

SITUATION ANALYSIS OF COVID-19 IN BIHAR STATE OF INDIA

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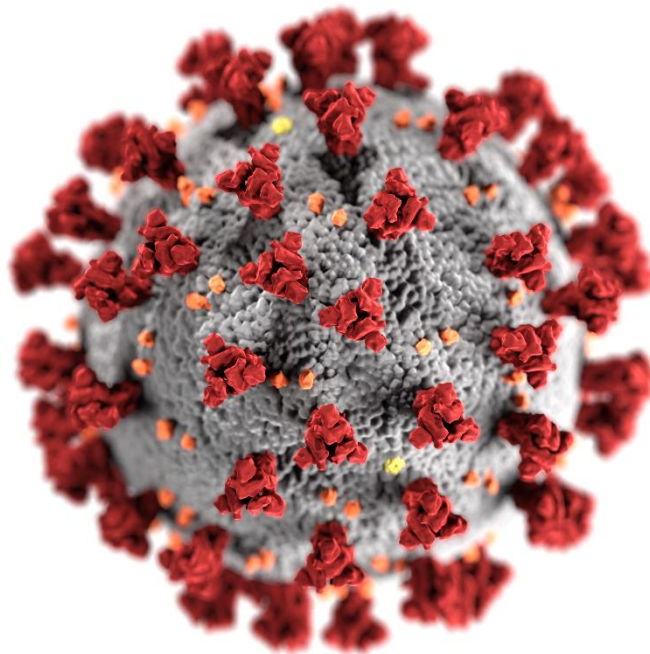
ABBREVIATIONS

CDC	Centres for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
GOI	Government of India
nCoV	Novel Coronavirus
NHP	National Health Profile
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organization

PART – I
PROJECT REPORT

INTRODUCTION

COVID-19 is a disease caused by a new strain of virus called Coronavirus. Earlier it was referred as “2019 novel coronavirus” or “2019 nCoV”. In December 2019, a virus was detected in three patients with pneumonia connected to the cluster of acute respiratory illness cases from Wuhan, China. Chinese scientists soon identified a novel coronavirus (2019 nCoV) as the main causative agent. (1) On February 11, 2020 WHO named this disease as COVID-19.



Source: <https://www.cdc.gov/>

Transmission: The virus is transmitted mainly via small respiratory droplets through sneezing, coughing, or when people interact with the infected person. Droplets can be gulped, or they can come in contact with person as they can stay on surfaces for longer duration, which can infected them when they touch their nose, mouth or eyes. (3)

Incubation Period: The incubation period for COVID-19 range from 2-14 days, most commonly around four to five days.

Symptoms: Usual Symptoms

- Fever
- Dry cough

- Tiredness

Infrequent Symptoms

- Aches and pains
- Sore throat
- Diarrhoea
- Conjunctivitis
- Loss of taste and smell

Significant Symptoms

- Difficulty in breathing or windedness
- Chest pain and pressure
- Loss of speech and movement

Prevention: Regular use of soap and water to wash hands.

- Use of mask to cover your mouth and nose.
- Maintain physical distance with person who is sneezing or coughing.
- Avoid going out of the house unnecessarily.
- Avoid gathering and make use of sanitizer after touching any surface or item.
- Avoid touching your face. (4)

On March 24, 2020 the Government announced “a complete lockdown for 21 days, restricting outside movement of the whole 1.3 billion population of India” as a preventive measure against the 2020 coronavirus pandemic in India. (GOI) This was Phase One lockdown. Since cases rose more and more, three more lockdown phases were implemented, viz. lockdown Phase Two- April 15, 2020, to May 3, 2020, Phase Three- May 4, 2020, to May 17, 2020, and Phase Four- May 18, 2020, to May 31, 2020.

According to MoHFW, India reported 5,85,792 confirmed cases out of which 3,47,839 were recovered and 17,409 deaths were reported till 30th June, 2020. The total number testing done at that time in India was 88,26,585. Whereas Bihar reported a total of 9,988 confirmed cases, 7,544 were recovered and 68 deaths.

Bihar is the 3rd most populated state in the country having 88.71% rural population which mostly consisted of laborers and workers. The first case identified was a 38-year-old man from Munger district in Bihar, who had a travel history from Qatar. As per data, number of cases start increasing in the mid of April 2020. According to health department a total of 10,385 migrant workers have returned to Bihar till May 15, 2020 and they have been put under quarantine facilities. (5)

Timeline:

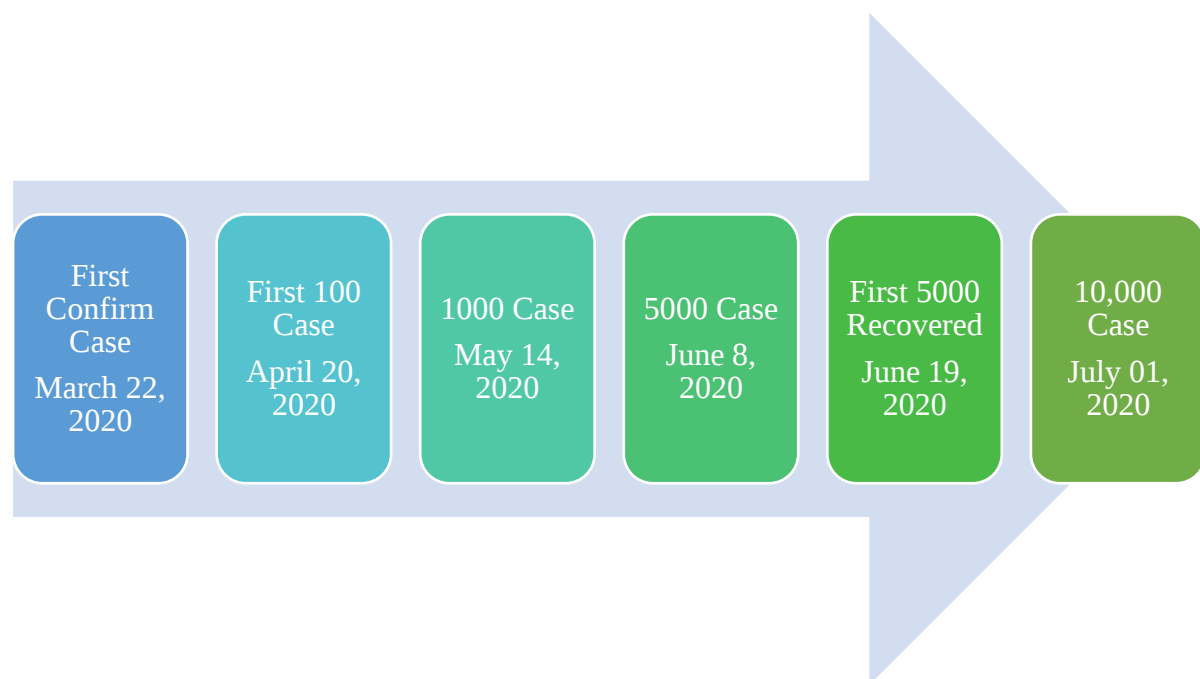


Figure 1: Case Timeline

OBJECTIVES

BROAD OBJECTIVE:

- To observe the current scenario of COVID-19 in the state of Bihar during the 4 lockdown phases in India.

