Summer Training Report

- **Inter-Country Variations in Age-Sex Specific Burden Of COVID-19: A Literature Review.**
- **Online Course- Leading Change In Health Informatics.**

Report By -
Shreeparna Das

Under The Guidance Of
Sunil Rajpal

MBA (Hospital and Health Management)
2019-2021

ACKNOWLEDGEMENT

"Gratitude is the healthiest of all human emotions. The more you express gratitude for what you have, the more likely you will have even more to express gratitude for."- Zig Ziglar

I owe a great many thanks to a great many people who helped me and supported me during the project. During this unprecedent situation when every part of the world is suffering from the pandemic COVID-19, doing summer internship at organisation was not physically possible. So as a substitute and confirming that our learning never stops, IIHMR University provided all the facilities to the students. I consider myself to be very fortunate as a student of this institution as we get continuous support and guidance.

First and foremost I like to express my special gratitude to Dr.P.R.Sodani (Pro-President, Dean Training, IIHMR University) Dr.Pankaj Gupta (President,IIHMR University) for providing guidance time to time and giving us the wonderful opportunity to do this project.

I express my sincere thanks to Mr. Abhishek Sharma for giving immense suggestions.

My deepest gratitude to my mentor Dr.Sunil Rajpal (Assistant Professor) at IIHMR University for his valuable guidance, advice for successful completion of my project .I genuinely thank him for directing me and for being accessible at every time whenever I required his suggestions. It would not have been possible to complete this project on time without his active cooperation.

I also present my acknowledgement to all the administrative department of IIHMR University for giving relevant information time to time.

Last but not the least I would like to extend special thanks to my family and friends for moral support and for sharing their experiences too that actually helped me in my project.

CONTENTS –

ABBREVIATIONS

1.	**CFR**	**Case Fatality Rate**
2.	**GR**	**Growth Rate**
3.	**IFR**	**Infection Fatality Rate**
4.	**COVID-19**	**Coronavirus Disease 2019**
5.	**SARS-CoV-2**	**Severe Acute Respiratory Syndrome Coronavirus 2**

Introduction

Coronavirus disease 2019(Covid-19), which is caused by severe acute respiratory syndrome coronavirus 2(SARS-CoV-2),has evolved to a global pandemic with confirmed cases of more than thirteen million (13,113,308 cases) and about five hundred seventy two thousand eight hundred ninety three (572,893 cases) deaths so far .[counts as dated till 13july,2020][1] From the current closed cases 8,208,439 (cases which had an outcome) over 93% (7,635,546 cases) have been discharged/recovered and 7% is the death rate . (till date 13july,2020) Source- [1].

The virus that causes Covid-19 is a coronavirus. There are many different types of coronaviruses, and they infect a wide range of mammals and birds. And some even cause mild respiratory disease in people every year, so coronaviruses are not new. But the virus that causes COVID-19 is. This virus originated in bats, so that means that bats carry this virus and are infected with this virus all the time. But this virus developed a special trick. It developed the ability to jump between species and infect people. And then it developed another very special trick to be able to be transmitted between people, and that's how it came to cause the pandemic that we're experiencing now.

At the end of the 2019 SARS coronavirus two emerged in Wuhan, China. As this disease contagious in nature it spread rapidly all over the world. The first case in the United States (U.S) were reported on January19th,2020 in the Washingtone state [2]. On March 11,2020, due to the alarming levels of spread and severity of COVID-19 worldwide and by the alarming levels of inaction, WHO has characterized the Covid-19 situation as a pandemic [3] Till the second week of April 2020, high incidence (2.9/100,000)and cases fatality rates(1.7%) were observed in Pakistan .[4] In India ,the first case of coronavirus disease 2019 (COVID-19) was detected on Jan 30,2020. A majority of patients initially identified had a travel history .These patients acted as a primary cases and started infecting the general population .[5] Until March 1,2020, India had only three confirmed cases but ever since the contagious infection has grown exponentially.[6] In Europe the most successful policy response to the pandemic has been by Germany. One critical aspect of German policy response has been in their systematic reporting of daily data that is highly disaggregated, which makes it possible to analyse key characteristics of the Covid-19 outbreak in Germany and improve our collective understanding of the global pandemic [7]

Sex; biological and physiological traits characterizing males and females ; and Gender ,a continuum of socioculturally constructed roles and behaviors associated with men, women, and gender-spectrum diversity, are among the most important determinants of health and disease outcomes .[8] However ,these fundamental factors are often ignored in biomedical research and are rarely incorporated into clinical care .Collecting sex- disaggregated data is essential to understanding the risk factors of poor health, early health , and health inequities. [9] Public health policies needs to address the sex impact of this pandemic so that targeted treatment strategies can be implemented, such an early recognition and aggressive testing in subgroups, and to prevent bias in treating men and women As the world responds to this extraordinary crisis, we need to have sex-specific analysis of the outbreak by health agencies and governments to better inform public health policies .[10]

