as stated by Gina Wisker:

> *“Research is about asking and beginning to answer questions, seeking knowledge and understanding of the world and its processes, and testing assumptions and beliefs”* [5]

Amongst the several definitions about research, we would like the reader to focus on the parts about *‘new’* and ‘asking’. Discovering *new* information or reaching a *new* understanding; new and original needs emphasis as it is one of the core principles of any good research. According to Cajal, the traits that are needed especially by young investigators and researchers are “Hard Work, ambition, patience, humility, seriousness, and passion for work, family, and country. But above all, master technique and produce ***original*** data; ***the rest will follow***”. [6]

Second, asking is the key. As rightly pointed out by Einstein, you need to have ‘passionate curiosity’; to be inquisitive; to have a fascination to ask and answer questions.

“Some men see things as they are and ask, why? Others dream things that never were and ask why not?"

George Bernard Shaw[7]

Why, Why not, How, What, Why, In What ways?

Research is therefore a method for investigating and collecting information aimed at the discovery of new facts or interpretation of existing information, in order to discover or revise facts, theories and applications.

It is a fundamental part of our life. Research is either difficult or not interesting because the true meaning of research is not known. This problem is further compounded because important reviews on the topic are dispersed and/or are not freely available online.

Through the chapters that follow, we intend to teach and encourage and motivate students, scholars and scientists to become inclined towards and generate good, original and ethical research.

Tasks for the Researcher:

✓ Know the definition of research.

✓ Try to go on the web or to your library to find out more and read essays to clear your concepts about what research is actually about.

✓ Try to identify your research field, area, topic and issues of interest.

✓ Start asking yourself. Develop some curiosity about the field that you are working in and find the 'gaps' in knowledge and questions that are waiting to be answered.

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[1] http://dictionary.cambridge.org

[2] http://dictionary.reference.com

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[4] Coombs Hilary. *Chapter 1: Getting Started. In: Research Using IT.* Houndmills, Basingstoke, Hampshire; PALGRAVE Study Guides: 2001. pg 1.

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[6] Santiago Ramon y Cajal. Advice for a Young Investigator. Bradford Books The MIT Press; 1999.

[7] Learningful Quotes. Available: http://www.learningful.com/quotes_n,o,p.htm

Why do people do research?

Haider A. Naqvi, Fahd Khalid Syed

"After all, the ultimate goal of all research is not objectivity but truth."

Helene Deutsch

"Most people are forced to do research. Research in an academic world is an unequivocal criterion for promotion. This being the situation leaves little option for individuals; 'publish or perish' is the law of the academic world. This is the reason there is such a concern regarding authorship, intellectual property rights and plagiarism.

Critical question is: why people do research besides this compulsion. Some do research for the sake of inquisitiveness. While other do it for the sake of discovering the mysteries of science. There might be less noble reason, like fame or recognition." [1]

In any case dictionary defines research as "diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, and applications"." [2]

Based on this definition, ideally research should be done for the sake of inquisitiveness, curiosity, to answer important questions, to fill the gaps in knowledge and/or for personal development rather than for the sake of promotions or publications. The latter would come automatically.

Tasks for the Researcher:

- ✓ Try to set your goals and objectives about why do you want to do research.
- ✓ Try to do research for the sake of inquisitiveness, curiosity, to answer important questions, to fill the gaps

in knowledge and/or for personal development rather than for the sake of promotions or publications. The latter would come automatically.

✓ Have the right reasons to pursue research.

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What are the parts of a Research Process?

Mahrukh Fatima, Ferha Saeed

> *"Research serves to make building stones out of stumbling blocks."*
>
> ***Arthur D. Little***

The entire research process can be divided into multiple parts or stages. It is not necessary that the each part or stage should be completed before proceeding to the next step; but often these steps are overlapping and you may need to go back to a stage depending on how your study proceeds. You may learn new things while going through these various steps and may need to come back to a step, make changes and then proceed accordingly. So after having answered why do you want to do research and having the right reasons for it, your research may proceed in the way as outlined in table 1.

These steps can also be categorized into three different stages of research for doctoral students (Table 2), as pointed out by Jonathan Grix in her book on the Foundations of Research (Reproduced with permission of Palgrave Macmillan).[5]

Table 1: Steps of the Research Process

Identifying your area of research
Identifying the gaps in knowledge or the important questions that you want to address
Formulating a Research Question or hypothesis
Initial Literature Review
Narrowing down and focusing your research question or hypothesis
Identifying a subset of further questions
Selecting the appropriate research method
Detailed Literature Review
Identifying and narrowing down your goals and objectives (There may be primary and secondary objectives and gains from your study)
Writing a Research Proposal or Protocol
Getting permission from the department and approval from Ethical Review Committee.
Work and plan on the practical aspects: Resources, timeline and budget
Possibly apply for a Grant
Practical Aspects: Doing experiments or 'fieldwork'; Collecting the Data
Analyzing the Data (Statistical Analysis)
Present your findings in simple and easy to understand ways. Tables, graphs and charts may be employed.
Answering your research questions based on your findings
Producing Conclusions
Writing down your results as a paper, dissertation or thesis

Choosing the right journal of forum for sharing your findings
Publishing your Findings
Promoting or Sharing your findings.
Getting feedback
Implementing your findings. The research should translate into practice and bring about a change
The Road Ahead: Identifying and starting work on unanswered questions or questions/queries that emerged from your study

Tasks for the Researcher:

- ✓ Know the different part/aspects of the research process.
- ✓ Try identifying areas/parts of the research process where you are strong in.
- ✓ Try identifying areas/parts of the research process where you are weak in; and plan on improving your knowledge and skills regarding that particular area.
- ✓ Revisit the different parts of the research process during your research study.

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[1] Discovery Quotes. Available: http://healpain.net/articles/pain-hld.htm

[2] Coombs Hilary. *Chapter 1: Getting Started. In: Research Using IT*. Houndmills, Basingstoke, Hampshire; PALGRAVE Study Guides: 2001. pg 1-13.

[3] Wisker, Gina. *Chapter 5: Research Questions and Hypothesis. In: The Postgraduate Research Handbook: Second Edition*. Houndmills, Basingstoke, Hampshire; PALGRAVE MACMILLAN, PALGRAVE Study Guides: 2008. *pg 48-64.*

[4] Grix, Jonathan. *Appendix 1: Stages of the Research Process. In: The Foundations of Research*. Houndmills, Basingstoke, Hampshire; PALGRAVE MACMILLAN, PALGRAVE Study Skills: 2004. *pg 154-160.*

[5] Grix, Jonathan. *Appendix 1: Stages of the Research Process. In: The Foundations of Research*. Houndmills, Basingstoke, Hampshire; PALGRAVE MACMILLAN, PALGRAVE Study Skills: published 2004. *pg 157; reproduced with permission from Palgrave Macmillan.*

Table 2: Possible stages of the Doctoral Process

	Sequence of Research Stages	Action
Stage I ↓	1. Formulate your research problem; articulate your 'hunch' or tentative proposition	Learn Tools and Terminologies of research; Initial exploratory literature review
	2. Redefine and focus your topic and proposition	
	3. Select your variables or means of 'testing' your questions	Second Literature review. In Addition seek support by bouncing ideas off peers/friends/ supervisor/ and by attending conferences for networking; undertake critical literature review.
	4. Have clear central research questions or key hypotheses	
	5. Locate approach vis-à-vis others: begin writing the first chapter, setting out stages 1-4 above	Clarify your methodological approach
	6. Select Methods of enquiry	
	7. Produce a chapter outline of the whole thesis	Be familiar with debates/schools of thought/ methods used and approaches on chosen topic; apply for external funding for fieldwork

Stage II ↓	8. Prepare groundwork for fieldwork 9. Sketch out fieldwork plan 10. Fieldwork	Locate Data; contact archives, institutions, individuals etc. Give conference papers; possibly publish; seek external feedback on proposed topic Data Collection: Interviews, Archives, questionnaires, etc.
Stage III	11. Data Analysis 12. Evaluate data 13. Redefine central research questions or hypotheses in the light of empirical data analysis 14. Concentrate on writing-up stage	Categorize data ready for analysis; analyze data Possibly publish your preliminary results; analysis and interpretation of data; relate evidence to research question asked, draw conclusions Revisit all previous stages, draw thesis together

(Grix, Jonathan. Appendix 1: Stages of the Research Process. In: The Foundations of Research. Houndmills, Basingstoke, Hampshire; PALGRAVE MACMILLAN, PALGRAVE Study Skills: published 2004. pg 157; reproduced with permission from Palgrave Macmillan.)

How to choose your Research Topic?

Abaseen Khan Afghan, Masoom Kassi

"Somewhere, something incredible is waiting to be known."

Dr. Carl Sagan

Often as students we become involved in projects that have already been formulated. If that is the case, then it is imperative to identify the particular aspect of the project that is of interest to us so that we enjoy what we do.

If we wake up in the morning and do not want to go to our place of research, then we probably are in the wrong field and not in an area of research that interests us.

You should also try researching the topic yourself. This would help clarify the goals and objectives of the project that you are involved in and also increases your confidence in the validity of the project. Maybe you could come across an angle that your principal investigator might have missed or overlooked. Or maybe, this may help in generation of further ideas for future research projects. Also, this would greatly aid in writing up of the research paper or project report later on.

On the other hand, if you are the principal investigator of the project and have the liberty of choosing your own research topic, then firstly as a rule, it is very important that you work on a topic that is of interest to you. That is the key I guess.

Second, you may start broadly by first identifying the field that you are interested in followed by the specific area of interest. This should be followed by enumerating the list of issues or unanswered questions that you would like to answer.

Take your time before deciding on your final topic. Critique and question yourself. Evaluate your research question before you actually start doing the project. Ask yourself at the very outset that:

- ✓ *What would this project help in answering?*
- ✓ *Would this be of use to others?*
- ✓ *Has the question already been addressed by previous studies?*
- ✓ *Does it need to be done?*
- ✓ *Will it be of any benefit to the scientific community in general and the public at large?*
- ✓ *Would it be practical?*
- ✓ *Would this fill a gap in the existing pool of knowledge?*
- ✓ *Can the means to do the project be arranged?*
- ✓ *Do you have the necessary time and resources that the project requires?*[1]

'Choose the best question: one that is neither too broad nor too narrow.'[2]

Often practicality of the project is an issue to be considered before embarking on the project. No point in realizing midway that the project cannot be completed in the time that you have and leaving it half done.

Keep on asking yourself. Your best critic is you, yourself. The more time that you spend on this phase of the project, the lesser the number of problems you would face later on and the more the chances that the project would leave to a positive outcome.

The key to good research is good preparation and organization. You need to be sure and have a clear idea about what you want to work on before you start your research project. The usual tendency is to jump to the practical aspects of the project such as data collection too soon, later realizing changes that if had been made earlier could have saved a lot of time and effort.

One important additional point is to understand and realize one's limitations. When you are about to embark on a project, you cannot answer everything under the sun in one go. Gina Wisker in her book very aptly describes the concept of *"Slice of Cake"* in this context. The concept basically states that if the entire area of your interest can be represented by a cake, then your research study is like a slice of that cake. You can then try to answer other important questions i.e. take other slices of cake later on or one by one rather than trying to eat the entire cake in one go. You would not be able to digest it and the study would be left incomplete as you would eventually be overwhelmed by the amount of work that would need to be done. [3]

Table 3: Qualities of a Research Topic/Question:

✓ New
✓ Original
✓ Appropriate
✓ Focused
✓ Important
✓ Significant
✓ Precise
✓ Clear
✓ Addresses a gap in knowledge
✓ Is of Interest to the researcher

Tasks for the Researcher:

- ✓ Try to choose your research topic based on the discussion in this section.
- ✓ Take your time in deciding on your final topic; and constantly critique and question yourself.
- ✓ Know the qualities of a good research topic/question.

References and Further Reading:

[1] Coombs Hilary. *Chapter 1: Getting Started. In: Research Using IT*. Houndmills, Basingstoke, Hampshire; PALGRAVE Study Guides: 2001. pg 1-13.

(2) Research Room Menu. Developing a research question. Available:

http://www.esc.edu/esconline/across_esc/writerscomplex.nsf/0/f87fd7182f0ff21c852569c2005a47b7

[3] Wisker, Gina. *Chapter 5: Research Questions and Hypothesis. In: The Postgraduate Research Handbook: Second Edition*. Houndmills, Basingstoke, Hampshire; PALGRAVE MACMILLAN, PALGRAVE Study Guides: 2008. *pg 48-64*.

What is the difference between a research question and a research hypothesis?

Fahd Khalid Syed, Sajjad Ahmed Sherjeel

> *"It is a good morning exercise for a research scientist to discard a pet hypothesis everyday before breakfast. It keeps him young."*
>
> ***Konrad Lorenz***

Depending on how you see the world as later described in detail in research methodology, you would either be working and trying to answer a research question or you would be testing a hypothesis.

A Research Question is a statement which identifies the problem that the research is going to address. A strong research question should be concise and accurate. It should tell exactly what the study is trying to accomplish.

A well stated research question should include all the variables about the study in question.

For example:

Instead of: What are the risk factors of stroke? , a better research question would be: What is the relationship between high blood pressure and stroke among people aged greater than 50 years?

A Research Hypothesis is the researcher's prediction of the answer to the Research Question. 'The hypothesis is formulated following the review of related literature and prior to the execution of the study. The related literature leads the researcher to expect a certain relationship.'[1]

A good hypothesis states as clearly and concisely as possible the ‘researcher's expectations concerning the relationship between the variables in the research problem.’ [2]

For example:

High blood pressure will increase the risk of stroke among people aged greater than 50 years.

To prove or disprove his hypothesis, the investigator then gathers the required information.

Tasks for the Researcher:

- ✓ Know the difference between a research question and research hypothesis.
- ✓ Try evaluating your previous research projects’ research topics as to whether they were research questions or research hypothesis.

References and Further Reading:

[1] Formulation and Statement of a Research Hypothesis. Available: http://www.mnstate.edu/wasson/ed603/ed603lesson6.htm Accessed 13/May/2009

[2] Research Methodology. Troy University Course Syllabus. Available: http://spectrum.troy.edu/~drj/Research%20Methods%202005.htm Accessed 13/May/2009

[3]http://globetrotter.berkeley.edu/DissPropWorkshop/nuts&bolts/question.pdf

[4]http://www.ryerson.ca/els/Handouts%20for%20ELS%20site/Research%20question%20and%20hypothesis.doc

What is a Research Protocol?

Naveed Zafar Janjua, Devesh V. Oberoi, Mahwash Kassi

"There is nothing like looking, if you want to find something. You certainly usually find something, if you look, but it is not always quite the something you were after."

JRR Tolkien

'The research protocol or proposal is the foundation of a research project. Increasingly, it is becoming more systematic and organized. This is usually done after the question phase i.e. when you have decided the research topic you want to work on. Especially if you are working towards a degree e.g. MPhil, PhD or any other research degree, it is an essential requirement that the research proposal is accepted by the review board before you embark on your project.

A research protocol is, therefore, a roadmap that guides the investigator from conceiving an idea to publishing his/her results. To be brief every study should be planned. An unplanned study according one of my teachers is a fishing expedition.

Quality of any research study depends on how well both design and execution phases of the project are accomplished. There is a positive relationship between the research protocol and overall quality and acceptance of the resulting research study. [1]

Stated simply, when you have a good protocol, you can do a good study, without facing many problems later on.

It is, however, advisable to get your research protocol reviewed by those who are experts in research methodologies (epidemiologists) and/or by people/faculty/mentors in the same field.

The Components of a Research Protocol

The components of a typical research protocol or proposal include:

- A descriptive title
- The name, titles, degrees, addresses and affiliations of the investigators and co-investigators
- Abstract
- Introduction/Background
- Literature review/Literature Survey
- Justification/ Rationale
- Study objective and/or research questions
- Study Methodology and Study Methods
    - Study population and its recruitment
    - Study design
    - Study setting
    - Study duration
    - Sample size determination
    - Sampling strategy
    - Variable list
    - Methods of data collection
    - Data collection tools
    - Plan of Analysis
- Ethical considerations & human subject protection
- Quality control
- Expected benefits from the study
- Operational plan, proposed timeline & budgeting
- Plan of dissemination of results
- References
- Biographical information on investigator and institution

I will elaborate some of these things and more detail can be found in textbooks and literature in journals.

Some Components are as follows:

Study title

It should be brief and explanatory. It should indicate the research topic and as stated, should be concise yet clear. Often, it is better to include the type of study and its setting.

For example, `A case-control study of risk factors of acute hepatitis B in Karachi`.

Introduction/Background

This is the section where you will introduce your research topic. Relevant details about the problem being addressed should be provided; e.g. the pathophysiology of the disease, global burden, similar settings and than local data (if available) should be stated.

Literature review/Literature Survey

The literature review includes a description about what others have done in this field in other countries and then in your country. It forms the basis of your study. The literature review should be in depth to identify potential cofounders and effect modifiers and to determine the areas in which knowledge is needed. The literature review should thus identify any 'gaps' in knowledge.

The existing theories and important studies relevant to your research topic should be highlighted and debated. You should try to explain what your study would add in the light of the available literature.

Justification/Rationale

This is very important. It should explain as to why you want to do this study. Is there any gap in the existing knowledge that you want to fill?

One justification usually stated in epidemiological studies is that the study has been conducted in other settings and the finding can be different in our setting (but this is not a good justification).

Your work should be new and original as explained earlier.

Study objective and /or research questions

This section should identify the immediate purpose of study and should be very clear and concise.

An Objective always starts with `to` (word of accomplishment)

> *For example, `To identify the risk factors of acute hepatitis B in Karachi`.*

Study Methodology and Methods:

The study methodology should include a detailed description of the methods selected with reasoning. You should explain why a particular method of data collection was selected.

*(The difference between research **methodology** and research **methods** should be clear. Although the words are often used interchangeably by researchers, there is a clear difference between these terminologies. This is further explained in the chapter on, "What is the difference between research methodology and research methods.")*

This section should also include a brief description of the experimental design of the study, materials used for the project, the sample size of the study population, inclusion and exclusion criteria and the study population, and the statistical tools and tests that are to be used for the analysis of the results of the study.

Study design

Important designs are:

- Randomized controlled clinical trial

- Cohort Study
- Case Control Study
- Cross-sectional Study
- Case series
- Case reports

Details of the designs can be found in the types of studies section of the book and any epidemiologic text.

Just naming of the design is not sufficient. It should include the details what you want to do, how you are going to recruit subject, how going to follow etc.

Study population and its recruitment

This section should include a description of the study population. Inclusion and exclusion criteria should be clearly stated.

Study setting

This section should include a description of the research setting; whether it is in the community or a hospital. The important characteristics of the study setting should also be included. For example, in case of a hospital the following questions should be addressed:

- ✓ *What are the important characteristics of this/these hospital?*
- ✓ *Which type of patient visit this hospital?*
- ✓ *What catchments does the hospital serve?*
- ✓ *How big is it?*
- ✓ *What diagnostic and treatment facilities does it have?*
- ✓ *Is it a special centre for some specific disease?*

Study duration

The exact or proposed duration of the study should be included in this section.

Sample size determination

This section should address how and according to what assumptions sample size is calculated? It is very important to detect what you intend to do with adequate power. Consult a statistician to determine the exact sample size required to do your study before you embark on your project.

Sampling strategy

This section should include how sampling will be done; whether it is random (specify type of random sampling) or convenient sampling. The exact criteria for how cases and controls will be identified should be explicitly stated.

Variable list

This section should state and define all the variables you want to measure.

Methods of data collection

The section should include a clear description of the method you are going to apply, e.g. medical records, questionnaires and interviews. If you are using a specific standard test or tool to measure something, then you should state the test/tool you are applying and support your argument with specific reasons for applying this test. The specificity & sensitivity of the test should also be stated; especially if some new test is to be applied. A comparison with other available tools should be included in this section.

Plan of Analysis

This section should include how you are going to analyze your data. You should explicitly state what you are looking for and which statistical method you will apply.

This may range from simple descriptive analysis to hypothesis testing or it may be multivariate analysis.

It is always advisable to get help from a statistician for the statistics and analysis aspect of the studies. Even if you know how to analyze data, a statistician can point out specific tests and methods and can help analyze data in a better way.

Ethical considerations & human subject protection:

This is very important to consider. Now every study should be subjected to ethical review by an Institutional Review Board.

Ethical considerations include:

<u>Obligations to study subjects</u>

Considerations include: Protection of their interest. Complete information regarding risk benefit for participating in any research study is complete right of every subject; nothing should be concealed. Maintaining confidentiality of information obtained from subjects.

<u>Consent form guidelines.</u>

<u>Obligation to society</u>

Considerations include: Avoiding conflict of interest, partiality; communicating finding; data sharing etc.

<u>Obligation to funding agencies or employers</u>

Considerations include: Specifying obligations in contract how research be conducted and it will involve ethical, technical, administrative or legal responsibilities.

<u>Obligations to colleagues</u>

Considerations include: Promoting and preserving public confidence in epidemiologic research while not over and under estimating the epidemiologic methods. Disseminating the study findings.

Quality control

This section should state how quality control checks will be introduced and maintained.

Some of the key points are.

- ✓ Training of the data collector
- ✓ Field testing and pilot sties.
- ✓ Field editing and final editing
- ✓ Data entry mistakes checking etc.

Expected benefits from the study

This section should explicitly sate as to how this study would be of benefit to others (the community and the general public at large; as well as the benefit to the scientific community and scientific literature).

Operational plan, proposed timeline & budgeting

The exact plan, timeline and duration of all the research activities mentioned earlier should be clearly outlined. These should ideally be enumerated with proposed timeline and deadlines stated against each of the research activities.

The overall budget for the study should also be stated, accompanied by a breakdown of the costs of each of the research activities outlined earlier.

Plan of dissemination of results

This section should state as to how the findings will be shared with others e.g. by some presentations, reports to the community, publishing results in a journal etc.

References

The References section should include a list of all the resources (journals articles, book chapters, online articles) that have been used or consulted while conducting the study

References should be quoted in Vancouver or Harvard style or as per requirements of the review board."

Tasks for the Researcher:

- ✓ Identify the different parts of a research protocol/proposal and know the importance and components of each part.
- ✓ If you have identified your research topic/question, try developing a research protocol based on the discussion in this section.

References and Further Reading:

[1] Excerpts from this article also available online by the same author: Guidelines for Biomedical Research**.** Dr. Naveed Zafar Janjua. Available online: http://www.pakmedinet.com/page/methodology1 (Accessed August 5, 2007).

[2] Ott MG. Importance of the study protocol in epidemiologic research. J Occ Med 1991; 33(12): 136-39.

[3] The Chemical Manufacturers Association's Epidemiology Task Group. Guidelines for good epidemiology practices for occupational and environmental epidemiologic research J Occ Med 1991; 33(12): 1221-29

[4] Tomenson JA and Paddle GM. Better quality studies through review of protocols J Occ Med 1991; 33(12): 1241-43. .

[5] Fowkes FGR, Fulton PM. Critical appraisal of published research: introductory guidelines. BMJ 1991; 302:1136-40.

[6]International Committee of Medical Journals Editors. Uniform requirements for manuscripts submitted to biomedical journals. N Eng J Med 1997; 336(4): 309-16.

[7] Avan BI, White F. Why a research study need a design? JPMA 200;151:197

[8] World Health Organization. Preparing a Research Project Proposal. Geneva 1991.WHO/HRP/PP/1991.

[9] Jan W Kuzma. Basic Statistics for Health Sciences. 2nd edition. Mayfield Publishing Company, Mountain View California 1992.

[10] Hennekens CH & Buring JE. Epidemiology in Medicine. 1st edition. Little brown Company USA 1987.

[11] Friedman LM, Furberg CD, DeMets DL. Fundamental of Clinical Trials. 3rd Edition. Springer 1998.

[12] World Health Organization. Operational Guidelines for Ethical Committee that Review Biomedical Research. WHO Geneva 2000. TDR/PRD/ETHICS/2000.1

Do you need to buy a computer?

Rana Muhammad Asad, Daniyal Ali

"I do not fear computers. I fear the lack of them."

***Isaac Asimov*[1]**

From emailing to finding important information from journals and online resources, the use of computers is increasingly becoming important. The use of computers will not only save you a lot time and paperwork in the conduct of your research but it will also make your job a lot easier.

Whether you like it or not, you will need a computer to write your research paper or dissertation, while using statistical software to analyze and present your findings or simply to read or search the latest journals online.

There is a general reluctance shown at first by scholars and young scientists to use computers if they are not well acquainted by this machine, especially in developing countries. Whatever the case, some may learn faster than others but eventually with a bit of effort, all can then manage and do their research tasks independently.

The first thing to do is to get a computer for yourself. This will help break the ice. A few advices from your friends and colleagues may all be that would be needed to get you going.

Take a Course:

Once you get your new computer, take some time to learn how to use it. Computers can be very frustrating, especially if this is your first one. There are literally hundreds of computer user groups and evening and weekend courses available at public schools, libraries, and colleges.

A good training course would really help you master the fundamentals and learn about different and better ways of getting your research tasks done.

Which computer to buy?

Considering that most research projects would involve computing skills such as:

- Word processing
- The use of statistical software
- The Internet

You may not need to empty your valet to buy the latest machines. Advice from your computer administrator at your university would be helpful since you would often need to transfer information and files from your machine to ones at your campus and ***compatibility*** may pose a problem. So it is better to have a machine that is similar to the one at your place of work to avoid such issues.

Still Don't Know What to Buy?

Some people feel so confused when it comes to buying a computer, particularly their first computer, that they don't want to have to make a decision and would just prefer that someone just tell them what to get (so they can blame them later). Do I want an Acer, Compaq, Dell, Gateway, Hewlett Packard, IBM, Micron, Toshiba or any unbranded computer system. It can get pretty confusing, especially if you don't have a real good idea as to what you need. That is why I started this document out with having you ask yourself what I am going to be using the computer for.

Here is what we would recommend for a low-end home computer system. You can buy the following system in refurbished models or in used ones:

Table 4: Low-end Home Computer System Recommended Specifications

Low-end Home Computer System Recommended Specifications
2.4Ghz Pentium 4 Processor
Intel D845 series Mother Board
512MB DDR RAM
40 GB Ultra ATA hard drives
48x CD-ROM drive
15 inch color monitor
Integrated AGP graphics
Integrated audio with speakers
56K PCI data/fax modem (if needed)
PSII or USB Keyboard & Mouse
Windows XP Home Edition
Microsoft Office suit.
Norton or McAfee Virus Scan
Surge protector or any good quality Servo motor voltage stabilizer

For a more advanced high-end home computer, this is what we would recommend:

Table 5: Advanced High-end Home Computer System Recommended Specifications:

Advanced High-end Home Computer System Recommended Specifications
Intel Core 2 Duo 2.8Ghz Processor
Intel DG43 series Mother Board
01GB DDR2 RAM
160GB SATA hard drive
Combo Drive (DVD ROM with CD writer)
17" inch color LCD monitor
Integrated AGP graphics
Integrated audio with speakers
56K PCI data/fax modem (if needed)
PSII or USB Keyboard & Mouse
Windows XP Professional Edition
Microsoft office suit.
Norton or McAfee Virus Scan

This is more or less a middle of the road set of recommendations, you would need to add or delete options based on your specific needs. You can of course replace the Intel processor with a comparable AMD processor. Other options that you may want to consider adding to the system would be a printer, scanner, tape backup, digital camera, network card and hub for a home network, and of course additional software applications.

Shopping Tips:

To end this document, we thought we should pass on a few tips to help you be a smarter shopper

Take a copy of the specifications for your ideal computer that you obtained above with you when you visit the computer stores in your area. This will give you a basis for comparison when you look at systems from other computer manufacturers. Don't be afraid to show the salesman your ideal computer specifications and ask how their computer system compares to it.

Do not buy the first computer that you see, whether it's at one of the manufacturer's Web sites or in a local computer store. Gather all of the information that you can and compare prices and components. Buying a new computer is a major investment for most of us and you don't want to get stuck with something that you're not going to use.

Last but not least, take some time to learn the terminology. You want to be able to ask intelligent questions when you meet with a salesman and in order to do that, you need to learn the language. You also need to be able to understand what the salesman is talking about so you don't get talked into buying something that you don't need or leave out something that you do need.

In Closing:

There are many other fine sites on the Web that are no doubt more current with the latest and greatest computer components and software. We encourage you to visit these other sites and by all means, make an informed decision when you buy.

Also to reiterate that advice from your computer administrator at your university would prove very helpful since you would often need to transfer information and files from your machine to ones at your campus and ***compatibility*** may pose a problem.

Good luck!

Tasks for the Researcher:

- ✓ Understand the importance of the use of computers in research.
- ✓ Identify the various areas of research where computers would be of great use and help to you.
- ✓ Try talking to the computer administrator at your institution about the computer that would suit your needs and try getting one for yourself. It will really help you out a lot.
- ✓ Break the ice. Start using computers. An initial advice from your friends and/or colleagues may all be that may be required to get you running.
- ✓ Try visiting computer shops or online shops and try identifying a system that would fulfill your needs as a researcher. Compare this with the specifications suggested by our computer system support engineer.

References and Further Reading:

[1] QuoteWorld.org. Available: http://www.quoteworld.org/quotes/643

[2] Coombs Hilary. *Chapter 1: Getting Started. In: Research Using IT*. Houndmills, Basingstoke, Hampshire; PALGRAVE Study Guides: 2001. Pg 1-13.

JOURNALS

Why read Journals?

Ahmed Ayaz Sabri, Awais Ashfaq

"Research is Creating new Knowledge."

Neil Armstrong

Research is a vast field and it will be very difficult for a young investigator to start effectively without proper guidance. It is very important to know about the different journals and their effective use before starting research work. Selection, understanding and proper utilization of journals is as important as the practical research work. The following article would be a useful guide for beginners**.**

Why should one read Journals? There are multiple reasons for it. We will take the example of medical journals in the following section:

Medical journals are a way for doctors and medical students to keep themselves abreast of the most recent and relevant developments in their field. This is essential for long term medical practice, as medicine is a constantly changing field. The diagnosis, pathophysiology, and the first line treatment of a particular disease yesterday might well have changed today, and any textbook will be out of date by a couple of years, if not months.

Regular journal reading will subconsciously make you more observant and vigilant towards the patients. It will ultimately help you in providing better health care. [1]

It is also a way of keeping yourself up to date to the developments not just in your field, but other related fields as well. Day by day the word 'inter-disciplinary' is stressed upon as many diseases now need an integrated approach amongst various related disciplines to accomplish the desired results. Journals are the only way of achieving these goals.

How to read journals?

Approach to medical journals by beginners should be different from that of regular readers. For a novice, it is firstly important to know what the types of articles published in medical journals are.

Types of articles published in Medical Journals:

In brief, the types of articles usually published by standard medical journals include:

(1) Original articles (*the results of a research study conducted by an author or group of authors trying to answer a new, original hypothesis*);

(2) Review Articles (*that is a like a book chapter acting as a latest review to all the developments that have taken place over the past few years regarding a particular topic. They thus provide comprehensive, scholarly overviews of important clinical subjects);*

(3) Editorials (*written by the editorial board of the particular journal, they provide analysis and focus on a particular article published in a medical journal. Often an issue of a journal has a particular theme. The editorial is often a way of conveying to the readers why the particular theme/topic was chosen and its importance);*

(4) Case Reports (*report unusual/rare presentations of common diseases or presentations of rare or 'new' diseases*).

(5) Letters to the editor (*is a forum for readers to comment about a particular article published in the particular journal. These usually are sent within 2*

weeks of publication of the particular article that the readers want to comment upon).

(5) Other Articles: *Some journals have other sections such as interviews of important people related to the medical field, articles on health policy, human rights, health law etc.* [2]

Which journals to read?

Certain rules:

In order to become a consistent reader of journals, you need to follow certain rules in the beginning. Start with student medical journals (Table 6) to get acquainted with the nature and content of medical journals, and then proceed to other general medical journals (Table 7). You should also keep yourself up to date with articles published within your local journals (Table 8).

Keep it simple; do not worry about understanding everything that you read. A good thing to do is to always keep a medical and/or an English dictionary with you, and when in doubt, never hesitate to ask a senior.

Always start reading the journal from the article that attracts you most and then proceed to reading other articles. Level of interest can be judged by going through the summaries/ abstract or the first paragraph of an article. If you don't find any article of your interest, then read relatively simple articles like review articles before you go for original research papers. Do not try to read whole journal in one sitting. Make it a habit to visit different sites of various medical journals at least twice a week.

How to read and evaluate any research article?

Awais Ashfaq

A valuable skill to develop is the ability to critically read and evaluate research literature. Without this ability, one will not be able to differentiate between a lay man's report and one of quality. A top-grade report stands unshaken under the critical process of peer review. In essence, every user of literature, by doing a critical analysis, is carrying peer review to its ultimate end.

Awareness of the potential for *bias* underlies a critical reading of any research report. But bias is not the only issue to keep in mind. A great deal may be learned by taking a systematic approach to a critique of any research literature. Here are some of the most important questions that should be considered when reading any research article:

- ✓ ***Research objectives:*** Does the research report clearly state its objectives? Do the conclusions address the same objectives?
- ✓ ***Study design:*** What type of study was it? Was sample selection random and appropriate to the study design? Were cases and controls comparable and drawn from the same reference group?
- ✓ ***Data collection:*** Were criteria for diagnosis precisely defined? Were end points (or outcomes) clearly stated? Were research instruments (whether mechanical or electronic devices, or printed questionnaires) standardized? Can the study be independently replicated?
- ✓ ***Discussion of results:*** Are results presented clearly and quantitatively? Do tables and figures agree with the text? Are various tables consistent with one another?
- ✓ ***Data analysis:*** Does the report address the statistical significance of its results? If not, are you able to draw a reasonable inference of significance

(or non-significance) from the data you presented? Were the statistical tests appropriate to the data? Does the report discuss alternative explanations for what might be spurious statistical significance?