SPECIFIC OBJECTIVES:

- To study coronavirus situation analysis in the districts of Bihar.
- To study key indicators such as mortality, recovery rate of COVID-19 disease.
- To enlist the measure steps taken by the government and at community level in lockdown and unlock phases

LITERATURE REVIEW

Varsha K. conducted a study on “Novel Coronavirus (COVID-19) in India: Current Scenario” in which she explained the basic protocols as per Government of India advisories. In her study, she has described the most possible mode of transmission, diagnosis, treatment, some basic advice and guidelines instructed by WHO, Ministry of Health and Family Welfare, Govt. of India and ICMR. As there is no specific treatment available for COVID-19 the suspected cases were treated by antivirals like Lopinavir/ Ritonavir (220mg/ 50mg) given 2 tablets twice a day for 14 days. Most of cases found till date was of age > 60 years which is high risk group. She concluded that India must take lesson from China and other affected countries how the situation is getting worse. Indians should follow the protocols strictly as advised by the Government of India as doctors, paramedics and Government are doing their best to control the pandemic. Citizens should understand their responsibility and follow the protocols and advisories for their own safety and for their dear ones.

Tridip et al. conducted a study on “Assessment of Lockdown Effect in Some States and overall India: A Predictive Mathematical Study on COVID-19 Outbreak” in which they proposed different mathematical models and parameters for the study. Six different locations were taken into consideration for the study where five locations were the top 5 affected states i.e., Maharashtra, Tamil Nadu, Delhi, Gujarat and Punjab and another location was rest of India. Three different models (mathematical, statistical forecast, ensemble) were chosen for the study during March 14, 2020 till May 3, 2020. These models were used for the observation of daily cases in six different locations. The outcome of models are as follow:

- Statistical forecast has three models (ARIMA, TBATS and HYBRID) in which ARIMA model shows better results on test prediction data in Delhi and Gujarat state.
- TBATS model provide best result among the two models on test prediction for Punjab state.
- HYBRID model shows better on test prediction data in Maharashtra, Tamil Nadu and India.

Ensemble model is the combination of mathematical model and statistical forecast model which was used to assess the daily time-series data trend in all different locations. He concluded that number of cases are 81794 and deaths are 2649 till May 15, 2020. The only way to control the outbreak is to quarantine yourself and follow lockdown measures.

Richa et al. conducted a literature review on “COVID-19 Sets off Mass Migration in India” in which she described about reverse migration of laborers/workers from various states of the country to their native places. It is the second largest mass migration after partition in 1947. The first migration was when the India and Pakistan was divided. Maharashtra and Delhi was having the most migrated persons from the state of U.P, Bihar, Rajasthan, West Bengal according to 2011 Census, with around 54.3 million migrating out of their home state. 40 million interior transients have influenced because of lockdown according to World Bank report. The number of internal migrants is two and a half times more than international migrants. Due to complete lockdown in the country laborers got panicked because all industries, textiles, construction were forced to shut and that leads them started moving to their native places. But unavailability of transport facility they started moving barefoot with their families which include infants, pregnant women and elderly person.

STATE PROFILE - BIHAR

Table 1: Population Statistics

Category	Census 2011	Census 2001
Total Population	104,099,452	82,998,509
Male	54,278,157	43,243,795
Female	49,821,295	39,754,714
Growth in population	25.42%	28.43%
Total population percentage	8.60%	8.07%

Table 2: Rural vs Urban Population

Category	Rural	Urban
Population (%)	88.71%	11.29%
Total Population	92,341,436	11,758,016
Male Population	48,073,850	6,204,307
Female Population	44,267,586	5,553,709
Population Growth	24.25%	35.43%

Table 3: Health Facilities – as per NHP 2019

Facilities	Public Sector	Private Sector	Total
Hospital	1,147	1,887	3,034
Hospital Beds	11,664	19,193	30,857
ICU Beds	583	960	1,543
Ventilators	292	480	771

Interpretation: According to NHP 2019, approximately 19 lac hospitals beds, 95,000 ICU beds and 48,000 ventilators are accessible in India. Bihar has only **1.6%** in terms of beds and ventilators whereas following states have thickened in terms of beds and ventilators:

Uttar Pradesh	14.8%
Karnataka	13.8%
Maharashtra	12.2%
Tamil Nadu	8.1%
West Bengal	5.9%
Telangana	5.2%
Kerala	5.2%

- According to the data of Bihar Medical Council, the total number of registered doctors are **44,390**.
- Convenience of convergence of infected patients, will require fast extension of current limit or adjustments in affirmation strategy for routine patient care in Bihar.

METHODOLOGY

Study Type: Quantitative Observational study

Study Duration: 3 Months (April 1, 2020 – June 30, 2020)

Sample Size: The selection area of sample is throughout the India and districts of Bihar, which comprises of various portions i.e., number of confirmed cases, active cases, recovery, deaths and number of RT-PCR tests done

Type of Data: Secondary Data Collection

Study Tool: Microsoft Excel

MODE OF DATA COLLECTION

Source of data was different websites and repository system like Git-hub repository which include the information collected by various departments and organizations all over India. Bihar data is taken from Health Department, Govt. of Bihar. Git-hub repository is taken as it handles the general information of COVID-19. (9) Hence, it is a Secondary Data.

The collected data was in an unorganized structure and many information were absent as there are numerous organizations engaged with doing the entries. After examining the information completely you become acquainted with what is absent in the information and what significant data can be acquired. Separate sheets are created without interrupting the raw data.