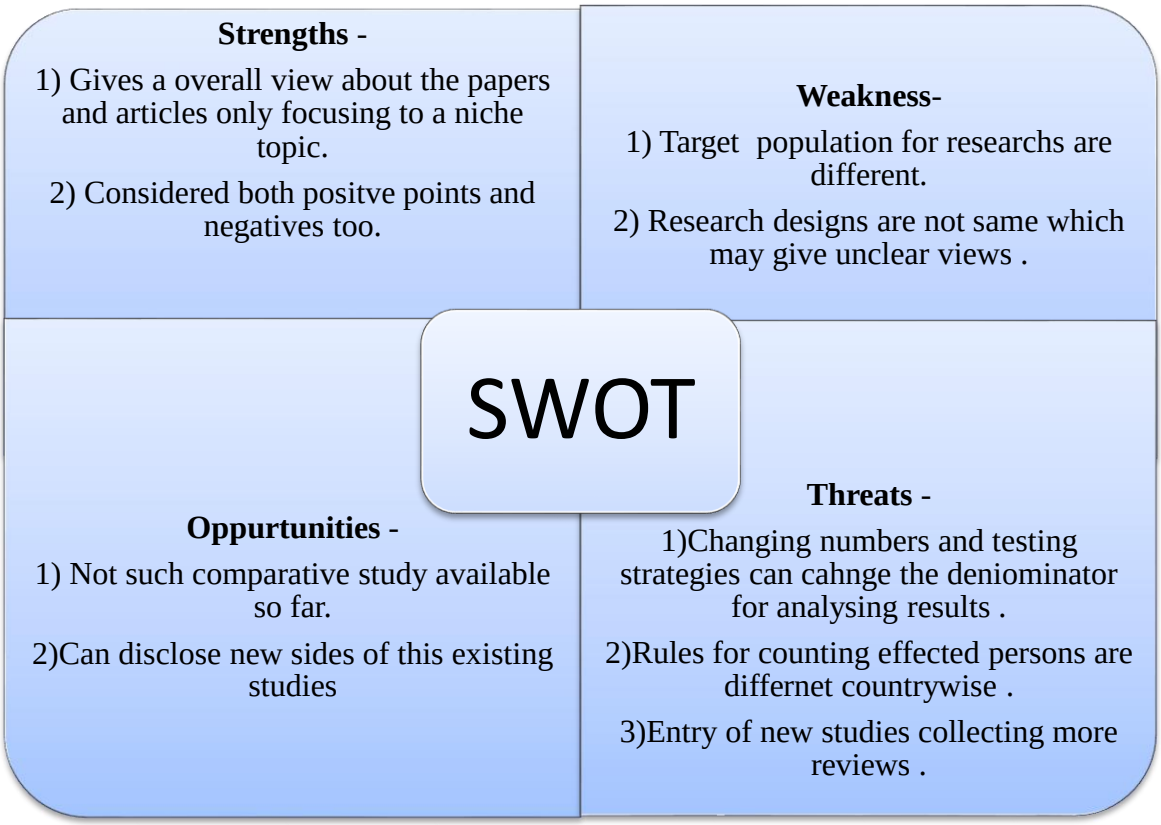
There is a increasing evidence that the COVID-19 survival chances are sensitive to age pattern and other co-morbidity conditions of the infected population .[11] Early evidence from China and Italy reveal a steep age gradient in risk of death and can vary across contexts .An important concern here is to examine the overall as well as age specific COVID-19 infection and mortality risk from a gender lens. Preliminary evidence from various countries suggest that men are at greater risk of both infections and deaths ,but these inferences should be carefully interpreted [12].

The case fatality rate is the number of confirmed deaths divided by the number of confirmed cases. The early reports of COVID-19 cases and deaths in India suggests that males are at a greater disadvantage than females with CFR of 3.3% and 2.9% respectively. Although available sex-disaggregated data for COVID-19 show equal numbers of cases between sexes, current evidence indicates that fatality rates are higher in men than in women. [13] As there is still lot of unknown things different countries studies depicted different results we are still trying to discover is the burden of Covid-19 is equal for both the sexes? Does it vulnerable to mens more than females? Is this matters different upon population diversity? is there any relationship of age and mortality rate of Covid-19 and is this vary with gender? So, here we are trying to asses these variations in age sex specific variations across countries through a systematic review of literature . Since hard data will take time to be published, we are doing a systematic review of literature to understand .

❖ **Objective of the study** –

- To understand the age-sex specific co-morbidities contributing in COVID-19 mortality.
- To understand age-sex specific burden of COVID-19 across countries.

❖ SWOT ANALYSIS OF THE SYSTEMATIC LITERATURE REVIEW =



METHODOLOGY

- **STUDY DESIGN** – All the data collected from secondary sources .It is a narrative review of Published research papers and articles that taken from sources like-ResearchGate, PubMed, Lancet
- Inclusion Criteria- Papers or articles should forcused on age,sex burden on the Covid-19 confirmed cases .
- Exclusion Criteria – news paper reviews based on any research papers , or papers which also included any health related issues apart from age ,sex criteria .
- SAMPLING-

I. Research paper – 7

II. Media Article – 19

RESULTS AND FINDINGS

CFR [Case Fatality Rate] is the number of confirmed deaths divided by number of confirmed cases. In this table shown top ten most affected countries by COVID-19 and the Current CFR.