- ✓ ***Conclusions:*** Are the findings justified by the data? Do the findings relate appropriately to the research objectives originally set forth?

Tasks for the Researcher:

- ✓ Try to identify the journals of interest in your area of research.
- ✓ Try to identify as to which journals are available in your library and those that are available online. Amongst journals that are available online try to identify which are open access and which does your institution has subscription to?
- ✓ Try developing a habit of reading journals and articles that are of interest to you.
- ✓ When reading any article, try critically reading it so that you understand the findings and its implications better.

References and Further Reading:

[1] Villanueva T, Ravichandran B**.** Digesting Journals. StudentBMJ 2006;14:265-308 July

[2] Guidelines for authors. The New England Journal of Medicine. http://www.nejm.org

[3] Sabri AA. Reading Medical Journals: A beginners guide for Medical Students. 10/90 Student J 2007. 1 (1): e2. Available online: http://www.promotingresearch.com/e2.html

Table 6: List of Student Medical Journals

The PLoS Medicine Student
http://journals.plos.org/plosmedicine/studentforum.php
Student BMJ
http://www.studentbmj.com/
McGill Journal of Medicine
http://www.medicine.mcgill.ca/mjm/index.htm
Medscape Med Students
http://www.medscape.com/medicalstudents
The New Physician
http://www.amsa.org/tnp/
Global Medicine
http://www.globalmedicine.nl/
Global Pulse
http://www.amsa.org/globalpulse/
The Lancet Student
http://www.thelancetstudent.com/
Student JAMA
http://jama.ama-assn.org/ms_current.dtl

Table 7: List of some Medical journals

New England Journal of Medicine (NEJM)
http://content.nejm.org/
Journal of the American Medical Association
http://jama.ama-assn.org/
The Lancet
http://www.thelancet.com/
British Medical Journal (BMJ)
http://bmj.bmjjournals.com/
Annals of Internal Medicine
http://www.annals.org/
PLoS Medicine
www.plosmedicine.com/

Table 8: List of some Local Journals

JPMA
http://www.jpma.org.pk/
JCPSP
http://www.cpsp.edu.pk/jcpsp/
JAMC
http://www.ayubmed.edu.pk/JAMC/

What is an Impact Factor?

Abdul Malik Achakzai, Masoom Kassi

"Research is formalized curiosity. It is poking and prying with a purpose."

Zora Neale Hurston

At present there are thousands of journals and someone new to the field might find it difficult to decide about which journals to read.

Here the **Impact Factor** of the journals can act as a rough guide.

> *"The Impact factor, often abbreviated IF, is a measure of the citations to science and social science journals. It is frequently used as a proxy for the importance of a journal to its field."* [1]

Formula to calculate an impact factor:

"A journal's impact factor is calculated from this equation:

Journal X's 2005 impact factor =

Citations in 2005 (in journals indexed by Thomson Scientific [formerly known as Thomson ISI]) to all articles published by Journal X in 2003–2004

divided by

Number of articles deemed to be "citable" by Thomson Scientific that were published in Journal X in 2003–2004." [2]

Roughly, the higher the number of citations the articles of a particular journal get, the higher the impact factor. Although controversial, it is still a rough guide to the quality of the particular journal.

And for a novice researcher to the field, it would be a good idea to start from journals that have high impact factors. However, to rightly understand the true purpose, the meaning, the use, abuse and the limitations of the impact factor, please go through the readings suggested.

Tasks for the Researcher:

- ✓ Know in simple terms the definition of an impact factor.
- ✓ Know what it can measure and what it cannot measure
- ✓ Try learning about the debate that is going on about this topic. See how it affects you.

References and Further Reading:

[1] Impact Factor. From Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Impact_factor

[2] The PLoS Medicine Editors. The Impact Factor Game *PLoS Medicine* Vol. 3, No. 6, e291 doi:10.1371/journal.pmed.0030291

[3] Impact Factor. From Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Impact_factor

[4] The Thomsan Scientific Impact Factor. http://scientific.thomson.com/free/essays/journalcitationreports/impactfactor/

[5] The PLoS Medicine Editors. The Impact Factor Game PLoS Medicine Vol. 3, No. 6, e291 doi:10.1371/journal.pmed.0030291 http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.0030291

[6] Porta M. Quality of impact factors of general medical journals. BMJ 2003;326:931 http://www.bmj.com/cgi/content/full/326/7395/931

[7] Garfield E. Journal Impact Factors: A brief overview. CMAJ. 1999 Oct 19;161(8):979-80. http://www.cmaj.ca/cgi/content/full/161/8/979

LITERATURE SEARCH

What are the different Search Engines?

Osama Ishtiaq, Mahrukh Fatima, Aitzaz Bin Sultan Rai

"If we knew what we were doing it wouldn't be research."

Albert Einstein

Sources of literature include books, journals, databases and the internet. 'Nowadays, the Internet provides free access to a great deal of the literature, either in full text or citation/abstract format, and it offers search capabilities good enough to fulfill most information needs.' [1]

Increasingly, almost all journals have made their articles available online and easily searchable through search engines. These search engines have made searching for articles and relevant literature a click away.

A more specific approach here would be to directly access these Websites. Table 9 outlines some of these different international and local search engines. Numerous factors eventually determine which search engine you will choose for information.

Table 9: List of some of the Common Search Engines

Search Engine	Website
PubMed	http://www.pubmed.gov/
PubMedCentral	http://www.pubmedcentral.nih.gov/
Google Scholar	http://scholar.google.com/
Public Library of Science (PLoS)	http://www.plos.org/
SCOPUS	http://www.scopus.com/
EMBASE	http://www.embase.com/
The Cochrane Collaboration	http://www.cochrane.org/
WHO: World Health Organization	http://www.who.int/publications/en/
PakMediNet	http://www.pakmedinet.com/
IndMed	http://indmed.nic.in
IranMedex	http://www.iranmedex.com/english/index.asp
African Index Medicus	http://whqwings.who.int/RIS/RISWEB.isa/
CAS: A Division of American Chemical Society	http://www.cas.org/
CAB Abstracts	http://www.cabi.org/
Pscych INFO	http://www.apa.org/psycinfo/
MathSciNet: Mathematical Reviews on Web	http://www.ams.org/mathscinet/search.html

Which search engine to choose?

Ferha Saeed, Jawad Kiani

The choice of particular search engine is determined by several factors; most important being the **cost**. Some of these search engines such as pubmed and google scholar are public and anyone can search for literature and use them free of cost. They do offer registration; but that offers extra perks and personalization such as the ability to save your searches online along with other useful options to make your literature search an easier job. On the other hand, there are search engines which have unique powerful capabilities but all this is not free and often subscription has to be bought at an institutional level, which can be very expensive.

The next factor which determines the choice of the search engine is your **field/area of research**. Some search engines have articles exclusively regarding a particular topic e.g. 'CAS' has articles specifically related to chemistry and related sciences; thus suiting some investigators more than others.

Another factor in the choice of the search engine, which is an important debate these days, is **open access**. Let me explain this with the help of an example.

For example, although I can search for literature on pubmed for free but often or most of the time, only the title and abstracts are the parts that are available for free viewing. This may not be of good use for an investigator, especially in the developing world, who has limited access and limited subscriptions to articles in international journals.

To address this important issue and make literature freely available online for everyone, the concept of Open Access is being encouraged. There is a paradigm shift occurring and increasingly journals and scientists are moving towards and encouraging open access in research. Not only are some journals or groups of journals open access, i.e. articles are completely available online for free, but so are some search engines, which limit their search to only Free Full Text Articles i.e. allow searching only on articles that are completely and freely available online. For example, PubMedCentral is a search engine which is a completely 'free digital archive'.

Similarly, PLoS (Public Library of Sciences) is a group of journals that are open access. Their journals include:

- ✓ PLoS Medicine,
- ✓ PLoS Biology,
- ✓ PLoS Computational Biology,
- ✓ PLoS Neglected Tropical Diseases,
- ✓ PLoS ONE,
- ✓ PLoS Pathogens and
- ✓ PLoS Genetics.
- ✓ PLoS Hub

Its editorial boards include experienced and leading researchers and scientists from leading journals and diverse backgrounds who have joined together to promote a culture of open access. Already they have achieved numerous milestones in terms of the impact that their publications and journals are having.

Another feature which might determine your choice of your search engine is the **specific features and tools** of the particular search engines.

For example:

The Related Articles Link in PubMed automatically returns for you a complete list of articles that are similar to the one you are viewing in terms of title, keywords etc.

Some search engines also display how many times a particular article has been cited by others, e.g. Google Scholar. This may be of use for some investigators.

Also, **the scope, the coverage and the horizon** of the search engines might determine which one you want to use. For example, some search engines limit their searches to only indexed articles while others may include other local journals and conference proceedings too.

Ultimately, it all depends on you and your research question and the methodology and the strategy/approach adopted to answer your research question.

It would be best at this point in time if the investigator could take time in visiting the sites of these search engines and learn more about them and identify search engines that would best suit him. Also talk to your librarian if the institution has access to some of the search engines; that would give you more tools and features to work with.

Some of the search engines useful for literature search were depicted in Table 9 in previous section. To my surprise, the list further goes on. Try searching in google and talk to your mentor regarding search engines relevant to your field of interest and familiarize yourself with the tools and features of each of them to make your literature search a lot easier and more powerful.

References and Further Reading:

[1] Features – Researching Medical Literature on the Internet. Available: http://www.llrx.com/features/medical.htm

How to search in Search Engines?

Ali Hyder Zaidi, Akshay Sharma

"Enough Research will tend to support your conclusions."

Arthur Bloch

You can search your area of interest by:

- Using keywords that appear in the title of the research articles.
- Using keywords that appear anywhere in the article
- Using names of authors that have written on your area of research
- Using names of journals that are on the same subject as your research

You can also limit and focus your area of search by:

- Selecting the years e.g. all research articles published in the last 5 or 10 years
- Selecting the research designs e.g. only review articles or only randomized controlled trials.
- Selecting the language e.g. return articles only written in English.
- Selecting the research subjects e.g. studies done only on human subjects or animal subjects or both. You can also limit by asking the search engine to return articles published only on women or men or both.
- Selecting the age groups e.g. infants, children, adults or elderly or by entering specific ages.
- Selecting only articles that are available as 'Full Free Texts'

Try to limit your search to 2-3 keywords. The journey does not end here. You would then have to review the title and abstracts to select the articles relevant to your research topic. Often search engines allow articles of your interest to be selected using ‘checkboxes’ against the articles.

Recently, most databases like PubMed have added an ‘Advanced Search’ option on their websites, which allow you to perform the above selections easily.

Some databases also allow you to save the searches you conducted after you have registered (often free). You could also email yourself or your colleague the search results to maintain a record and return to them later on.

What are Boolean Operators?

Boolean operators are the key terms that help computers and databases understand what the list of articles that the researcher wants returned and how would he/she want his search to be limited or narrowed to.

The Boolean Operators include:

AND: The use of AND while searching for articles implies that the researcher only wants articles that contains all the keywords specified to the search engine.

OR: OR implies that the database or search engine should return or retrieve articles that contain at least one of the specified keywords.

NOT: As evident, NOT is used when you do not want the search engine to retrieve particular articles and these should not be included in the search results.

The following example helps explain this concept further:

For example:

- *Article 1 has the keywords: Trachoma, Surgery, Treatment*

- *Article 2 has the keywords: Trachoma, Public health, Prevention*
- *Article 3 has the keywords: Trachoma, Environment, Pakistan*
- *Article 4 has the keywords: Surgery, Cure, Treatment, Chlamydia*

Based on this if we search using the following keywords, the search engine would return results as depicted below:

- *'Trachoma': All articles with the keyword 'Trachoma' would be included in the search results.*
    - *Article 1, 2 and 3*
- *'Trachoma' OR 'Surgery': All articles with either of the keywords 'trachoma' or 'surgery' would be returned:*
    - *Article 1, 2, 3 and 4*
- *'Trachoma' AND 'Surgery': Only articles that have both the keywords stated would be included:*
    - *Article 1*
- *'Trachoma' NOT 'Environment': All articles on trachoma but exclude ones on environment:*
    - *Article 1 and 2*

Combining Boolean operators (NESTING):

You can also combine Boolean operators for a more systematic and organized approach to your search.

For example, if you wanted articles returned on 'Trachoma' AND 'Treatment' as well as articles on 'Trachoma' AND 'Pakistan'; the following would be used:

'Trachoma' AND (Treatment OR Pakistan)

- ✓ So the search engine would first search and return articles that contain both 'Trachoma' and 'Treatment' as keywords (Article 1); and then make a second search for articles that contain both 'Trachoma' and 'Pakistan' as keywords (Article 3); and finally combine these two searches and return the results:

  - Article 1 and 3

How to use these operators in different search engines?

Usually the above method holds true for most search engines. However, you may have to take a look at the help section of the particular search engine that you are using to familiarize yourself with the way they want the boolean operators to be used and how do they want you to search for a particular topic. The exact rules for searching efficiently have been laid down by the different search engines and are easily accessible and often straightforward and easy to understand. This would also help you to learn some shortcuts and other methods for efficient use of the particular search engine.

Tasks for the Researcher:

- ✓ Know what are search engines?
- ✓ Try to identify search engines that are relevant to your field of study.
- ✓ Try talking to your mentor about which search engines to use.
- ✓ Try going online and read about the various features and tools of different search engines of your interest.
- ✓ Try learning about how to search in search engines.
- ✓ Know what are Boolean operators?
- ✓ Try using the Boolean operators AND, OR and NOT in your searches.
- ✓ Try combining Boolean operators in your searches.
- ✓ Learn about the particular syntax that your search engine of interest requires for use of Boolean operators.

References and Further Reading:

[1] Fink, Arlene. (2008). Practicing Research: Discovering Evidence that Matters (Chapter 2: The Research Consumer as Detective, pages 52-55). Thousand Oaks, CA: SAGE Publications, Inc.

Tips on Effective Biomedical Literature Search

Farooq A. Rathore, Fareeha Farooq

"For every minute spent in organizing, an hour is earned."

Benjamin Franklin[1]

Biomedical literature search is an integral part of a doctor's life whether he is a resident searching for his thesis/ dissertation or a consultant who wants to remain updated with the latest trends in medical sciences. Unfortunately often in developing countries there is no formal training in biomedical research or hands on workshops to teach this important aspect of medical education.

We have seen residents and even senior doctors spending hours on performing medical literature search and still they are unable to retrieve their desired articles. These tips and guidelines are primarily meant for young researchers based but we believe that with some local adjustments these can be helpful to any young investigator fishing for medical literature in the sea of Medical Sciences.

Preparing for the search:

- ✓ Internet has revolutionized the concept of medical literature search. It is cost effective, time saving and allows a researcher to browse millions of articles. Polish you computer and Internet browsing skills before proceeding any further.
- ✓ Get yourself a computer based on your research needs as outlined in the chapter on do you need to buy a computer?
- ✓ Allocate an appropriate time, focusing completely on the literature search.

- ✓ If there is more than one researcher working on a project/ article, then it may be desirable that each colleague searches for a specific portion or question only; e.g. epidemiology, historical aspects, new advancements etc. This will avoid duplication of efforts and save time.
- ✓ Chose an appropriate Internet browser. There are more than a dozen web browsers available but personally we would prefer Mozilla Firefox.
- ✓ Divide your research question into a list of sub-questions. Prepare a list of keywords for each of the sub-topic before you actually start the literature search. It will make your search quicker and more focused.

What and Where to Search:

- ✓ Decide about the source of information that you are interested in. The main sources of biomedical literature are journal articles, books, thesis, dissertations and general information available online. Go for the online search engines and journal options first; but try to go through other sources to make sure your literature search is complete and/or comprehensive.
- ✓ Carry out the literature search in a library. Biomedical literature search can be carried out at home, but it is always better to do it in the library because of the following reasons
    - a. Many libraries have institutional access that allows an individual access to full text articles.
    - b. Colleagues and librarian are around who can help you in case you are lost at the sea (of medical literature)
    - c. The quite library environment helps in concentrating on the actual research work.

d. One can always consult a text book or journal (not available on line) while working in a library rather than at home.

- ✓ Visit the libraries of medical colleges/universities located in your vicinity. Many institutions have different subscriptions and access to literature that may be different from your parent institution.
- ✓ Check if your institution has access to digital libraries of journals and books available online. Searching online and having full text subscription to these journals and books can prove very useful. These subscriptions purchased by universities gives its researchers full text online access not only to millions of articles (from Elsevier, Bentham Science, Springerlink , Taylor & Francis etc) but also to online books and data bases from, for example, McGraw Hill Collections.

Making the Best Use of PubMed:

- ✓ While performing an online literature search start at the PubMed (www.pubmed.com). It is the largest online database of biomedical literature indexing over 18 million citations from MEDLINE and other life science journals for biomedical articles back to 1948.
- ✓ If you are new to PubMed it would be worth spending an hour or so exploring the tutorials and FAQs (frequently asked questions) located at the left sidebar of the PubMed home page.
- ✓ Register yourself for free (right upper corner) and always run a search after logging in. It will allow you to save searches and setup alerts at your personal "My PubMed page".
- ✓ If you are interested in a particular research topic and want to remain updated, then set up an alert in the PubMed. You will receive weekly or monthly article

alert (depending on your preference) as they appear in the PubMed.

- ✓ Learn to use the “Limits”. You will be able to narrow down and focus your search based on the language, journals, authors, time line, subsets and type of article limits.
- ✓ Try to display the search in “Abstract Plus” format. It will not only display the abstract (if available) but also display a list of similar and relevant articles on the right side.
- ✓ Look out for the full text options. If there is a full text link available it will be displayed with the abstract. Never try to cite after reading the abstract; this is a bad practice. Try to read the full text of an article before drawing any inferences or quoting that article in your literature search.
- ✓ The default display in PubMed is of 20 results at one page. This can be increased to 500 citations display from the drag down menu. This is particularly useful while dealing with more than 50 results.
- ✓ PubMed offers a community tool bar with many useful features that are going to make your research experience more rewarding. (http://pubmed.ourtoolbar.com/)
- ✓ While doing literature search it is always good to visit PubMed Central (PMC) (www.pubmedcentral.com). PMC is the U.S. National Institutes of Health (NIH) free digital archive of biomedical and life sciences journal literature. It has thousands of articles available free of cost and in some cases the archives date back to 1896. This is particularly useful in the context of developing countries with limited or no access to these expensive subscriptions to journals.

Sources Available Free of Cost:

- ✓ In biomedical research there are many quality journals that are absolutely free of cost and open access. Try learning about these sources to enhance your literature search.
  - o www.pubmedcentral.com
  - o http://www.amedeo.com/

Retrieving full-text articles:

- ✓ Search PubMed by setting the limits to "Free full text "only. And/Or you can run the search engines through the institutional access provided. In most of the cases the full text options are indicated by a green icon by the side of article title.
- ✓ If an article is not available at your institution, you can contact the librarian to provide for the article or you can write to the corresponding author. Many authors do respond to the requests for an article.
- ✓ If still full text is required and access nor a request for an article is responded by the author, it won't be a bad investment paying 30 US dollars for the full text article. You would need a credit card to make the article available immediately online. Otherwise, a bank draft can also be sent.

General Guides/Tips:

- ✓ Always keep a backup of your literature search on a USB drive or a CD ROM once you have finished the literature search. Computer Hard drives are known to malfunction at times and may result in loss of precious data.
- ✓ Share the results of your literature search with your colleagues, mentors and/or supervisors. They may help you guide further.

Further Readings and References:

- Quotes from http://creativequotations.com
- FREE online issues available for all Clinics titles http://www.theclinics.com/home/free_issues
- Current free trials from Sagepub http://online.sagepub.com/cgi/freetrial
- Opt-in Access to Newly Launched Wiley-Blackwell Journals http://www3.interscience.wiley.com/aboutus/new_journals_opt-in_form.html
- Medical and Life Sciences Trial Subscription http://www.worldscinet.com/trial/medical.shtml
- HEC National Digital Library http://www.digitallibrary.edu.pk/
- Participants of Digital Library http://www.digitallibrary.edu.pk/institutes.php
- Eligibility Criteria for HEC digital library http://www.digitallibrary.edu.pk/eligibility.html
- PubMed® Online Training http://www.nlm.nih.gov/bsd/disted/pubmed.html
- PubMed Help http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=helppubmed&part=pubmedhelp
- Open access article collection http://www.pubmedcentral.nih.gov/fprender.fcgi?tabindex=7
- A link to a huge collection of online e-books and journals http://www.4shared.com/dir/11299999/70b4af29/sharing.html
- Open Access e-Books http://www.digitallibrary.edu.pk/OAEBooks.html

RESEARCH METHODOLOGY, RESEARCH METHODS and STATISTICS

What is the difference between research methods and research methodology?

Rakhshanda Rehman, Talha Khawar

"Research is to see what everybody else has seen, and to think what nobody else has thought."

Albert Szent-Gyorgyi

As defined by Gina Wisker [1],

> *"Methods are the vehicles and processes used to gather data."*
>
> *"Methodology is the rationale and philosophical assumptions underlying a particular study rather than a collection of methods, though methodology leads to and informs the methods."*

Research methods, therefore, are the means, the instruments or the tools a particular investigator chooses to accumulate the information required to answer his research question. We all have used at least one or more of these tools for our research projects. These, for example, include questionnaires, interviews, medical records, or audiovisual materials. *See the chapter on methods of data collection to learn more about these tools.*

On the other hand, research methodology, in simpler terms is the manner or the approach the investigator adopts in answering his/her research question.

As simply stated by Grix [2],

> *"A project's methodology on the other hand is concerned with the discussion of how a particular piece of research should be undertaken and so can be best understood as the critical study of research methods and their use.*

> *The term refers to the choice of research strategy taken by a particular scholar as opposed to alternative research strategies."*

The section of methodology should therefore not only propose the strategy for answering the particular research question or hypothesis but also a detailed account of all the different methods that would be used to collect the required data and information. A comparison with other methods should be made and the choice of the particular method should be explicitly stated and backed by arguments.

Methodology, therefore, in simpler terms is the strategy or the approach adopted by the researcher or investigator.

Tasks for the Researcher:

- ✓ Try to differentiate between the terms 'research methods' and 'research methodology'.
- ✓ Know the components of the section of research methodology.

References and Further Reading:

[1] Wisker, Gina. (2008). *The Postgraduate Research Handbook: Second Edition (Chapter 6 Research Methodologies , page 65-75)*. Houndmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN, PALGRAVE Study Guides.

[2] Grix, Jonathan. (2004). *The Foundations of Research. (Chapter 2 : page 30-32)* Houndmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN, PALGRAVE Study Skills.

What is a Research Paradigm?

Masoom Kassi, Salman Fasih Khan

“He who does not research has nothing to teach”

Research paradigms refer to the broad ‘**approaches’** to research.

Paradigms refer to ‘our understanding of **what** one can know about something and **how** one can gather knowledge about it.’

Positivistic Research Paradigm:

If you are the sort of researcher or you are working in an area of research where for you the world is ‘knowable’ i.e. if you ask the right set of questions, you can discover and know whatever there is to know and discover all the required facts, then you probably are considering and working on the positivistic research paradigm.

The area of research where this holds particularly true are the ‘sciences’; and usually the methods that are used to prove the hypotheses are quantitative.

Thus for the positivistic researcher, the world is ‘definable, fixable, provable, and can be discovered and described.’ [1] Positivists seek ‘objectivity’ and ‘believe in the possibility of making causal statements’. More emphasis is on ‘explanation’ rather than ‘understanding’.

Positivistic research paradigm has emerged as the leading research paradigm in the last several decades.

Interpretivism

Having understood the positivistic approach to research, the most important thing to realize about the other paradigms is the fact that they are ‘anti-positivist’.

Here, on the contrary if you are the sort of researcher or you are working in an area of research where for you the world is ‘indefinable’ i.e. you can interpret and ‘add meaning’ to this world depending on the person, setting and time, then you probably are using the anti-positivistic research methodology.

Such area of research involves ‘making theories and contributing to meaning rather than testing theory and meaning’; and usually the methods that are used to prove the hypotheses are qualitative.

Thus for the anti-positivistic researcher, the world is ‘indefinable’, and ‘he can ask questions but never gain absolutely final answers’ and the meanings and understanding he derives are all ‘relative’. [1]

Here in contrast to the 96ositivist approach, the focus is on ‘understanding’ rather than ‘explanation’. Subjectivity and the way each researcher interprets the world he/she lives in cannot be ignored and this ultimately affects the meaning and conclusions we derive from the results of a study. Interpretivists, therefore, ‘do not try to establish causal relationships in the social world, as their emphasis is on understanding.[2]

Postpositivistic (Critical Realism) Research Paradigm

Post positivists lie in the spectrum from **explanation (positivism)** to **understanding (interpretivism)**. Post-positivists and critical realists have tried to combine the ‘why’ and ‘how’ approaches to research. In simple terms, critical realists ‘see not only to understand but also to explain the social world.’ [2]

Tasks for the Researcher:

- ✓ Try to learn the meaning of research paradigm.
- ✓ Try learning more about the major research paradigms quoted in this section.
- ✓ Try to identify which research paradigm are you following and /or which area of your research relates to the paradigms mentioned.

References and Further Reading:

[1] Wisker, Gina. (2008). *The Postgraduate Research Handbook: Second Edition (Chapter 6 :Research Methodologies , page65-75)*. Houndmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN, PALGRAVE Study Guides.

[2] Grix, Jonathan. (2004). *The Foundations of Research. (Chapter 5: Introducing the Key Research Paradigms, pages 76-99)* Houndmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN, PALGRAVE Study Skills.

What are the different Methods of Data Collection?

Rakhshanda Rehman

"To Write it, it took three months; to Conceive it, three minutes; and to collect the Data in it, all my life"

After having decided the research topic you want to work on, you then need to select the appropriate method for getting those answers to your research questions. As rightly pointed out by Robson,

A researcher who is out to collect data and the different methods he employs, for example, questionnaires or interviews is just like how a detective would go about in solving a case and collecting information pertaining to it. [2]

Selection of the appropriate method depends on the type of information you are seeking. Usually for most researchers, the most common methods available include:

- Questionnaires
- Interviews
- Standardized Tests
- Attitude Scales
- Direct Observations
- Experiments
- Documents
- Audiovisual Materials
- Record reviews
- Collection of email or electronic messages
- Web based/Internet Survey

These research methods can further be classified into:

[1] Quantitative Research Methods:

[Typically questionnaires) which deal with 'quantity and quantifying information'.

Following are some of the examples of quantitative research methods:

- ✓ Questionnaires
- ✓ Surveys

Usually these involve large sample sizes.

[2] Qualitative Research Methods:

(Typically interviews) which deal with 'subjective' experiences e.g. 'perspective of individuals. [3]

Following are some of the examples of qualitative research methods:

- ✓ Interviews
- ✓ Observations
- ✓ Life histories

Usually these involve small sample sizes and are more time consuming.

The choice of method depends on the research question and often involves a combination of both qualitative and quantitative approaches.

The use of specific methods not only allows a researcher to gather and collect the required information to answer his/her research question; but also allows other researchers to replicate the study in their context. [3]

Tasks for the Researcher:

- ✓ Try to enumerate the different methods of collecting and gathering data.
- ✓ See which methods of data collection have you used previously and which would be of use to you in your current and/or future research studies.
- ✓ Know the difference between and the importance of the quantitative and qualitative methods of data collection.
- ✓ Try to learn where quantitative methods of data collection would be of use and where qualitative methods would be better suited.

References and Further Reading:

[1] Famous Quotes; Research Quotes. Available: http://famous-quotes.ws/category/Research

[2] Robson C. Real World Research. 2nd Edition. Blackwell Publishing. Oxford. 2002.

[3] Grix, Jonathan. (2004). *The Foundations of Research. (Chapter 5: Introducing the Key Research Paradigms, pages 76-99)* Houndmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN, PALGRAVE Study Skills.

What is a questionnaire? What are the different types of Questions?

Mohammad Ans, Hrishikesh S. Kulkarni

"The Trouble with research is that it tells you what people were thinking about yesterday, not tomorrow. It is like driving a care with a rearview mirror."

Bernard Loomis

A questionnaire is one of the most important building blocks of a research project. This statement holds particularly true for community based projects.

From the research point of view, questionnaire-based studies are one of the most convenient to perform, as they have minimal dependence on the mentor, there are no invasive procedures which need consent or put the patient at risk and can be used in the short-term for cross-sectional or case control studies. They can also be used to follow up patients in cohort studies, to see the evolution of a disorder.

The most important secret behind a good questionnaire is a good and focused hypothesis. Often the tendency is to accumulate everything about anything related to the topic in question. This is a fallacy due to several reasons:

- ✓ Leads to wastage of too much time
- ✓ Data entry becomes unmanageable
- ✓ If the questionnaire addresses a respondent, after a few questions the quality of the responses decline as the respondent just wants the questionnaire to end soon.

Eventually such projects perish as a sizeable number is never achieved due to the long list of things that the questionnaire wanted to address.

To prevent this from happening, more time needs to be spent on framing the right question and be focused rather than diffuse. For example, rather than saying that you want to do a project on Diabetes Mellitus, your question should address a specific aspect related to the disease process; example the incidence of a particular side effect due to a specific drug used in Diabetes.

Questionnaires can be administered orally or in a written form. The written form may be suitable in populations with a high literacy rate. However, in many developing countries this is not possible and hence, the questionnaire needs to be administered orally. The advantages of the written form are that the subject gets a greater sense of privacy and can honestly provide answers without bias being introduced in the presence of an interviewer. This becomes especially important in a questionnaire assessing needs, when the interviewer is a member of the healthcare team caring for the patient. It can also be used in multi-centric studies without bias being introduced due to the different interviewers. This is a major disadvantage of orally administered questionnaires. The other disadvantage is a Pygmalion effect, where expectation of the interviewer influences the answers of the subject.

Following is an important description about questionnaire construction and the types of different questions used in questionnaires.

Definitions:

Questionnaire:

Questionnaires are usually paper-and-pencil instruments consisting of series of questions which help in getting statistically useful information about people's attitudes, knowledge, beliefs and perceptions on variety of topics.

Questionnaires occupy vital role in the success of survey studies. Construction of questionnaires needs to be focused a lot because outcome of your study depends entirely on the questionnaire design and you can't expect good end if there are flaws in the beginning of your project.

Respondent:

A Respondent is the person who fills questionnaire.

Incorrect questions, inappropriate language, bad format and wrong ordering of questions may have negative impacts on the outcome of your survey research. Questionnaires, in the field of medicine, are usually used in observational studies like cross sectional or longitudinal study. Development of a suitable and reliable questionnaire involves several steps taking substantial time. This article illustrates the sequential steps involved in the development and testing of questionnaires. Moreover it describes types of questions and merits and demerits of each type.

Project and Population Conceptualization:

First step of "questionnaire making" consists of two parts:

1. In the first step of questionnaire making, background of proposed research is examined and the points of interest are demarcated. This includes detailed review of purpose, objectives and hypothesis of research project. A thorough understanding of the problem through literature search and readings is a must.

2. Second step consists of determining background of audience (respondents) especially their educational/readability levels, religious affiliation and limitations and the process used for selecting the respondents (sample vs. population).Important aspects which must be taken care of are given below.

    - Can the population be enumerated?

- Is the population literate?
- Will the respondents cooperate?
- Are there issues with the understanding of subject?
- What are religious and ethical restrictions?

Questionnaire Conceptualization:

This step further consists of 3 parts.

1. In the first step theoretical framework of project is converted into statements and questions while establishing a link between objectives of study and questions (statements). For example the researcher should indicate those variables which questionnaire is going to measuring i.e. knowledge, attitude, behavior, feeling etc

2. In the next step, types of questions, appropriate scales of measurement and ordering of questions are defined.

3. In the last step, questions are designed in reference with "Project and Population Conceptualization" and types and scales of measurement.

Testing of Questionnaire:

In order to be sure about the accuracy of questionnaire, it's always advised to pre-test it on a smaller number of people before its final administration on sample. This is called pilot testing of questionnaire. Reliability of questionnaire is established using a pilot test by collecting data from 25-30 subjects who are not included in the actual sample and results are analyzed to check the accuracy of questionnaire.

Types of Questions:

Questions can be divided into many types. Important ones are described below

Table 10: Types of Questions

• Close ended questions (Fixed response)
• Open ended questions (Variable response)
• Contingency Questions
• Likert Scale Questions
• Visual Analogue Scale questions
• Dichotomous or Ipsative questions
• Leading questions
• The double barreled questions

Closed ended questions:

These questions have fixed response and the respondent has to choose one of the mentioned choices. These types of questions help you in calculating statistical data and percentages. Closed ended questions are more specific, take less time to answer and more meaningful. The response rate is higher with surveys that use closed-ended questions.

Examples:

Check all those which are true according to you

☐ *Male* ☐ *Female*

In which medical college do you study?

☐ *KEMU* ☐ *AKU* ☐*RMC* ☐*PMC*

Do you smoke?

Yes ☐ *No*☐

Open ended questions:

Open format questions are those questions which allow respondents to express their thoughts about a particular question. In these types of questions, there are no predetermined set of responses and the person is free to answer however he/she chooses and you can get many unexpected answers. It's difficult to categorize your results with these types of questions and the response rate is also low as respondents have to think and answer in their own words.

Example:

What are your views about antidepressant drugs?

………………………………………………………………………

………………………………………………………………………

Contingency or Filter Questions:

Those questions which are in series and answered only if the respondent gives a particular response to a previous question are called contingency questions. This avoids asking those questions to people that do not apply to them. They are also known as filter questions.