DATA ANALYSIS & INTERPRETATION

Results:

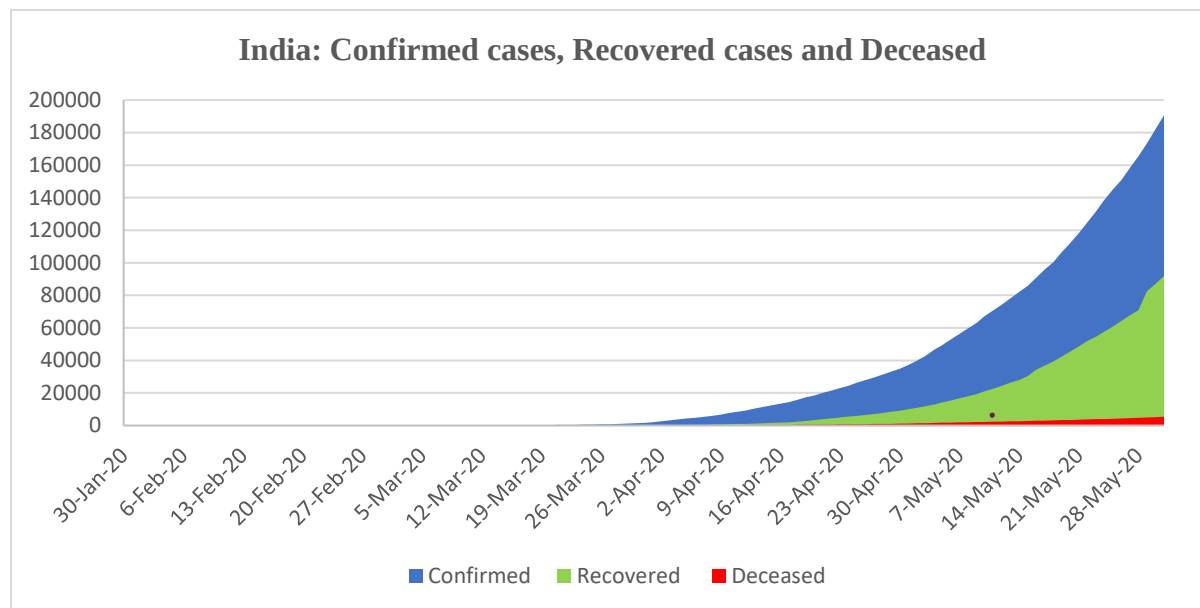


Figure 2: Confirmed, Recovered and Death Cases

Interpretation: Graph shows the steep increase in the terms of confirmed cases in the mid of April, 2020.

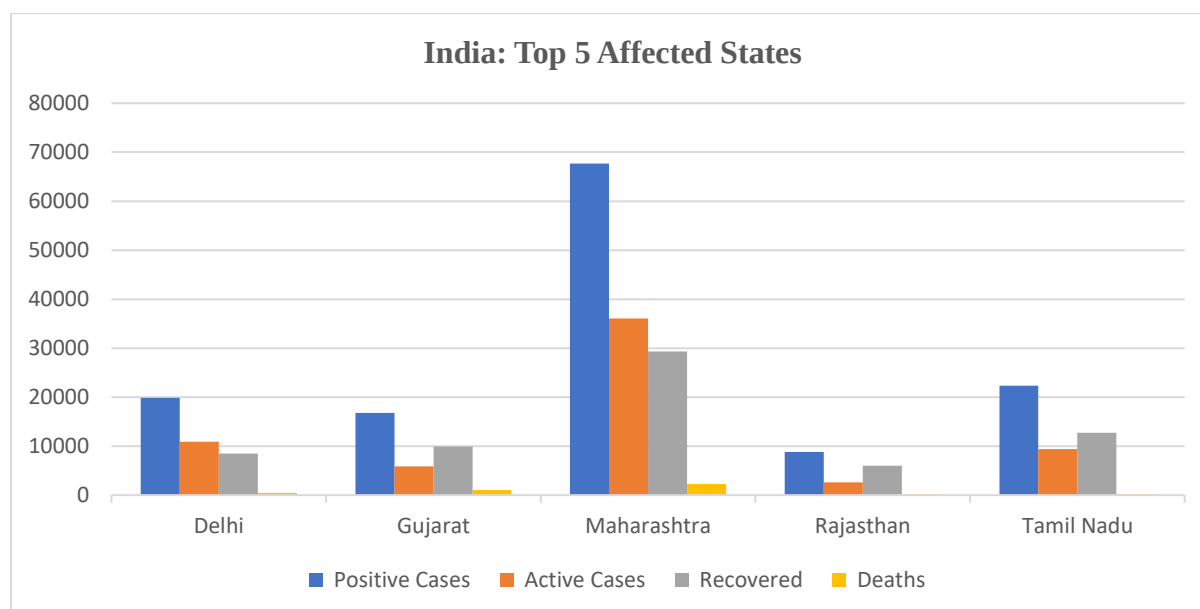


Figure 3: Most affected states

Interpretation: Maharashtra having the highest among all the Indian States in number of Confirmed cases and Active cases.