Table 1. Case fatality rate – (Updates as per date Jul 9,2020)

COUNTRY (Top ten most affected countries)	Current case fatality rate of Covid-19 % (Only observation with ≥100 cases) percent
USA	4.33%
BRAZIL	3.97%
INDIA	2.75%
RUSSIA	1.52%
PERU	3.56%
CHILE	2.17%
UK	15.51%
MEXICO	11.93%
SPAIN	___-
ITALY	14.42%

- **AGE PYRAMIDS COUNTRYWISE –**

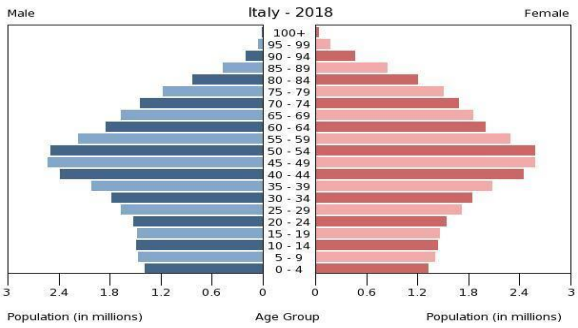
Age structure of Italy–(%above age 50)

Age 55-64 years -13.29%
65years and over -21.69%

CFR rate of Italy –

- 14.42%

Figure.1- Population Pyramid of Italy-2018



In a study that have been conducted in Italy named "Case fatality rate and characteristics of Patients dying in relation to Covid-19 in Italy. Gives a clear viewpoint reviews the Italian experience with Covid-19 with an emphasis on fatalities. When the overall fatality rate of persons with confirmed Covid-19 in the Italian population have been collected ,it was observed the rate was significantly higher than other countries. It may be related to 3 factors **Fatality Rate and Population Age** – The demographic characteristics of the Italian population differ from other countries. In 2019, approximately 23% of the Italian population aged 65 years or older.[14] As Covid-19 is more prone to older age, Thus, older age distribution in Italy may have a impact on fatality rate than other countries. Even when CFR of Italy and China been compared the result was high for Italy than China. Among the dataset the distribution of cases is very different for this 2 Countries: individuals aged 70 years or older represent 37.6% cases in Italy and only 11.9% in China. A relevant number of cases in Italy are in people aged 90 years or older (n=687) and this age group has a very high fatality rate (22.7%) [15] Data on cases aged 90 years or older were not reported in China. Thus, the overall older age distribution in Italy relative to that China may explain the higher average case fatality rate in Italy.
Though there is stated more two reasons of having high CFR, like- How Covid-19 deaths being identified in Italy and testing strategies. Still that current data illustrate that Italy has a high propotion of older patients with confirmed COVID-19 infection and that the older population in Italy may partly explain differences in cases and case fatality rates among countries. Within Italy, Covid-19 deaths are mainly observed among older, male patients who also have multiple comorbidities [16] However, It also stated that because of

limited data that derived from the first month of documented Covid-19 cases in Italy later on the mortality pattern can change also.