Examples:

Question – 1: Please specify gender:

☐ *Male* ☐ *Female*

Question – 2: What's duration of your menstrual cycle?

☐ *28 days* ☐ *30 days* ☐ *29 days* ☐ *27 days*

Now if the person is male, second question doesn't apply to him. You can write with first question that if male, please skip next question

Have u ever taken antidepressant drug?

☐ *Yes* ☐ *No*

What's the frequency of use of antidepressant drugs?

☐ *Once daily* ☐ *Once in a week* ☐ *Once in a month*

In case of NO in first question, second question loses its meaning.

Such types of questions are called contingency questions or filter questions.

Likert Scale Questions:

Likert questions can help you ascertain how strongly your respondent agrees with a particular statement. In this type of questions, usually level of agreement or disagreement is measured. In this type of question, researches may ask an opinion question on 1-to-5 bipolar scale. (it's called bipolar because there is a neutral point and the two ends of the scale are at two extremes of the opinion).They are also called bipolar questions.

Example:

Circle one option:

I feel butterflies in stomach when I am tensed.

1)Strongly disagree 2)Disagree 3)Neither agree or disagree 4)Agree 5)Strongly agree

Dichotomous or Ipsative Questions:

In these types of questions respondent has to choose between two options. They are also called Forced Choice questions. They are mostly preferred for personality analysis to avoid faking.

Example:

Do you feel a lot of stress all the time?

1) Yes 2) No

Visual Analogue Scale Questions:

In these types of questions respondent is supposed to answer level of agreement or disagreement or intensity of some sensation. VAS is usually a horizontal line, 100 mm in length, anchored by word descriptors at each end.

Example:

You want to know the intensity of pain. For this purpose patient is asked to mark it on following scale.

How severe your pain is?

No pain...Very severe pain

How much you are tensed?

No tension……………………………………………………………Highly tensed

Leading Questions:

Leading questions are not appreciated for scientific work because they make your results biased. They strongly encourage a specific type of response.

Example:

Majority of people suffer from exam anxiety. Do you feel same?

As you have given your opinion in first part of question, it becomes biased.

Double barreled questions:

Those questions which give rise to different possible response to their subparts are called double barreled questions. Such questions should be avoided and two or more separate questions should be asked instead. They are not preferred for scientific studies.

Example:

How often do you smoke and drink?

The respondent may be smoker and non-drinker at the same time, so the question loses its meaning for him.

What are standardized questionnaires, tools, scales and/or inventories?

Hrishikesh S. Kulkarni

"Just as the largest library, badly arranged, is not so useful as a very moderate one that is well arranged, so the greatest amount of knowledge, if not elaborated by our own thoughts, is worth much less than a far smaller volume that has been abundantly and repeatedly thought over."

Arthur Schopenhauer[10]

As outlined in the previous chapter, questionnaire-based studies are useful tools to definitively diagnose certain medical and psychological conditions. They are often used to assist clinical judgment and are especially useful in research for objective measurement and comparison of clinical conditions. At times, **standardized questionnaires, tools, inventories or scales** are available for use, which have been developed after following rigorous procedures and have been tested in different scenarios and finally validated for use. These are especially useful and not only do they add validity to the study but also allows the study to be compared to other settings where the similar scale, tool or standardized questionnaires were used.

Commonly used tools are outlined in Table 11.

Table 11: Commonly used standardized questionnaires, scales and/or tools

Aga Khan University Anxiety and Depression Scale (AKUADS)
Beck Depression Inventory
Critical Care Family Needs Inventory (CCFNI)
HADS (Hospital Anxiety and Depression Scale)
Impact of Event scale for post-traumatic stress Symptoms
Mini-Mental Status Examination (MMSE) used to evaluate dementia
Room Criteria for Irritable Bowel Syndrome
Symptom Score Index for Benign Prostatic Hypertophy

As shown in the table, commonly used questionnaires for medical conditions include the Symptom Score Index devised by the American Urology Association for benign prostatic hypertrophy [1] and the Mini-Mental Status Examination used to evaluate dementia. [2] Irritable bowel syndrome can be scored with the ROME criteria.[3] The advantage of such questionnaires is that they do not need any advanced diagnostic modalities like imaging or interventional procedures for diagnosis and can be easily implemented, especially in resource-limited settings.

Such scales are also useful in studies as well as the diagnosis of psychiatric disorders in community settings. Commonly used questionnaires include the Hospital Anxiety and Depression Scale for anxiety symptoms, Beck Depression Inventory for depressive symptoms and the Impact of Event Scale for post-traumatic stress symptoms. Questionnaire studies are also useful in social studies such as to assess unmet needs. Many of these questionnaires can be scored and providing objective methods of comparison of psychiatric conditions.

However, as easy as it is to perform a questionnaire based study, the methodology of these questionnaire-based studies needs to be perfect in order for the results to be valid. One of the most common mistakes done by undergraduate students are to use questionnaires verbatim, most of which have been devised in countries other than theirs, and in a language not spoken by a majority of the population. The results of such studies have questionable validity as the interpretation of questions by the local population may be different than originally intended.

The length of the questionnaires is a major issue in both methods of administration. Thus, many questionnaires now have mini-questionnaires, for the convenience of both the interviewer and the subject. The original 45 item CCFNI has been modified to a 14 item CCFNI.[5] While modifying questionnaires, it is important to restrict the number of items so that the questionnaire does not become redundant and there is a doubt on the reliability and validity.

The process of how to validate a questionnaire employs detailed statistics as well as rigorous procedures. Briefly, for the knowledge of a novice researcher, the definition of certain terms that are often used in the context of validity and reliability of questionnaires or scales are given in the next topic.

What is the meaning of Reliability and Validity of a tool or an instrument? What are the methods to ensure them?

Hrishikesh S. Kulkarni

Reliability:

It is the ability of a test or instrument to get a consistent estimate when repeated in a group of similar subjects. It is equivalent to repeatability.

Validity:

It is the ability of a test or instrument to measure what it intended to measure. It is thus an estimate of the precision.

Methods to ensure reliability:

- **Test-retest reliability**: The consistency of the instrument when it is administered multiple times by the same person.
- **Inter-observer reliability**: The consistency of the instrument when it is administered by the different people.
- **Internal consistency**: Internal consistency of an instrument occurs when the components of the instrument are found to appropriately measure the same concept being studied.
- **Cronbach alpha:** It is a single-number estimate of how closely components of an instrument correlate with each other. It is obtained by computation.

Methods to ensure validity:

- **Construct validity:** Construct validity ensures how well your concept or constructs actually translates into a functioning instrument. It is comprised of translation validity and criterion-related validity.
- **Translation validity:** It identifies if your instrument is a good measure of your concept or construct. It comprises of face validity and content validity.
- **Face validity:** The instrument, at an initial glance, appears to measure what it intendes to.
- **Content validity:** If the content or the items in the questionnaire appropriately represent identify the concept being studied.
- **Criterion-related validity: It is a post-study** analysis which demonstrates whether your instrument actually functions appropriately to identify the condition (or illness) based on your theory of the construct. This is done using factor analysis.

Of course, before embarking on the process of validation of a questionnaire/scale, always ensure someone hasn't already validated the scale for your population. In such a case, you can directly start using it and the subsequent research becomes a lot simpler.

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What are the different Types of Studies?

Haq Nawaz

"Research is the process of going up alleys to see if they are blind."

Marston Bates

Types of Scientific Studies

There are several different ways to classify scientific studies but these are most commonly divided into either observational or experimental studies.

In observational studies researchers simply make observations on the research subjects without any interventions and try to make conclusions based on those observations. In other words the researcher is a passive participant in the study.

In an experimental study the researcher controls the study environment to some degree and records information about the study subjects after manipulation of certain variables.

All types of studies begin with an observation which is developed into a question and subsequently a hypothesis. The next several steps involve designing an experiment for data collection and gathering and recording the data. The results are then analyzed and communicated to the scientific community.

Observational Research:

Observational research is usually conducted in a natural setting to study the relationship between a specific factor and certain aspect of health or illness. Since the study design does not involve any intervention it cannot be used to determine cause and effect even though it may suggest an association. An example would be a study determining levels of anxiety and depression among people living in an area hit by an earthquake.

Observational studies are relatively simple to perform and involve data collection in addition to statistical analysis to determine an association between certain variables. Since we are unable to counter the effect of unknown variables which may have a role in determining the association observational studies are frequently followed by experimental studies to further refine the results.

The most common type of observational research is the epidemiologic study, which is considered the basic science of public health. It involves studying often large groups of population to identify factors that may put the health of individuals at risk of contracting disease.

Epidemiologic studies employ various designs such as

[1]Cross-sectional design

A cross-sectional study or sample survey provides information about a population based on a sample from the population at a specific time point. In a cross-sectional study, epidemiologists define a study population and then gather information from members participating in the survey, about their disease and exposure status. Since the information is collected at a specific time-point it is like taking a snap-shot from the population. Although these studies provide information regarding relationship between a variable and a disease.

[2] Prospective design

A prospective or cohort study draws inferences about a population based on a sample survey and proceeds to follow the sample forward in time to record occurrence of a specific outcome. The study population is selected depending on exposure irrespective of whether the study sample has the disease or health outcome being investigated.

[3] Retrospective design

A retrospective or case-control study observes population in the present by using a sample survey based on the presence or absence of a disease or health outcome being studied. The research team then works backwards to determine the presence or absence of specific risk factors.

Although retrospective studies are cheaper and completed more quickly than prospective studies they may have inaccuracies of data due to recall errors and have little control over variables that may affect disease occurrence. Regardless of which study design is employed to investigate a question it is important to understand that epidemiologic studies point out associations between certain factors and disease outcome. These studies not only contribute important information about disease entities but also help design clinical trials.

Experimental Research:

Basic science research enables investigation of fundamental biological processes. It is performed under carefully controlled conditions where one variable (the independent variable) is steadily altered to examine the effect on a second variable (the dependent variable). Since all other variables are kept constant, cause (the independent variable) and effect (dependent variable) are closely related.

Basic science research is often conducted in-vitro or in-vivo (such as in laboratory animals). Even though research in animals may help in understanding basic biological phenomena there are obvious differences in how humans may react to various treatments as compared to laboratory animals.

A clinical trial is experimental research that utilizes human subjects to investigate effectiveness of various treatments. Typically two groups of subjects are monitored; one which gets the treatment and the other which serves as the control group and does not get any treatment. Subjects involved in the study are randomly assigned to the treatment or control group. The strength of the study lies in the study design as wells as the number of participants in the study which may be an indication of how well the results may be replicated when employed at a larger scale.

The double-blind, placebo-controlled study is considered the most 'authentic' among clinical research studies. The subjects are assigned to the experimental and control groups randomly and neither the subject nor the researcher carrying out the study is aware of the test substance or placebo being administered.

The National Institute of Health has further defined four phases of a clinical trial research (Phase I-IV) in which the treatments are initially tested for safety, dosage and side effects in smaller group of people (Phase I) and then to a larger groups (Phase II, III). Phase IV involves post marketing surveillance of the drug/treatment in the long-run.

The Meta-analysis

The meta-analysis utilizes a statistical approach to combine results from different studies that answer the same question. This is done to reconcile variations in findings of several studies answering the same question with similar methodologies.

Tasks for the Researcher:

- ✓ Try to learn more about the different types of studies.
- ✓ Identify which types of studies have you been a part of and which study type would suit to answer your research question best.
- ✓ Learn more about the specific characteristics of each study type.

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What are the different forms of bias?

Awais Ashfaq, Mohsin Shah

"Science is a wonderful thing if one does not have to earn one's living at it."

Albert Einstein

BIAS: Origin: 1520-30, From *biais – oblique*

According to dictionary, it can be defined as:

> *"a particular tendency or inclination, esp. one that prevents unprejudiced consideration of a question; prejudice."*
>
> *In statistics, it is often defined as "a systematic as opposed to a random distortion of a statistic as a result of sampling procedure."*[1]

'"Bias" as used in the field of statistics refers to directional error in an estimator. Statistical bias is thus an error you cannot correct by repeating the experiment many times and averaging together the results.'[2]

Researchers, by being human, must exercise constant vigilance to avoid bias while working towards a valuable objective as it may creep in – usually inadvertently, perhaps subconsciously, and often as a consequence of some aspect of research design. Although the best researchers are carefully trained in its avoidance, bias assumes so many forms that it is difficult to recognize and avoid all of them. Knowledge and examples of the different forms would help preventing bias in studies.

Observer Bias:

When the observer (or interviewer) is fully aware that the person being interviewed has a certain disease, the observer may subconsciously attribute certain characteristics to the subject. The result of this bias is that those characteristic are more likely to be recorded for cases than controls. The solution of choice is to “blind” the observer as to whether the subject is a case or a control.

Sampling Bias:

Bias may enter whenever samples are chosen in a nonrandom fashion. **Convenience Sampling** (choosing only subjects who are easy to find) leads almost invariably to biased results. **Systematic Sampling** (choosing every nth person from a list) carries the potential of subtle error, especially if the list has some repetitive pattern. Telephone and household sampling have their own potentials for bias. What if no one answers the phone or come to the door? Should the interviewer skip that household? On the contrary, the interviewer should try again and again realizing that a household where no one is at home in the daytime is quite different from one where someone is nearly always present.

Selection Bias:

Were the cases and the controls drawn from the same population? This question, which sounds simple, has profound implications. **Selection Bias** may lead to a false association between a disease and some factors because of different probabilities of selecting persons with and without the disease and with and without the variable of interest. This problem was first quantified by Berkson (1946) and is sometimes referred to as the **Berksonian Bias** or hospital selection bias.

Response Bias:

When participation in a study is voluntary, **response bias** (sometimes called **non-respondent bias** or **self-selection bias**) is important. Owing to their psychological makeup, internal motivation, concern for their own health, educational background, and many other reasons, persons who choose voluntarily to participate in research studies are known to differ from those who decline to do so. Nevertheless, many important research studies (e.g., the landmark Framingham Heart Study – the Massachusetts study that reported on the dangers to "yo-yo" dieters, who shorten their life expectance by swinging through cycles of weight loss and gain) depend in part on volunteers. A way to control for response bias is to compare characteristics of volunteer subgroups with those of randomly chosen subgroups.

Dropout Bias:

It is the mirror image of response bias. In long-term studies, a certain proportion of participants, for reasons of their own, choose to drop out. These persons are likely to differ from those who continue.

Memory Bias:

There are several well known aspects of **memory bias** (also known as **subject bias**). Memory, for recent events is much more accurate than that for long ago events. Hence, persons interviewed concerning pat illnesses tend to report a greater prevalence in the recent past than in the distant past (Stocks, 1944). A perhaps more profound form of memory bias is the tendency of persons with a disease to overemphasize the importance of events they may consider to be predisposing causes.

Participant Bias:

This is an interesting form of bias that derives from the participant's knowledge of being a member of the experimental or control group and his or her perception of the research objectives. For example, a participant in a heart disease intervention study may report and exaggerate minor symptoms actually unrelated to the disease under study.

Lead Time Bias:

The lead time bias evolves from the fact that by detecting disease earlier in its course, the time from diagnosis to death is increased even if early treatment is totally ineffective. A simple comparison of post-diagnosis survival in screened versus unscreened subjects will be biased in general because of the apparent time gained by earlier detection.

Does early detection of chronic disease actually result in improved survival rate, or does it merely provide a longer period between first detection and death? This bias has also been explained, in detail by Cole and Morrison (1980).

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What is Data Entry?

Sajjad Ahmed Sherjeel, Saad Siddiqui

"As we acquire more knowledge, things do not become more comprehensible, but more mysterious"

Albert Schweitzer

Once the process of data collection is complete, provided that the information from the subjects was collected in a written form, the researcher will end up with a variable stack of papers depending on the sample size and the number of variables. The information contained in these papers need to be transcribed into a computer program before it can be analyzed (unless the researcher plans to use a calculator and manually apply statistical tests!). The following discussion outlines and explains this important step of the research process: the 'Data Entry'.

First step in the process of data entry is to create a database structure according to the requirements of the research questionnaire, meaning creating tables with appropriate Variable ID (variable name in most cases) as the column headings, and categorizing each variable as either being string (abcde….) or numerical (1234….). Certain variables may also be needed to be coded to numbers (e.g. 1=Yes, 2=No). Once this is completed, data entry can begin.

Creating the database and then entering data is usually accomplished by the same software. A number of softwares are available in the market which can be customized according to the requirements of the research questionnaire, and there are also few companies which would develop a software specific to the needs of the study.

Data entry softwares:

Data entry softwares could be divided into two categories

1. Softwares which are designed solely to enter data
2. Softwares which can serve the dual function of data entry as well as data analysis

Both have their advantages and disadvantages. Generally softwares designed primarily for data entry provide superior control over data coding and error detection. They also have added features like assigning 'must enter' status thus controlling missing values, limiting and specifying what exactly can be entered in a particular field (e.g. if age can only be between 20-30 and 50-60 so 45 could not be entered!), and skip the question (e.g. go to next question if answer is 'Yes' or skip to Q __ if the answer is 'No') therefore streamlining the data entry process. However, these softwares do not have strong data-analyzing capabilities, and generally data needs to be exported to a specialized software for analysis.

It is beyond the scope of this book to review each software. Examples include *EpiData* (http://www.epidata.dk) which is a powerful tool of data entry and can handle basic statistical analysis and *SPSS* (www.spss.com) which can be used not only for data entry, but it is a very powerful statistical analysis software as well.

When entering the data, there are certain points which should be kept in mind.

Assigning a **Unique ID** to every questionnaire not only ensures that no questionnaire is left out or there is no double entry of the same questionnaire, but it is also easier to refer back to the paper if an error is found in the database.

Coding string variables into numerical not only saves time entering them, but also there is no chance of errors arising due to spelling mistakes (during data analysis, SMOKING and SMOLING would be treated as two different values).

If the question requires choosing only one option from many, only one variable needs to be created and the options should be coded numerically.

If the question asks to tick as many as applicable, a separate variable should be created for each option and these should be coded 'Yes' and 'No'.

Whenever possible, limit the number of letters/digits that can be entered in a field (e.g. 111 can not be entered by mistake instead of 11)

Whenever possible, place a check on what exactly can be entered in a field (e.g. only 1-5 can be entered so 0 or any alphabet can not entered by mistake).

Data Validation:

Data validation is also a very important component of data entry, which ensures that the entered data is accurate and error-free. The errors which might arise during data entry are:

- Data from a subject is not entered
- Data from a subject is entered twice
- The value of a variable is omitted or entered incorrectly

The current standard of validating data is to use the "double data entry" system, in which complete set of data is entered into two separate databases by individual people, and then these two databases are compared for any differences. The differences found are corrected by referring back to the papers from which data was entered. Though this system is time-consuming, it ensures high accuracy.

An alternate method is to use paperless, direct data entry[1] using hand-held computers or personal digital assistants (PDAs) at the time of collection of information.

A number of data entry softwares are available in the market like Microsoft Excel and SPSS (PASW) in which data can be entered into a spread-sheet format,

Tasks for the Researcher:

- ✓ Know what the process of data entry is about? What are its important components and principles?
- ✓ Know what is data coding?
- ✓ Know what is data validation?

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Statistics in Research

Muhammad Ibrahim, Sajjad Ahmed Sherjeel, Abaseen Khan Afghan, Mohsin Shah

"There are three kinds of lies: lies, damned lies, and statistics."

Benjamin Disraeli[1]

Why know about Statistics in Research?

Statistics is an important integral part of the research process. Knowledge of statistics is not only important if you want to analyze your data but it will also help you in critically reading any research article as you would be able to understand the findings better. Even if you do not want to analyze your data yourself, this knowledge will help you in communicating with a biostatistician better. This knowledge will also aid you in designing your research study in an improved way.

Statistics in itself is a complete subject and it is beyond the scope of this book to outline all the different important aspects of statistics in research.

What we have tried to do is include a description and definition of important terms, terminologies and concepts at the end in the Glossary Section for easy reference. Consult these definitions as you come across statistical terms in various papers or during your research study.

The key lesson here for a young researcher and scientist is that it would indeed be worthwhile to learn more about statistics from books and if possible do a training course in statistics as well. Also, I would like to suggest that if possible be present with the statistician when he/she does the analysis of your research projects. Some direct advice at the time of analysis will indeed prove valuable.

Even physicians and clinicians need to be aware of this subject of statistical analysis. Even those physicians/clinicians who are not doing research need to know the basic fundamentals of the topic; otherwise they would not be able to understand the implications of an important research finding and apply them to their management of patients.

This will also help you in the write up of your article as well. Some of the suggested essential readings are included at the end.

What is a p-value?

The likelihood or probability of observing a result by chance is usually expressed as a **p-value,** which is expressed as a proportion. A probability of 5% corresponds to a p-value of 0.05; similarly a probability of 10 percent corresponds to 0.10.

The p-value represents probability, i.e., the likelihood of a given event's occurrence. The value of p ranges from 0 (event almost impossible to occur) to 1 (event almost certain to occur).

In statistical hypothesis testing, p-value represents the probability of an event occurring, **provided that the null hypothesis is true**.

The *lower* the p-value, the *less* likely the result would be observed, assuming the null hypothesis to be true. If the p-value is lower than a set threshold (traditionally 0.05), we assume that the result is statistically significant and we reject the null hypothesis.

For Example:

If we were comparing the means of two samples, and we found them to be 130 and 140.

Our null hypothesis would be that the two samples would have the same mean.

We apply the appropriate statistical test to compute p-value.

Lets say the p-value is calculated to be 0.04.

This means that that the two sample means differ so much that probability of the result we obtained (difference of 10 between two sample means) if the null hypothesis were true is only 0.04. Because this probability is so low (lower than the threshold of 0.05), it is concluded that the two samples do not have the same mean.

We can state that since **$p \leq 0.05$**, we **reject the null hypothesis** and conclude that the difference we obtained between the two sample means is **statistically significant**.

What are the different statistical programs available for analysis?

A list of the some of the most commonly used statistical programs for analysis includes:

- PASW (Formerly Statistical Package for Social Sciences (SPSS))
- SAS
- SNAP
- MINITAB

SPSS is one of the most commonly used programs. It not only offers data entry but powerful data analysis facilities as well. There are numerous websites that offer notes on learning the software. Some of these are outlined in the references section. With a little background knowledge in statistics and the use of Microsoft office, some of these are very easy to understand and follow.

The product is available at the manufacturer's website, (www.spss.com) and there are numerous software packages to suit the needs of students, researchers and even institutions.

Consult your institutions' statistics experts on the softwares they use and if they offer any training courses.

Tasks for the Researcher:

- ✓ Try to realize how important a role statistics has in research.
- ✓ Learn more about how knowledge of statistics can help you in your research process.
- ✓ Understand what is a p-value?
- ✓ Learn more about the different softwares used for statistical analysis.
- ✓ Consult your institution's statistics experts about the software they use.
- ✓ Try doing a training course in statistics and epidemiology at your institution or in your city/country.

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What are Screening Tests? How to measure their specificity, sensitivity and predictive values?

Haq Nawaz, Mahwash Kassi

"Research has been called good business, a necessity, a gamble, a game. It is none of these – it's a state of mind."

Martin H. Fischer

There are several diseases which if diagnosed at an earlier, asymptomatic stage in their natural history offer better chances for treatment and rehabilitation. People at a high risk of acquiring a disease may be identified or screened by a simple laboratory investigation. If it turns out positive further more definitive diagnostic approaches can be utilized to confirm the diagnosis. One such example of a screening test is the early detection of cervical cancer through pap-smear which has saved the lives of millions of women around the world. The screening of such diseases is carried out to diagnose a disease in its pre-clinical stage or to identify those with a high probability of having a condition.

For a screening program to be effective it is essential that the disease being screened should be common and have a detectable pre-clinical stage. The infrastructure to deliver the screening and follow-up services should be well-developed to cater for a large proportion of population at risk. In addition the screening test should be simple, safe, inexpensive, culturally acceptable and easy to administer and interpret.

Screening may have certain undesired consequences in the form of false-positive and false-negative results. False-positives may lead to unnecessary anxiety and needless investigations whereas false-negatives may result in false reassurance and consequent harm to patient. Therefore it is important to evaluate the efficacy, safety and cost-effectiveness of a given screening test before being considered for implementation in large populations.

With reference to these screening tests, there are certain key definitions and terms that a researcher should be familiar with. These include: *(See the 2 X 2 table along as you read through the following definitions.)*

True Positives (TP) – a:

Individuals with a positive test result who actually have the disease (i.e. Test Positive and Disease Present = a)

True Negative (TN) – d:

Individuals with a negative test result who actually are disease free (i.e. Test Negative and Disease absent = d)

False Positive (FP) – b:

Individuals with a positive test result who actually do not have the disease/condition i.e. are disease free (i.e. Test Positive and Disease absent = b).

False Negative (FN) – c:

Individuals with a negative test result who actually have the disease (i.e. Test Negative and Disease Present = c)

Sensitivity and specificity are measures utilized to describe the ability of a screening test to correctly identify a person as having a disease or being disease free.

Sensitivity (SNout):

Sensitivity is the proportion of individuals correctly identified by the test as having the disease. It is the 'probability that a test will be positive given patient with the condition'. [1]Thus, stated in another way, a *highly sensitive test is good for ruling out* ***(SNout)*** the disease condition.[2] It is always desirable to have a highly sensitive screening test since a low proportion of false-negative results are expected and fewer cases are missed.

Specificity (SPin):

Specificity is the proportion of individuals correctly identified by the test as not having the disease. It is the 'probability that a test will be negative given a patient without a condition'.[1] Thus, stated in another way, *a highly specific test is good for ruling in* ***(SPin)*** the disease condition. [2] A screening test with low specificity will result in a high proportion of people testing positive without actually having the condition and will unnecessarily undergo further diagnostic procedures. It is therefore recommended that a screening test have a high specificity.

Often in the development of a screening test or its application, specificity and sensitivity are of paramount importance to the researcher/scientist. However, when we talk about its application in clinical settings in the context of one patient, specificity and sensitivity may not provide all the answers. For example, a patient with a positive test result would like to know that what is the probability of me actually having the disease; because the test may also give false positives?

Or similarly, a concerned person or a clinician who has a patient with numerous risk factors but with a negative test result would like to know that what is the probability that given this person has a negative test result, he actually is disease free as well; because tests may also give false negatives?

Here is where positive predictive value and negative predictive value come into play.

Predictive Value of a Screening Test:

The probability of having a disease once the results of a test become available is known as the predictive value of the test.

Positive Predictive Value (PPV):

'It is the probability that a patient will have a condition given a positive test result.'[1] Positive predictive value is thus the probability that a patient who has been tested positive actually has the disease.

Often clinicians are asked by their patients after an investigation turns out positive as to whether they actually have the disease. Positive predictive value answers this particular question.

Negative Predictive Value:

'It is the probability that a patient will not have a condition given a negative test result.'[1] Negative predictive value of a test is thus the probability that a patient who has been tested as negative or normal by a test does not actually have the disease.

The predictive value of a test depends in part on the prevalence of a particular condition.

Ideally a test should be 100% specific and 100% specific. However, practically in the context of screening tests, there is always a trade off between the specificity, sensitivity, PPV and the NPV. This is because often a particular cut off is used to identify a particular disease condition and raising or lowering a cutoff would directly affect the variables stated and thus may increase specificity but may lower sensitivity or vice versa.

Usually the trade-off is such that screening tests are able to identify a group of individuals as clearly having the disease or being disease-free with another group in between (gray zone) where decisions to test further may have to be individualized.

Formulas:

Studies employing or using screening tests are typically illustrated using a 2 X 2 table with 4 variables True Positives, False Positives, False Negatives and True Negatives depicted as a, b, c and d, respectively as shown in Table 12. Formulas can then be calculated using these 4 variables. (*Note that in calculating the positive and negative predictive values, the rows are used; while in calculating the sensitivity and specificity the columns are employed)*.

Typically the screening test results i.e. positive or negative are on the left side of the table (expressed in rows - horizontally), while the results of whether the person has the disease or not is expressed on top (expressed in columns - vertically). Often a 'Gold Standard' is used to identify Cases (i.e. those who have the disease or condition) and Controls (i.e. those who do not have the disease or condition).

For example, in studies for screening of osteoporosis in women, a new screening tool like *Quantitative Ultrasonography* is often compared to the results of the DEXA scan, the gold standard for diagnosing osteoporosis.

Table 12: The 2 X 2 Table:

	Disease Present (Patients/ Cases)	**Disease Absent (Normal/ Controls)**		
Screening test – Positive	a	b	*Total number of people who tested positive* $= a + b$	$\boldsymbol{PPV} = \frac{\boldsymbol{a}}{\boldsymbol{a+b}}$
Screening Test – Negative	c	d	*Total number of people who tested negative* $= c + d$	$\boldsymbol{NPV} = \frac{\boldsymbol{d}}{\boldsymbol{c+d}}$
	Number of people with the disease condition $= a + c$	*Number of people without the disease condition* $= b + d$	*Total Number of people* $= a + b + c + d$	
	$\boldsymbol{Sensitivity} = \frac{\boldsymbol{a}}{\boldsymbol{a+c}}$	$\boldsymbol{Specificity} = \frac{\boldsymbol{d}}{\boldsymbol{b+d}}$		

References and Further Reading:

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How to Write a Scientific Paper?

Dr. P Ravi Shankar

"But to Write Well is as hard as to be good"

Somerset Maugham

Writing a paper requires a logical and systematic approach. Often in developing countries and during medical school years, some projects are done out of 'necessity'; the purpose being to give students a thorough exposure to the different parts of a research project. Increasingly, however, the quality of these projects is improving and warrants the need for it to be published. One should make sure before writing a paper that it would be of sufficient interest to the readers and would have a chance of being accepted for publication.

How to write a scientific paper?

You have designed your protocol, obtained funding, conducted your research and now want to tell the world about your findings. You are excited and want to convert your findings into a publishable research paper. In this chapter I will discuss how to write a scientific paper and give certain instructions regarding how to get it published.

Why should you publish?

The world of academics is becoming increasingly centered on publications. In the developed west and increasingly even in the developing east 'publish or perish' is becoming increasingly true. The authors of a recent book on writing a scientific paper list various reasons for publication.[1] The most obvious one and the driving force behind much of the research work done in South Asia and even in other regions is academic promotions. In Nepal and other South Asian countries however, 'years of experience' has greater weightage compared to publications and research and the authors of a recent article have pointed out the fact that many medical teachers have been promoted to Professors without having published a single research paper![2]

Increasingly research by medical students is becoming common in our part of the world. Many journals have sections devoted to student research and student ideas and the 10/90 student research journal is focusing entirely on student research. At the international level, journals like the McGill Journal of Medicine and New Zealand Medical Student Journal encourage student research. The Asian Medical Student Journal was a worthwhile initiative from Asia which however did not continue

An editorial in the Singapore Medical Journal states that a successful researcher is usually a good communicator with the ability to maximize the transmission of his/her research findings in a written form to scientific peers and the lay public.[3] In the west and increasingly in more standard and higher ranking universities in developing nations the employer expects a faculty member to publish a certain number of research papers in a year. Publications in peer-reviewed, indexed medical journals is an important means to achieve recognition for an individual, department, hospital, college or university.[4] Research output and impact of the research is an important parameter in ranking a university. Obtaining grants for research projects also require good written communication skills. The other reasons for publishing are to let the world know about your findings, as a requirement for Bachelors, Masters and PhD degrees, to enhance academic prestige before you defend your doctoral (PhD) thesis, to benefit the wider community, to improve teaching and learning and even to practice writing in English!

However writing can also be a source of enjoyment. Many doctors and other healthcare professionals have been acclaimed writers and it has been said that dealing with and trying to minimize suffering makes a doctor a more sensitive observer of the human condition. Writing can be a channel of expressing the joy of scientific discovery. Scientific writing also has other benefits. The process of writing involves performing a thorough literature search, collecting and analyzing data, drafting and repeatedly revising the manuscript.[4] Authors who have published will be better able to understand and appreciate other scientific papers and can more effectively read and critically appraise articles.

Types of papers:

The various types of studies have been already been mentioned. A recent article in the Singapore Medical Journal describes various types of papers.[5] 'To briefly recapitulate these include original article, case report, technical note, pictorial essay, review, commentary, editorial, letter to the editor, others and non-scientific material.'[5] In this chapter I will be mainly concentrating on writing an original research article. Writing a case report will be described subsequently. An original article or for that matter most scientific papers is a highly structured piece of writing. Writing clearly and effectively is an important skill. Some people are more talented at writing compared to others. However, I believe all can be effective writers through constant practice.

Parts of a paper:

The acronym **IMRaD** effectively describes the various parts of a scientific paper. I stand for Introduction, M for Materials and methods, R for Results and D for Discussion.

Usually, when scientific papers are sent for publication, they are accompanied by a title page, which includes the title of the article along with the names of contributing authors and the corresponding author and their respective institutions. Often 3-10 keywords need to be stated. They will help the search engines in identifying the article and put them in various categories. Graphs, figures and Tables may be included as a separate file or after the text in the same file. Not to forget, the references section should include and cite all the sources that were used in writing the article.

Length of an original article in a journal

The length ultimately depends on the guidelines and policy of the particular journal to which you are submitting your manuscript. Certain journals publish shorter articles than others. As a generalization, general medical journals publish shorter articles as their target audience is busy practicing doctors across a broad range of specialties. Most journals however look for an article between 2500 to 3000 words. Journals dealing with social issues in medicine and with qualitative studies like 'Social Science and Medicine' permit longer articles even up to 8000 words.[1] These days many journals are allowing more space and words for authors who are describing qualitative studies. As a rule of thumb, it is easier to get shorter articles published than longer ones. Most authors write an article in a general format and then customize it to suit the requirements of the specific journal to which they are submitting the manuscript. Let us now concentrate on the individual parts of an original article.