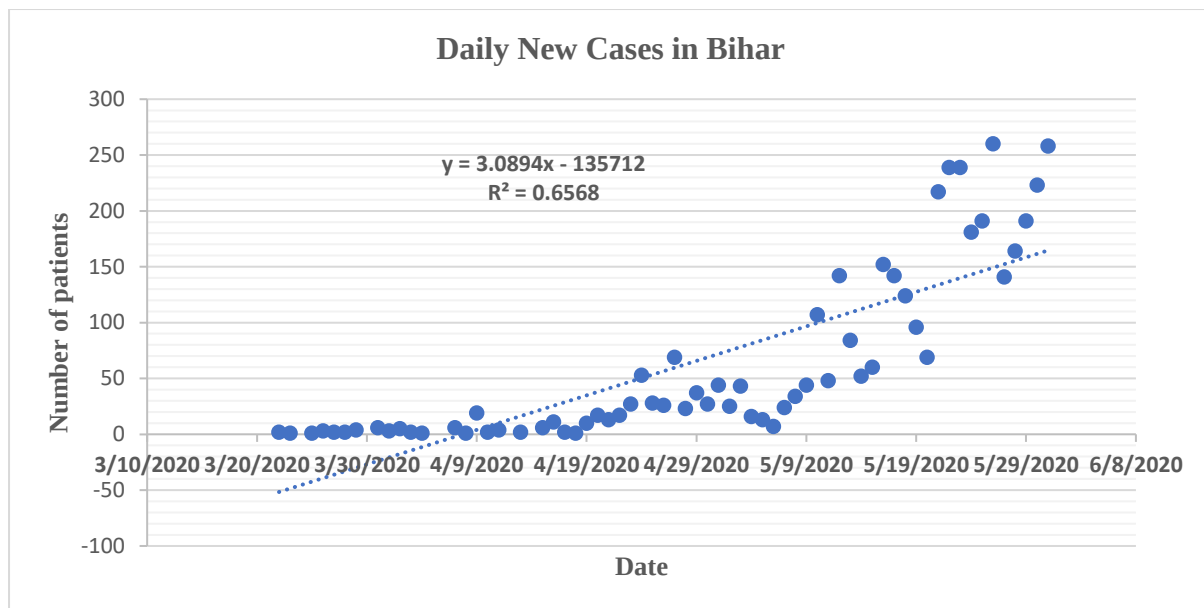


Figure 4: Trend Analysis of Daily Cases

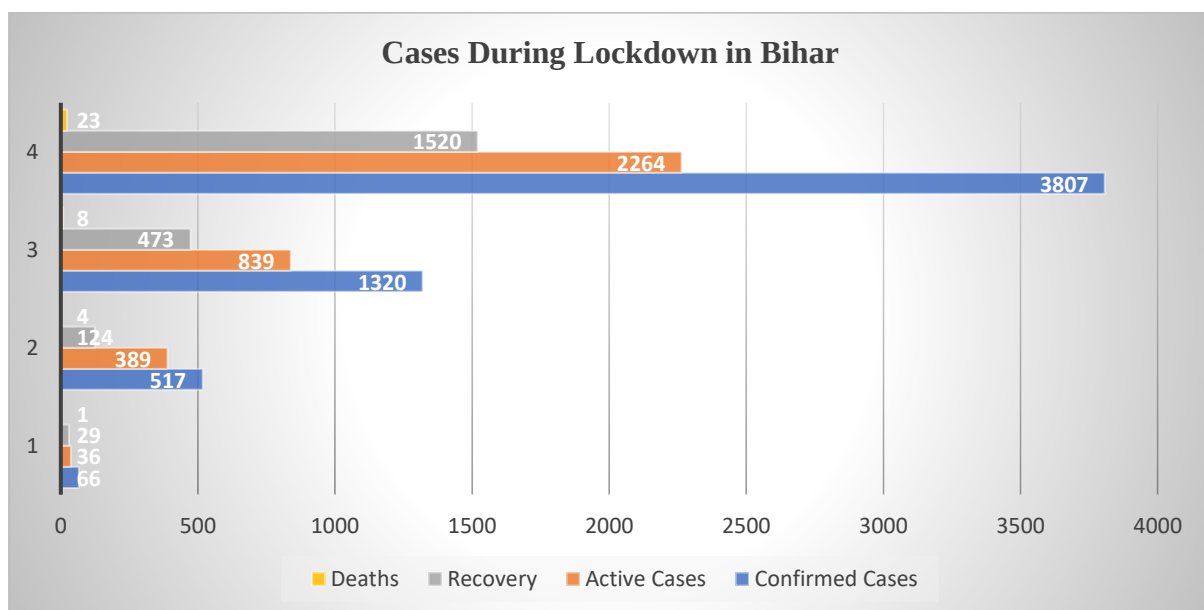


Figure 5: Cases in Bihar During Lockdown

Interpretation: During lockdown 4, Bihar took a steep increase in confirmed cases with increase in recovery rate.