Figure2. Population Pyramid Of India -2018

AGE STRUCTURE OF INDIA-

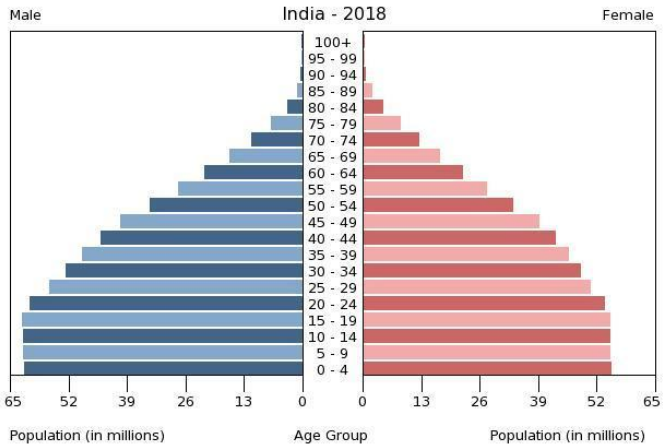
(%Above age 50)-

Age 55-64 years – 7.6%

65 years and over- 6.39%

CFR of INDIA-

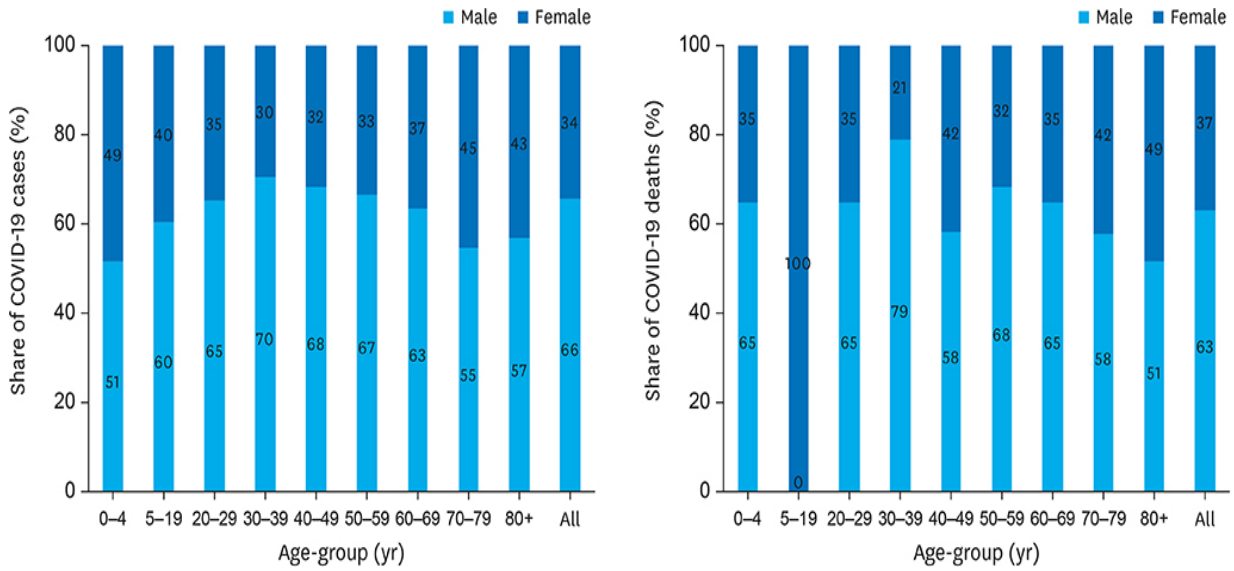
- 2.75%



In a study that conducted in India to examine via gender lens and present a disaggregated view of age-sex specific Covid-19 infection and mortality risk in India. By using the data they analysed the burden of the cases and deaths for age-sex categories. The early reports of COVID-19 cases and deaths in India suggests that males are at a greater disadvantage than females with CFR of 3.3% and 2.9% respectively[17] .The results explain females have 34.3% share in total burden COVID-19 infection . The burden is more or less similar among under 5 boys (51.5%) and girls (48.5%). The burden increases among males in middle age group and reaches a maximum of 70.4% for the age group 30-39 years. The share of females in the total burden increases with age. The burden among females is over 40% for the age groups 70-79 years and 80+ years.

Figure 3. Male and Female share in total burden of COVID-19 cases and deaths in India, May20,2020

Estimated burden is based on the assumption that the age-sex distribution of the cases with missing information is similar to the age-sex distribution of the reported cases.



Source: Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India [published online Jun02,2020] https://doi.org/10.35500/jghs.2020.2.e17

The burden of females in total COVID-19 deaths is 36.9% It also can be noted as the absolute burden of deaths among females is higher than males than the absolute burden among females in total number of infection. Females in the age group 30-39 years have lowest burden of deaths (21.3%) whereas elderly females in the age group 80+years have more or similar burden (48.5%) in total death for this particular age group. In general females share a lower mortality than males but here we can see at the age of 5-19 years there is no male mortality so for that the entire burden lies to female age group.

Table 2 – Age-specific relative burden of COVID-19 infections and deaths by sex in India, May 20,2020

Age Group	Male (% Share)		Feamle (% Share)		Total (%Share)	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
0 to 4 years	1.7	1.1	3.0	1.0	2.1	1.2
5 to 19 years	10.9	0.0	13.8	2.5	11.7	0.9
20 to 29 years	23.6	2.2	24.2	2.0	23.8	2.1
30 to 39 years	24.5	5.4	19.8	2.5	23.0	4.6
40 to 49 years	18.1	12.7	16.1	15.5	17.5	13.7
50 to 59 years	12.2	27.9	11.7	22.0	12.1	26.0
60 to 69 years	6.6	32.8	7.4	30.5	6.8	31.8
70 to 79 years	1.9	13.6	3.0	17.0	2.2	14.7
80+ years	0.6	4.3	0.9	7.0	0.7	5.1
All	100.0	100.0	100.0	100.0	100.0	100.0
Total [a]	73,654	2,165	38,373	1,268	112,027	3,433

Source- Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India [published online Jun02,2020] https://doi.org/10.35500/jghs.2020.2.e17

[a]Note: Denotes cumulative number of confirmed cases and deaths as on May 20, 2020. The age-sex distribution is based on the assumption that the cases with missing information have similar age-sex distribution as of the reported cases.

Above table represents the age specific relative burden in infections and deaths among males and females as well as for the combined cases. As per the data collected till May 20,2020 referring the research study adolescents (below 20 years) account for 13.8% share in total COVID-19 infections. But as a share of deaths due to COVID-19 is comparatively low 2.1%.