Title and title page:

The title conveys the first impression of an article. It should be clear, concise, focused and should explicitly state what is in the article. [6] Journal Editors, Reviewers and eventually Readers will assess and judge your article initially on the basis of the title. Hence, framing of the title should be given adequate time and consideration.

The title is what appears on the table of contents of the journal and is what would be searched for on the internet. The ideal title should be concise but at the same time should be informative. While making the title consider the likely target audience of the journal and choose your words accordingly.[6] Experienced authors suggest that authors make a provisional or interim title while first writing a paper. The title will be subsequently modified as the writing progresses.[6] Certain journals require a short or running title which is printed on the top of every page of the article. The word count for the full and short title is sometimes specified by the journal. Certain journals have character counts for the title.

Titles are usually written in title case i.e. first letters of all important words are capitalized.[1] A double barreled title or a title consisting of two clauses separated by a colon gives the author/s two chances to get the message across. Research into titles has shown that titles have been steadily increasing in length, the number of authors is increasing and basic science papers have longer titles compared to clinical papers.[7]

Most journals today follow a blinded peer review process where the reviewer/s does not know the identity of the authors and vice versa. Many journals accept manuscript submissions through e-mail or online (bench press) submission process. Each author should provide two versions of the manuscript. The blinded version does not contain the authors' identifying information and is usually sent out for peer review. The complete manuscript contains the identifying details of the author. The title page generally contains the affiliations of the author, the name of the corresponding author and address for correspondence. For papers authored by health science students, it is recommended that a faculty member be the corresponding author as students are likely to change their address after passing out from the institution. In certain journals, a statement of conflict of interest and of sources of funding is also mentioned on the title page. The word count for abstract and text should also be mentioned if required by the journal. Certain journals are having an open peer review process where both authors and reviewers know each others identity. Some journals also want the e-mail address of all the authors to be mentioned on the first page. Certain journals contact the authors by e-mail and confirm that they are willing to be a part of the research paper. Table 9 summarizes the important instructions for various sections of a research paper.

Abstract and keywords:

The abstract is a concise, factual and accurate mini version of the contents of the paper.[8] The abstract is the second most commonly read part of a scientific paper after the title. It gives the reader an idea about the manuscript and helps him/her make a decision about whether to read further. According to the International Committee of Medical Journal Editors (ICMJE), the abstract should provide a background of the study, the study's purposes, basic procedures, the main findings and their possible implications and principal conclusions.[9] Abstract is also an important part of a thesis or dissertation and is submitted to scientific conferences and proceedings. The paper is accepted for presentation in the conference based on the quality of the abstract. The abstract should reflect the main text of the article[8] and is often the only part of the paper freely accessible to other researchers especially in developing countries. Many indexing services provide free access to abstracts.

Abstracts can be of two types – structured and unstructured. The structured abstract is becoming more common especially for original research articles. The structured abstract has five main parts – Background, Objectives, Methods, Results and Conclusions. The names of these subdivisions can change according to the journal. An unstructured abstract does not have subdivisions. The word limit followed by most journals for an unstructured abstract is 150 words while that for a structured abstract is 250 words. The abstract should stand alone that is it should make sense on its own without reference to the text of the manuscript.[8] The abstract is a difficult part of the paper to write and is usually written last after other sections of the manuscript have been completed. The use of abbreviations should generally be avoided and should be used only if the word is being used repeatedly in the abstract and should be explained in full on first use.

Many journals require anywhere between three to ten keywords. Keywords should be carefully chosen as these will then help determine how your article would be made available in search results. Include all areas or important points that your study has addressed. Choice of appropriate keywords makes it more likely that the article is located during online search by other researchers. So keywords should be chosen carefully.

Ideally 'terms from the Medical Subject Heading (MeSH) list should be used.'[9] MeSH is maintained by the National Library of Medicine of the United States and is freely accessible online. You can search whether the term chosen by you is included in the MeSH database. If MeSH terms are not available then other terms can be used. Keywords are generally arranged alphabetically separated by commas or semi colons according to the journal style.

Introduction:

The Introduction has been stated as the most difficult part of the paper to write.[1] If the editor does not like the introduction then he/she will not read the rest of the paper. This section describes work which has been done by other workers supported by relevant references, the gaps in our knowledge about the topic and why the particular topic is worth investigating.[1, 10] It generally concludes with the objectives of the study or the research questions. The objectives must be specific and tell the reader what they can expect from the paper. Abbreviations should be explained in full on first use in the text. The introduction like other parts of the manuscript should always follow the journal instructions. The introduction stimulates the interest of the reader and motivates him/her to read the rest of the manuscript. The introduction should be to the point and as focused as possible.[10] The section can be divided into two parts, background information and purpose.[10] Background information describes relevant works which have been carried out in the particular area. Purpose should clearly state why the particular study is being undertaken. New, different or special aspects of the study should be highlighted. This section answers the question 'Why the study was carried out?'

Materials (Patients) and methods:

This section concentrates on the materials and methods you would be using in the study. If the study involves patients, then Patients and Methods would be a more appropriate heading. In the latter case the exact characteristics of the patient population in question should be adequately described.

For a previously used method mention the authors who used the method first and quote them in the references. If you are using a questionnaire, mention if it is a standard one, and if not, how the questionnaire was developed and validated.[1] The sampling methods, levels of significance and sample size calculation should be mentioned if appropriate. The method of obtaining approval from the study participants, ethical considerations and the granting of approval by an ethics committee should also be mentioned.[1] For studies obtaining information from human subjects, the issue of obtaining informed consent is becoming important. For animal studies, the animals should be housed and handled according to the criteria set forth by the institute, region or country.

A good materials and methods section will tell other researchers and readers how the study was performed and enable them to repeat the study if needed. Checking the materials and methods section has been mentioned as a guide for efficient reading.[11] The reader should first check the title, then the authors, then the abstract followed by the materials and methods to check if the manuscript would be of interest to them. This will save the time of the readers and they can restrict their reading to articles of their interest. The study can only be considered 'valid' if you as a reader completely agree that the particular data and information required to answer the particular research question can be collected using the specified method and/or methodology.

A recent article describes a three step process to writing the materials and methods section.[12] The first step is to describe the research plan, then you should describe the materials or subjects and lastly the methods used should be described. The individual journal instructions should be followed like for other sections. The findings of the study should not be mentioned in the Materials and methods. Findings are a part of the Results section.[13] This section answers the questions 'What was done?'

Results:

The results are the heart of the paper.[1] The results should be stated in a manner which would allow other investigators and readers to derive the same conclusions as supported by your study. The response rate of a survey should be mentioned. Tables, graphs and figures form part of the result section. Certain journals require the tables, graphs and figures to be placed within the text in the results section while others require them to be placed at the end of the manuscript. In a published manuscript these are usually interpolated within the manuscript text. The first step in writing the results section is to review the analyzed data and decide what to present.[13] Deciding which sections are relevant to the questions posed in the introduction may be helpful. Raw data and intermediate calculations are not included. However, certain journals may ask the author to submit the raw data if needed. Check that the data is accurate and consistent throughout the manuscript.[13] It is becoming increasingly common to present the actual p-values for all statistical analyses carried out. The Statistical Package for Social Sciences (SPSS) and other statistical packages will provide the actual p-values for the various statistical tests.

You should determine before writing the results section about data which would be better represented in text and that would need to be further elaborated as graphs or as tables and figures. If the latter need further explanation, then this should be provided in the results section as well. The results section refers to data which has been obtained from experiments already carried out and should be written in the past tense.[13] Generally the results and discussion sections are separate but certain journals combine these into a single section. The decision would be based on the journal that you are submitting your paper to. Do not attempt to interpret or draw conclusions from the data. This is done in the Discussion section. Results answer the question 'What was found?'

Presenting the statistics:

The widespread availability of easy to use statistical software encourages the proliferation of confusing data and results. If needed, the authors should consult an experienced biostatistician at the initial stage of the study design. The exact statistical tests, the softwares and the approach used should also be stated in the methods section of the paper. The study design, population and sample size, data collection methods and methods of statistical analysis should be reported.[14] While reporting the results of statistical tests use appropriate measures of central tendency and variation. For highly skewed data median and interquartile range may be better measures than mean and standard deviation. Statistical significance must be distinguished from clinical significance. Statistical significance shows how far a given association exceeds that which can be expected by chance while clinical significance deals with the likelihood that the findings of the study can make a difference to clinical practice and patient care.[14] For doctors clinical significance is of greater importance than statistical significance.

Tables:

Tables present information in a concise and efficient manner.[15] Presenting data in tables can reduce the length of the text. Tables can summarize numerical data and statistical results. It can also synthesize main findings from the literature and present textual data especially in review articles.[15] The tables in a manuscript should tell a story. As stated previously, tables should present data objectively and they should be detached from the text i.e. there should not be a need to consult the latter. Tables also help in making comparisons to other study's data and also aids in collecting information for other investigators who are interested in writing a review article or a meta analysis on the subject.

The title of each table and graph should be self explanatory (called the 'scissors test').[1] On cutting off the title from the table or graph it should still make sense. It is recommended that the number of columns should be less than 6 and the number of rows not more than 10 to 12. The figures in the rows and columns should add up. Tables should be numbered consecutively and if you are using someone else's table or your own table published previously then include a reference at the bottom.[1] MS word allows the authors to create satisfactory tables. Certain journals do not want internal vertical and horizontal lines in the tables.

Graphs:

Graphs are used to present information clearly and effectively and demonstrate relationships between the variables in the data.[16] Graphs reveal trends or patterns. Deciding whether to present the data in a table or a graph is often a dilemma faced by authors. If the data shows pronounced trends, presents an interesting picture or reveals relationships between the variables then a graph could be a better option.[16] The size of the graph and the letterings should be large and clear. If the independent variable and the dependent variable are numeric then line diagrams or scatter graphs can be used. If only the dependent variable is numeric then bar graphs can be a good option.[16] Error bars are necessary for all bar graphs and in scatter diagrams, the correlation of regression ®, equations and P values should be included. The misuse of pseudo three dimensional graphs has been mentioned as a common error with regard to graphs in a recent article.[16] The graph wizard in MS Excel is a good option for creating graphs. Other softwares are also available.

Discussion:

Discussion has been mentioned as the second most difficult section to write.[1] It requires a high degree of abstraction in writing. In this section, the findings of the results are interpreted and compared with those of previous studies. The authors should ensure that the objectives mentioned in the introduction have been addressed in the discussion. What the study adds to our knowledge of the subject should also be mentioned. If there are unanswered questions or queries that you would like future projects to answer, then this should also be included in the discussion section. The limitations of the study should be detailed. The maximum number of references should be in the discussion section.[17] The author of a recent paper mentioned things to include and avoid in the discussion.[18]

The discussion should include your research paper's main results and its major implications. This should be followed by a comparison to what has already been done by other authors at the local, national, regional and then at the international level. If certain aspects of your paper's results need clarification and further elucidation, then this should be done in the discussions section.[18] The findings should not be over interpreted, there should not be unwarranted speculation, the importance of the findings should not be inflated and tangential issues should not be dwelt upon. Conclusions that are not supported by the data should not be drawn.[18] The discussion answers the question 'What do the findings mean?'

Conclusions and recommendations:

The conclusion section should provide a quick summary of the most important findings.[1] This section makes recommendations based on the principal findings of the study. A common error noted is making recommendations which are not based on the study findings. For public health papers a point to be considered is how the paper will change public health practice. Certain journals do not have a separate conclusion section. In this case the last one or two paragraphs of the discussion deal with the study conclusions.

Acknowledgements:

This section acknowledges the help of various individuals and organizations who participated in the study. Generally all those involved in the study who does meet the authorship criteria are mentioned in the acknowledgements. Funding agencies, co-workers, hospital patients, participants, students should be thanked as appropriate. The administration of the institution where you are working, departmental colleagues, heads should be mentioned in this section if they have not made a substantial intellectual contribution to the manuscript to warrant authorship but have helped you in other ways during the study that needs acknowledgement. Sources of funding can be mentioned in this section.[1]

References and Citing Styles:

(Following is a brief outline on referencing and citing. To learn and understand what is the difference between referencing and citing and why the different styles, please refer to the section of Referencing and Citing)

References are a difficult section to write. Like other sections, the instructions of the specific journal should be followed. A number of reference management software is now available which make the job of organizing and writing references easier. Some times the number of references is limited by the journal. The authors of a book on writing a scientific paper[1] state that as a general rule the authors should quote one or two classic references in the particular field, several references from the year in they which are submitting the article, references from the journal in which they are intending to publish and references of their own and from their group. The last will increase their citation rate.

The two most commonly used styles of referencing are **Harvard** and **Vancouver**.

Harvard and Vancouver Styles of Referencing:

In Harvard style, the authors' names and the year of publication are mentioned in the text in parentheses while in Vancouver style, references are quoted in the text as superscript numerals or as numbers in parentheses. In Harvard style, the references are arranged alphabetically in the reference section while in Vancouver style, references are arranged according to the order of first citation in the text.

However, there are a number of modifications of these two styles according to the criteria of individual journals.

What is EndNote?

EndNote is a software available to manage bibliographies. It has powerful searching abilities and the different referencing styles are already fed in. It also allows you to search across different databases around and you easily find your article of interest. After you have made your articles bibliographical list, the referencing styles can easily be changed suiting the journal where you want to send your article to, saving you precious time. The software is compatible with the different operating systems and also gives you many other powerful tools and features which can be integrated with different other softwares you use, such as Microsoft Word.

To learn more about EndNote, visit:

http://www.endnote.com/

Table 13 summarizes the important instructions for various sections of a research paper.

The covering letter:

Nearly all journals require a covering letter to be submitted along with the manuscript. While preparing the covering letter follow the instructions of the journal to which you are submitting. You should mention that the manuscript has not been previously published or submitted elsewhere for consideration of publication. Certain journals also require a statement affirming that if the manuscript is accepted for publication the authors will transfer copyright to the publisher. Word counts for various sections and designation of a corresponding author may also be required. If you have published papers which are similar to the submitted manuscript then it should be mentioned in the covering letter.

Certain journals do not require authors to sign the covering letter, others require only the corresponding author to sign while others require the signature of all authors. Certain journals accept scanned, signed copies of the letters while others require letters to be posted to the editorial office.

Authorship:

Authorship should be earned and not gifted.

Authorship credit should be based on:

> *"a) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; b) drafting the article or revising it critically for important intellectual content; and c) final approval of the version to be published. Authors should meet conditions a, b, and c."*[9]

Usually the manuscript is the product of work of a single author or a few authors.[17] The remaining authors help in reviewing the work, data analysis or study design. Determining the order of authorship may also be difficult. The individual who has done the majority of the work is usually listed as the first author and other authors are listed in order of contribution.[17] In many cases, the senior most author is listed last and is often the corresponding author for the manuscript. Authorship is based on consensus among the various authors involved in the manuscript.

Why papers are not accepted for publication?

An author in 2004 had looked at the top ten reasons why manuscripts were not accepted for publication in the journal 'Respiratory Care'. These reasons were wrong choice of journal, wrong format of the paper, not following journal instructions, poor writing (use of stilted, flowery or deliberately complicated writing), getting carried away in the discussion, suboptimal reporting of the results, inadequate description of the methods, poor study design, failure to revise and resubmit after peer review, and failure to write and submit a full paper after an abstract presentation.[19] These have been mentioned in ascending order of seriousness with the most serious causes listed last.

The use of language:

Most scientific writers use the term 'we'. The use of 'I' in scientific writing is quite uncommon though it may be appropriate on occasion. The second person is virtually never used in scientific research.[20] It is always better to use the active voice than the passive in scientific writing. Use of active voice makes sentences shorter and easier to read. A clear and direct writing style makes the article more readable, enhances clarity and reduces ambiguity. If a sentence is running longer than 20 words then break it up into two sentences.[20] Get your manuscript reviewed by someone else, especially a person who is likely to be critical.

What a reviewer looks for in a manuscript?

For a scientific paper to be publishable it must be relevant, original, and scientifically valid.[21] A valid research paper is one where there is a logical, justifiable and clear progression from research question to conclusion. A reviewer critically looks at the material and methods section and decides whether the methods used are valid and reproducible. The results and discrepancies if any, between the text and tables/graphs are also looked at. The conclusion section and whether the conclusions are warranted by the study findings are carefully scrutinized. The language of the paper and the logical flow of ideas are also important. As stated before it is important to use simple and direct language and short sentences.

The reviewer also looks at the references, whether the section is up to date, are important references missing and have the references been cited in the journal style. In papers using statistics, the correct choice of a statistical method, sample size calculation and the proper reporting of statistics are also important.

The process of writing a paper:

Most authors first write the materials and methods and then the results. The third section which is written is the introduction and finally the discussion. References are added as and when required. After the manuscript is completed the abstract is written. Once the writing is completed ask a colleague to critically go through the manuscript. When the paper is finished it is useful to keep it aside for a few days and then reread it; when often a surprising number of errors can be found.[22] Before sending for publication double check that the manuscript is in accordance with the journal instructions. Also ensure that you have written permission to use previously published material and the identity of individual participants or patients is not revealed.[22] Most journals send the manuscript out for peer review; on receiving the reviewers' comments try and reply to them as quickly as possible. Mention how you have responded to each of the queries in a revision letter. Once the article is accepted, the publisher will send proofs prior to publication and these have to be returned as quickly as possible. Most journals allow anywhere between 48-72 hours to return proofs.

Prof's writing rules:

Prof. Colin Binns has mentioned ten writing rules or 'ten commandments' for writing a scientific paper.[1] I am mentioning some of the rules here.

The midnight rule: Most reviewers will be fitting your paper into a tight schedule. Reviewing is not a paid activity and reviewers may be looking at your paper late at night or on an airplane. An easy to read layout, small sentences, paragraphs dealing with only one subject and minimal use of abbreviations can help to improve readability.[1]

The girl friend rule: Is your work understandable to your girlfriend or boyfriend? The paper should be read by experts as well as lay persons.

The grandmother rule: The Professor advises authors to visit their grandmothers regularly and leave a copy of their writing with her. This will serve to create a back up of the manuscript and the grandmother will also give them a meal which will be beneficial for nutrition and health.[1]

The 'first and last' rule: The key positions at the beginning or end of a section or the paper are vitally important. Authors should not waste the advantages of these positions and special attention should be paid to them while writing these sections.

The 'Alice in Wonderland' rule: The author advises the inclusion of enough graphs, tables and figures in the manuscript to make it easier to read.[1] However, the number of graphs and tables which can be included varies from journal to journal.

The 'pillow rule': Sleep with your objectives or research questions under your pillow and remember them at all times. Ensure that they are clearly stated in the introduction, the literature review covers the objectives, these are addressed in the methods and results and are repeated and discussed in the discussion.[1]

'Time waits for no man or woman': Authors should not wait too long to write their research paper. Otherwise, often the topic may lose its relevance, the references may have to be redone or someone may publish on the topic before them. Also remember that journals may take a long time to publish the paper. Keep a time frame of around six months for acceptance after revision and modifications, and anywhere between six months to two years for publishing after acceptance.

'Human at last': Human interest items can be added occasionally. Short poems in introduction or occasional human interest quotations or boxes can be used. Many journals however, do not allow these and you are again bound by the rules of the submitting journal.

Publication:

Publication is too big a topic to be covered in detail in this chapter which mainly concentrates on writing a scientific paper. I will be mentioning certain broad guidelines only. The first task is to match the manuscript with the journal. It is no use submitting the manuscript to a wrong journal as stated previously. Then find out if the journal charges for publishing. Many journals from both the developed and developing countries have started charging authors for publishing their manuscripts. Open access publishers from developed nations often waive charges for authors from developing countries. Obtain a copy of the instruction to authors of the particular journal and ensure that you format the manuscript according to the journal requirements. I generally write the manuscript using Vancouver reference style and if the submitting journal is using Harvard style then I save the Vancouver copy under a different file name. This is useful in case the Harvard style manuscript submitted to the journal is rejected. In that case I do not have to reformat the references and other sections again.

Most journals accept submissions through e-mail or through the online submission system. Online submission may be difficult if you do not have a reasonably fast internet connection. Before beginning the online submission process, most journals require that the corresponding author or the submitting author register with the journal. Manuscripts are generally submitted in MS word format and the journal converts the article to the Portable Document Format (PDF) for further processing. Save documents in MS word 97-2003 format as many computers may not have the latest 2007 version of Windows. If you are using an online submission system (often referred to as 'bench press') then you have to approve the PDF version of your article before it goes for editorial processing. Many journals accept scanned versions of the covering letter and other forms while certain others require these to be posted to the editorial office.

Proofs these days are sent either online or through the manuscript tracking system. Certain journals have a writable PDF version of the proof which enables corrections to be carried out in the PDF manuscript. Others put page and line numbers and you can e-mail your corrections quoting these line numbers. Submitting proof corrections as early as possible is of vital importance and ensures the publication process is not delayed.

In the end, specific requirements for manuscripts vary from journal to journal. However, the broad guidelines which I have mentioned will ensure that your manuscript has a better chance of making it to the list of published articles.

Table 13: Important instructions for various parts of a research paper

Part of the research paper	Important instructions
Title	Concise & informative
	Consider the target audience
	Write in title case
Abstract	Follow journal instructions
	Structured or unstructured
	Write clearly and generally avoid abbreviations
Keywords	Appropriate choice important
	Choose Medical Subject Headings (MeSH) if possible
Introduction	Can be divided into two parts: background and purpose
	Explain abbreviations in full on first use
	Write clearly and carefully
Materials and methods	If using a previous method or instrument, mention and reference it
	Concentrate on the statistical methods
	Three step process: first, research plan, then materials or subjects and lastly describe the methods
Results	Enough information provided to allow readers to reach same conclusions
	Keep in mind the research question or objectives
	Do not duplicate data in both the text and

	tables/graphs
Tables	Tables should be understood without referring to the main text Number of columns < 6 and rows < 10 (maximum 12) The figures in the rows and columns should add up
Graphs	Decide on the type of graph/s to be used Data showing pronounced trends, presenting an interesting picture or showing relationships between variables in graphs Size of graph and lettering should be large and clear
Discussion	Findings of the results interpreted and compared with previous studies Address the study limitations Do not over interpret findings or speculate beyond the facts
Conclusions	Quick summary of most important findings Check that the recommendations are based on principal findings
References	Reference management software can be used Vancouver and Harvard style of referencing Cite references from the journal you intend to publish in if possible

How to choose a journal for publishing your work?

Choosing the right journal for your paper is the key. Some articles may well be accepted and welcomed by some journals and on the other hand be rejected and not endorsed by others.

Make sure that you have gone through the journal's policy on the type of papers it wants. For example, some journals may just be interested in basic science research and others in clinical research, while others may be interested in both. Some journals may be more interested in non-communicable diseases, while others may have a soft corner for tropical diseases. You have to go through the journal policies before submitting your article to a journal.

Yes, the impact factor of the journal is important when choosing a journal but as a student one also has to be realistic in terms of asking yourself about the chances of it being accepted in a big journal. If the research is ground breaking and completely original, you can go for it.

One thing one can do is to browse journals that have published articles that are similar to the one that you are trying to publish.

How should I access these journals?

Devesh V. Oberoi

In this day and age almost all the indexed journals provide online submission and review process. Thus, there should be no hassle of paper work and dispatching the article by post. You can register on the journal website and submit your article electronically i.e. online. Unless it addresses a very broad issue, it is always advisable to publish your paper in a specialty journal.

Once submitted, the article is read by the journal's Editor (in-house review). If the Editor finds it interesting or useful, the article will be sent for peer -review where the quality of your paper will be judged by the experts/researchers working in similar or related areas. However, poor research articles may sometimes be rejected in the in-house review itself. The panel of eminent reviewers will comment in favor of or against your paper in their review submitted to the Editor. The article is usually reviewed by multiple reviewers and their comments help the Editors in making their decision to accept or reject the paper. Many times, the authors may be asked revise the manuscript as per journal's requirements and resubmit the paper after corrections or revision. Positive or favorable reviews from the peer reviewers increase the chances of your publication in the journal's forthcoming issues. Once accepted the authors may be required to sign the copyright and the financial disclosure statements.

What are the chances of my paper getting accepted for publication?

Most of the good journals have a rejection rate of 70-75% or more. Some top notch journals may have a rejection rate as high as 90-95%. This information is often provided in the guidelines to authors on the journal's websites. However, one should not get disheartened with the rejection of the paper by the journal as every rejection is an opportunity for you to make some improvements in your research, be it the central idea, research methodology, the statistical analysis or the implications. Any good paper will find a journal for its publication; the difference may however lie in the quality or the impact factor of the journal.

Summary:

There are a number of reasons for scientific publication and an important one in South Asia is for academic promotions. The successful researcher is usually a good communicator and has the ability to transmit information to peers and the general public. A thesis is a requirement for many Masters and PhD courses. There are many types of scientific papers but in this chapter the author mainly concentrated on an original research article. Introduction, Materials and methods, Results and Discussion (IMRaD) is the basic format of a research paper. The length of the article varies according to the journal but most journals look for an article between 2500 to 3000 words.

The title conveys the first impression of an article and tells the reader what the article is about. The title page has information on the name and affiliations of the authors, the corresponding author and address for correspondence. Readers generally search for an article using keywords. Ideally terms from the Medical Subject Headings (MeSH) should be used. Structured and unstructured are the two main types of abstracts. The word count for an unstructured abstract is generally 150 words while for a structured one it is around 250 words. The introduction section concentrates on previous work on the topic, looks at gaps in knowledge, mentions why the work is necessary and concludes with the study objectives. The materials and methods section describes what materials were used and how the study was done. Results describe the main findings of the study and tables, graphs and figures are part of the results. Care is needed while preparing tables, figures and graphs. The discussion section interprets the study findings in the light of previous research. Conclusions and recommendations should be made based on the study findings. There are two main styles of referencing, Vancouver and Harvard. A number of reference management software is available.

Authorship is based on substantial contribution to conception and design, data acquisition, data analysis and interpretation, drafting the article and/or critically revising it for intellectual content and approving the final version of the manuscript. Many authors first write the material and methods section, then the results, followed by the introduction and finally the discussion. Professor Colin Binns has formulated ten writing rules and some of them have been mentioned in this chapter. The process of writing and publishing a manuscript can be long and time consuming and the author should respond promptly to communications from the editor and the editorial office to avoid unnecessary delay.

Tasks for the Researcher:

- ✓ Be familiar with the possible reasons for publishing.
- ✓ Be able to identify the various parts of a research paper and familiarize yourself about the general guidelines for each of these sections.
- ✓ Try to identify the reasons why some papers are not accepted for publication.
- ✓ Familiarize yourself with the process of writing a paper.
- ✓ Familiarize yourself with journals that would readily accept your work.
- ✓ Read the authorship guidelines in detail of the journal you are aiming to send your article to. Try to follow their writing style and method of referencing to save you time in write up.
- ✓ Learn about the different referencing styles and try to learn more about EndNote. Ask if your institution has bought the software for use by its researchers.

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How to Write a Case Report?

Mahwash Kassi

> *"Case Reports can suggest new hypothesis and stimulate further study. They also serve as one of the easier ways for neophyte medical writers to find their way into medical literature."*
>
> ***Brian A. Morris***[4]

About Case Reports:

Case reports are important means to conveying unusual experiences to the medical community at large. They could either be rare or new presentation of cases/diseases; or rare presentations or rare side effects of common diseases or drugs, respectively.

Case reports help enhance critical thinking as its writing about a situation out of the ordinary and deviant from normal practice. They may serve as an important database to expand medical knowledge and hence reporting the information accurately is important.[1]

Although case reports are considered the least effectual way of presenting medical evidence; [2] for students and beginners, new to the realm of scientific writing, case reports are a good place to start.[1]The word *atypical* should be kept in mind. The worthiness to write and publish is actually governed by the novelty of the report.[3]

It is not wrong to say that case reports are perhaps the most interesting piece of medicinal literature to put together and write. Not only the simplicity but also the "easy publication" appeals to many individuals. They may label it as "second publication" but it does not take away the liberty for one to be creative. And being creative and yet maintain the acceptable format may come as a challenge.

Where to begin:

The ability to recognize the novelty in a case scenario marks the beginning of a case report. This can be in an early morning ward round or in some hospital where group discussions and meeting are done. The range is huge, from unknown drug reaction to atypical symptoms to unknown diseases altogether.

Once this is done, discussions help one make an entire mental plan of the whole scenario. Hence discussion with a colleague or a mentor is recommended. Remember that pictures, radiographs, and scans make case reports all the more interesting and ensure validity. It is of utmost importance that these are prepared beforehand.

How to write:

Before you actually begin write its advisable to go through the available literature and glance for similar case report, and see how your case report is similar or different from the one's earlier quoted. This will actually help rate the novelty of the case report and give an idea of how great a contribution will be done by this case repot. This may also help in judging where the potential journal that one may target.

However, some may write an initial draft before looking at other case reports. Though crude, it does however prevent the writing style to be influenced by other authors, and thus maintains the individuality of one's own and also helps avoid plagiarism. Literature search may be done once the initial draft is designed.

The formatting, referencing, order and size of pictures and table are then governed by the journal one targets.

Titles and subtitles help organize and ensure that nothing is missed. Following is a typical format but have a look at the authorship guidelines of the particular journal you are aiming for the exact specifications and format required:

- **Title**: Simplicity is the essence of a good title. It is good to make the title interesting and eye catching but too much effort put into this may actually make the title misleading. Avoid ambiguous titles.

- **Introduction**: importance aspects to cover in this part apart from '*what the case report is regarding'* are the already present information and how this case report is going to contribute. A mention of the portal or library used may be mentioned and reference of previous case report should be done. Remember to add the pertinent references as you write.

  The length worries a lot of authors. It is important to remember that it should just say all the important matter in a comprehensive manner. A good word count be around a 1000 words. It should be understandable and any complicated medical terminology should be explained.

- **Core Text/Case Presentation**: This part should give a detailed account of the case presentation with supporting data. The crux will obviously vary from case reports to case reports but follow the similar rule of patient history, physical exam, treatment, outcome and course of the disease may be mentioned.[2]Title and subtitles should also be given accordingly. Pictures and tables should not be an isolated portion of the article. These should be properly annotated and reference mentioned in the text. Again length varies with matter at hand; unnecessary details, for example trivial operative details should be avoided.

- **Conclusion**: remember that conclusions should never bring forward a new notion. It is more like saying what you have already mentioned in a little different and summarized way. This applies to all type of medical literature. In case reports however to highlight the novelty is of utmost importance. The applicability in the field of medicine and any recommendations is a good way to the end.

An **abstract/summary** may be written at the end. Abstracts may actually be tricky, but again simplicity is the rule. 250-500 words of a good succinct abstract would suffice.

The writing style has to be formal; needless to say that slang has to be avoided. Too much of intellectualization and verbalizing may not be a great idea. Final word of advice is to maintain the creativity and originality. A cup of coffee and a comfortable environment may actually help. Happy writing!

Important Note

Even though case reports are often not given too much importance, we would like to quote the article on the importance of case reports by Brian. A. Morris who mentions that not only was '**Toxic Shock Syndrome'** initially identified as a case report in Lancet in 1978 of some teenage girls presenting with the set of symptoms characterized by what we now know as Toxic Shock Syndrome (TSS); but also a case initially published in 1981 in the American Journal of Dermatopathology might have been the first report of a case of what we now know as **AIDS**.[4]

Thus rare presentations or new cases or uncommon side effects or odd results or unusual findings should be given its due importance and probed further to suggest a possible cause/hypothesis to explain the phenomenon.

Table 14: List of journals totally based on case reports

• Journal of Medical Case Reports. Available Online: http://jmedicalcasereports.com/
• Cases Journal. Available Online: http://casesjournal.com/casesjournal
• Journal of Radiology Case Reports: Available Online: http://www.radiologycases.com/index.php/radiologycases
• Journal of Dermatological Case Reports. Available Online: http://www.jdcr.eu/index.php?journal=jdcr
• Case Reports in Gastroenterology. Available Online: http://www.online.karger.com/ProdukteDB/produkte.asp?Aktion=JournalHome&ProduktNr=232833
• The American Journal of Case Reports. Available online: http://www.crcpr-online.com/
• Radiology Case Reports. Available Online: http://radiology.casereports.net/index.php/rcr
• Case Reports In Medicine. Available Online: http://www.hindawi.com/journals/crm/

Tasks for the Researcher:

- ✓ Know what constitutes a case report.
- ✓ If you have an unusual case that is worth reporting, identify the journal where such cases would be worth presenting and go through the authorship guidelines to identify the format required.
- ✓ Try going to the websites of journals accepting only case reports (mentioned above) and see how case reports are written and presented.

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ETHICS/PLAGIARISM IN RESEARCH

What is the significance of Ethics in Medical Research?

Amina Ahmad, Atif Zafar, Atif Majeed

"Ethics is nothing else than reverence for life."

Albert Schweitzer

An ever increasing number of advancements have brought the subject of ethics in medical research to the forefront because of the concern of the health profession and the society attached with it. [1]

While planning a research proposal, it is imperative to consider the likely benefits of research endeavors against the personal costs to the individuals taking part in that research. It requires researchers to strike a balance between the demands placed on them as professional scientists in pursuit of truth and their subjects' rights and values threatened by the research. [2]

Basic ethical principles include:

- ✓ Beneficence
- ✓ Non-maleficence
- ✓ Respect and justice

What are the Ethical Codes of Conduct?

Amina Ahmad

"When I do good, I feel good; when I do bad, I feel bad. That's my religion."