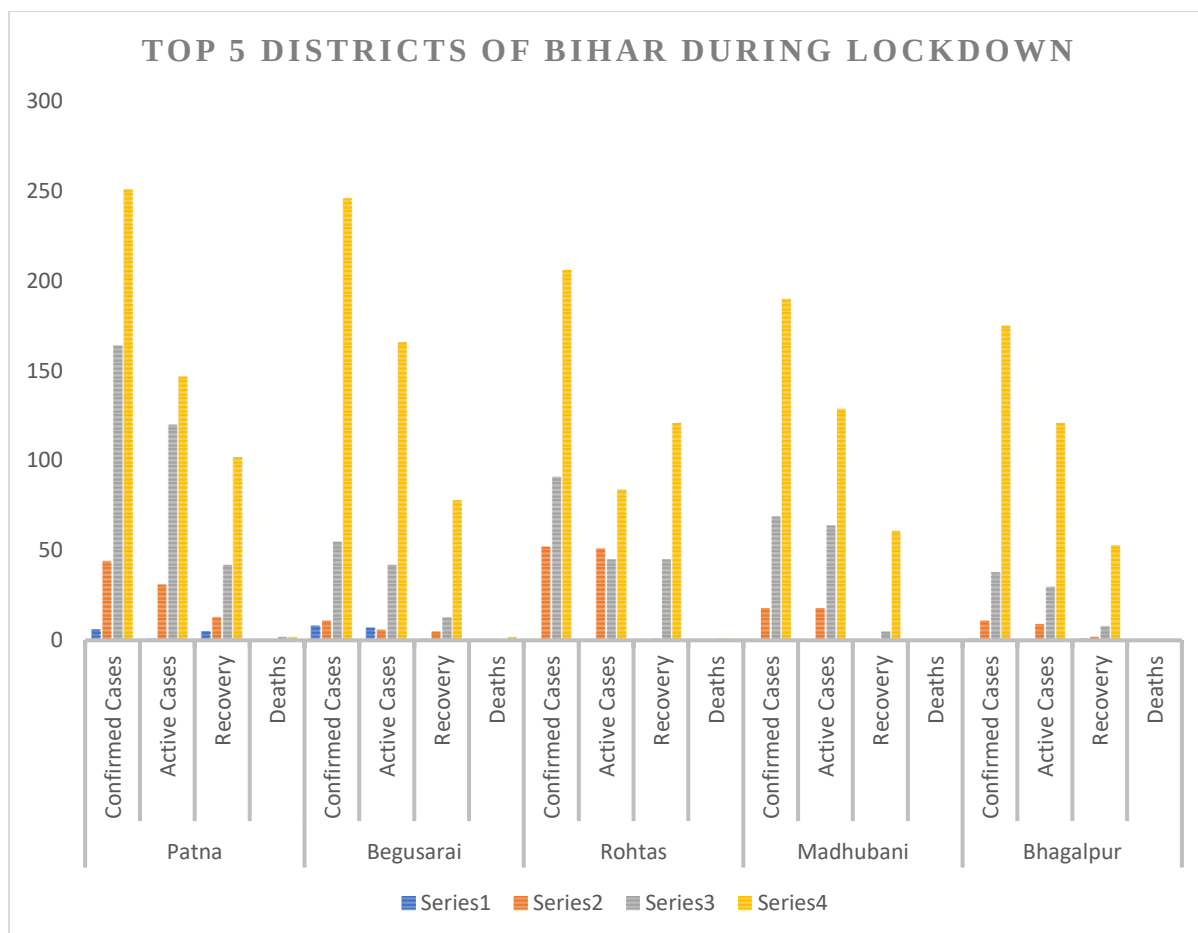


Figure 6: Top 5 Affected Districts of Bihar

Interpretation: Series 1,2,3,4 are the phases of lockdown 1,2,3,4 respectively. Each district shows increase in number of cases during lockdown phase 4.

Table 4: Testing Done

States	Testing Done	Confirmed per million	Active	Recovery rate	Mortality rate	Avg.Growth rate
Maharashtra	14,13,185	2256.51	40.56%	55.37%	3.96%	3%
Tamil Nadu	17,36,747	2005.68	31.18%	67.39%	1.43%	3%
Delhi	7,36,436	5904.56	15.22%	81.80%	2.98%	1%
Karnataka	9,02,026	718.15	58.94%	36.25%	1.97%	7%
U.P	8,89,986	127.28	30.44%	66.73%	2.83%	3%
Bihar	3,37,212	168.78	32.14%	67.08%	0.78%	6%

Interpretation: Bihar when compared with top 5 affected states is having least Mortality Rate of 0.78%. Average growth rate is high in Bihar with 6%.

Measure Steps Taken by Central Government & State Government

- At very initial stage, thermal screening was done specially at International airports as preventive measures.
- Janta Curfew was initiated followed by complete lockdown of the country to prevent from the spread of COVID-19.
- Use of social media and news channels to spread awareness among citizens regarding social distancing and basic hygiene.
- Indigenous technologies that are helping India fight COVID-19
 - COVID KAVACH ELISA TEST KIT
 - Hospital Care Assistive Robotic Device
 - Defense Research Ultraviolet Sanitizer
 - Disinfection Walkway
- Bihar government started providing quarantine facility for migrant workers.
- Bihar government has mapped the skills of more than 17 lakh of migrant laborers and has engaged more than 6-7 lakhs of them in different schemes.
- During the first two lockdowns, Bihar government followed the mandates and guidelines as instructed by the Central Government.
- After second lockdown some discretion was given to state government to act based on regional health scenario.
- Local government converted a stadium into 100 beds hospital for treatment of infected patients from COVID-19.
- As of May 21st, 2020, the state has 19 laboratories approved by ICMR for testing. The rate of testing has been fixed at Rs. 4,500 which now is reduced to Rs. 2,500.
- At quarantine center free food facility along with 500 rupees/day is provided.
- For ration card holder, Bihar government is providing free ration for one month.

CONCLUSION

The present study concludes the impact of COVID-19 in the state of Bihar. India reported total number 5,85,792 confirmed cases, 3,47,839 recovered cases, 2,20,478 active cases and 17,409 deaths till June 30, 2020. Out of which Bihar has 9,988 confirmed cases at that time where **Patna** the capital of Bihar was most affected among 38 districts with 735 confirmed cases, 402 active cases, 326 recovered and 7 deaths till June 30, 2020.

Bihar is the 3rd most populated state in India as per 2011 census, and testing done in the state is approximately 2197 test per million which is poorer compared to other 19 states. Several precautionary measures are taken by the Government of India such as “Janta Curfew”, complete lockdown and districts are divided into three zones i.e., Red Zone, Orange Zone and Green Zone during 2nd phase of lockdown. To control the outbreak every person should follow the Government advisories and protocols and should socially distance themselves.

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PART – II
ONLINE COURSE REPORT

INTRODUCTION

Introduction to Systematic Review and Meta-Analysis is an online course offered by Johns Hopkins University on an online learning platform, Coursera. It is a 6-week graded course with 9 modules along with 2 peer reviewed assignments. The course has two instructors, Dr. Tianjing Li, an Assistant Professor of Epidemiology and Dr. Kay Dickersin, Professor of Epidemiology at John Hopkins University. The course introduces to methods for performing systematic review and meta-analysis of clinical trials. It explains in detail the methods for building a team, formulating a research question and hypothesis, developing a search strategy, abstracting and collecting data, assessing the risk of bias of randomized controlled trials (using the latest Risk of Bias tool 2.0), and synthesizing the evidence both qualitatively and quantitatively. It acquaints with a few practicalities of conducting a systematic review through interactive hands-on exercises, including using Stata software to perform meta-analyses.

OBJECTIVES OF THE COURSE

- Explain the need for systematic reviews and meta-analyses
- List the important aspects of a systematic review
- Perform a comprehensive search for relevant literature
- Appreciate the role of tools to assess risk of bias, including their application to randomised controlled trials
- Explain the basic methods of meta-analysis
- Use Stata software to perform meta-analysis
- Describe issues in conducting systematic reviews of observational studies
- Summarise the findings of a systematic review or meta-analysis
- Evaluate the quality of a systematic review

COURSE CONTENTS

MODULE 1 – INTRODUCTION

Introduction to Systematic Review

A systematic review focuses on a specific question. It uses explicit, pre-planned scientific methods to identify, select, appraise and summarize similar but separate studies.

Not all review articles are systematic reviews. Four steps that differentiate a systematic review from a traditional narrative review are to identify all evidence on the topic, select them, appraise the quality of these evidences, and summarize them.

There are seven steps to perform a Systematic Review,

1. Establish a research team
2. Develop a protocol
3. Data collection, locating the studies and screening the results
4. Abstract data and appraise risk of bias in the individual studies
5. Synthesize findings, interpret, and assess overall body of evidence
6. Summarize in a Report
7. Update

Introduction to Meta-Analysis

By Glass (1976), “The statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings.” Meta-analysis is an optional component of a systematic review. A Meta-analysis can help in assess strength of evidence: to determine whether an effect exists in a particular direction. It can combine results quantitatively: to obtain a single summary result. It can investigate heterogeneity: to examine reasons for different results among studies.