Elderly aged (above 60) account for 9.7% share in total infection but they account for 51.6% share in total deaths. It also represents that the age specific relative burden in deaths among males aged 60 years is 50.7% whereas the same is 54.5% among females. The population in the age group 20-59 years have a higher relative burden of 76.4% in total cases but account for 46.4% share in total deaths [18] The burden is higher among the middle age population.

But the relative burden of deaths significantly higher among the older age group.

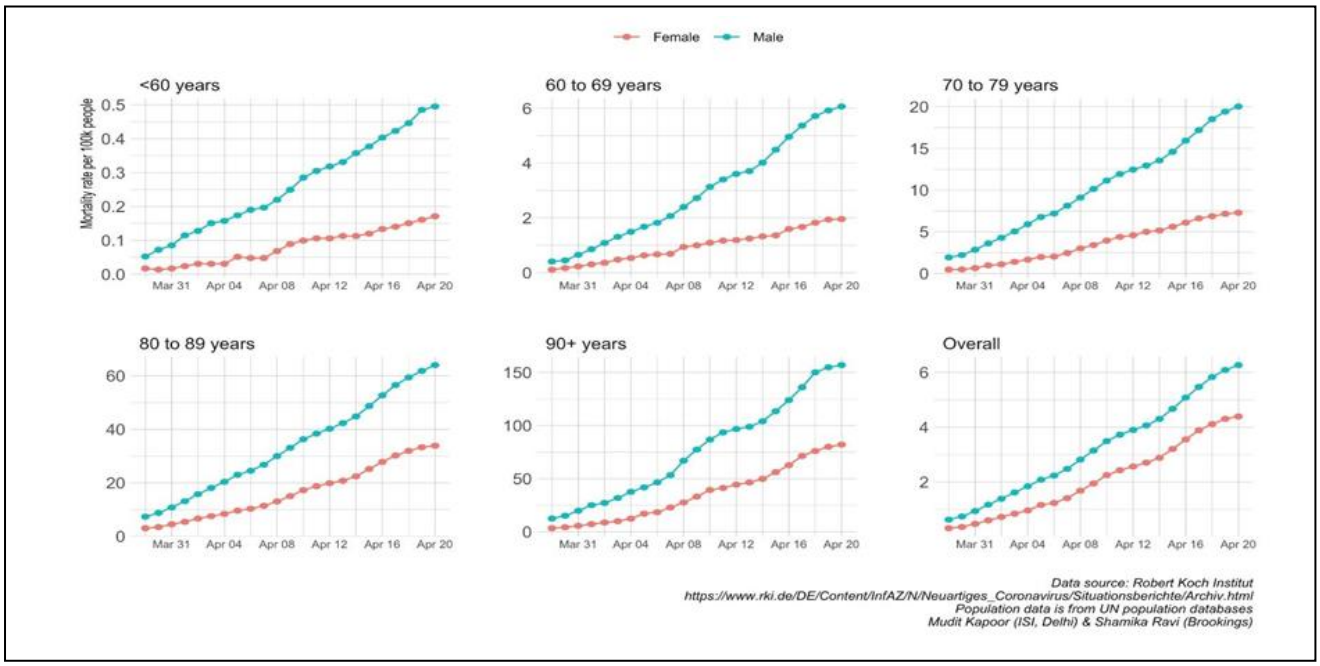
- **COVID-19 trends from Germany** (Different impacts by gender and age) -

  In a study carried out in Germany to see the different impacts by gender and age in Germany the result shows whereas the early stage of the outbreak the number of Covid-19 cases are higher in men soon it takes a rise for the women in a short period of time . The proportion of females now comprises the majority cases of the country. It's also stated identifying the exact cause for this gendered nature growth in Germany will require a more detailed analysis and understanding of the virus. It can be biological factors, behavioural factors or the both.

  In the study analyzed Covid-19 related mortality rates across age and Gender in Germany. The study says Germany has reported far lower mortality (less than 6 per 100,000 Population on April 20) than countries with smaller population like Italy (40 per 100,000 population) or Belgium (51 per 100,000 population) [19]

  This figure shows mortality rate per 100,000 Population for different age groups in Germany, Which are normalized by the population size of each group. Here they taken below 60 age as one group, and analyse people in their 60s,70s,80s and 90s separately.