Abraham Lincoln

As rightly pointed out by Cohen et al, the ethical codes of conduct should include:[2]

1. *"It is important for a researcher to reveal fully his or her identity and background.*
2. *The purpose and procedures of the research should be fully explained to the subjects at the outset.*
3. *The research and its ethical consequences should be seen from the subjects' and institutions point of view.*
4. *Ascertain whether the research benefits the subjects in any way (beneficence).*
5. *Where necessary, ensure the research does not harm the subjects in any way (non-maleficence).*
6. *Possible controversial findings need to be anticipated and where they ensue, handled with great sensitivity.*
7. *The research should be as objective as possible. This will require careful thought being given to the design, conduct and reporting of research.*
8. *Informed consent should be sought from all participants. All agreements reached at this stage should be honored.*
9. *Sometimes it is desirable to obtain informed consent in writing.*

10. *Subjects should have the option to refuse to take part and know this; and right to terminate their involvement at any time and know this also.*
11. *Arrangements should be made during initial contacts to provide feedback for those requesting it. It may take the form of a written resume of findings.*
12. *The dignity, privacy and interests of the participants should be respected. Subsequent privacy of the subjects after the research is completed should be guaranteed (non-traceability).*
13. *Deceit should only be used when absolutely necessary (e.g use of placebo in randomized controlled trials)*
14. *When ethical dilemmas arise, the researcher may need to consult other researchers or teachers."*

What are the principles of research involving human subjects?

Atif Zafar

"Science may have found a cure for most evils; but it has found no remedy for the worst of them all – the apathy of human beings"

Hellen Keller

Research has revolutionized the human society, and as years pass, the impact of medical research is expanding. Today we see more and more human recruitments into medical research, and with all its beaming outcomes, the trend is likely to increase in the coming days.

For instance, a successful drug response on animal subjects in the pharmaceutical laboratories has to be tried and tested on thousands of human subjects before it finally gets into the market.

Similarly, many intriguing surgical procedures are tried upon dozens of human surgical patients before we see them in publications and medical text. So it is highly essential for all to acknowledge and understand certain principles before involving human subjects in their research thesis or projects.

This, in no way, means that animals have no welfare whatsoever. However, humans are the ‘reason’ why all these endeavors are underway, and one of the most basic principles of the healthcare system and its research is: “to do no harm”.

The Declaration of Helsinki and International Conference on Harmonization and guidelines for Good Clinical Practices are available online and it is highly advisable for all researchers to go through them at least once so as to have a clear ethical stance on the issues surrounding human subjects and related data. [1]

There are multiple other codes and ethical standards formulated apart from these two standard criteria. These include the Belmont report and Indian Council of Medical Research guidelines; and almost every university’s ethical review committee or board formulates guidelines and these are available at the university’s websites. You should familiarize yourself with all the aspects of ethics of doing research on human subjects before embarking on your project. This is extremely important.

These guidelines, codes and policy statements form an important backbone of researches involving human subjects. It needs to be pointed out and clarified here that involving human subjects signifies both direct as well as indirect human involvement, even if this implies to only usage of hospital data belonging to human subjects. In fact, most reputable journals are unwilling to accept papers that do not strictly follow these guidelines. Many developed countries have even incorporated certain points and ideologies from these guidelines into their legislation.

The basic ideology revolves around the principle of the well being of the human subject. All decisions, protocols, methodologies must assure that the benefits outweigh the risks, and the whole research project would in no way be harmful to the society.

The healthcare provider has been given the responsibility to protect his/her patients or subjects, and to assure that all formalities, risks, benefits, complications and implications of the subjects involvement have been thoroughly discussed and the subject has provided his full consent. Although consent has a key role in human subject's research, but the physician or healthcare provider assumes the responsibility of making sure that the protocol is applicable legally, socially and ethically.

The declaration also states the importance of protocol formulation and its implementation; and in the case of experiments, the necessity of it being tried on animals first before embarking upon human subjects.

To minimize the exploitation of dependent and weak subjects, the declaration of Helsinki has also elaborated on the conditionality of their involvement, which obviously, is the guarantee that their involvement will be for their own benefit as well as for the community in general.

Here we would like to highlight the importance of and the dire need for the local, national and international ethical review committees (ERCs) or ethical review boards (ERBs) to play their role.

These committees that have been given the responsibility of assuring that all the projects before starting should have a protocol that inculcates the standard ethical issues described above. These review committees need to strong and independent; and should not be influenced by any political, financial, social and other factors.

We as students and researchers need to realize the importance of ethics in research and must have approval from an ethical review committee before embarking on research projects;

because at times there may be issues that we may not be aware of that the committee may point it out to us for our own benefit and for the benefit of mankind.

Other qualities of an ethical researcher:

Atif Majeed

As is the research project important it is also important that the researcher must also have certain qualities. These are the components which one should develop with in oneself.

Empathy is the ability to feel the feelings that the other perceives. Although it may be a hindrance initially and one might have to dissociate from these feelings at times but in order to bring about a positive change, we need to realize that our research involves human subject and will impact humankind. Human subject consideration, therefore, is very important.

Courtesy is another component of a good researcher. One must have the courtesy to understand the principles and limitations of ethics and remain with in.

Beneficence is an obligation by a good researcher towards the betterment of the humanity and the environment. Keeping self interests aside and determining what is better for the sake of improving quality of life of the people at large should receive priority.

Consent & Confidentiality of the information provided is the right of every participant of the research. One needs to ensure not only proper 'informed' but also what is termed as 'understood' consent. Confidentiality and anonymity of all the subjects/medical records needs to be maintained.

Honesty is the cornerstone. It may be very simple to convert an insignificant data to a significant one by what is known as 'Data Cooking' i.e. falsification and fabrication of data or by concealing certain facts and overstating others. So the researcher needs to ensure that whatever is being projected is actually true as well.

Summary:

Researchers must abide by the Ethical Considerations throughout the Research Process.

We would like to encourage all researchers and investigators to further increase their awareness and understanding of the ethical dilemmas and moral issues associated with a research plan.

Taken as a whole, it is unethical to expose subjects to research that is not scientifically sound, is not performed by competent investigators in certified facilities, and is not expected to provide valid scientific answers.

Tasks for the researcher:

- ✓ Understand the importance of ethics in research
- ✓ Know what are the general ethical principles?
- ✓ Know what are the ethical codes of conduct?
- ✓ Know what are the guidelines for procuring informed consent?
- ✓ Know your responsibility as a researcher for maintaining ethical practices.
- ✓ Try going through the declaration of Helsinki to understand these concepts further.
- ✓ Understand the important principles of research involving human subjects.
- ✓ Try learning about the ethical review committee (ERC) at your own institution and go through their guidelines.

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PLAGIARISM

What is Plagiarism?

Farhad Shokraneh, Salman Fasih Khan

> *"If you steal from one author it is plagiarism; if you steal from many it is research."*
>
> ***Wilson Mizner***

There is no absolute definition for plagiarism. Wikipedia quotes from *Random House Compact Unabridged Dictionary*, 1995 that:

> *Plagiarism is the "Use or close imitation of the language and thoughts of another author and the representation of them as one's own original work."* [1]

Here the author copies someone else's findings, thoughts or ideas and them as his own original work. Therefore the citation and mentioning the bibliographic information of the original work could helps authors to disclaim complains aimed to criticize the thought or impute plagiarism.

Similarly, in a joint statement issued by the Singapore Medical Journal and the Medical Journal of Malaysia, Peh and Arokiasamy quote that:

> *"The World Association of Medical Editors (WAME) defines plagiarism as the* ***use of others' published and unpublished ideas or words*** *(or other intellectual property)* ***without attribution or permission****, and presenting them as new and original rather than derived from an existing source.*

> *To put it simply, this crime refers to* ***stealing someone else's work or ideas, and passing it off as one's own****. For a researcher, this form of scientific misconduct represents fraud of the worst order."*[7]

Nowadays, plagiarism in academic environment has turned into a problem that challenges the scientific honesty. Unfortunately the practice is found to be rampant and wittingly or unwittingly is a global phenomenon. Recently, editors of many journals have identified cases of overt plagiarism in works submitted to their journals; some of which even made their way through the entire review process to get published in respectable journals. Optimistically we want to imply that this phenomenon originates from unawareness of writers; however, in some cases there is no way to rationalize the reasons of plagiarism. He who uses others thoughts and represents them as his/her own breaks the intellectual properties law and should punished by the country's rules or by the academic society in general.

What are the Types of Plagiarism?

To classify plagiarism, we need to be experts in peer-reviewing of papers and have to have widespread study. We could categorize plagiarism by type of materials, type of authors etc. The main types often discussed include:

1. Self-Plagiarism:

Sometimes authors use their own writings in two or several works without citing the original work or referring to notes that in chronic phases leads to multiple publications (duplication) in different resources.

2. Manipulated Plagiarism:

In this case the author uses another author's thoughts, information, opinions or data and then manipulates them and publishes the work as his own. Identifying this sort of plagiarism is not easy for common reviewers.

3. Ideal Plagiarism:

In this case, the author robs the paper or data from private or personal properties of another author before the original work was published. The main author could not prove the plagiarism claim because there was no time to record the writing and plagiary considered as the owner of work.

4. Authors-Fight Plagiarism:

Often teamwork and co-authorship face the problems of, for example:

What the order of authors should be in the publication?

Who should be the corresponding author?

Who should be the first author? Etc.

What might happen is that some authors may be annoyed by the order of authors' names or want to be the corresponding author of a particular paper. If the complain or issue is not resolved, this may lead to envy and revenge. What may happen is that the author seeking revenge may send the same copy of the paper to another journal, in which the acceptance and publishing process is quicker. When the copied paper gets published, this envious author alerts the first journal that a duplicate publication has occurred. In some journals this problem is solved to an extent by inserting a separate part of paper titled "Authors Contribution".

5. Translated Plagiarism:

This is an easy way to translate a good work to another language and publish it as original work. Capturing this plagiary is difficult except for up-to-date reviewers. [2]

6. Whole Work Plagiarism:

This amateur type is discovered in students' class works specially. They clear the name of authors' names and replace own names.

7. Unintentional Plagiarism:

Unawareness about citations value and/or forgetting citations are examples for this type. The author's goal is not to break the intellectual properties law and the mistake is not deliberate.

8. Grammatical and Structural Plagiarism:

In countries where English is a second language, some of authors have phobia in English writing. They fear from errors occurs in structure and grammar of sentences and may copy the identical phrases from similar work to their works and replace some words or data. For common sentences like "thesis statement" there are a few problems but in methodology, results and discussion sections, it is possible that Plagiarism detecting software can detect the work as copied and plagiarized.

9. Juice Plagiarism:

Copying the main ideas and parts of paper and mixing them with new parts so the work seems as new writing is juice plagiarism. This type is the most difficult type of plagiarism to detect by human or machine factors. [3]

What is the difference between a Pirate and a Plagiarist?

These two words usually are used in the same meaning but there are some minute differences. A pirate does robbery of inventions like machines or softwares without permission. While the term Plagiarist is used mainly in the context of scientific writings and considers the use of writings without citing or authors' permission.

What are the different Plagiarism Detection Tools?

Plagiaristic trends in academic societies have lead scientists to design plagiarism detection tools and softwares. Although it might seem expensive, but it is worth spending; considering the cost of a plagiarism offense against an author or journal. Some of these are listed in the following table 15:

Table 15: Plagiarism Detecting Tools and Softwares

eTBLAST	http://invention.swmed.edu/etblast/index.shtml
Déjà vu	http://spore.swmed.edu/dejavu/
CheckforPlagiarism.Net	http://www.checkforplagiarism.net/
Turnitin	http://turnitin.com/

Anecdote: Even in writing of this book on research, we employed 'CheckforPlagiarism.Net' software to prevent plagiarism and to our surprise there was indeed plagiarism (intentional or accidental) in the some of the works submitted by some researchers from around the world. But as is the rule for plagiarism, ignorance is no excuse. Some of the works totally had to be abandoned and some authors denied contribution because in some cases, it was totally unacceptable and were mere copy paste jobs. Finding this was very disappointing. But we are happy that this fault was corrected before the publication of the book rather than finding it afterwards.

We would encourage all authors and especially editors of journals to employ these tools to prevent any plagiarism from happening. We are deeply indebted to the developers of this tool as it saved us a lot of trouble and more importantly from the misdeed of not properly attributing the true author and the true source.

Note: In most cases, as pointed out by one of the developers of these softwares, the tools and softwares in a way do not directly detect 'plagiarism'. According to Katie Povesjil, vice president of marketing for Turnitin,

> *"We find* ***text that matches sources*** *in our databases, and we highlight those matches and identify possible source of the matches. Whether those*

matches constitute plagiarism ***must be discerned by human judgment****. While our software cannot substitute for human judgment, our software can provide information and context to assist or amplify human judgment."*[6]

So ultimately, the author/editor has to decide but it really does help in 'amplifying human judgment' and catches even very minor offenses of plagiarism that otherwise would have easily been missed.

How to avoid Plagiarism as a researcher?

Research ethics advises authors to avoid plagiarism. ***Citing*** the used references in scientific works is the best way of preventing plagiarism. There are some guidelines on the internet that helps authors to observe ethical writing tips. In the next section we will examine all the different reasons to cite as well as the difference citing styles.

Tasks for the Researcher:

- ✓ Know what is plagiarism? Ignorance is no excuse.
- ✓ Understand what constitutes plagiarism and know its different types.
- ✓ Learn more about plagiarism detection tools and see how they can help you as an author/editor.

References and Further Reading:

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[2] Sadeq-Mohammadi HR. an editor's notes, sixth note: Translated Plagiarism. Available from: URL: http://profs-against-plagiarism.blogspot.com/2009/03/blog-post_9117.html [Persian]

[3] Sadeq-Mohammadi HR. an editor's notes, sixth note: Derivative Plagiarism. Available from: URL: http://profs-against-plagiarism.blogspot.com/2009/03/blog-post_12.html [Persian]

[4] eTBLAST. Available from: URL: http://invention.swmed.edu/etblast/index.shtml

[5] Déjà vu. Available from URL : http://spore.swmed.edu/dejavu/

[6] Study Questions Plagiarism-Detection software. By Dennis Carter. Available from : http://www.ecampusnews.com/news/top-news/?i=58004;_hbguid=c42f2fa9-881b-488a-9f5c-43e7b10d6ff1

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CITING/REFERENCING

What is the difference between a Reference and a Citation?

Farhad Shokraneh, Ali Hyder Zaidi

"As long as one keeps searching, the answers come."

Joan Baez

As rightly pointed out earlier, research ethics advises authors to avoid plagiarism. ***Citing*** the used references in scientific works is the best way of preventing plagiarism. There are some guidelines on the internet that helps authors to observe ethical writing tips. We cite others' works in many different ways. Firstly, we should know that what is the difference between a reference and citation and why we cite.

Citation:

According to Cornell University's College of Arts and Sciences website, "a *citation* occurs when you use a specific source in your work and then follow up with the proper bibliographic information; plagiarism issues arise when you use a specific source, but **fail to indicate what you have borrowed**, and/or **fail to provide proper bibliographic information."**[8]

A Reference:

"A *reference* is the bibliographic information that guides readers to your source."[8]

Thus stated simply:

- "References occur in the reference list
- Citations of those references occur in the body of the text.

References provide the information necessary to retrieve published, or in some cases, unpublished, sources of data, research, and other material used by the author. References occur in the "reference list", the final section of a paper written in APA style.

In the body of a paper, the author indicates which references were used to support the statements being made. These indications are called ***citations***.” [9]

Most of the times, authors borrow information from references in their writings. In this way, they write the list of references they cite at the end of their works. In some cases the references are written down in footnotes. References appear at the end of writings in titles like references, bibliography, cited works or notes. Referencing a work means that we borrowed some part of others' works in our work. If we don't highlight the part we borrowed, we are plagiarizing. So we must cite the parts in context and within the text.

Sciences grow by using the past scientists' experiences. Isaac Newton's famous quotation that now is the motto of Google Scholar:

> *“If I have seen a little further it is by standing on the shoulders of Giants.”*
>
> ***Isaac Newton***.

is an evidence that shows the importance of citations and collaborative entity of sciences which makes-up citation networks studied in Scientometrics. Study on citations is a part of Scientometrics.

Why We Cite?

There are many rational reasons for citations. Garfield has listed 15 major reasons for citation: [6]

1. *Paying homage to pioneers.*
2. *Giving credit for related works (homage to pioneers).*
3. *Identifying methodology, equipments, etc.*
4. *Providing background readings.*
5. *Correcting one's own work.*
6. *Correcting the work of others.*
7. *Criticizing previous work.*
8. *Substantiating claims.*
9. *Alerting researcher to forthcoming work.*
10. *Providing leads to poorly disseminated, poorly indexed, or uncited work.*
11. *Authenticating data and classes of fact- physical constants, etc.*
12. *Identifying original publications in which an idea or concept was discussed.*
13. *Identifying the original publications describing an eponymic concept or term as, e.g., Hodgkin's disease, Pareto's Law, Friedel-Crafts Reaction, etc.*
14. *Disclaiming work or ideas of others (negative claims).*
15. *Disputing priority claims of others (negative homage).*

Do we need the permission of author to cite their Works?

According to fair use statement, there is no need for permission if you cite some parts of the work, e.g., up to 100 words. However in especial cases you need a formal permission of the author or the publisher. The three major situations include:

1. Copying a table or chart or picture
2. Using major parts of a paper, e.g., more that two paragraphs
3. Translating whole or major parts of a the work

What are the different types of borrowing?

We could use any of following types to borrow a part of others' works. After every borrowed paragraph, you must insert the number of reference or author's name and the year or page number within the parentheses at the end of paragraph. How you cite depends on the *Citation Style* you choose or the journal's instructions for authors. Full bibliographic information of references appears in the references list at the end of your paper.

1. Direct citation

When you have access to the reference, you can cite it directly in the following ways ways:

I. Paraphrasing

In this type of citation you study the article sentence by sentence, change some words and then write your paragraph. The number of your sentences is equal with the original paragraph's sentences but your wording was changed. Notice that the changing the words should not change the meaning.

II. Summarizing

For summarizing you should read the paragraph from the reference and then write it again in fewer words and perhaps fewer sentences. Consider that your summary must not delete an important part or change the meaning of original resource.

III. Interpreting

After reading the original paragraph, you can write your own interpretation in your own words. You should be sure that your interpretation is true and has no conflict with original paragraph. This type is better than I and II because you can adopt the words and structure of paragraphs from different resources and write them in your own words and keep your writing style in the same way. In this way, you use your own mind to interpret and this makes you writing valuable.

IV. Quoting

In some cases if we want to use a famous quotation or if we don't want to change the wording or content of sentence or phrase in an article, then quoting is the suggested type for borrowing here. For example, Newton's quotation mentioned above. To highlight this quotation you need to indent the quotation and insert it between quotation marks. Some authors use italic form too.

2. Non-direct citation

When you have no access to the original work, you should use "quoted in", "stated in" or "wrote in" method. For example, if you are reading paper A, you find good ideas that are cited in that paper from paper B, so you look at the references list at the end of paper to note bibliographic information of paper B and try to find that particular source/article. If your search is futile and you cannot find paper B by searching the libraries and internet, then firstly, try sending an email to the author of paper B.

Suppose all these methods to find the article fail and you could not find B. In this case you have the beneficial information from B. Also you have the bibliographic information of B which was written in A. We, however, cannot cite the work we have not seen up to now. There is information from B about which we don't know if it is true or does article B really contains the cited information. So we cite A instead in the following way, e.g.:

"Pashtoon Kasi (2009) quotes in Shokraneh, lists avoiding plagiarism as one of the essential ethical issues in scientific writing."

In this italic sentence, you have Pashtoon's Paper (Paper A). Pashtoon has cited Shokraneh's Work. You want to cite Shokraneh's Work but you have no access to his work so you cite Pashtoon's work and list his work at the end of your work. You should not list Shokraneh's work as one of your references because you have never seen his work. Furthermore you are not responsible for Shokraneh's statements because indirectly you announced that Pashtoon is responsible.

Hope this clarifies some of the issues in borrowing.

What are the different International Referencing Styles?

International Reference Writing Styles

When citing within the text and writing references lists, we need to follow a Citation Style. Most of journals have their own styles and write their styles in "Instructions for Authors" section in the journal or the webpage of journal. But there are some famous and most-used international styles which are used more than other styles. All of these styles have at least 2 similar characteristics:

1. Standardizing

These styles seek to define a standard for citing and reference writing for scientific writings. They use punctuation marks to determine the fields like authors, title, year, etc. using these marks make the discriminating of fields possible for all of authors from any country and language, e.g. in Vancouver style we write the authors name at first then inserting a dot we can write the title. Titles in Vancouver Style are between two dots. Every author could understand that the words between two dots are belonging to the title even if the reference was written in Chinese or Persian.

At the same time, these punctuations and syntax make importing and exporting of the bibliographic information easy for softwares like library softwares or Bibliographic Information Management Softwares like Reference Manager™ or EndNote™. Programmers could define fields' discrimination rules by punctuation.

2. Abbreviating

Abbreviating helps benefit the authors, researchers and publishers in several ways:

- Writing, publishing, storing and retrieving the bibliographic information needs money and is a time-consuming process. So the styles have tried to use abbreviating rules. Writing more letters waste the time of authors. So abbreviating saves their time.
- Less letters also leads to less words and surely less lines and pages for the publisher, hence reducing the cost and time of publishing.
- Since, all this information needs to be stored in an electronic format in hard disks of computers, less letters lead to fewer numbers of bytes and less volume load on hard disks. So databases could store more information in a smaller volume. This thus saves volume as well as money of databases owners as well.
- Finally retrieving more letters takes more time of users and abbreviated information can thus help the databases and computers to do their job and processes quickly.

As Medical Sciences grew fast and more journals emerged, the Vancouver style was designed and adopted in medical sciences to create uniformity. In Vancouver style we abbreviate the first name of authors, name of journals (in NLM Standard), and page numbers and so on.

Every reference in the references list contains the necessary bibliographic information that can help the readers to find and access the reference. This information also distinguishes the reference from other similar resources and makes it unique; e.g. the word *Ophthalmology* is a common word in the title of several books and we can distinguish the book we are citing by writing the names of the authors, publisher, publisher's city and the year.

Although there are some famous styles in the world, but almost every journal modified them a little to suit their own needs and so hundreds of different citing styles emerged;

making the life of an author very difficult. This led the ISI to produce bibliographic information management softwares, which have made the job of citing/referencing a lot easier.

Following is a brief description of the commonly used referencing and citing styles. We have taken only the example of how to cite a journal article based on these different styles and how to cite them in-text. Other useful information could be found on the internet especially on the Monash University Library Website and the Online Writing Lab of Purdue University.

I. APA Style

This is one of the most commonly used styles in the scientific community and is also recommended by the American Psychological Association. In the social and behavioral sciences resources you can usually see the use of this style. (7) Below is an example how to cite a journal article in-text as well as in references in APA style.

**** In-Text Citation***

This style's in-text citations are based on two elements: author and year. References list of paper could be sorted alphabetically by authors' name. All lines after the first line of every reference should have indention. Readers can see the name of author in the text and can then refer to references list. Sorting references alphabetically in the references list helps readers to find the related reference easily by the author's name. In cases where we cite more than one reference from a unique author, readers can then look at the year of publication. And in cases If we cite more than one work of a particular author that are published in the same year, then we put a, b ... after stating the year of publication, e.g.:

> - *Kasi (2007) writes that doctors working for longer working hours were more likely to be stressed*

- Doctors working for longer working hours were … (Kasi, 2007).

- We need to reduce working hours by … (Kasi, 2007a)

**** Journal's Article***

Kasi, P. M., Khawar, T., Khan, F. H., Kiani, J. G., Khan, U. Z., Khan, H. M., et al. (2007). Studying the association between postgraduate trainees' work hours, stress and the use of maladaptive coping strategies. *J Ayub Med Coll Abbottabad, 19*(3), 37-41.

II. Chicago Style

This style was one of the first writing styles and was suggested by Chicago University Press. This style's features have been utilized by other writing styles. It also contains pagination, capitalization, punctuation, etc. rules. Some times it is called 'Turabian Style', which summarized Chicago style with emphasis on citation-related information. Chicago style is mostly used in books and publishing companies so there are notes and bibliography in this style. We mentioned notes here but you should know that in bibliography, references are sorted by authors' last name when in notes the first name and last name appears in normal state without inversion. There is another difference between notes and bibliography. Bibliographies have no number at the first of bibliographic information because they were sorted by authors' last name but in notes we use numbers as you will see below.

**** In-text Citation***

In-text citation in this style could be written by page number (like MLA style) or by year of publication (like APA style) between parentheses.

-Working hours of postgraduate trainees need to be reduced … (Kasi 2007, 37)

**** Journal's Article***

Kasi, P. M., T. Khawar, F. H. Khan, J. G. Kiani, U. Z. Khan, H. M. Khan, U. B. Khuwaja, and M. Rahim. "Studying the Association between Postgraduate Trainees' Work Hours, Stress and the Use of Maladaptive Coping Strategies." *J Ayub Med Coll Abbottabad* 19, no. 3 (2007): 37-41.

III. Harvard Style

This system uses bibliography or references list as mentioned in Chicago style. In references list, we should use numbers but in bibliographies, we sort references list alphabetically by authors' last name as we used them within the text.

**** In-text Citation***

This feature is similar to other styles but more precise. Author's name, year of publication and cited page number appears between parentheses within the text.

- *According to these findings … (Kasi et al., 2007: 37*)

**** Journal's Article***

KASI, P. M., KHAWAR, T., KHAN, F. H., KIANI, J. G., KHAN, U. Z., KHAN, H. M., KHUWAJA, U. B. & RAHIM, M. (2007) S**tudying the association between postgraduate trainees' work hours, stress and the use of maladaptive coping strategies**. *J Ayub Med Coll Abbottabad,* 19**,** 37-41.

IV. MLA Style

Modern Language Association (MLA) style is similar to above mentioned styles but commonly used for humanity sciences works.

**** In-text Citation***

Author's name and page number are written between two parentheses. In cases that you used author's name in the text, writing the page number in parentheses is enough.

- (Kasi et al. 37)

- Kasi et al mentioned that... (37)

Journal's Article

Kasi, P. M., et al. "Studying the Association between Postgraduate Trainees' Work Hours, Stress and the Use of Maladaptive Coping Strategies." J Ayub Med Coll Abbottabad 19.3 (2007): 37-41.

V. Vancouver Style

Vancouver style is unique and more different. It uses abbreviating methods more than other styles. Also in-text citations are more different and economical for publishers. International Committee on Medical Journal Editors (ICMJE) tried to define an adaptive style for medical journals and it seems that this style is ubiquitous in medical societies.

In-text Citation

This style uses sequential numbers between parentheses or brackets or superscripted in the text. The references list is sorted by the numbers and ordered sequentially regarding the text and not alphabetically.

- Talati et al find that ... (1) these finding are similar to Kasi et al. (2)

- Talati et al find that ... [1] these findings are similar to Kasi's. [3]

- Talati et al find that ... [1] these findings are similar to Kasi's.[2]

***Journal's Article**

1. Talati JJ, Syed NA. Surgical training programs in Pakistan. World J Surg. 2008 Oct;32(10):2156-61.

2. Kasi PM, Khawar T, Khan FH, Kiani JG, Khan UZ, Khan HM, et al. Studying the association between postgraduate trainees' work hours, stress and the use of maladaptive coping strategies. J Ayub Med Coll Abbottabad. 2007 Jul-Sep;19(3):37-41.

What is the difference between a Bibliography and a Reference?

The references list includes bibliographic information of all of resources you used in the writing and cited them. Every reference in you references list should be cited at least one time within the text. In a bibliography you mention all of works you consult in your scientific writing even if you don't use them as a reference. Some bibliographies encompass related works so as to guide readers to related and useful readings. Most of journals use references lists instead of a bibliography. As you read above, in Chicago style that mostly used in books, we see notes and bibliographies.

What are Bibliographic Information Management Softwares?

Although the international reference writing styles have suggested standard ways on how to cite and reference but each journal has still has her own referencing style. These can be found in the "instructions for authors" section of journals' websites. Now, there are hundreds of reference writing types used in these different journals. Although you can follow the journal’s referencing style and type the reference based on the syntax yourself, however, in two situations you would need to use softwares to do your work more quickly.

First situation is when the number of your references is more than usual for example in review papers. Bibliographic management softwares can make keeping record of your references a lot easier.

Second situation often arises when your paper gets rejected when you sent it to a particular journal and now you want to send it to another journal. References writing style of the second journal may be different from first one and if that is the case, then you have to change all of references and perhaps in-text citations. Changing them manually can be a very time consuming and daunting task.

Here, bibliographic Information Management Softwares help the authors in retrieving, storing, setting up, citing and changing the references. Most of databases and journals have designed a compatible file for their referencing style, which can easily be imported into these Softwares. Using these softwares you can cite when you write. Also you can change referencing styles easily. Furthermore, by storing the references in a file you will have a library of references that contains thousands of ready-to-cite references.

Most used and well-known bibliographic information management softwares are *Reference Manager™* and *EndNote™* both produced by ISI (Institute for Scientific Information).

EndNote is a software available to manage bibliographies. It has powerful searching abilities and the different referencing styles are already fed in. It also allows you to search across different databases around and you easily find your article of interest. After you have made your articles bibliographical list, the referencing styles can easily be changed suiting the journal where you want to send your article to, saving you precious time. The software is compatible with the different operating systems and also gives you many other powerful tools and features which can be integrated with different other softwares you use, such as Microsoft Word.

Table 16: Sofwares for Managing and Publishing Bibliographies

EndNote: Bibliographies made easy	http://www.endnote.com/
Reference Manager: Bibliographies made easy on the Desktop and Web	http://www.refman.com/
ProCite: Your information toolbox	http://www.procite.com/
RefViz: Explore Research Literature Visually	http://www.refviz.com/
Citation: Bibliography and Research Note Software	http://www.citationonline.net/9-home.asp
StyleEase Bibliography and Citation Software	http://www.styleease.com/
Sonny Software: Reference Management and Bibliography Software	http://www.sonnysoftware.com/

Why have different Styles of referencing? Could a classification be suggested?

Perhaps organizations like ISO could define a standard in reference writing to be applicable all over the world. In that case, however, the entity of different sciences will be ignored.

You know that sciences include the laws, theories and hypotheses. Proportions of these three scientific statements are not same in all sciences. Mathematics, physics and chemistry have many laws. The number of theories in psychology, psychiatry, management, economy is more than the laws. On the other hand medical sciences are based on hypotheses and testing of these hypotheses.

It seems that the number of hypotheses is more than the theories and the number of theories is more than laws. Based on this we can classify the sciences into three classes. This classification is just a suggestion and based on author's experiments.

In *law-based sciences*, most of the laws are famous and perhaps we do not need to cite them. Gay-Lussac's Law in chemistry and Newton's three laws of motion in physics are famous enough and don't need to be cited. Also most of laws are known beside the names of scientists who found these laws and these can be counted as in-text citations which have no references because the laws are stable enough. You know that apparent statements don't need to be cited. But if you are doubtful about them, you must cite.

In *theory-based sciences*, number of theories and surely theoreticians are more and the theories then may change into laws. So these sciences need citations and references. As the readers of theory-base sciences want to know the theoretician of the stated sentence, we need to cite their names between two parentheses beside year or page number. If we use only a number in references instead of authors' names, reader, the person who is studying the text, has to leave the text and turnover the pages to find references at the end of writing to know the name of theoretician.

Hypothesis-based sciences have many hypotheses that are suggested, tested, accepted of rejected. Every scientist can test many hypotheses during his/her lifetime. So the authors of hypotheses are not as famous like law-based sciences; and also readers have little tendency to leave the text to find reference at references list. Observing copyrights laws, we have to cite the works and write the references too. In these hypotheses-based sciences we try to don't trouble the reader much by inserting many parentheses and authors' names within the texts. At the same time, we also help publishers by summarizing citation in numbers and references by abbreviating them. This summarization in hypothesis-based sciences is rational because the number of hypotheses is more than theories and laws so the number of papers and also journals in these sciences are more than other sciences. So the special citation style is a great help for authors and publishers to save their money and time. Vancouver style in medical sciences is the best example for citation style in hypotheses-based sciences.

As I mentioned above, this classification is not scientific. We tried to use this classification to make the discussion understandable for readers. We know that every science have some laws, some theories and some hypothesis and so this classification may not be applicable to all settings.

References and Further Reading:

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ESSAYS and DEBATES in RESEARCH

How is Research Integrated in Current HealthCare Practice?

Ourania Kakisi

"Evidence-based healthcare is the conscientious use of current best evidence in making decisions about the care of individual patients or the delivery of health services."

Cochrane AL, 1972.

Introduction:

Most of the particular concerns and problems arising in managing Healthcare systems arise from the huge volume of medical knowledge, discovery of new technologies and treatments and the advancements of medical research that are waiting to be integrated into everyday practice. Moreover, achieving a sustainable level of preparedness for change is considered imperative for the organization of a Healthcare system, and a considerable need for modernization and continuous effort is apparent. This can be at all times costly, requires unique personnel and managerial expertise that has to be controlled centrally in the organization but can also admittedly lead to significant advances being readily available to the society in need, bridging the gap between research and utility in the clinical context.

A significant amount of research is oriented in the control of hypotheses and experimental models that are relevant to nosocomial management and the quality of Healthcare. For Medicine, evidence-based research protogenously has proven a useful tool for the minimization of medical error, the categorizing of advancements in medical sectors and the rendering of knowledge accessible to all. As for Healthcare management, there exists a lot of documented interest in quality control of procedures and treatments, cost -

effectiveness and the need to offer the best available medical care while rendering Healthcare systems of various countries more effective.

It is widely perceived that the integration of evidence based practices as such implemented in medical research can be beneficial to the evolution and cost effective management of Healthcare systems worldwide.