Producers and Users of Systematic Reviews

More than 60% of the systematic reviews are done by independent authors, investigators, researchers, clinicians, professionals who are interested in a particular topic and the Cochrane Collaboration produces less than 40% of the systematic reviews.

The Cochrane Library is a collection of databases that contain different types of high-quality, independent evidence to inform healthcare decision-making. The Cochrane Library is owned by the Cochrane and published by Wiley, Inc. It is the single best place to find independent, high quality evidence for health care decision making.

It is a not for profit organization with collaborations from more than 120 countries. Working together to produce credible, accessible health information that is free from commercial sponsorship and other conflicts of interest.

Features of a Systematic Review:

- Facilitates efficient integration of information for rational decision making
- Provides a clear and transparent process
- Demonstrates where the effects of health care are consistent and where they vary
- Minimize bias (systematic errors) and reduce chance effects.
- Meta-analysis can provide more precise estimates than individual studies
- It can be readily updated as needed
- It allows decisions based on the totality of the available evidence.

MODULE 2 – FRAMING THE QUESTION

Resources for Framing the Question

There are various resources to follow for framing a question for a systematic review, they are:

- Finding What Works in Healthcare
- Cochrane handbook for Systematic Reviews of Interventions

Deciding the Type and Scope of the Question

They are different types of questions in a systematic review, they are:

Epidemiology Questions: Incidence, Prevalence, Etiology

Intervention: Therapy, Screening, Diagnostic Accuracy, Prognosis, Harm, Prevention

John Tukey, a well-known statistician in the 1960s said, “The most maxim for data analysis to heed, and one which many statisticians have shunned, is this. Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise.”

A researcher has to decide whether a question is a broad or a narrow question.

Narrow Questions:

- May not be applicable to multiple settings, populations or exposures
- Can result in spurious or biased conclusions.

Broad Questions:

- May be valid
- Searches may be more time-consuming
- Difficult Synthesis and interpretation
- Difficult to maintain

Elements of the Question

Steps in the Practice of Evidence-Based Healthcare are,

1. Framing the question to be answered
2. Finding the best evidence
3. Critically appraise the evidence
4. Apply that evidence

Components of Well-Constructed and Answerable Clinical Questions,

P – Patients or populations

Define condition or disease, including explicit diagnostic criteria, population and setting of interest (age, race, sex, community, hospital, outpatient)

I – Interventions/Exposure

Timing of exposure, route of administration, dose intensity, duration of exposure or therapy.

C – Comparison group(s)

For trials: Placebo, standard therapy, no treatment.

For Epidemiological study: No exposure, non-cases (hospitals, neighbourhood, etc.)

O – Outcome

Criteria for defining, important to consumers, providers, unpublished data

Refining of the Question

clinicaltrials.gov defines five elements to every outcome. They are

1. Domain
2. Specific measurement(s)
3. Specific metric(s)
4. Method(s) of aggregation
5. Time point(s)

Refinement of Question: Generally not possible to formulate an answerable question without knowing a bit about what data are available. Need to guard against testing a hypothesis.

Examples of Framing the Question

The lecturer uses some examples for systematic reviews. One such example was, “Is a history of exercise training associated with falls in community dwelling and institutionalized people?”

Analytic Frameworks

An analytic framework is a logic model that links and defines clinical concepts, evidence, and populations as they relate to outcomes.

Why it is used?

- To clarify implicit assumptions
- To identify logical flaws as key questions are developed
- To identify distinct bodies of evidence to be included in the review

- To address multiple questions in a review
- To outline a complex chain of logic between intermediate and clinical outcomes
- Components of an Analytic Framework
- Specifies populations, interventions, and outcomes and sometimes comparators, timing, and settings
- Identifies potential modifiers and mediators of effectiveness
- Clarifies links between intermediate and health outcomes.

MODULE 3 – FINDING THE EVIDENCE - SEARCHING PRINCIPLES

This module is divided into 4 sections:

1. Introduction
2. Identify key sources and techniques for searching
3. Building a high-quality search strategy
4. Documenting the search and conclusions

Introduction

In this section, the lecturer Claire Twose explains about various of sources that is needed to use in order to do a comprehensive, unbiased search.

To develop a protocol for conducting the search:

- Source: Databases, hand-searching
- How it is searched: Dates, Strategies
- How to make decisions: Duplicate screening
- How to document: Dates and numbers included or excluded

Identifying Key Sources and Techniques for Searching

Major bibliographic databases for RCTs and observational:

- MEDLINE/PUBMED
- EMBASE
- Cochrane Central Register of Controlled Trials (CENTRAL)
- National and regional databases: LILACS
- Subject-specific databases: CINHALL, PsychINFO, OTSeeker

Citation databases: Web of Science, Scopus, Dissertation, thesis databases: ProQuest

Gray literature databases: OpenGrey or SIGLE

Almost all of the large, bibliographic databases, at least the ones that are subject specific, include something called a Controlled Vocabulary. It is a standardize list of terminology that's used in indexing information to facilitate retrieval.

Other techniques used for sources are: Hand-searching and “snowballing”

Finding evidence is also done through personal communication via experts in the field and industry

Building a High-Quality Search Strategy

- Develop a search: Based on the defined clinical question, break into concepts (PICO), find synonyms for terms
- Use Boolean logic: OR synonyms, AND concepts
- Use Controlled vocabulary when available: In PubMed, use MeSH and keywords found in citations to key article, MeSH databases
- Revise the search strategy
- Include tested study design filter if available
- Use PRESS tool to check search strategy

Documenting the Search and Conclusions

Download and store results in Endnote, ProCite, Reference Manager (same company), and RefWorks, QUOSA.

Use fields to store key information (e.g. how record is identified, reason for exclusion)

PRISMA is a standard transparent reporting of systematic review and meta-analysis. It is a tool that can be used to sort of get an overview of what is required to do a high quality rigorous review.