  Figure-4 Mortality rate per 100,00 population by age and gender in Germany



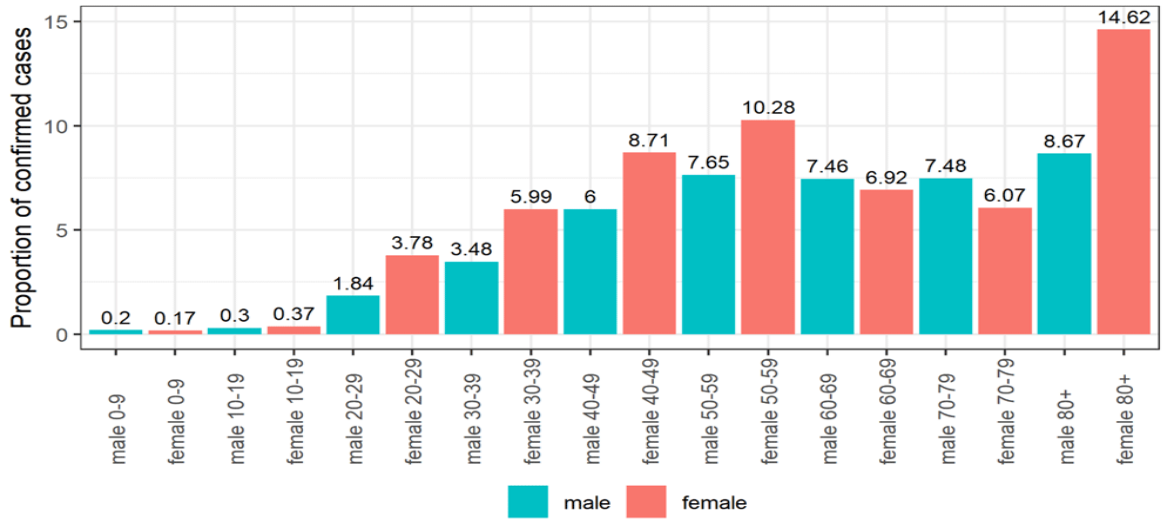
Source: COVID-19 trends from Germany show different impacts by gender and age. [Published May 1,2020]

The results show that the COVID-19 related mortality rate in Germany is rising significantly with age and over time, for all the age groups in the population. The mortality rate is systematically higher for men compared to women in all age groups; and the difference in the mortality rates of men and women have increased with time [20]

Proportion of confirmed cases by age group and gender –

Population data for Spain stratified by age group and gender for 2019 are obtained from the National Institute of statistic of Spain. [21] Notifying the large percentage of older adults with over 60 males and females representing 11.41% and 14.16% of the whole population respectively. Here the graph shows proportion of the confirmed cases in age group and gender wise calculated. Depicting a lower risk of covid-19 in the younger age (less than 20). Proportion of confirmed cases are higher in the adult female ages (20-39) than adult male (20-39) age group . Respectively higher risk been observed at older age groups for both the genders.

Figure- 5. Proportion of confirmed cases by age group and gender of Spain

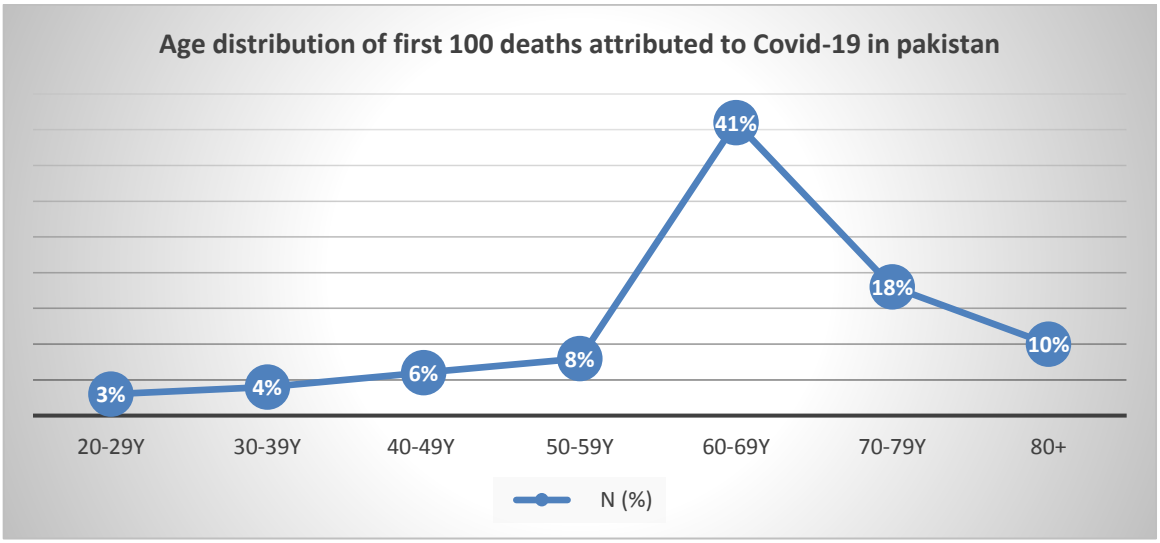


Source- Assessing the age-and gender-dependence of the severity and case fatality rates of COVID-19 disease in Spain. [online] [Published Jun 02,2020] DOI: https://doi.org/10.12688/wellcomeopenres.15996.1

Age distribution of deaths attributed to Covid-19 in Pakistan –

As a retrospective record review was conducted at National Institute of Health (NIH) Islamabad, Pakistan to analysed first 100 deaths reported and recorded with the National Emergency Operation Centre of NIH (NEOC) , among Covid-19 cases , Confirmed through RT-PCR.[22] This study was conducted to determine temporal and spatial distribution of first 100 deaths attributed to COVID-19 in Pakistan and their associated demographic factors . Demographic, Epidemiological and risk factors information was obtained, and travel history was recorded. A total of 100 mortalities (Overall CFR- 1.67%) were analysed. Median age of patient was 64.5 years with a range of 22-84 years. 75% cases were males among first 100 deaths in Pakistan. Among all age groups 60-69 years were most affected age groups while no death had been reported under 20 years.