Discussion:

Medicine is nowadays practiced through the continuous use and extended comparison, scrutiny and documentation of principles arising from medical practice, trials and hypotheses, results that are called “evidence”. This is a wider concept of organizing medical knowledge defined in 1972 by Cochrane as the “conscious, analytical and justified use of the best available medical evidence for the determination of the best decision concerning patient care”. Another definition states that ‘[evidence based medicine]... is the procedure of systematically collecting, evaluating and implementing scientific findings as a basis for clinical decision making”.

Such evidence arising from primary and more complex research can eventually become the more distinguished *evidence based guidelines*, which are established on the level of central organizations and are the first grounds for the designation of official regulations, policy and protocols. Evidence however can also be extrapolated regularly in a personalized manner by the individual doctor at various settings. The doctor is everyday called upon choosing for the best available practice to treat an acute or chronic patient problem. Choosing from the “sea of evidence” however on a personalized manner, lacks generizability and control over the best acceptable practice since it is affected by personal knowledge and judgment and cannot be measured or considered widely effective due to the vast variability in medical opinions.

Using techniques from statistics and other mathematical models, evidenced based practice is found most usually in the form of meta- analysis of the medical literature, cost- benefit analyses and randomized control studies (RCTs). The analysis of various forms of evidence in medicine goes beyond the scope of this essay. The various forms of evidence usually undergo quality control for their classification according to their reliability, the degree of their freedom from systematic bias, and lastly their clinical adaptability of the information they provide according to variously established criteria.

These criteria differ from one country to the other and their purpose is to evaluate and extrapolate the findings of evidence based research in the clinical setting. However, where there is no such centrally controlled evaluation, this task is left upon each individual doctor or hospital manager and practical relevancy can be often under or over estimated as mentioned above.

Many researchers have raised questions regarding the implementation of evidence based medicine in clinical practice. It is given that after the explosion of technologies and the internet, the various research outcomes are somewhat freely available to the clinical doctor. However, some elaborate that if guidelines and protocols are to be established universally, the clinical doctor loses part of his initial professional specification which contains estimating the particular characteristics of each patient and his potentials (either economical or behavioral) prior to the designation of treatment. Other arguments against evidence based medicine offer the image of a research that is often guided by various interests of pharmaceutical or other companies resulting to low reliability and accountability. Others claim that their scope is often very far away from issues that really matter for given populations (as the 90-10 issue:(*More on this in "What is the 10/90 gap" essay in the essays/debates section).*

Many nations, with the example of the UK, have implemented a system of national control and use of the evidence that is produced from medical research with the inauguration of the

“NHS centers for Review and Dissemination”. These centers observe the production of clinically relevant and important information, from the stage of financing until the categorizisation of data and its implementation. These efforts are in the first line of bridging the gap between primary research and medical practice and are bright examples for the future of every nation’s Healthcare systems.

Evidence Based Medicine in Healthcare

In Healthcare management such as in the management of other areas of business, there exists a wide array of criticism for the use of “trends” and “ fashions” that are adopted sometimes over enthusiastically, are implemented without success and are rendered obsolete in favour of the next trend etc etc. Often, revolutionary and aspiring tactics and evidence make a very long time to appear in practice although they have established benefits. In another context, large organizations and smaller ones usually tend to show wide differences in practices in the same country. All of the above show that there still exists a gap between research and its implementation in Healthcare by Healthcare officials.

Moreover, there is currently a lot of distress mainly due to the traditional accountability that medical doctors face in recognizing and responding to duty, which is stressful for clinical doctors in various settings in the practice of their profession and in serving the dignity and safeguarding of human life.

For the successful integration of research outcomes in practice and in Healthcare management organization, a knowledge transfer network needs to be solidly founded from researchers as well as relevant manager’s viewpoints. Researchers should be able to see through the eyes of managers for the recognition of current problems as well as managers to be convinced for the clinical usefulness of research (Lavis, 2003).

In 1999 the Institute of Medicine issued the following three categories for the discrimination of the observed gap between research and the implementation of its outcomes.

> *1. Extended use of research in some areas that are rarely producing realistic benefits*
>
> *2 Wrong use of research due to misinterpretation, and*
>
> *3. Reduced use of research from otherwise useful areas*

Practically, examples from the integration of evidence based medicine in everyday Healthcare practice are the HTAs and the Cochrane database.

Initially and again in the UK, Health Technology Assessments are a brilliant tool in the direction of evaluating research outcomes. HTA reports as they are called are tools of validation of research produced knowledge regarding new technologies. In their synthesis publications and clinical trials are taken into account as best evidence and they are presented in the form of a report. A technology can be a medical procedure, biological product, screening test, clinical aid tools, diagnostic equipment, transplantation, medical implants or even systems to internally manage and organize Healthcare (Evidence-based management in Healthcare).

With the use of an HTA report a hospital board can be aided in evidence based informed decision making, the adoption of new practices, information regarding insurance coverage, the levels of use of available services and the relevant costs. These reports can sustain in repeatability and can withhold detailed scrutiny.

Sometimes, the task of drafting and conducting an HTA report is the duty of the managerial personnel of a given hospital, however, where this is not an option due to the high level of specialization required and the allocation of resources, this task can be handled by external private offices with due payment. Important issues in choosing such an agency are its expertise and full detachment from any sort of pharmaceutical of medical industry interest (Hayes, 2006)

Important knowledge network is also the Cochrane Register for Systematic reviews that performs state of the art reviews regarding cutting edge issues in Healthcare research that are readily available for clinical integration.

Conclusions:

For sustaining a dynamic and ever evolving model of Healthcare, the concept of evidence base is and can be a tool of knowledge for doctors as well as Healthcare managers and decision makers. Nowadays, knowledge is not anymore the benefit of the few but is fruit of the systematic and collaborative experience and practice of institutes worldwide.

We do not support a solution where managers of Healthcare systems will turn exclusively to academic researchers or to Medline in search for solutions in the large problems that Healthcare faces. For the implementation of research outcomes in a successful manner a constant leadership by committees that are composed by doctors as well as managers and hospital personnel is needed. Tools such as meta-analyses and systematic reviews are important sources of information for relevant decision making at the hospital and private level, while validation from government sources as such as in the UK is considered mostly useful in maintaining a high level of quality in Healthcare service. Similar efforts are urgently needed worldwide and especially in low resource settings where the best clinical decision often is not available. In such settings, there is proven need for either the most cost effective or the most cutting edge research technology (e.g vaccination) due to high prevalences in diseases that have long been extinct or re emerging. Research outcomes should be transferred readily worldwide through the use of centralized and controlled mechanisms with detachment from financial or other interests that hinder the true modernization of Healthcare delivery.

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Basic vs. Applied Research: Why the debate?

Prof Dr. NM Butt

"The history of Science from Archimedes on is built on both elegant theories and solutions to real world problems."

Stephen Quake[2]

Important Parameters for development of Education and Research:

Research is an important and essential aspect of higher education. Those countries which pay attention to higher education and research are dominating the world and form the elite group of "Advanced Countries" and those which have neglected science and education are classed the "Under Developed" countries or at the most "Developing Countries". While the life of the inhabitants of advanced countries is filled with all sorts of comforts and conveniences the lives of people in the developing countries is filled with all kinds of difficulties and miseries.

When the education is the basic requirement for the welfare of the society the research development in science and technology is essential for the economic and strategic welfare of the society.[4]

While the priority in allocation of adequate funds are important for making a country well educated, it is very important to cater the adequate needs of the teachers of the nation. And when the needs of the teachers are taken care of, it is also essential that the system of high merit and justice is also instituted so that the teachers selected are devoted and appointed on pure merit. This is required for all levels of education. A continued support to these aspects of education and research for the country will certainly establish its viability and economic prosperity.

Having pointed out these important parameters for development of education and research it is important to come down to illustrate the importance of “Basic and Applied Research” for industrial development of a country.

Basic vs. Applied Research:

While often one hears that Research and Development (R&D) should lead always to an application in industry, this is rather one extreme view and if one looks into the careful R&D systems of advanced countries like USA, Japan, countries of Europe etc., one would see rather a balanced approach towards execution of research.

It will then be found that both fundamental and basic research is an essential part of applied and industrial research. There is a fair distribution of funds and efforts, both for basic as well as for applied research. The relative distribution of resources among basic, applied and industrial research depends on the status and priorities of the country concerned. There could be slight differences in the relative percentage of the funding of the three types of research; at the best none is too much neglected or the other too much preferred. As said earlier, a balanced distribution among the three is very important for attaining optimum benefits for the progress of the country. The R&D funding departments of the governments of the advanced countries like USA, France, Germany, UK, China or Japan are examples of balanced and properly distributed funding which have resulted into the economic and social progress of these countries.

The basic research leads to new ideas and new inventions which are applied for fabrication of industrial products of use of the public welfare, whether these are consumer goods or items of health care or medicine, they are the products of research. Moreover, it is an established fact that those industries which support R&D in their organizations produce products of high quality and also earn more profit than those industries which do not so. The research results by the Laureate Economist, Robert Solow clearly indicated that the companies supporting R&D for their products earn 30% more profit than others which do not support research.

The industries have usually supported research which is quickly applicable to the industrial products[1] but some industries do cater for basic research and fall into the pattern which is rather more useful if the industry has to have a lead among their competitors.

Traditionally the universities have been concentrating on basic research but trends in later years have been emphasizing that some part of attention should be given by the universities to produce target oriented research of direct utility to industries.

However this topic is of such importance that even today the traditional debates of "Basic vs. Applied Research" is on focus in Canada. The chair of Science, Technology and Innovation Council, Mr. Howard Alper revealed the suggestions of a recent report of the Council that appropriate balance of funding is 70% allocation to "fundamental research" and 30% to applied and targeted priorities. The President of University of Calgary, Harvey Weingarten in this report highlighted the tilt towards basic research and on the other hand the Nobel Laureate John Polanyi of the University of Toronto has emotionally stressed the importance of basic research in the current debate on "Basic and Applied Research" going on in Canada.[3]

This Basic to Applied ratio of 70:30 for research and development is currently being debated and opinions of the researchers are being asked on the internet to comment on this ratio and whether to support or suggest other ratio of their own views. While some scientists favor excessively the academic or basic research and regard it as an essential basis for evolution of new technologies others value the application-oriented research as more fruitful and need based for the national progress.

Catering to the importance of basic research recently the National Science Foundation of USA,[4] specifically allocated a grant of $200 million under "American Recovery and Reinvestment Act" to fund the repairs and renovations at the nation's academic research facilities. These funds are approved by the President Obama, supporting that "*Investments in research and education build stronger economic foundations for the country"* as said by the NSF director Arden L. Bemet.

It may be stated that the real benefit is believed to be not strictly imposing water tight compartments between Basic and Applied Research but preferably, as also the well known scientists whether in earlier times like Gauss and Archimedes have been playing around with basic and applied researches of great value to public welfare and utility. Also in recent times scientists like Nobel Laureate P. de Gennes of France solved complicated problems of Polymer Chemistry for benefit of Chemical Industry and on the other the Laureate Charles Towns not only worked for laser developments of great value to industry but also worked for basic researches in radio-astronomy. We have numerous examples in early history of science and of today that those scientists who cater both to Basic and Applied Research leave strong traces of land mark of their work appreciated and remembered for long times. The example of Enrico Fermi, as a scientist easy both in theory and experiment, is well known when the first pile-experiment of USA seemed to fail and Fermi was smiling knowing the reason, of later known zenon-poisening, on grounds of strong theoretical concepts.

While the advanced countries can afford emphasis on research of high creative and fundamental level, the need of R&D for developing countries have to have a balance favoring applied research with focused attention for industrial applications but at the same time not neglecting too much the necessary basic research. Academically excellent basic research have to have a fair attention for inspiring young generation to be attracted towards research careers and also at the same time looking after the applied needs of industrial applications to give economic boost to the financial base of the countries.

An interesting discussion on the opinion of Basic vs. Applied Research in a recent article "Guest Column: The absurdly artificial divide between pure and applied research" in the opinion section of the New York Times[2] is interesting to go through.

Acknowledgements:

It is pleasure to acknowledge the suggestion of Dr. Pashtoon Murtaza Kasi to write this brief article, the matter of Basic vs. Applied Research, a matter of great interest for researchers for a long time.

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What are the shortfalls, scope and success of Scientific Method in Medicine?

Ahmed Ijaz Gilani

"Lost in a gloom of uninspired research."

William Wordsworth

Although exploration and inquiry is a basic human instinct, modern science was ushered in by the development of the scientific method. Modern science differs from other systems of knowledge in several important ways.

First and foremost, science is essentially empirical; meaning that only observation, experimentation and rational deduction are to be considered legitimate sources of knowledge. Secondly, it is cumulative in the sense that it grows piece by piece, one research study at a time. Thirdly, it has modest goals. Although science is knowledge par excellence of *'how'* of natural phenomena, *'why'* is not one of its concerns. Purpose or lack thereof, has to be left to theology or philosophy. Bertrand Russell famously remarked that there was no place for 'ontological realism' in the realm of physics.

These features of science have various important conclusions for the researchers. One conclusion, of theoretical nature, is that science unlike its popular conception, is impermanent and in a constant state of flux. Claiming infallibility for science is hence ludicrous. One has only to look at the not so distant history of science, to see that various theories and paradigms come in and out of favor, although each in its hay day is cherished and defended as cosmic truth by its adherents. Empirical evidence, as well as the conclusions drawn from it, is subject to error.

Second conclusion stemming from gradualness of science, of practical importance to its prospective practitioners, is that the practice of science doesn't have to be the privilege of the genius but anyone with an 'average intelligence' can partake in this endeavor. Einstein once remarked that science is nothing but refinement of everyday thinking.

Modern medicine, like any other area of science today is no exception to the above mentioned principles. Several recent examples can be cited to support the above mentioned thesis. Firstly, an accepted mode of thinking can be outdated fairly quickly in today's world. An example from genetics is given to illustrate the point.

A few years back, as the human genome project was edging to conclusion, it was thought that most complex disease like hypertension, diabetes and major depression have a large genetic component to them. It was hoped that the completion of the human genome project will quickly explain how heredity contributes to disease and lead the way to gene based diagnostic tests. Writing in the New England Journal of Medicine, Francis Collins, the head of the human genome project claimed, "the practice of medicine has now entered an era in which the individual patient's genome will help determine the optimal approach to care, whether it is preventive, diagnostic, or therapeutics. Genomics (...), is poised to take center stage in clinical medicine"(Guttmacher and Collins, 2002). In the years following this statement, a great deal of resources and effort was put into linkage and association studies, which so far have failed to reveal genes with a large effect on complex diseases. Many have now argued for changing course and to look for rare gene variants of large effect (Goldstein, 2009). Others have concluded that the contribution of genes is perhaps trivial without an enabling environment (Dennis, 2003).

Similar paradigm shifts are common in the clinical practice as well. An example from diabetes can help being home this point. It has been thought for a long time that elevated blood glucose level is the primary cause of pathology in diabetes. Hence reducing blood glucose levels was considered the key indicator for management and reduction of complications such as atherolsclerosis. Clinical studies showed the efficacy of this strategy for microvascular complications like diabetic retinopathy however it was largely assumed for macrovascular complications such as myocardial infarction, stroke etc. Recently evidence from ACCORD trial has shown that aggressive glucose reduction increases the risk of death (Razani and Semenkovich, 2009). This rigorous trial has resurfaced a deluge of older studies which drew the same conclusion but were largely ignored by the medical community.

Examples from theraputics show that our thinking about the efficacy, safety and utility of drugs may evolve with time. Vioxx (rofecoxib), a Cox2 inhibitor is a recent example. On September 30, 2004, 5 years after FDA approval, after more than 80 million patients had taken this medicine, the company withdrew the drug. Evidence was accruing that the drug increased the risk of myocardial infarctions and strokes. If we rule out malice on part of the drug developer, clinical trials like any other scientific experiment are subject to reinterpretation and identification of methodical or observation errors.

The above mentioned examples point to the need for intelligent evaluation of clinical trial and pathophysiological research data on one hand and constant research on the other hand. The scientific method has shown its utility by being the prime foundation on the top of which modern technological advancements stand. It fees us from the tyranny of personal intuition, guess work and authoritative instruction. On the other hand it is a constant struggle for truth, which in any case comes in various shades and forms. It is essential for a physician to acknowledge that clinical practice must follow well-accepted guidelines, on the other hand, he/she must be cognizant of the limitations of the corpus of scientific knowledge.

Abraham Kaplan, a notable philosopher of science in his book, The Pursuit of Wisdom notes, ‘if science is taught as though the answers are always to be found in the back of the book, the learner will either be incapable of considering more adequate answers…- or else he will abandon science altogether in quest of some book with answers more to his liking' (Kaplan, 1977).

It is thus essential for the physician to have a critical eye, to question accepted facts when they contradict personal observation, and be able to take part in the scientific enterprise through conducting original research. Only by breaking the idols of undue admiration of authority and servitude of foreign opinion, can notable success be achieved in research.

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What is ‘Data Cooking’?

Haider A. Naqvi

> *"Research is what I'm doing when I don't know what I'm doing."*
>
> ***Wernher Von Braun***

Concerns have been expressed against copying and plagiarism.[1] But ‘Data Cooking’ is another issue which plagues our universities worldwide; and is much more common than what we think.

‘What is ‘Data Cooking’? It is basically the **falsification** and **fabrication** of data, which unfortunately is becoming a part of scientific research throughout the world.

At times, rather than actually doing a research study, researchers, faculty and especially clinicians, and unfortunately young students; who are under pressure to produce publications to show progress or for promotion etc resort to making up their own data.

The most common practice seen at times is to increase the numbers to meet the sample size requirements; e.g. after having done 50 or so questionnaires/interviews, the researcher increases the sample size (by just multiplying it by 2, 4, or even 10) because either he/she thinks that he/she does not need to or because he/she does not have time for it.

But why?

Lacking training in research methods, with additional burden of meeting deadlines for promotions, people resort to tinkering with numbers. Another compulsion behind this falsification is that negative results are not interesting to publishers. With the burden of meeting deadlines, and churning out papers, which are bread and butter of academics, such falsifications take roots in one's career. Of course lack of mentorship is the main reason behind this research misconduct. In the absence of role models, exemplifying integrity, people resort to data cooking and distortion of facts.

There was one professor of psychology who used to write very elaborate papers in peer-reviewed journals. One day a colleague got suspicious that he never goes out in the field collecting research data. He reported this to the journal editors, who asked for the corroborating data, which was never there. Subsequently Professor was asked to step down from his academic position. A teacher of mine told me this true story, with an advice to keep a record of all data, in case of any conflict. Now-a-days research ethics mandate that researcher keeps a record of all data-forms, at least up to five years of publication. This is generally made available on public domain too. This can also prove to be handy in case of a reanalysis of facts and concepts. However it is essential to keep the identity of the research subjects' confidential.[2]

Most of us are acquainted with individuals who have fabricated their data – in part as well in totality. Question is: who would be the whistle blower? Truth has its price in terms academic rivalries, oppression and victimization.

We are in need of developing a system which deters such academic misconduct; training people in research integrity through mentorship from the grounding years, supervising and auditing the high-stake projects and penalizing those who are found guilty.'[3]

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What is ‘Parasitism’ in Scientific Manuscripts?

Naila Yaqoob

“Art is either plagiarism or revolution."

Paul Gaugin (French Artist)

The concept of replication/copying originates from Adam’s son “Qâbil” (“Abel”) who observed the burial of a crow by another crow and then followed the same by burying his brother “Hâbil” (“Cain”) after having murdered him.[1] To observe and mimic are the first and basic steps in the hierarchy of human learning and intellect development. The purpose of copying justifies its ethical soundness.

With the passage of time, the art of learning crossed the boundaries of observation, and man started making hypothesis which travelled the journey of experimentation and ultimately opened the doors of research for the human mind which remained restless since its creation. As the human mind travelled through stages of research positivity, its other extreme was also passing through the journey of innocent copying to cheating and ultimately entered into an intellectual succession of bootlegging i.e., intellectual/scientific parasitism.

This is also one of the indicators of the second law of nature; the entropy of the earth is always positive i.e., leading towards an end. This fact is indicative in every aspect of this universe. The cases of scientific/intellectual theft are increasing which not only pirate the work of others (Plagiarism) but also deceive fellow colleagues and the public by presenting wrong information/data; a contributing factor towards the earth’s entropy.

The concept of plagiarism has gained much awareness during last two decades but besides plagiarism, a lot more things needs to be addressed. Scientific Manuscripts are the outcome of one's very long and tough theoretical and practical efforts. Publishing a manuscript imposes a lot of responsibilities on the authors as well as on its viewers/readers. If we take a look into the basic structure of a manuscript (Table 17), every step is a hub where possible loopholes can be identified and need to be properly eradicated while structuring a document. The current situation is even worse than only plagiarism and has evolved into many forms. The whole fact is more descriptive by the term **pests on science** which is making the scientific community to lose mutual respect.

Table 17: Possible Parasitic Loopholes in the Basic Structure of Manuscript Writing

Structure/Part	**Possible loopholes**
Hypothesis/Idea	Lack of Knowledge/Ghost Writing
Literature Review	Improper or no citation (Plagiarism)
	Rephrasing owner's work
Experimental/Survey/	Violation of ethical standards
Demographic data	Fabrication of data
Results/Discussion	Results Fabrication
	Results Falsification
	Unsubstantial claims
	Self-plagiarism
References	Improper or no citation
	(Plagiarism/Research Parasitism

Scientific Parasitism is spreading like a web around the scientific community. It covers but cannot be limited to:

- Brainwave abduction and plagiarism
- Authoritarian Misconduct
- Deception
- Data Fabrication
- Unsubstantial Claims

There are a few of the hidden or internal-authors' issues, which unluckily do not get required attention i.e., the parasitic or commensal behavior. **Parasitic and commensal behavior** is widely practiced at pre-publication stage (Table 18). This behavior could be in various forms and unluckily does not come in to focus or get public attention; only self-plagiarism cases were focused in either editorials or on web pages.

Commensalisms, intellectual blackmailing, sometimes practiced while manuscript writing; is to demand authorship in return for a few of the facilities or funding being provided by an individual. The supporter (who is usually a person responsible to provide the facilities) deserves to be properly acknowledged but has no rights reserved to enjoy owner- or co-authorship without his practical and physical contribution.

Most of the university/organizational policies define more privileges for the first author (the major contributor). But the professorial/ authoritative misconduct prohibit the main contributors to be at the first or at the deserved place in authors' sequence. These authors (authoritarians) are like pests on their own fellows or research students. This parasitism is a very common practice in most of underdeveloped countries where students are unaware or where no effective policies are, to be implemented to protect the researchers' rights.

Table 18: Possible Scientific Crimes at Pre-Publication stage

Structure/Part	Possible crimes
Ghost Writing	No show of major contributor
Authoritative misconduct	Intellectual blackmailing
	Demanding authorship
Self Plagiarism	Extrapolation of one's own data without previous citation of one's work
	Multiple publications/presentations

Disseminating information or new findings is an essential responsibility on behalf of any researcher. The human mind is receptive to the cultivation of new ideas. Every moment huge innovative findings come in front of the public but much is left unpublished. There are many deliberate and/ or inadvertent reasons to suppress results from being published. They are:

- ✓ Doubtful about work significance
- ✓ Lack of confidence in writing art
- ✓ Lack of awareness (Where to Publish and/ or How to Publish)
- ✓ No interest to publish (just working to satisfy job descriptions)

Stated reasons might not be valid with reference to the cases in all the developed countries; but are major contributing factors in underdeveloped ones, mostly Asian countries. The major culprits are the scarcity of resources and unawareness towards worth of publication. No matter what the facts are, leaving unpublished information is research dishonesty that the researcher commits. Research dishonesty may fall into:

- Resources/Facilities Misconduct
- Financial Misconduct
- Time Misconduct

A miscellaneous issue, incorporating in the world of scientific parasitism is "***Sabotage***". Sabotage [2] may involve:

- ✓ Corrupting and/ or stealing files from others' desk and/ or computer
- ✓ Disrupting others' experiments [2]
- ✓ Contaminating the research materials or chemicals

Scientific parasitism not only exists during research and pre-publication stage of a manuscript; rather its roots spread more, once it goes into its viewer's hands. There are many interlinked reasons that push the researchers for deliberate plagiarism:

Table 19: Interlinked Reasons pushing researchers for deliberate plagiarism

Reasons
• Financial Incentives
• Scientometry
• Career Pressure
• To make boss happy
• Fame/Praise/Show off

“Plagiarism” is already well understood around the globe with various different policies to fight the issue. Plagiarism is being committed in various forms:

- ✓ Copy-pasting author’s exact idea/scheme/words as one’s own [3]
- ✓ Citation plagiarism (Providing No or improper citation) [3]

The Higher Education Commission, [4] Government of Pakistan has implemented various policies against the substantial claims of plagiarism and devised a “Zero Tolerance Policy”. Each academic/research institution within the country has to abide by the policy by any means. Various authors were blacklisted during last five years because of plagiarizing and multiple publications in different journals or conferences. The “blacklisted faculty” has also confronted multiple penalties [4] including:

- ✓ warning to job dismissal (and/or)
- ✓ Disqualification for Research Grants (and/or)
- ✓ Snub to Promotion and/or Demotion (and/or)
- ✓ Banned to supervise students (and)
- ✓ Highlighted in Print media

Some of the universities have started working on grass-root level and ***Plagiarism Report*** is becoming a pre-requisite before submitting a PhD thesis.

A number of easily accessible freeware and commercial softwares are available on internet to detect the plagiarized percentage in any documents. But the other parasites which are multiplying within the scientific community need huge efforts to be killed. Obviously, the very first step is ***Awareness***. The act of responsibility starts and ends with the author and in-between are those who are not honest in doing their work. Recognizing and respecting the rights of the individuals is the key to honest working relationships. Continuous personal up gradation on knowledge and skill helps one from becoming pest on others. Above all, ensuring consistency in penalties encourages the righteous and discourages the violators.

Acknowledgement

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[3] "Plagiarism" Wikipedia, the free Encyclopaedia (http://www.en.wikipedia.org/wiki/plagiarism)

[4] "HEC Plagiarism Policy" (www.hec.gov.pk/QALI/Quality_Assurance/QA_DIV.html@157)

Why 'Open Access'?

Talha Khawar, Salman Fasih Khan

"Published research results and ideas are the foundation for future progress in science and medicine. Open Access publishing therefore leads to wider dissemination of information and increased efficiency in science"

PLoS (Public Library of Science)

As stated by the Public Library Of Science (PLoS – www.plos.org, "Published research results and ideas are the foundation for future progress in science and medicine. Open Access publishing therefore leads to wider dissemination of information and increased efficiency in science, by providing:

- **Open Access To Ideas.**

Whether you are a patient seeking health information, an educator wishing to enliven a lesson plan, or a researcher looking to formulate a hypothesis, making papers freely available online provides you with the most current peer-reviewed scientific information and discoveries.

- **Open Access To The Broadest Audience.**

As a researcher, publishing in an open access journal allows anyone with an interest in your work to read it - and that translates into increased usage and impact." [1]

As pointed out earlier, especially in developing countries with limited or no access to expensive journal subscriptions, although a researcher can use a search engine such as PubMed for free but often or most of the time, only the title and abstracts are the parts that are available for free viewing.

As an anecdote, almost 4 out every 5 articles that are eventually required for a research study cannot be viewed or downloaded because it requires journal subscription. And the cost of one article usually ranges from 30-70$, which is too expensive for researchers especially from institutions and countries where not much money is available for research and research is not a priority.

This search result, thus, may not be of good use for an investigator.

To address this important issue and make literature freely available online for everyone, the concept of Open Access is being encouraged. There is a paradigm shift occurring and increasingly journals and scientists are moving towards and encouraging open access in research. Not only are some journals or groups of journals open access, i.e. articles are completely available online for free, but so are some search engines, which limit their search to only Free Full Text Articles i.e. allow searching only on articles that are completely and freely available online. For example, PubMedCentral is a search engine which is a completely 'free digital archive'.

Similarly, PLoS (Public Library of Sciences) is a group of journals that are open access. Their journals include:

- ✓ PLoS Medicine,
- ✓ PLoS Biology,
- ✓ PLoS Computational Biology,
- ✓ PLoS Neglected Tropical Diseases,
- ✓ PLoS ONE,
- ✓ PLoS Pathogens and
- ✓ PLoS Genetics.

Its editorial boards include experienced and leading researchers and scientists from leading journals and diverse backgrounds who have joined together to promote a culture of open access. Already they have achieved numerous milestones in terms of the impact that their publications and journals are having.

Important Resources and links:

PLoS: Public Library of Science
"PLoS is a nonprofit organization of scientists and physicians committed to making the world's scientific and medical literature a freely available public resource."
http://www.plos.org/

Directory of Open Access Journals
"This service covers free, full text, quality controlled scientific and scholarly journals. We aim to cover all subjects and languages. There are now 2794 journals in the directory. Currently 836 journals are searchable at article level. As of today 142393 articles are included in the DOAJ service." Available:
http://www.doaj.org/

The Budapest Open Access Initiative
"The Budapest Open Access Initiative arises from a small but lively meeting convened in Budapest by the Open Society Institute (OSI) on December 1-2, 2001. The purpose of the meeting was to accelerate progress in the international effort to make research articles in all academic fields freely available on the internet." Available:
http://www.soros.org/openaccess/index.shtml

Health InterNetwork Access to Research Initiative
"The HINARI program, set up by WHO together with major publishers, enables developing countries to gain access to one of the world's largest collections of biomedical and health literature. Over 3750 journal titles are now available to health institutions in 113 countries, benefiting many thousands of health workers and researchers, and in turn, contributing to improved world health." Available: http://www.who.int/hinari/en/

SciELO Brazil
"The Scientific Electronic Library Online - SciELO is an electronic library covering a selected collection of Brazilian scientific journals." Available:
http://www.scielo.br/

SPARC: The Scholarly Publishing and Academic Resources Coalition

"SPARC ®, the Scholarly Publishing and Academic Resources Coalition, is an international alliance of academic and research libraries working to correct imbalances in the scholarly publishing system. Developed by the Association of Research Libraries, SPARC has become a catalyst for change."
http://www.arl.org/sparc /

Misleading Open Access Myths

Available from the advocacy page of BioMedCentral:
http://www.biomedcentral.com/info/about/advocacy12

Promoting free access

The Free medical Journals Website.

Dedicated to the promotion of free access to medical journals over the Internet.
http://www.freemedicaljournals.com/

The Free Books for Doctors Website.

Dedicated to the promotion of free access to medical books over the Internet.
http://www.freebooks4doctors.com/

What are the Research Opportunities for Students in Developing Countries?

Devesh V. Oberoi

"Research is what I'm doing when I don't know what I'm doing."

Wernher Von Braun

At the moment, medical students especially from the developing world do not participate in many research activities. Nevertheless the entire blame does not fall on the students as most of the medical colleges/institutions do not provide the basic research atmosphere, guidance and infrastructure or even the awareness needed for undergraduate research. Thus by the time the students obtain their professional degree (M.B.,B.S. or M.D. /or equivalent) they have absolutely no idea about the importance and implications of a research based clinical practice.

A recent study showed that at a given point of time there are around 100,000 undergraduate medical students in India, out of whom only 0.9% of the students have shown a research aptitude through various research programs. The condition may not be very different in other developing countries. There is lack of unawareness about the prevailing research opportunities and inadequate guidance from mentors. The problem is further compounded by limited access to the basic resources and the lack of a conducive research environment. These factors eventually hinder the entry of students into the field of research.

Many students desirous of getting involved in research alongside their medical curriculum are faced by 3 basic questions

1. *Can I do research during my MBBS curriculum?*

2. Will involvement in research affect my studies or grades? And finally,

3. What are the research opportunities available for undergraduates?

The answers to the first two questions are quite simple. Any desirous can do research and even publish the study in a reputed journal during student life. Ideally speaking, involvement in research will not affect your grades much. All the medical students are smart enough to strike out a proper balance (it is not as difficult as securing a seat in a medical school). You only need to be motivated to become a part of the research community and contribute to it.

Now the final question pertains to the various research opportunities available for undergraduates. In the United States, the National Institutes of Health, apart from various medical schools, provides tremendous research opportunities to undergraduate students. The same has been replicated in India too by few National bodies as listed below. Students should be aware of all such opportunities and be prepared to grab them during less hectic seasons of their medical school curriculum.

A list of few research opportunities for medical students in India are as follows:

I. **Short Term Research Studentship : Indian Council of Medical Research**

Since 1979, the Indian Council of Medical Research (ICMR) took has been providing research opportunities to undergraduate students in all medical colleges across the country and the program has been running successfully till date.

It is a 2 month (excluding the 1 month that is required for preparing the report) studentship wherein the students are required to choose your guide (any faculty member in their college, belonging to any department) depending upon their own area of interest. The topic could be picked up across any subject in the entire medical curriculum.

Students may look for the ICMR notification for the studentships (usually displayed in the second week of January) on your college notice boards. (One may also find the news on the ICMR website www.icmr.nic.in). The next step is to pick up a guide and decide a topic for your short term studentship (or ask your guide to help you in deciding the topic for research). Research is supposed to be conducted at your medical school and you will not be paid any additional allowances for travelling purposes that may be required for the data collection.

Once this is done, prepare a protocol for your research (as per the ICMR guidelines) and mail it to the ICMR before the deadline (usually third week of February) and wait for the results (announced usually in April). If you stick to the ICMR guidelines there are high chances that your protocol will be accepted. Once the protocol is approved by ICMR start your project and finish it off within 3 months (including final preparation of the project report) and dispatch it to ICMR. In next 3-4 months you shall receive your stipend money (Indian Rs.5000/-) and in subsequent 3-4 months a certificate of completion of studentship.