PRISMA 2009 Flow Diagram

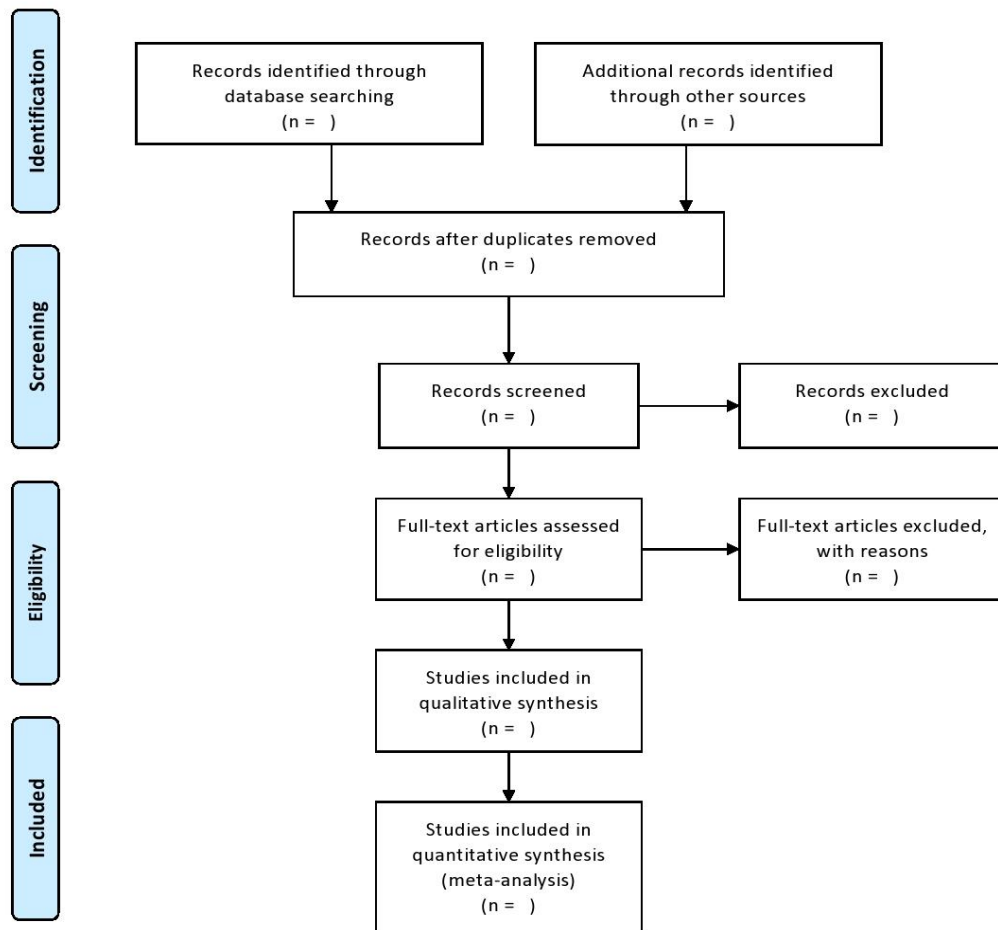


Figure 7: PRISMA Flow Diagram

source: <http://prisma-statement.org>

MODULE 4 – ASSESSING THE RISK OF BIAS IN CLINICAL TRIALS

Bias and Risk of Bias

A bias is a systematic error, or deviation from the truth, in results or inferences. Biases can operate in either direction: different biases can lead to underestimation or overestimation of the true intervention effect. It is usually impossible to know to what extent biases have affected the results of a particular study, although there is good empirical evidence that particular flaws in the design, conduct and analysis of randomized clinical trials lead to bias. Because the results of a study may in fact be unbiased despite a methodological flaw, it is more appropriate to consider risk of bias.

Study Quality

“Quality” refers to the methods used to conduct a study – the way the study was actually done. Elements of study quality that can be assessed by reading study report are:

- Internal validity
- External validity
- Relevance, originality
- Ethics

MODULE 5 – MINIMIZING METABIAS

Standards of Systematic Reviews

The IOM's standards address the entire systematic review process, from locating, screening, and selecting studies for the review, to synthesizing the findings (including meta-analysis) and assessing the overall quality of the body of evidence, to producing the final review report.

There can be bias in conducting a systematic review. In this section, it is called as “Meta-bias”.

Three forms are:

1. Selection bias
2. Information bias
3. Analysis bias

Selection Bias

Selection bias occurs when individuals or groups in a study differ systematically from the population of interest leading to a systematic error in an association or outcome.

Information Bias

Information bias (also called observation bias or measurement bias) happens when key information is either measured, collected, or interpreted inaccurately. Two different investigators extract data based on the objectives and form of the study; thereafter, the extracted data are reviewed. Since the size and format of each variable are different, the size and format of the outcomes are also different, and slight changes may be required when combining the data. If there are differences in the size and format of the outcome variables that cause difficulties combining the data, such as the use of different evaluation instruments or different evaluation timepoints, the analysis may be limited to a systematic review. The investigators resolve differences of opinion by debate, and if they fail to reach a consensus, a third reviewer is consulted.

Analysis Bias

The aim of a meta-analysis is to derive a conclusion with increased power and accuracy than what could not be able to achieve in individual studies. Therefore, before analysis, it is crucial to evaluate the direction of effect, size of effect, homogeneity of effects among studies, and strength of evidence

Reporting Transparently

To address the issue of suboptimal methodology and to improve reporting of systematic reviews, an international group developed guidelines for reporting of meta-analyses which is known as PRISMA. It is “an evidence-based minimum set of items that should be used to report systematic reviews and meta-analyses”. PRISMA can be used to report the results of a systematic review evaluating the effects of an intervention, whether the review is limited to randomized controlled trials or includes other types of research.

MODULE 6 – QUALITATIVE SYNTHESIS AND INTERPRETING RESULTS

Qualitative Synthesis

An assessment of the body of evidence that goes beyond factual descriptions or tables. That, for example, simply detail how many studies were assessed, the reasons for excluding studies. The range of study sizes and treatments compared, or the quality of each study as measured by a risk of bias tool.

Why do we need?

The purpose of a qualitative synthesis is to try to convey your understanding having looked at the data now in its entirety about how this intervention might be working or not working. Making judgements about qualitative research requires a deep engagement with ‘rich, thick description’ and the context of the study. Qualitative synthesis is by its nature a subjective process. The themes presented in qualitative work may be submersible, but their meaning is sometimes inseparable from the data and not usually generalisable beyond it.