Figure -6 Age distribution of first 100 deaths attributed to COVID-19 in Pakistan



Source-Mortality Analysis of COVID-19 Confirmed Cases in Pakistan
https://www.medrxiv.org/content/10.1101/2020.06.07.20121939v1.full.pdf

In Pakistan initial cases shows more cases having international travel history which later on lead to local transmission. Results showed that age above 60 years is the most vulnerable age group as depicted in other studies [23]. Children and young age groups are seem to be protected while middle age group having highest community exposure are mildly affected. An increased has been observed with increasing age. High CFR among 60+ patients is relatable to their low immunity and Co-morbidities.

DISCUSSION –

Looking at the data of different countries taken together and try to reach to a point it seems like the results came somehow same from every studies. The number of effected person due to COVID-19 gender wise means to men and women is similar for many countries. Except one which Pakistan where 72% cases were male. Though there is doubt about accuracy of reporting COVID-19 in women. It's also need the further testing of COVID-19 to be sure about the frequency of covid-19 in men and women.

In all countries that report by sex, men diagnosed with Covid-19 are more likely to die [24] The male female death rates tend to be higher in older people than the rates of in younger age. and also, we can derived that rates of mortality above age 60 is much high for male gender. Though its been seen middle age people have high chances of getting infected and mildly affected. For many countries no such mortality has been reported for below age 20. So, analysing the available data till now we can say younger age (less than20years) is protected.

Though few studies explained this result are not unexpected. The outcomes of illness were worse for men than women during previous coronavirus epidemics: men had worse outcomes of illness from severe acute respiratory syndrome[SARS],[25] and a higher risk of dying from Middle East respiratory Syndrome(MERS) [26]

Through the graphic representation we can able to see in the studies conducted in Spain and Pakistan among the confirmed cases of COVID-19 the higher risk lies to above age 60 .Even it stated in UK, men with COVID-19 are more likely to need intensive care and they are more likely to die .

SEX AND GENDER- Although sex and gender used interchangeably still there is different meaning lies with this. Sex refers to the underlying biological profile of a person [27] It influences a range of bodily responses that are important in tackling infection or disease. Gender refers to the roles, activities and attributes that any society consider appropriate for men and women and people with non-binary identities. Gender defines what is expected, valued or allowed in the behaviour of men and women [28]

There is a chance of both sex and gender could have role in explaining why men are at much risk of COVID-19 than women, But no conclusive studies have yet been carried out.

One biological theory centres on the genetic differences between men and women, Particularly in regarding of immune system. The X chromosome is known to contain the largest number of immune -related genes in the whole genome [29] With XX chromosome women have double copy of their genes whereas males have single copy XY. This boost extends to both the general reaction to infection (the innate response) and also to the more specific response to microbes including antibody formation (adaptive immunity) [30] Thus women's immunity power to combat infections is higher .This might mean women are able to tackle corona virus more effectively but it's not proven.

Conclusion - The analysis puts forth inferences like While males have a higher mortality burden for most of the countries, the infection rate is more or less equally distributed among both the gender. while in the most of the countries there is no mortality below age 20 due to COVID-19. Smoking habits and Community exposure is being seen as one of the main reason for male getting exposed to this disease. Age is a clear risk factor for this severe disease and death .The testing strategy is differ from country to country, it may even effect in the results .Predictions is not efficient but well planned interventions should be carried out. Thus, the gendered impacts of COVID-19 Outbreak need to be effectively analysed for potential public health and policy inferences.

LIST OF STUDIES –

Authors	Title	Research Design	Result
1.Mohammad Safiqul Islam , Md Abdul Barek , Md Abdul Aziz , Tutun Das ,Md Jakaria	Association of age, sex, comorbidities, and clinical symptoms with the severity and mortality of COVID-19 cases: a meta-analysis with 85 studies and 67299 cases	PubMed, Science Direct, SAGE were searched to collect data about demographic, clinical characteristics, and comorbidities of confirmed COVID-19 patients from January 1, 2020, to May 17, 2020. Meta-analysis was performed with the use of Review Manager 5.3	Eighty-five studies were included in Meta-analysis, including a total number of 67,299 patients with SARS-CoV-2 infection. Males are severely affected or died than females (OR = 2.26, $p < 0.00001$; OR = 3.59, $p < 0.00001$) are severely affected, or died by COVID-19 and cases with age ≥50 are at higher risk of death than age <50 years (OR =334.23)
2.Selene Ghisolfi , Ingvild Almas , Justin Sandefur , Tessa Bold	Predicted COVID-19 fatality rates based on age, sex, comorbidities, and health system capacity	The data was collected in two steps , first Covid-19 mortality rates in French hospitals and condition them on age, sex and comorbidities . Next to account for the likelihood of higher fatality rates among hospitalized cases in under resourced health system,Incorporate regional differences in the relative odds of infection fatality from childhood influenza .	The adjustments by age, comorbidity, and health system capacity all appear important, especially in low income contexts: calculating IFRs without adjusting for comorbidity would yield estimates for Africa up to 30% lower than our benchmark predictions, and 60% lower than our predictions if adjusting for neither comorbidity nor health system capacity.