II. Summer Research Fellowship: Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India

JNCASR, Bangalore accepts students from variety of disciplines (M.B.B.S is one of them) and places them in any reputed research center anywhere across the country (as per students choice and availability) under an able guide for a period of 2 months. During this period students will be required to work under his guide's idea or generate his own ideas in well equipped laboratories. Students are expected to submit their research report to the governing or scholarship providing body. Students may come up with a high impact publication as well. However, at the time of applying, the students will be required to prepare a research protocol on the topic of their choice and attach it with their application form along with a recommendation letter.

Information about notification can be accessed in national dailies as well on the website www.jncasr.ac.in in the months of October – November every year.

Stipend granted: Rs. 4000/- per month for 2 months. Accommodation may or may not be available depending upon the research center chosen.

III. **Summer Research Fellowship: Indian Academy of Science, Bangalore and Indian National Science Academy, India.**

Reminiscent of the JNCASR fellowship, the students shall be placed under an able guide across any reputed centre across the country for a period of two months. Information regarding notification can be accessed in National Dailies or through the website www.ias.ac.in around November -December every year. Monthly stipend Rs.5000/- is awarded for 2 months + A certificate after completion of the program. Accommodation may or may not be available depending upon the research center chosen.

IV. **KISHORE VAGYANIK PROTSAHAN YOJNA, Indian Institute of Science, Bangalore, India.**

The "Kishore Vaigyanik Protsahan Yojana" is an ongoing program started by the Department of Science and Technology, Government of India, to encourage students of Basic Sciences, Engineering and Medicine to take up research careers in these areas. The aim of the program is to identify and encourage talented students with aptitude for research.

Generous scholarships are provided (up to the pre-Ph.D. level) to the selected students

Stipend: Rs. 4000-5000 / -p.m. for the entire duration of M.B.B.S curriculum.

More information can be accessed at http://www.iisc.ernet.in/kvpy/index.htm

V. **Indian Institute of Technology, Mumbai: Summer Fellowships and Summer Internships.**

These fellowships are meant for students from engineering and medical stream. The Fellowships (for graduates) are for one year duration while the internships (for students) span a period of 2-3 months. The students are required to stay at the Institute's campus for the duration of the fellowship. The monthly stipend for the fellowship ranges between Rs.8000-10,000 while for the internships it is usually between Rs.2000-3000.

More information can be accessed at: http://www.iitb.ac.in/fellowship.html

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[6] www.iitb.ac.in

[7]http://owl.english.purdue.edu/workshops/hypertext/ResearchW/1draft.html

[8] http://www.pri.univie.ac.at/~derntl/papers/meth-se.pdf

[9]http://www.processimpact.com/reviews_book/peer_review_process.doc

[10]http://www.equator-network.org

What is the importance of Collaboration?

Haider A. Naqvi, Sohail A. Qureshi

"If I have seen a little further, it is by standing on the shoulder of giants."

Isaac Newton[4]

During recent times, divide between clinicians and researchers has become more pronounced. Though there are professional development tracks for both, a genuine research question generally emanates from clinical coal mines. The case can be sighted of John Snow, Anesthetist by practice who carried out "shoe leather epidemiology', going from house to house and reporting surveillance data on Cholera related deaths. Snow's conclusion that contaminated water was associated with cholera related deaths is a prime example of observational data. Another example is association of lung cancer with cigarette smoking[1]. We see many other examples if we examine the chronicles of research-history.

Training in research methods does confer the advantage of assessing the outcome with accurate test statistics. To be able to think divergently on issues and measure outcome-variables accurately is an art as well as a science. One can learn the science through courses but the mastery of Art requires patience, discipline and mentorship. Research generally is a team game; team which relies on the strengths of its members is expected to win the prized trophy of scientific breakthrough – recognition, publication and research grants may very well be the milestones in this journey. At times, team work is the actual accomplishment. In handling the complex dynamics of human interaction there is an actual character development of an apprentice. Good mentors watch out for such subtle, supplemental learning.

Similar dichotomy exists between basic science and applied research. Basic scientists feel – rightly or wrongly - that clinicians don't want to share their patients when it comes to clinical trials. Clinicians pretend to be the gate keepers, though they only provide service in lieu of a fee. Basic science research is long and precarious, taking years in order to have conclusive evidence as opposed to some areas in applied research where people just tinker with numbers[2]. Researchers in later area may churn out papers but it is at the cost of dogged bench research, which lays down the conceptual-foundation.

Collaboration is of paramount importance when it comes to a research inquiry. Often, while searching for an answer we find ourselves venturing in to an unknown territory. It is through collaboration that we are able to solve the scientific puzzle. The illnesses, so far have not started distinguishing themselves in sections and departments. The sooner we are able to recognize this the better it is; there are research issues at the interface of disciplines, which can never be solved unless one takes a multidisciplinary approach. Science has no boundaries, no drawing room clichés. It is ruthlessly honest, demanding integrity, collaboration and teamwork. Though it may not be focused on proving the truth, it does focus on falsifying the falseness of evidence or a hypothesis[3].

The dichotomy of a clinician and researcher, or Basic science and Applied research is just a difference in Medical world view. Both, have a common goal i.e. patients well being. Their approach might be different. One is focused on the whole while the other might be looking at the obvious piece. It is just like lateralization; the left brain and right brain might have different specializations though one may not be superior to the other. These might be complementary, a whole brain which can reason logically, communicate coherently and be able to appreciate the abstractness of varied situations.

A Prayer:

In the end, for believing researchers, we cite a prayer on Collaboration:

> *'God give me serenity to accept my limitations, courage to collaborate where I can, and wisdom to put forth my own question!'*

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What is the 10/90 gap?

Jawad Kiani, Atif Majeed

10/90 gap refers to the statistical finding of the Global Forum for Health Research [1] that only ten per cent of worldwide expenditure on health research and development is devoted to the problems that primarily affect the poorest 90 per cent of the world's population." [2]

"

This concept was important to be introduced to researchers, especially from the developing world, so that they could identify and work on problems that are of interest to them and also which are affecting their country in general. This would help in solving problems of developing countries as well as providing opportunities for breakthroughs related to diseases and problems affecting them.

"We need to identify and work on our own problems"

Our teachers at our medical college have always taught us and have emphasized that that we as clinicians and scientists of the developing countries would have to take up the role of advocacy as well. There aren't many public health specialists in the country fighting for the cause, so we need to equip and educate ourselves with the dynamics of public health and health policy and planning as well.

This is very important since many of the decision makers in the country aren't educated with respect to public health and we would have to educate ourselves so that we can fight for the cause better. We are currently working on problems that are affecting a small fraction of the world and not addressing properly the problems affecting the majority.

Millions of people today either die or are adversely affected by diseases or problems which are not getting due attention in terms of research and funding. Solutions to some of these are available and for some newer, better and more innovative ones would need to be developed. For example, the major killer still of children is diarrhea. Malaria still is killing thousands of individuals each year.

Increasingly, the image of research is that is often guided by various interests of pharmaceutical or other companies and their scope is often very far away from issues that really matter for given populations.

We need to bridge this gap as well and be thoughtful of choosing an area of research that would be of benefit to the majority of mankind as well.

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[2] Wikipedia contributors, "10/90 gap," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/w/index.php?title=10/90_gap&oldid=87289317

APPENDIX

Appendix – I: A Brief Guide to Oral and Poster Presentations

Stanislaw Szlufik, Sajjad Ahmed Sherjeel, Abaseen Khan Afghan, Saad Siddiqui

"Facts are not science – as the dictionary is not literature"

***Martin H. Fischer*[1]**

Importance of Conferences:

An indispensable part of any research project is sharing of its findings. The most common way of letting other researchers know of your research findings is:

- Either to publish the study in one of the journals; or
- By presenting your findings as an oral presentation or a poster at national and/or international conferences.

Presenting your research findings at scientific conferences is useful due to a number of reasons.

- Scientific conferences provide a platform for networking with the fellow scientists from around the world. It is also an opportunity for scientists of similar interest from diverse backgrounds to learn from each other and build upon collaborations.
- While publication of the research paper in a peer reviewed journal might take anywhere from six months to as long as two years, conferences provide you with a platform for rapid dissemination of your results.

- The abstracts of the research presentations in a conference often get published in various forms; for example, on the organizer's website, on databases of academic institutions, and if they are good international academic conferences, as a supplement to an indexed journal. Therefore, the findings of your study quickly get distributed and known.
- The entire process of making the presentation, the discussion and the question and answer session; all eventually help in the writing-up of the research paper to be published. As a good practice, jot down all the different important points that you came across while making your presentation and also note down all the questions that were asked after your presentation as well as the discussions that were generated after your presentation. Especially, the questions that are asked at the conferences by your fellow scientists help in:
    - writing the 'discussion' section of the research paper;
    - identifying the limitations of your study; and
    - identifying questions and areas for future research.

However, without proper preparation even the best research project would go unnoticed. Therefore, in addition to research skills, it is imperative that researchers learn good communication and presentation skills as well.

Effective Oral Presentation:

- Planning and preparation are one of the most important stages of making of a good presentation and should be given due consideration. The earlier the speaker starts the planning stage, the better he would be prepared and thus, would be more confident and at ease when delivering the presentation.

- At the beginning, every speaker should collect all the necessary information *(e.g. Images, Photomicrographs, References etc)* that would be used in making of your presentation. Certain key issues here need to be addressed before proceeding further.
  - ✓ First, *Know Your Audience*: it is very important to know who would be your audience as this would help in deciding how detailed your presentation should be.
  - ✓ Second, determine the length i.e. the time allotted for the talk; if it is short e.g. only 5 minutes, then your presentation needs to be straightforward and needs to highlight the key issues and the most important findings of your research.
  - ✓ Third, *Know the Requirements*: Try to know the guidelines and the specific format suggested by the organizers; also try to know what resources would be available to you before you start making your presentation.
- ✓ Your talk should be clear, well-constructed and logically prepared.
- ✓ The sequence, the style and the content of the presentation should be such that all members from the audience should easily understand the aim of your research and your findings.
- ✓ Typically, research presentations at international conferences have a pre-determined format e.g. Introduction/Background, Methods, Results, Discussion, Conclusions and/or Recommendations. Stick to the format specified by the conference committee and when you deliver the talk, there should be a slight transition when moving from one heading to the next.

- ✓ Preparation should start by highlighting the background of your study. It should introduce what has already been done on the topic and what your study aims at achieving. Also try to outline the main objectives (Primary and/or Secondary Objectives of your research study).
- ✓ Nowadays, almost all presentations are delivered using multimedia projectors and computer softwares. Try learning the software e.g. PowerPoint or Flash to make effective use of all the tools to make an effective presentation.
- ✓ The presenter should be cautious on the use of too bright colors and complicated backgrounds. Typically white background with black font or blue backgrounds with white and/or yellow font are a good start till one learns more about this area.
- ✓ Instead of using complete sentences on your slides, it is better to outline the key message or the key word and elaborate on it when you deliver your talk. This would help the audience focus on what you are saying rather than getting overwhelmed by unreadable lines on the slides.
- ✓ Typically, on the PowerPoint presentation each slide should not consist of too much text. More text needs more attention, and you would loose your audience's interest.
- ✓ If your research involves a complicated method or technique, it is advisable to briefly define the particular terms and methods in the beginning so that the audience can have a better understanding of your presentation.
- ✓ The use of graphs, tables and figures is encouraged; but make sure that everything is clearly labeled and that the fonts are not too small.
- ✓ Use of unnecessary pictures should be avoided.

- ✓ The words of your slide should not be too small and should be easily readable. Try projecting your slides on a multimedia projector to get an idea of how would your slides would appear to the audience.
- ✓ Rehearsal and practicing before the actual presentation is an essential step in giving a good talk. This would especially be useful in timing your exact presentation so that you do not exceed the assigned time limit and also lets you examine if all the main findings of your research were emphasized properly. Rehearsal and practice would also help in avoiding problems with communication and/or lack of words (getting *'Tongue-tied'*) at the time of the presentation.
- ✓ It is always advisable to present your talk to your colleagues or even a friend and get their feedback to make any changes if necessary.
- ✓ The shorter the allotted time of the talk, the more difficult it is to clearly present your research; therefore always remember to focus on the most important points, and the key findings without going into too much details.
- ✓ Making notes for what you are going to say on each of the slides can prove helpful.

Most of your work is accomplished when your presentation is ready and when you have timed yourself and practiced your talk. Important thing now is not to be afraid of the audience, and to stay calm. Other important things to note are:

- ✓ Before the time of the presentation, it is advisable to run through your talk one more time. It is also very important to go to the room of the presentation before it starts, and to see the location of the desk, furniture, audience, and if any special equipment is needed (e.g. microphone, pointer or batteries or any other electronic equipment); and if there is a problem, the speaker should contact the staff before the presentation in order to clear all problems.

- ✓ The speaker should check the presentation once on the computer and the projector in the presenting room, before the presentation starts – it is the only way to be sure, that there will be no technical problems associated with the presentation file, format and or projection.
- ✓ Whenever giving a presentation on PowerPoint/multimedia projector, always expect all the technology to fail and hence keep a backup copy on Over Head Projector transparencies, or even a printout of the complete presentation; should the need arise to use the whiteboard or give the talk orally without the use of any visual aids.
- ✓ During the presentation, the speaker should not stand behind the dice/desk all the time. Try to move about and interact with your audience.
- ✓ Try to keep calm and take deep breaths to ease any nervousness.
    - o Shaky voice? The more you practice the presentation, the less your voice will be shaky
    - o Shaky hands? Try to use your hands to emphasize the key points, as you use them in normal everyday conversation; this may help ease off the tension.
- ✓ Use short pauses to put emphasis on important points. These pauses will not only allow you to gather your thoughts about what you are going to say next, but they also give the audience some time to think about what they just heard. There should be a slight transition/pause when you are moving from one important heading/section to the next as well.
- ✓ *Talk to your audience, Not to Your Presentation:* The speaker should always face and address the audience

rather than constantly looking at the slides projected on the wall. A very useful and good solution for engaging the audience is to involve them in the presentation process, by making eye contact or by posing questions to the audience.

- ✓ At the end, the speaker should summarize the presentation, and emphasize once more the most important points of your presentation. It is also very important not to forget to acknowledge your institution and the place where this work was carried out as well as all your peers and supervisor who helped in the conduct, analysis, write-up and presentation of your research findings.

You should remember that your work does not end here and at most international conferences and meetings, there is a specific time allotted for questions, comments or discussion about the research study that was presented. Many people fear this part since questions from a diverse audience can be on any thing related to your study.

- ✓ Thus, you should be prepared beforehand and try to anticipate what may be asked pertaining to your research presentation.
- ✓ Try presenting your work first to your colleagues before the actual presentation and encourage them to ask questions. This would help increase your confidence and some of the questions on the day of the presentation may actually be the same that your colleagues posed earlier.
- ✓ Try to repeat the question clearly if the rest of the audience did not hear the question properly. Repeating the question may also be useful for you so that you also are clear about what is being asked.
- ✓ In your answers, try to be brief, precise and to the point.

- ✓ Understand and acknowledge the limitations of your study and if you are not able to answer a particular question, you can offer to find the answer in the literature and contact the questioner at a later stage.
- ✓ If the question demands more discussion and there is not much time allotted, it would be courteous to continue the discussion with the questioner during the breaks and/or after the presentations.

Effective poster presentation:

Creating a good poster presentation can initially be a cumbersome job, especially for a young scientist at the beginning of his career. However, preparing a poster is very similar to preparing an oral presentation and with a little help from an expert at your institution or a colleague who has already made a poster, you can create very good research posters. Some key issues to note are:

- ✓ Firstly, acquaint yourself with the requirements and specifications suggested by the conference organizing committee.
- ✓ Authors must know, the exact size of the poster (in centimeters or in sizes of the paper, e.g. A1, A2), and how much time they would be allotted for presenting the poster at the conference.
- ✓ Try to know the format of the poster and follow it as stated; a typical poster consists of a title, the names of the author, the institution, the main text (IMRaD – Introduction, Methods, Results and Discussion as in a research paper), acknowledgements, few important references and/or graphs, tables and pictures.
- ✓ It is important to start making your poster well in advance, especially if this is your first time, as the designing and printing requires time.

- ✓ Try consulting any experts if there are any at your institution. Some of them can make a great poster for you with a few discussions and suggestions from your side.
- ✓ The title should be easily readable from a distance of 2 m.
- ✓ The use of colors and background depends on the poster's authors, but they should remember that the text and the main findings of their research should be easily readable.
- ✓ Self-explanatory graphics, flowcharts, figures and tables should be the main part of the poster, and the main findings of your research should be emphasized. There should not be too much text on your poster.
- ✓ After preparing your poster, check for any errors or spelling mistakes before the final printing. Try to get your poster printed a few days before the actual conference and see how it looks after getting printed. Often, the results may be different from what appears on screen and you may need to change some fonts or colors depending on the print.
- ✓ The rules for effectively presenting your poster are similar to ones stated for the oral presentation. Remember to emphasize on the key findings and explain all the tables, graphs and/or figures included in the poster.
- ✓ Once you are all set for the conference, try finding a jacket/cover for your poster. This is especially important if you are traveling to a different city or country. You don't want to spoil your poster after all this effort.

References and Further Reading:

[1] Quote Available from Science Quotes and Sayings: http://www.quotegarden.com/science.html

[2] Mark D. Hill. Oral Presentation Advice. University of Wisconsin. Available: http://pages.cs.wisc.edu/~markhill/conference-talk.html Revised January 1997. Accessed 25th May 2009

Appendix – II: Lessons learnt from participation in the 57^{th} Meeting of Nobel Laureates in Physiology or Medicine with Students and Young Researchers

"Not many appreciate the ultimate power and potential usefulness of basic knowledge accumulated by obscure, unseen investigators who, in a lifetime of intensive study, may never see any practical use for their findings but who go on seeking answers to the unknown without thought of financial or practical gain."

Eugenie Clark

1st-6th July, 2007, Lindau, Germany.

The focus of my report would be to disseminate what I have learnt as a participant in the meeting and how can my report be of use to future participants and to the all the young scientists and researchers in general.

LESSONS LEARNT

"Nobel Prize Winners are humans too"

The first and foremost lesson that I have learnt from the meeting is that the Nobel Prize winners are 'humans' too. This is very important to know because earlier my image and probably everyone else's image was that the Nobel Laureates are some special gifted super humans out of this world; nothing like us. No doubt they are special in the work they have done, but the important thing is similar greater original work can also be accomplished by any of the young talent that is around us, even in the developing world.

Researchers need to have passionate curiosity:

All that we need is as Einstein put it is 'passionate curiosity'. An anecdote told by one of the laureates was that he went to meet one of his senior friends who had retired several years ago. To his surprise, he found him not in his home but the very frail old scientist was still working in his lab. When asked what he was up to, the scientist replied.

"A question has been bothering me; and I have got to know the answer; I have got to know the answer!"

Probably that is the sort of passionate curiosity we as young scientists require.

"The Road would be long"

The next lesson to be learnt is that the road would be long. There are no shortcuts in research. All those who had achieved what they had been through patience, perseverance and hard work. There is no substitute for hard work. No doubt to be a Nobel Laureate you have to have the lady luck smiling upon you as well, but the doors of the heaven would only open to those who care to unlock the nature's mysteries.

"Your research should be of great interest to you"

The subject and area of research chosen should be of interest to you. As mentioned by one of the laureates, you should be working in a field that when you wake up in the morning, you should want to go to work. You cannot spend your precious time working on things that are of little or no interest to you.

You will have to take a lead. The problem is often young students end up doing research which their supervisor suggested because they were not able to materialize what they wanted to do. So the solution is you have to aim high, but at the same time come up with reasonable and practical ways to go about it. So the idea needs to be practical and doable. It is often said that there is particular time for a particular discovery. So we need to think ahead but at the same time come up with practical ways of doing it.

"We need to be open and discuss our ideas freely"

Next, we need to be open and discuss our ideas freely with our fellow researchers. Often with increasing competition we find people working in isolation. This is a pity. This is because much greater things can be achieved if we work together for a cause.

One of anecdotes mentioned in the meeting was that if I have one idea and you have one idea, and if we share with each other our ideas, both of us will have two ideas. So knowledge unlike other things increases by sharing. We need to establish collaborations not only with our fellow researchers within our own university, but also with researchers in other universities in Pakistan and with other labs/universities throughout the world. One of the laureates mentioned about good labs in Pakistan that are doing excellent collaborations with other labs in UK and USA. This is something that needs to be encouraged.

"Discuss your ideas with many individuals"

Another thing that I learnt was that if you have an idea and are interested in it, you should discuss it with many individuals rather than one or two.

"Need to have good mentors"

The role played by a mentor cannot be overemphasized. A good mentor can not only guide his students but can be a huge source of motivation for his students as well. He is like a beacon. And we need to establish good practice of mentorship in our country. Currently, more often than not the supervisors aren't doing their jobs properly. They are often more worried about their name when it comes to publication. This is an area that needs to be worked upon especially in Pakistan.

"Failures and bad grades shouldn't discourage you"

Another interesting thing that I would like to share with the readers, a question which came up in the panel discussions was that how were the laureates as students early in their careers? The answers were very diverse. Some were average, some above average and some exceptional; so bad grades early on shouldn't discourage you as a researcher. Some of the laureates peaked later when they found the area that interested them. So you need to identify your area of interest as a first priority. And it is never too late to change your field. One of the laureates made a change very late in his career, and that change later on won him the Nobel Prize. Added to this, failures should not discourage you. As mentioned by one the laureates, it is not possible to not have failed in research; people who haven't failed, haven't tried anything new. Rather failures should be lessons and a motivating tool for you. One way of making research failures a learning tool and minimizing them is to have good controls. Bo having good controls you can see what exactly went wrong and what you can do to rectify the problem.

"Need to be a rebellion at times"

Another interesting feature about many a laureates was that they often were rebels. People who cared to think differently. So if idea doesn't conform to the current thinking and dogmas, there is no need to get disappointed or discouraged but you should go ahead and find answers to the questions you have.

"Areas that young researchers might want to focus on"

Some of the areas that some of the laureates suggested for young researchers to work on were: (1) Biochemistry: Even after all that is known about the subject, biochemistry will continue to produce major breakthroughs. (2) World of microbes: Microbiology: Day after day the microorganisms of the world continue to amaze us. There is still much to be known, especially these days there has been new interest in the normal flora and what exactly their role is. Recently it was suggested that Helicobacter Pylori, the organism associated with stomach ulcers, has also been found to be associated with Asthma. So everyday we are learning something new. (3) Bioinformatics: There is so much information available that the need of the hour is how to assimilate and put this information together. We need to develop new software and design better and more efficient databases. (4) Cancer research: This is an area that would not die out so soon. Newer mechanisms and newer drug targets are being discovered every other day. However, as suggested by one of the laureates, we also need to work on diagnostics as much as we are working on therapeutics. Much of the research that is going on is how to cure stage IV i.e. cancer that has disseminated. However, we need to develop ways of detecting cancers early, because surgery followed by chemotherapy or radiotherapy can cure a lot of cancers if detected early. We need to develop ways as to how these can reach the population in general. (5) Tuberculosis: Drug resistant strains are emerging. Here I would like to point out that when tuberculosis was on decline in the west, funding for research in TB stopped because it was considered that the disease was no longer their problem. So we as scientists/researchers of the developing world need to identify our problems and come up with solutions ourselves. With journals and grants now also made available through the efforts of Higher Education Commission (HEC), Pakistan, there is no reason why we should lag behind in the area of research.

"We need to identify and work on our own problems"

(5) Public Health: One of our professors back at my university, the Aga Khan University, used to say that we as clinicians and scientists of the developing countries would have to take up the role of advocacy as well. There aren't many public health specialists in the country fighting for the cause, so we need to equip and educate ourselves with the dynamics of public health and health policy and planning as well. This is very important since many of the decision makers in the country aren't educated with respect to public health and we would have to educate ourselves so that we can fight for the cause better. Also rightly pointed by one of the laureates in the panel discussion was that we are currently working on problems that are affecting 3% of the world and not addressing properly the problems affecting the 97%. These problems are ones to which some solutions are available and newer innovative ones also need to be developed. For example, the major killer still of children is diarrhea. Malaria still is killing thousands of individuals each year. We need to bridge this gap as well and be thoughtful of choosing an area of research that would be of benefit to the majority of mankind as well.

(6) Others: Genetics, immunology, nanotechnology and other basic sciences were also discussed to have great scope in the future.

"The importance of interdisciplinary research"

The research conducted needs to be interdisciplinary. This word came up so many times and almost every laureate emphasized the importance of doing research in teams and with people of other disciplines. Often, this is of great help as people of other disciplines can add a new angle and give you greater insight on your topic.

"The research that we do should be ethically and morally sound". Along with this, the research that we do should be ethically and morally sound. Increasingly, fraud is something which has crept into research as well. This is something which need not be said but it is something which has become increasingly important. Therefore, we as scientists/researchers should not forget that we owe are answerable to the society for our actions and shouldn't practice wrong doings in research.

"There is no formula for the Nobel Prize"

After all the lessons, the final but an important lesson is you cannot and you don't have to aim for the Nobel Prize. This was a very common question that what should I do to win a Nobel Prize. There is no formula to this glory. But as mentioned previously, there is a need for scientists to do good and original research.

In summary: our objective should be: To do good, original and ethically sound research that is of great benefit to mankind. And that is what Alfred Nobel wanted as well, to award individuals who had done work of greatest benefit to the mankind.

Appendix – III: Open Access Readings for Research

"After all, the ultimate goal of all research is not objectivity but truth."

Helene Deutsch

The following is a brief compilation of good open-access resources to learn further about basic and fundamental aspects of research. I have also put a link to all these at my website:

Promoting***Research***.com

http://www.promotingresearch.com

"A unique platform for educating young scientists/researchers about important aspects of research."

Promoting Research

Firstly, how do we start promoting research? Encouraging and motivating students and young scientists about research is very important. Following readings help shed some light on the subject.

Encouraging medical students to do research and write papers
Michael E. Detsky and Allan S. Detsky.
Can. Med. Assoc. J., Jun 2007; 176: 1719 - 1721. Available:
http://www.cmaj.ca/cgi/content/full/176/12/1719
Accessed August 5, 2007.

Guidelines for Biomedical Research.

Dr. Naveed Zafar Janjua. Available from PakMediNet:
http://www.pakmedinet.com/page.php?f=methodology1
Accessed August 5, 2007.

Medical Writing: English/Writing Skills.
Available from the Medical Academic Website:
http://www.akademisyen.com/dergiler/writing.asp
Accessed August 6, 2007.

Higher Education Commission Pakistan
Fuelling Innovation through initiatives geared towards developing a world-class, dynamic and flexible research sector.
http://www.hec.gov.pk/new/index.htm
Accessed August 6, 2007.

Research Projects Database.
Aga Khan University. Available:
http://www.aku.edu/res-office/show.asp
Accessed August 6, 2007.

Promoting research in training institutions in the African region. Paper prepared for the 21st session of African Advisory Committee for Health Research and Development, Mauritius, 22-25 April 2002. Available online:
http://www.afro.who.int/dpm/rpc/publications/promot.pdf

Dickler HB, Korn D, Gabbe SG. **Promoting translational and clinical science: the critical role of medical schools and teaching hospitals.** PLoS Med. 2006 Sep; 3(9): e378.

Bell J. **Resuscitating clinical research in the United Kingdom.** BMJ. 2003;327:1041–1043.

Association of American Medical Colleges. Washington (D. C.): Association of American Medical Colleges; 2006. Promoting translational and clinical science: **The critical role of medical schools and teaching hospitals. Report of the AAMC Task**

Force II on Clinical Research. Available online:
http://www.aamc.org/promotingclinicalscience.

James P B O'Connor and Dominic R J Kanga. **Academic medicine: time for reinvention: Medical education, training, and research are under threat because academic medicine is undervalued.** BMJ 2004 328: 45-46.

Woody Caan. **Academic medicine: time for reinvention: Teams are crucial for future clinical research.** BMJ 2004 328: 48.

Literature Search and Reading Articles

Research starts by searching the literature for relevant articles and then reading articles that are already known on the subject. Following links teach us how.

How to read a paper: The Medline database
Trisha Greenhalgh
BMJ, Jul 1997; 315: 180 - 183. Available:
http://www.bmj.com/cgi/citemap?id=bmj;315/7101/180
Accessed August 5, 2007.

PubMed for beginners.
Al-Ubaydli M. Article available from the StudentBMJ:
http://student.bmj.com/back_issues/0204/education/62.html
Accessed August 5, 2007.

Pubmed Overview
Available from PubMed:
http://www.ncbi.nlm.nih.gov/entrez/query/static/overview.html
Accessed August 6, 2007.

The Literature Review: A Few Tips on Conducting It
Taylor D. Available from Writing Support, University of Toronto:
http://www.utoronto.ca/writing/litrev.html
Accessed August 5, 2007.

Research Methodology

Once you know what your research question is, the next step is to determine how will you be able to answer the particular question. Information on different study designs is offered in the following article:

Study Designs.
Dr. Naveed Zafar Janjua. Available from PakmediNet.
http://www.pakmedinet.com/files/StudyDesigns.pdf

Analyzing your Findings

Statistical analysis is a subject that all researchers and physicians need to be aware of. Even those physicians/clinicians who are not doing research need to know the basic fundamentals of the topic; otherwise they would not be able to understand the implications of an important research finding and apply them to their management of patients. Following are some of the freely available articles on the different aspects of statistical analysis.

Role of p-value in Decision Making.
Prof. Anwer Kurshid. Available from PakMediNet:
http://www.pakmedinet.com/files/anwer1.pdf
Accessed August 5, 2007.

Medical Statistics using SPSS: an introductory course
Gareth Parry, Altamiro da Costa Pereira. Available:
http://www.shef.ac.uk/scharr/spss/
Accessed August 5, 2007.

SPSS Tutorial.
From University of Toronoto website:
http://www.psych.utoronto.ca/courses/c1/spss/toc.htm
Accessed August 5, 2007.

Raynald's SPSS tools.
Raynald Levesque.
http://pages.infinit.net/rlevesqu/index.htm

http://www.spsstools.net/
Accessed August 5, 2007.

Statistics Book: StatPrimer (Version 6.4)
B. Burt. Gerstman.
http://www.sjsu.edu/faculty/gerstman/StatPrimer/
Accessed August 5, 2007.

Online Statistical Calculations.
John C. Pezzullo.
http://statpages.org/
Accessed August 5, 2007.

Manuscript Writing

New students and young researchers are are always keen to know about this aspect, i.e. how do you write a research paper? How do you write a case report? What are the different parts of a research paper? Following readings will help teach them some of the basic aspects of manuscript writing.

How to write a Medical Research Paper?
Article available from the American Society of Cytopathology:
http://www.cytopathology.org/website/article.asp?id=16
Accessed August 5, 2007.

How to write a scientific article for a medical journal?
Kotur PF. Indian J. Anaesthe. 2002; 46(1): 21-25. Available:
http://medind.nic.in/iad/t02/i1/iadt02i1p21.pdf
Accessed August 5, 2007.

How to write research papers for publication?
Available from DEAR) Department of Education and Research, Department of Family
Medicine:
http://www.hsc.unt.edu/departments/dear/documents/Part1.pdf
Accessed August 5, 2007.

How to Write a Research Paper.
Alexandrov AV: Cerebrovasc Dis 2004;18:135-138 (DOI: 10.1159/000079266):
http://content.karger.com/ProdukteDB/produkte.asp?Aktion=ShowFulltext&ArtikelNr=79266&ProduktNr=224153

Accessed August 5, 2007.

How to...write a paper?
Cunningham SJ. J Orthod. 2004 Mar;31(1):47-51. Available:
http://jorthod.maneyjournals.org/cgi/content/full/31/1/47
Accessed August 5, 2007.

How to write a scientific paper?
Shukla S. Indian J Surg [serial online] 2007;69:43-46. Available from:
http://www.indianjsurg.com/text.asp?2007/69/2/43/32190
Accessed August 5, 2007.

How to write a patient case report.
Cohen H. Am J Health Syst Pharm. 2006 Oct 1;63(19):1888-92. Available:
http://www.ajhp.org/cgi/content/full/63/19/1888
Accessed August 5, 2007.

How to write a case report?
Anwar R. Article available from the StudentBMJ:
http://student.bmj.com/back_issues/0204/education/60.html
Accessed August 5, 2007.

How to write an evidence-based clinical review article?
Siwek J, Gourlay ML, Slawson DC, Shaughnessy AF.
Am Fam Physician. 2002 Jan 15;65(2):251-8. Available:
http://www.aafp.org/afp/20020115/251.html
Accessed August 5, 2007.

How to write an abstract.
Kathleen A. Conboy-Ellis. Available from Allied Health Professions Assembly:
http://www.aaaai.org/members/allied_health/articlesofinterest/conboy_ellis.pdf
Accessed August 5, 2007.

Medical Writing.
Presentation by Prof. Dr. Sarwar J Zuberi. Available from PakMediNet:
http://www.pakmedinet.com/files/rm.ppt
Accessed August 5, 2007.

Manuscript Submission

Once an article is ready to be sent for publication, article submission to a particular journal too is now an important aspect of the whole process. Following article highlights some of the basic steps.

General Method of Article Submission in a Medical Journal.
Article available from PakMediNet:
http://www.pakmedinet.com/page.php?f=authorsinfo
Accessed August 5, 2007.

Dissertations, Proposals and Grant Writing

Dissertations and grant writing is particularly important for PhD, postdoc and postgraduate students involved in research. This is an important aspect of their entire training. Some of the articles on the subject include:

Funding Opportunities: Aga Khan University
Aga Khan University Research Office Funding Opportunities.
Available:
http://www.aku.edu/res-office/res-urclist.shtml
Accessed August 6, 2007.