The objectives of conducting qualitative synthesis can be:

- To identify the main component of a systematic review
- Review the importance of the qualitative aspects of systematic review

MODULE 7 – PLANNING THE META-ANALYSIS

Meta-Analysis

A meta-analysis is the use of statistical methods to summarise the results of one or more separate studies. Studies comparing healthcare interventions, notably randomized trials, use the outcomes of participants to compare the effects of different interventions. Meta-analysis focus on pair-wise comparisons of interventions, such as an experimental intervention versus a control intervention, or the comparison of two experimental interventions.

The contrast between the outcomes of two groups treated differently is known as the ‘effect’, the ‘treatment effect’ or the ‘intervention effect’. Whether analysis of included studies is narrative or quantitative, a general framework for synthesis may be provided by considering four questions:

1. What is the direction of effect?
2. What is the size of effect?
3. Is the effect consistent across studies?
4. What is the strength of evidence for the effect?

Meta-analysis provides a statistical method for questions 1 to 3. Assessment of question 4 relies additionally on judgements based on assessments of study design and risk of bias, as well as statistical measures of uncertainty.

It is used to increase power and precision, quantify effect size and uncertainty which reduce problems of interpretation due to sampling variation. It can also help to assess homogeneity/heterogeneity of results.

Types of Data

1. Dichotomous (or binary) data
2. Continuous data
3. Ordinal data
4. Count and infrequent event
5. Time-to-event

Effect measures for Dichotomous Outcomes

Dichotomous (Binary) outcome data arise when the outcome for every participant is one of two possibilities, for example, dead or alive, or clinical improvement or no clinical

improvement. This section considers the possible summary statistics when the outcome of interest has such a binary form. The most commonly encountered effect measures used in clinical trials with dichotomous data are:

- Risk ratio (RR) (also called the relative risk)
- Odds ratio (OR)
- Risk difference (RD) (also called the absolute risk reduction)
- The number needed to treat (NNT)

Effect measures for Continuous Outcomes

The term ‘continuous’ in statistics conventionally refers to data that can take any value in a specified range. When dealing with numerical data, this means that any number may be measured and reported to arbitrarily many decimal places

Effect Measures for Ordinal Outcomes

Ordinal outcome data arise when each participant is classified in a category and when the categories have a natural order. For example, a ‘trichotomous’ outcome with an ordering to the categories, such as the classification of disease severity into ‘mild’, ‘moderate’ or ‘severe’, is of ordinal type. As the number of categories increases, ordinal outcomes acquire properties similar to continuous outcomes, and probably will have been analysed as such in a clinical trial.

Effects Measures for Counts and Rates

Some types of event can happen to a person more than once. It may be preferable, or necessary, to address the number of times these events occur rather than simply whether each person experienced any event (that is, rather than treating them as dichotomous data). We refer to this type of data as count data. Counts of rare events are often referred to as ‘Poisson data’ in statistics. Analyses of rare events often focus on rates. Rates relate the counts to the amount of time during which they could have happened.

Effects Measures for Time to Event

Time-to-event data arise when interest is focused on the time elapsing before an event is experienced. They are known generically as survival data in statistics.

MODULE 8 – STATISTICAL METHODS FOR META-ANALYSIS

Fixed Effect Model

Fixed-effects models are a class of statistical models in which the levels (i.e., values) of independent variables are assumed to be fixed (i.e., constant) and only the dependent variable changes in response to the levels of independent variables.

Random Effect Model

The random-effects method incorporates an assumption that the different studies are estimating different, yet related, intervention effects. The method is based on the inverse-variance approach, making an adjustment to the study weights according to the extent of variation, or heterogeneity, among the varying intervention effects. The random-effects method and the fixed-effect method will give identical results when there is no heterogeneity among the studies.

MODULE 9 – WRAP UP

Topics Covered:

- What is a systematic review and meta-analysis?
- How to formulate a research question?
- How to search for studies?
- How to collect data?
- How to assess the risk or bias of clinical trials?
- How to synthesize the information and avoid bias in this process?
- How to read the results of a meta-analysis?

Learnings:

Systematic review uses pre-specified and rigorous methods to identify, appraise, and synthesize all evidence on a given topic. As a systematic reviewer, we should try to minimize bias and errors at each step of doing a systematic review. The most important step in doing a systematic review is to frame an answerable question.

Learned about how to use PICO, the population, intervention, comparative intervention, and outcome to help you to frame an answerable question. You have listened to the lecture on searching for studies and that process should be as comprehensive as possible. Learned different steps for doing systematic review.

METHODOLOGY

The course is a 6 week online course divided into 9 modules.

Week 1: The first week contains 1 introductory video and 3 readings. It contains the first module including 3 videos and 1 video from an expert from the field.

Week 2: This week contains the second module which has 6 videos and 1 video from an expert from the field. It also contains first peer graded assignment to be submitted by the learner. At the end of the module, there is a quiz containing 5 questions

Week 3: Third week requires the learner to complete 2 modules consisting of 5 videos and 1 quiz after each module of 5 questions.

Week 4: This week consists of 2 modules same as the previous week. Fifth module has 5 videos and a quiz of 5 questions. Sixth module has 3 videos and 1 video from an expert from the field and a quiz of 5 questions.

Week 5: Fifth week has 2 modules, Seventh module has 5 videos and a graded quiz of 5 questions whereas the eighth module has 3 videos and 1 video from an expert from the field with a quiz at the end of 5 questions.

Week 6: This is the final week consisting of 1 video and the second peer graded assignment. It also 1 video of closing remarks.

All the videos are concise and in lucid English language with subtitles to understand. The course is very insightful and also contains a discussion page for learners to discuss and ask doubts to the course guide. There are various appropriate pictures and tables used for better understanding.

KEY LEARNINGS

- To understand the role of systematic reviews and meta-analyses in health care
- The essential steps of conducting a systematic review
- To understand the challenges associated with performing and interpreting systematic reviews
- To gain familiarity with the new tool (Stata) for assessing risk of bias in randomized controlled trials
- To appraise the quality of a systematic review
- To define the inclusion and exclusion criteria in a trial
- Understanding how to formulate a research question
- How to search for the appropriate evidences, and extract data
- Use of Stata to perform a meta-analysis
- Explain and interpret the results of meta-analyses.

REFERENCE

<https://www.coursera.org/learn/systematic-review>