Higher Education Commission: Research Grants
The Program provides financial support for research in all disciplines of basic and applied
sciences, engineering and technology, social sciences and humanities.
http://www.hec.gov.pk/new/rnd/Research_Grant.htm
Accessed August 6, 2007.

How to Write a Ph.D. Dissertation.
E. Robert Schulman and C. Virginia Cox. Annals of Improbable Research, Vol. 3, No. 5, pg. 8.
Available:
http://members.verizon.net/~vze3fs8i/air/airphd.html
Accessed August 5, 2007.

Guidelines for Synopsis and Dissertation Writing for CPSP
Available from PakMediNet:

http://www.pakmedinet.com/page.php?f=cpsp
Accessed August 5, 2007.

Community of Science: Funding resource, expertise database and abstract management system
Search the world's most comprehensive funding resource, with more than 22,000 records
representing nearly 400,000 opportunities, worth over $33 billion.
Available:
http://www.cos.com/
Accessed August 6, 2007.

The Impact Factor

Everyone nowadays talks about the impact factor and its uses and abuses. To familiarize yourself with what the term entails, browse the following two resources.

The Impact Factor Game
The PLoS Medicine Editors.
PLoS Medicine Vol. 3, No. 6, e291
doi:10.1371/journal.pmed.003029
http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.
pmed.0030291
Accessed August 6, 2007.

Journal Impact Factors
Available through Science Gateway:
http://www.sciencegateway.org/rank/index.html
Accessed August 6, 2007.

Latest Journal Impact Factors
Subscription required. Most academic institutions are automatically signed in:

http://admin-apps.isiknowledge.com/JCR/JCR

Accessed September 12, 2008

Ethics in Research/Plagiarism

Day by day ethics in research and the issue of plagiarism is gaining paramount importance. Following articles offer useful information on ethical guidelines, the general principles and other related information on the subject.

Ethical Guidelines, Plagiarism, and Ghost Writing
A collection of discussions from 2003 to 2004 from the World Association of Medical Editors
(WAME) available from:
http://www.wame.org/wame-listserve-discussions/ethical-guidelines-plagiarism-and-ghost-writing
Accessed August 5, 2007.

Ethical Review Committee Guidelines and General Principles
Aga Khan University Research Office. Available:
http://www.aku.edu/res-office/res-erc.shtml
Accessed August 6, 2007.

Ethical Committee for Research on animals.
Aga Khan University Research Office. Available:
http://www.aku.edu/res-office/res-ecra-tor.shtml
Accessed August 6, 2007.

Reviewing Manuscripts

Once you are a leading voice/researcher in your field, you might get invited to review articles written by your peers. This article explains some of the criteria for reviewing manuscripts.

Criteria for Review of Manuscripts.
Article available from American Society of Cytopathology:
http://www.cytopathology.org/website/article.asp?id=15
Accessed August 5, 2007.

Appendix – IV: Abbreviations:

"Data is what distinguishes the dilettante from the artist."

George V. Higgins

AKUADS: Aga Khan University Anxiety and Depression Scale
APA: American Psychological Association
CCFNI: Critical Care Family Needs Inventory
CPSP: College of Physicians and Surgeons Pakistan
EMR: Eastern Mediterranean Region
HADS: Hospital Anxiety and Depression Scale
HTA: Health Technology Assessments
ICMJE: The International Committee of Medical Journals Editors
IMRaD: A Pneumonic for the different parts of a paper i.e. Introduction, Methods, Results and Discussion
ISI: (Institute for Scientific Information)
LILACS: Latin American and Caribbean Health Sciences Literature
MeSH: Medical Subject Headings
MLA: Modern Language Association
MMSE: Mini-Mental Status Examination
NCBI: National Center for Biotechnology Information
NIH: National Institutes of Health
NLM: National Library of Medicine
PAHO: Pan American Health Organization

PLoS: Public Library of Science
PMC: Pubmedcentral
R&D: Research and Development
TSS: Toxic Shock Syndrome
VHL : Virtual Health Library

Appendix – V: Glossary of Important Terms Used in Statistics and Epidemiology – Table 20

Muhammad Ibrahim

"There are three kinds of lies: lies, damned lies, and statistics."

***Benjamin Disraeli*[1]**

Reproduced with permission from author from:

- ***Muhammad Ibrahim. BioStatistics and Research Methods. Published by Iqra Research Center, Anarkali Lahore.***

Some other important definitions and terms have been added to the table.

Absolute Value, the positive value of a number, regardless either the number is positive or negative.
Alpha Errors see type I error.
Alternative Hypothesis the opposite of the null hypothesis. It is conclusion when the null hypothesis is rejected.
Alternative of Residuals in regression, an analysis of the differences between y and r to evaluate a assumptions and provide guidance on how well the equation fits the data.
Analysis Of Variance (ANOVA) a statistical procedure that determines whether or not there are any differences among tow or more groups of subjects on one more factors. The f test is used in ANOVA.
Bar Chat Or Bar Graph a chart or graph used with nominal characteristic to display the numbers or percentages of observations with the characteristic of

interest.

Bavaria Plot a two- dimensional plot or scatter-plot of the value of two characteristics measured on the same set of subjects.

Bell – Shape Distribution a term used to describe the shape of the normal (Gaussian) distribution.

Beta Errors see type error.

Bias the error related to the ways the targeted and sampled population differs; also called measurement error, it threatens the validity of a study.

Binary Observation a nominal measure that has only tow outcomes (examples are gender; male or female; yes or no).

Binomial Distribution the probability distribution that describes the number of success x observed in n independent trials, each with the same probability of occurrence.

Blind Study an experiment study in which subjects do not Know the treatment they are receiving; investigators may also be blind to the treatment subjects are receiving; see also double blind.

Block Design in analysis of variance, a design in which subjects within each block for stratum are as signed to a different treatment.

Box and Whisker Plot a graph that displays both the frequencies and the distribution of observation. It is useful for comparing tow distributions.

Case - Control Study an observational study that begins with patient cases who have the outcome or deign investigated and control subjects who do not have the outcomes or disease and then looks back-word to identify possible precursors or risk factors.

Case-Series Study a simply descriptive account of interesting or intriguing characteristics observed in a group of subjects.

Categorical Observation a variable whose values are categories (an example is type of anemia). See also nominal scale.

Central Limit Theorem a theorem that states that the distribution of means is approximately normal if the sample size is large enough ($n \geq 30$) regardless of the underlying distribution of the original measurements.

Chi-Square (χ^2) distribution the distribution used to analyzed counts in frequency tables.

Chi-Square (χ^2) Test the statistical test used to test the null hypothesis that proportions are equal or equivalently, that factors or characteristic and independent or not associated.

Classes or Class limits the subdivisions of a numerical characteristic (or the widths of the classes) when it is displayed in a frequency table or graph (an example is ages by decades).

Clinical Trial an experimental study of a drug or procedure in which subjects are humans.

Cluster Random Sample a tow-stage sampling process in which the population is divided into clusters, a random sample of clusters is chosen, and then random samples, of subjects within the clusters are selected.

Coefficient of Determination (r^2) the square of the correlation coefficient. It is interpreted as the amount of variance in one variable that is accounted for variance in one variance that is accounted for by Knowing the second variable.

Cohort a group of subject who remain together in the same study over a period of time.

Cohort Study an observational study that begins with a set of subjects who have a risk factor (or have been exposed to an agent) and a second set of subjects who do not have the risk factor or exposure. Both sets are followed prospectively through time to learn how many in each set develop the outcome or consequences of interest.

Complementary Event an event opposite to the event being investigated.

Computer Package a set of statistical computer programs for analysis data.

Conditional Probability the Probability of an event, such as A, given that another event, such as B, has occurred denoted by P (A/B)

Confidence Interval (C I) the interval computed that the unknown parameter, such as the mean or proportion, is contained within the interval. Common confidence intervals are 90%, 95%, and 99%.

Confidence limits the limits of a confidence interval. These limits are computer farm sample data and have a given probability from sample data and have a given probability that the unknown parameter is located between them,

Confounded a term used to describe a study or observation that has one or more nuisance variables present that may lead to incorrect interpretations.

Confounded Variable a variable more likely to be present in one group of subjects than another that is related to the outcome of interest and thus potentially confuses, or "confounds," the results.

Conservative a term used to describe a statistical test if it reduces the of a type I error.

Construct Validity a demonstration that the measurement of a characteristic is related to similar and not related to measures other characteristics.

Construct validity: Construct validity ensures how well your concept or constructs actually translates into a functioning instrument. It is comprised of translation validity and criterion-related validity.

Content validity: If the content or the items in the questionnaire appropriately represent identify the concept being studied.

Contingency Table a table used to display counts or frequencies for two more nominal or quantitative variables.

Continuous Scale a scale used to measures a numerical (An example is age).

Control Subjects in a clinical trail, subjects assigned to the placebo or control condition; in a case control study, subjects without the disease or outcome.

Controlled for a term used to describe a confounding variable that is taken into consideration in the design or the analysis of the study.

Controlled Trail a trail in which subjects are assigned to a control condition as well as to an experimental condition.

Controls control subjects assigned to a place or control condition during the same period of time that an experimental treatment or procedure is being evaluated. The same period of time that an experimental treatment or procedure is being evaluated.

Correlation Coefficient r (Pearson product moment) a measure of the linear relationship between tow numerical measurements made on the same set of subjects. It ranges form – I to + l, with zero indicating no relationship.

Covariate the potentially confounding variable controlled for in analysis of covariance.

Cox Regression a regression method used when the outcome in censed. The regression coefficients are interpreted as adjusted risk or odds ratios.

Criterion Validity an indication of how well a test or scale predicts another related characteristic, ideally) a "gold standard" if one exists.

Criterion Variable the outcome (or depended variable) that is predicted in a regression problem.

Criterion-related validity: It is a post-study analysis which demonstrates whether your instrument actually functions appropriately to identify the condition (or illness) based on your theory of the construct. This is done using factor analysis.

Critical Region the region (or set of values) in which a test statistic must occur in order for the null hypothesis to be rejected.

Critical Value the value that a test statistic must exceed (in a absolute value sense) in order for the null hypothesis to be rejected.

Cronbach alpha: It is a single-number estimate of how closely components of an instrument correlate with each other. It is obtained by computation.

Crossover Study a clinical trial in which each group of subjects receives two or more treatments but in different sequences.

Cross-Sectional Study on observational studythe examines a characteristic (or set of characteristics) in a set of subjects at one point in time; a "snapshot" of a characteristic or condition of interest; also called survey or poll.

Crude Rate a rata for the entire population that is not specific or adjusted for any given subset of the population.

Cumulative Frequency or percentage in a frequency table, the frequency. (Or percentage) of observations having a given value plus all lower values.

Curvilinear Relationship (between x and y) a relationship that indicates that x and y vary together, but not in constant increments.

Decision Analysis a format model for describing and analyzing a decision; also called medical decision making.

Decision Tree a diagram of a set of possible action, with their probabilities and the values of the outcomes listed. It is used to analyze a decision process.

Degree of freedom a parameter in some commonly used probability distributions; e. g, the t distribution and the chi-square distribution.

Dependent Groups or Sample samples in which the values in on group can be predicted farm the values in the other group.

Dependent Variable the variables echoes values are the outcomes in a study; also called response of criterion variable.

Dependent-Groups t test see paired t test.

Descriptive statistics such as the mean, the standard deviation, the proportion, and the rate used to describe attributes of a set of data.

Dichotomous Observation a nominal measure that has only two outcomes (examples are gender; male or female; survival; yes or on); also called binary.

Directional test see one-tailed test.

Discrete Scale a scale used to measure a numerical characteristic that has integer values (an example in number of pregnancies).

Distribution (population) the values of a characteristic or variable align with the frequency of their occurrence. Distributions may be based on empirical derivation or may be theoretical probability distribution (e. g, normal, binomial, chi-square)

Dot Plot a graphical method for displaying the frequency distribution of numerical observations for one or more groups.

Double-Blind Trial a clinical trial in which neither the subjects nor the investigator (s) know which treatment subjects have received.

Error Mean Square the mean square in the denominator of fraction ANOVA.

Estimation the process of using information form a sample to draw conclusions about the values of parameters in a population.

Event a single outcome (or set of outcomes) from an experiment.

Expected Frequencies in contingency tables, the frequencies observed if the null hypotheses is true.

Experimental Study a comparative study involving an intervention or manipulation. It is sallied a trial when human subjects are involves.

Explanatory Variable sees independent variable.

F Distribution the probability distribution used to test the equality of two estimates of the variance. It is the distribution used with the F test in ANOVA.

F Test the statistical test for comparing two variances. It is used in ANOVA.

Face validity: The instrument, at an initial glance, appears to measure what it intends to.

Factor a characteristic that is the focus of inquiry in a study; used in analysis of variance.

False negative (FN – c) Individuals with a negative test result who actually have the disease (i.e. Test Negative and Disease Present = c)

False Positive (FP – b) Individuals with a positive test result who actually do not have the disease/condition i.e. are disease free (i.e. Test Positive and Disease absent = b).

False-Negative a test result that is negative in a person who has the disease.

First Quartile the 25^{th} percentile.

Fisher, s Exact Test an exact test for 2 x 2 contingency tables. It is used when the sample size is too small to use the chi-square test.

Frequency Distribution in a set of numerical observation, the list of values occurs among with the frequency of their occurrence. It may be set up as a frequency table or as a graph.

Frequency Polygon a line graph connecting the midpoints of the Topy of the columns of a histogram. It is useful in comparing two frequency distributions.

Frequency Table a table showing the number or percentage of observations occurring at different values (or ranges of values) of a characteristic or variable.

Frequency the number of times a given value of an observation occurs. It is also called counts.

Gaussian Distribution sees normal distribution.

Geometric Mean the root of the product of n observations, symbolized GM or G. it is used with logarithms or skewed distributions.

Gold Standard in diagnostic testing, a procedure that always identifies the true condition-diseased or disease free-of a patient.

Histogram a graph of a frequency distribution of numerical observations.

Historical Cohort Study a cohort study that uses existing records or historical data to determine the effect of a risk factor or exposure on a group of patients.

Historical Controls in clinical trials, previously collected observations on patients used as the control values against which the treatment is compared.

Homogeneity the situation in which the standard deviation of the dependent (y) variable is the sane regardless of the value of the independent (x) variable; an assumption in ANOVA and regression.

Homosecdasticity see homogeneity.

Hypothesis Test an approach to statistical inference resulting in a decision to reject or condition within a specified period of time.

Independence a rate gibing the proportion of people who develop a given disease or condition within a specified period of time.

Independent Events events whose occurrence or outcome has no effect on the probability of each other.

Independent Groups or Samples Samples for which the values in one group cannot be predicted form the values in the other group.

Independent- Groups t Test see two-sample t test.

Independent Observation: Observation determined at different times or by different individuals without the knowledge of the value of the first observation.

Independent Variable the explanatory or predictor variable in a study. It is sometimes called a factor in ANOVA.

Inference (statistical) the process of drawing conclusions about a population of observations from a sample of observations.

Interaction a relationship between two independent variables such that they have a different effect on the dependent variable; I. e. The effect of one level of a factor A depends on the level of factor B.

Intercept in a regression equation, the predicted value of y when x is equal to zero.

Internal Consistency (reliability) the degree to which the items on an instrument or test are related to each other and provide a measure of a single characteristic.

Internal consistency: Internal consistency of an instrument occurs when the components of the instrument are found to appropriately measure the same concept being studied.

Inter-observer reliability: The consistency of the instrument when it is administered by the different people.

Interquartile Reliability the difference between the 25^{th} percentile and the 75^{th} percentile.

Interrater Reliability the Reliability between measurements, made by the same person (or raters.)

Intervention the maneuver used in an experimental study. It may be a drug or a procedure.

Joint Probability the reliability of two events both occurring.

Level of Significance the probability of incorrectly rejection the null hypothesis is a test of hypothesis. Also see alpha value and p value.

Life Table Analysis a method for analyzing survival times for censored observations that have been grouped into intervals.

Likelihood Ration in diagnostic testing, the ratio of true-positives to false-positives.

Linear Combination a weighted average of a set variables or measures. For example, the prediction equation in multiple regressions is a linear combination of the predictor variables.

Linear Regression (of y on x) the process of determining a regression or prediction equation to predict y from x.

Linear Relationship (between x and y) a relationship indicating that x and y very together according to constant increments.

Log rank test a statistical method for over an extended period of time.

Logarithm (In) the exponent indicating the power to which e (2. 7 18) is raised to obtain a given number, also called the natural logarithm.

Logistic Regression regression technique used when the outcome is a binary or dichotomous variable.

Log-Linear analysis a statistical method for analyzing the relationships among three or more nominal variables. It may be used as a regression method to predict a nominal outcome form nominal independent variables.

Marginal Frequencies (probabilities) the row and column frequencies (or probabilities) in a contingency table; I.e. the frequencies listed on the margins of the table.

Matched-groups t test see paired t test,.

Matching (or matched groups) the process of making tow groups homogeneous on possible confounding factors. It is sometimes done prior to randomization is clinical trials.

Mean Square Among Groups an estimate of the variation in analysis of variance. It is used in the numerator of the f statistic.

Mean the most common measure of central tendency, denoted by in the mast is the sum of the x values divided by the number n in the sample.

Measure of Dispersions index or summary numbers that describe the spread of observations about the mean. See range; standard deviation.

Measurement Error the amount by which a measurement is incorrect because of problems inherent in the measuring process also called bias.

Measures of Central Tendency index or summary numbers that describe the middle of a distribution. See mean; standard deviation.

Median (M or M d) a measure of central tendency. It is the middle observation; i.e. the one that divides the distribution of values into halves. It is also equal to the 50th percentile.

Medical Decision Making or Analysis the application of probabilities to the decision process in medicine. It is the basis for cost-benefit analysis.

Mode the value of a numerical variable that occurs the most frequently.

Model Class the interval (generally form a frequency table or histogram) that contains the highest frequency of observations.

Model or Modeling a statistical statement of the relationship among variables.

Morality Rate the number of patients in a defined population over a specified period to time. It is the number of people who die during a given period of time divided by the number of people at risk during the period.

Morbidity Rate the number of patients in a defined population who develop a morbid condition over a specified period of time.

Multiple Comparisons Comparisons resulting form many statistical tests performed for the same observation.

Multiple R in multiple regressions, the correlation between actual predicted values of y/s,

Multiple-Comparisons Procedure a method for comparing several means.

Multivariate a term that refers to a study or analysis involving multiple independent or dependent variables.

Multivariate Analysis of variances (MANOVA) an advanced statistical method that provides a global test when there are multiple dependent variables and the independent variables are nominal. It is analogous to analysis of variance with multiple outcome measures.

Mutually Exclusive Events two or more events for which the occurrence of one event precludes the occurrence of the other.

Negative Predictive value 'It is the probability that a patient will not have a condition given a negative test result.' Negative predictive value of a test is thus the probability that a patient who has been tested as negative or normal by a test does not actually have the disease.

Nominal Scale the simplest scale of measurement. It is used for characteristics that have on numerical values (example are race and gender) it is also called a categorical or qualitative scale.

Nondirectional Test sees two-tailed scale.

Non-Mutually Exclusive Events two or more events for which the occurrence of one event dose not preclude the occurrence of the other.

Nonrandomized Trial a clinical trial in which subjects is assigned to treatments on other than a randomized basis. It is subject to several biases.

Normal Distribution a symmetric, bell-shaped probability distribution with mean u and standard deviation, the interval (u ± 20) contains 95% of the observations. It is also called the Gaussian distribution.

Null Hypothesis the hypothesis being tested about a population. Null generally means "no difference" and thus refers to situation means in treatment group and a control group).

Numerical Scale the highest level of measurement. It is used for characteristics that can be given numerical values; the differences between numbers have meaning; (examples are height, weight, blood pressure level). It is also called an interval or ratio scale.

Objective Probability an estimate of probability form observable events or phenomena.

Observed Frequencies the frequencies that dose not involve an intervention or manipulation. It is called case-control, cross-sectional, or cohort, depending on the design of the study.

Observed Frequencies the Frequencies that occur in a study. They are generally arranged in a contingency table.

Odds Ration (or) an estimate of the relative risk calculated in case-control studies. It is the odds that a patient was exposed to a given risk factor divided by the odds that a control was exposed to the risk factor.

Odds the probability that an event will occur divided by the probability that the event will not occur; I.e. odds = p/ (I – p), where p is probability.

One-Tailed Test a test in which the alternative hypothesis specifies a deviation. Form the null hypothesis in one direction only. The critical region is located in one end of the directional of the test statistic. It is also called a directional test.

Ordinal scale used for characteristic that have an underlying order to their values; the numbers used are arbitrary.

Outcome (in an experiment) the result of an experiment or trial.

Outcome Variable the dependent or criterion variable in a study.

Paired t Test the statistical method fro comparing the difference (or change) in a numerical variable observed for two paired)or matched) group. It also applies to before and after measurements made on the same group of subjects.

Parameter b the population value of a characteristic of a distribution (e. g. the mean u).

Percentage a proportion multiplied by 100.

Percentile a number that indicates the percentage of a distribution that indicates the percentage of a distribution that is less than or equal to that number.

Placebo a sham treatment or procedure. It is used to reduce bias in clinical studies.

Point Estimate a general term for any statistic (e. g. mean, standard deviation, proportion).

Poisson Distribution a probability distribution used to model the number of times a rare event occurs.

Pooled Standard Deviation the standard deviation used in the independent-groups t test when the standard deviations in the two groups are equal.

Population the entire collection of observations or subjects that have something in common and to which conclusions are inferred.

Positive Predictive Value It is the probability that a patient will have a condition given a positive test result.' Positive predictive value is thus the probability that a patient who has been tested positive actually has the disease

Post Hoc Comparisons methods for comparing have a gives disease or condition after a diagnostics procedure is preformed and interpreted. They are similar to the predictive value of a diagnostic.

Posterior Probability the conditional probability calculated by using Bayes, theorem. It is the predictive value of a positive test (true-positive divided by all positives) or a negative test (true-negatives divided by all negatives.

Power the ability of test statistic to detect a specified alterative hypothesis or difference of a specified size when the alternative hypothesis is true (i.e. l- Β where Β is the probability of a type to detect an actual effect or difference.

Predictive Value of a Positive Test the predictive of time that a patient with a negative diagnostic test result does not have the disease being investigated.

Predictive Value of a Positive Test the proportion of time that a patient with a positive diagnostic test result has the disease being investigated.

Predictive Value The probability of having a disease once the results of a test become available is known as the predictive value of the test

Pretest Odds in diagnostic testing, the odds that a patient has a given disease or condition before a diagnostic procedure is preformed and interpreted. They are similar to prior probabilities.

Prevalence the proportion of people who have a given disease or condition at a specified point in time it is not truly a rate, although it is often incorrectly called prevalence rate.

Prior provability the unconditional probability used in the numerator of Bares, theorem. It the prevalence of a disease prior to performing a diagnostic procedure.

Probability Distribution a frequency distribution of a random variable; which may be empirical or theoretical (e. g. normal, binomial).

Probability the number of times an outcome occurs in the total number of trials. If A is the outcome, the probability of A is denoted P (A).

Product Limit Method see Kaplan-Meier predict limit method.

Proportion the number of observations with the characteristic of interest divided by the total number of observation. It is used to summarize counts.

Prospective Study a study designed before data are collected.

P-Value the probability of observing a result as extreme as or more extreme than the one actually observed form chance alone (i. e. if the null hypothesis is true).

Qualitative Observations characteristics measured on a nominal scale.

Qualitative Observations characteristics measured on a nominal scale; the resulting number has inherent meaning.

Quartile the 25th percentile or the 75th percentile, called the first and third quartiles, respectively.

Random Assignment the use of random methods to assign different treatments to patients or vice verse.

Random Error or Variation the variation in a sample that can be expected to occur by chance.

Random Variable a variable in a study in which subject are randomly selected or randomly assigned to treatments.

Randomized Clinical Trial an experimental studies in which subject form a population so that each has known chance of being in the sample.

Range the difference between the largest and the smallest observation.

Ranks a set of observation arranged according to size, for lowest to highest or vice versa.

Rate a proportion associated which a multiplier, called the base, (e. g. 1000, 10,000 100, 000,) and computed over a specific period of time.

Ratio a part divided by another part. It is the number of observation with the characteristic of interest divided by the number without the characteristic.

Regression coefficient the b in the simple regression equation $y= a + b x$. It is sometimes interpreted as the slope of the regression line. In multiple regressions, the b s are weights applied to the predictor variables.

Relative Risk (RR) the ratio of the incidence of a given disease in exposed or at risk persons to the incidence of the disease in unexposed persons. It is calculated in cohort or prospective studies.

Reliability a measure of the reproducibility of a measurement. It is measured by kappa for nominal measures and by correlation for numerical measure. OR, it is the ability of a test or instrument to get a consistent estimate when repeated in a group of similar subjects. It is equivalent to repeatability.

Representative Population (or sample) a population or sample that is similar in important ways to the population to which the findings of a study are generalized.

Residual the difference between the predicted value and the actual value of the outcome (dependent) variable in regression.

Response Variable see dependent variable.

Retrospective Cohort Study see historical cohort study;

Risk Factor a term used to designate a characteristic that is more prevalent among subjects who develop a given disease or outcome that among subjects who do not. It is generally considered to be causal.

Risk Ratio sees relative risk.

Sample a subject of the population.

Sampled Population the population form which the sample is actually selected.

Sampling Distribution (of a statistic) the frequency distribution of the statistic for many samples. It is used to make inferences about the statistic from a single sample.

Scale of Measurement the degree of precision with which a characteristic is measured. It is generally categorized into nominal (or categorical), ordinal, and numerical (or interval and ratio) scales.

Scatter Plot a two-dimensional graph displaying the relationship between tow numerical characteristics.

Scientometry is the scientific field of study that studies the progression and value of science through the number of scientific articles published in a given period of time.

Self-Controlled Study a study in which the subjects serve as their own controls, achieved by measuring the characteristic of interest before and after an intervention.

Sensitivity (SNout) Sensitivity is the proportion of individuals correctly identified by the test as having the disease. It is the 'probability that a test will be positive given patient with the condition'

Sensitivity the proportion of time a diagnostic test is positive who have the disease or condition. A sensitive test has a low false-negative rate.

Simple Random Sample a random sample in which each of the n subjects (or objects) in the sample has an equal chance of being selected.

Skewed Distribution a distribution in which there are a few outlying observations in one direction only. If is skewed to the left, or negatively skewed; if large, the distribution is skewed to the right, or positively skewed.

Slope (of the regression line) the amount y changes for each unit that x changes. It is designated by b in the sample.

Spearman's Rank Correlation (r h o) a nonparametric correlation that measures the tendency for two measurements to very together.

Specific Rate the proportion of time that a diagnostic test is negative in patients who do not have the disease or condition. A specific has a low gales-positive rate.

Specificity (SPin) is the proportion of individuals correctly identified by the test as not having the disease. It is the 'probability that a test will be negative given a patient without a condition'.

Specificity the proportion of time that a diagnostic test is negative in patients who do not have the disease or condition. A specific has a low gales-positive rate.

Standard Deviation the most common measure of dispersion or spread, denoted by in the population and s or s d in the sample. It can be used which with the mean to describe the distribution of observations. It is the square root of the average of the squared deviation of the observation from their mean.

Standard Error (S E) the standard deviation of the sampling distribution of a statistic.

Standard Error of the Estimate a measure of the variation a regression line. It is based on the differences between the progression line. It is based on the differences between the predicted and actual values of the dependent variable y.

Standard Error of the Mean the standard deviation of the mean in a large number of samples.

Standard Normal Distribution the normal distribution with mean zero and standard deviation l, also called z distribution.

Statistic a summary number for a sample (e. g. the mean).Often used as an estimate of a parameter in the population.

Statistical Significance generally interpreted as a result that would occur by chance; e. g. l time in 20, with p-value less that or equal 0.5. it occurs when the null hypothesis is rejected.

Statistical Test the procedure used to test a null hypothesis (e. g t test, chi-square test).

Stratified Random Sample a sample consisting of random sample from each subpopulation (or stratum) in a population. It is used to that the investigator can be sure that each subpopulation is appropriately represented in the sample.

Subjective Probability an estimate of probability that reflects a person's opinion or best guess from previous experience.

Sums of Square quantities calculated in analysis of variance and used to obtain in mean squares for the F test.

Survey an observation study that generally has a cross-sectional design. A commonly used design to collect opinions.

Survival Analysis the statistical method for analyzing survival data when there are censored observations.

Symmetric Distribution a distribution that has the same shape on both sides of the mean. The mean, median, and mode are all equal. It us the opposite of a skewed distribution.

Systematic Error a measurement error that is the same (or constant) over all observations. See also bias.

Systematic Random Sample a random sample obtains by selecting each k^{th} subject or object.

T Distribution a symmetric distribution with mean zero and a standard deviation larger than that for the normal distribution for small sample sizes. As n increase, the t distribution approaches the normal distribution.

T Test the statistical test for comparing a mean with a norm or for comparing two means with small sample sizes ($n < 30$). It is also used for testing whether a correlation coefficient or a regression coefficient is zero.

Target Population the population to which the investigator wishes to generalize.

Test Statistic the specific statistic used to test the null hypothesis (e.g. the t statistic or chi-square statistic).

Testing Threshold in diagnostic testing, the point at which the optimal decision is to perform a diagnostic test.

Test-Retest (Reliability) a measure of the degree to which an instrument or test provides a consistent measure of a characteristic on different occasions.

Test-retest reliability: The consistency of the instrument when it is administered multiple times by the same person.

Third Quartile the 75^{th} percentile.

Translation validity: It identifies if your instrument is a good measure of your concept or construct. It comprises of face validity and content validity.

Trial an experiment involving humans, commonly called a clinical trial. It is also a replication (repetition) of an experiment.

True negative (TN – b) Individuals with a negative test result who actually are disease free (i.e. Test Negative and Disease absent = d)

True Positive(TP – a) Individuals with a positive test result who actually have the disease (i.e. Test Positive and Disease Present = a)

True-Positive a test result that is positive in a person who has the disease.

Two-sample T Test the statistical test used to test the null hypothesis that two independent (or unrelated) group have the same mean.

Two-tailed Test a test in which the alternative hypothesis specifics a deviation form the null hypothesis in either direction. The critical region is located in both ends of the distribution of the test statistic. It is also called a directional test.

Two-way Analysis of Variance ANOVA with two independent variables.

Type I Error the error that result if a true null hypothesis is rejected or if a difference is concluded when there is no difference.

Type II Error the error that result if a false null hypothesis is not rejected or if a difference is not detected when there is no difference.

Unbiased (of a statistic) a term used to describe a statistic whose mean based on a large number of samples is equal to the population parameter.

Uncontrolled Study a experimental study that has no control subjects.

Validity, It is the ability of a test or instrument to measure what it intended to measure. It is thus an estimate of the precision. OR, it is the property of a measurement that measures the characteristic it purports to measure

Variance the square characteristic of interest in a study that has different values for different subjects or objects.

Variance the square of the standard deviation.

Variation (within subject) the variability in measurements of the same object or subject. It my occur naturally or may represent an error.

Vital Statistics mortality and morbidity rates used epidemiology and public health.

Weight Average a number formed by multiplying each number in a set of numbers by a value called a weight, adding the resulting products, and then dividing by the sum; of the weight.

Yates Correction the process of subtracting 0.5 from the numerator at each term in the chi-square statistic for 2X2 tables prior to squaring the term.

Z Approximation (to the binomial) the z test used to test the equality of two independent proportions.

Z Distribution the normal distribution with mean zero and standard deviational. It is also called the standard normal distribution.

Z Ratio the test statistic used in the z test. It is formed by subtracting the hypothesized mean form the observed mean and dividing by the standard error of the mean.

Z Score the deviation of X form the mean divided by the standard deviation.

Z Test the statistical test for comparing a mean with a norm or comparing two means for large samples (n>30).

Z Transformation a transformation the changes a normally distributed variable with mean $\overline{X}$ and standard deviation s to the z distribution with mean zero and standard

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A Final Note:

Reiterating what has already been said, this book has indeed been a very useful learning exercise and as stated, all of us will always remain students in this vast field of research.

As rightly pointed out by Angela Brew earlier, *Students need to be* ***fully inducted*** *into the culture and community of researchers. They need to develop a* **knowledge** *of what it is to engage in the subject in a research-based way, to understand the* ***key issues and debates*** *in the subject area and* ***know what researchers in the subject do****, in general and specifically."*

I would leave my readers to ponder again on the following notes realizing that our job as a researcher will always remain unfinished and a lot needs to be done:

"The Woods are lovely, dark and deep,

But I have promises to keep,

And miles to go before I sleep,

And miles to go before I sleep."[3]

Robert Frost

And always remember that the traits needed as a young investigator and researcher are:

"Hard Work, ambition, patience, humility, seriousness, and passion for work, family, and country." But above all, master technique and produce original data the rest will follow."[1]

Ramon Cajal

We would welcome comments, critique, suggestions and guidance on existing chapters as well as contributions for future chapters for the book as we would like this learning and teaching exercise to continue. A supportive culture needs to be encouraged and we need to be open and discuss our ideas freely with each other. Please feel free to contact us with guidance, critique and contributions:

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"If I have seen a little further it is by standing on the shoulders of Giants."

Isaac Newton.

This book on research is an attempt to try to answer the basic fundamental questions that come to the minds of **young students, researchers, scholars, investigators, trainees or scientists**. It is an outcome of collaboration between ***43 researchers from 11 different countries*** (Pakistan, India, United States, Iran, United Kingdom, Nepal, Canada, Greece, Poland, Japan and Australia):

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We hope researchers benefit from this endeavor of ours.

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