3.William Joe, Abhishek Kumar ,Sunil Rajpal , U.S.Mishra , S.V. Subramanian	Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India	Used crowdsourced data (www.covid19india.org) To provide preliminary estimates for age-sex specific COVID-19 case fatality rate (CFR) for India. Used binomial confidence interval for the CFR estimates. Also, an adjusted-CFR is developed to capture the potential mortality among the currently active infections.	As of May 20, 2020, males share a higher burden (66%) of COVID-19 infections than females (34%) but the infection is more or less evenly distributed in under-five as well as elderly age groups. The CFR among males and females is 2.9% and 3.3%, respectivelyThe age-specific COVID-19 CFR assumes 'Nike-swoosh' pattern with elevated risks among the elderly. The World Health Organization world standard population structure standardized CFR for India is 3.34%. The adjusted-CFR is estimated to be 4.8%.
4.Amitava Banerjee , Laura Pasea, Steve Harris, Arturo Gonzalea-Izquierdo ,Ana Torralbo , Laura Shallcross	Estimating excess 1-year mortality associated with the covid-19 pandemic according to underlying conditions and age : A population based cohort study	In this population-based cohort study, method which used linked primary and secondary care electronic health records from England (Health Data Research UK–CALIBER).	Among 50.7% women and 49.3% male , It's estimated that more than 20% of the study population are in the high risk category of whom 13.7% were older than 70 years or younger with at least one under lying condition . 1-year mortality in the high risk population was estimated to be 4.46% (95% CI)

5.Shahir Asfahan , Kunal Deokar , Naveen Dutt , Mehul Agarwal	Extrapolation of mortality in COVID-19: Exploring the role of age, sex, co-morbidities and health care related occupation	Data of 44,672 patients of whom 1023 deaths has been released in the public domain by China's centre for disease Control with details on age groups, gender,co-morbidities,and occupation under creative common license .100 survivors and 100 deaths were generated using random number . Logistic regression performed on the datasets using,ages,genders ,co-morbidities and occupation as predictor variables in relation to outcome of survival or death .	Most of the mortality 81% was in the ages above 60 years .From total died population accumulation of male is 63.8% . Occupation varies like farmers , industry, health workers, retiree, rest were classified as others. Logistic regression of the predictor factors reveals only age and comorbidities affects significantly in mortality .

6. Leonidas Palaiodimos , Damianos G Kokkinidis, Weijia li, Dimitrios Karamanis, Jennifer Ognibene, Shitij Arora, William N. Southern, Christos S Mantzoros	Severe obesity, increasing age and male sex are independently associated with worse in-hospital outcomes, and higher in-hospital mortality, in a cohort of patients with COVID-19 in the Bronx, New York	This retrospective study included the first 200 patients admitted to a tertiary medical center with COVID-19. The electronic medical records were reviewed at least three weeks after admission. The primary endpoint was in-hospital mortality.	Total 200 patients were included . Median age is 64 years . The most common comorbidities is hypertension, Diabetes ,Hyperlipidemia . Male sex and increasing age were independently associate with higher in hospital mortality .

LIST OF FIGURES –

LIST OF TABLE –

- **References**

1. Covid-19 Dashboard by the Worldometer's COVID-19 data [internet] [updated 2020] [Accessed July 13,2020] https://www.worldometers.info/coronavirus/#countries%20%E2%80%93%20worldometer

2. Pavan K. Bhatraju, Bijan J.Ghassamieh, Michelle Nichols, Richard Kim, Keith R. Jerome, Arun K. Nalla ,et al. Covid-19 in critically ill patients in the Seattle Region-Case Series , NEJMoa2004500. Published online 2020 Mar30.PMCID-PMC7143164 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7143164/

3. Hui Poh Goh, Wafiah Ilyani Mahari, Norhadyrah Izazie Ahad, Li Ling Chaw, Nurolaini Kifli, Bey Hing Goh, et al. Risk factors affecting COVID-19 case fatality rate : A quantitive analysis of Top 50 affected counties [posted May25,2020] https://www.medrxiv.org/content/10.1101/2020.05.20.20108449v1.full.pdf

4. Ambreen Chaudhary, Aamer Ikram, Mirza Amir Baig, Muhammad Salman,Tamkeen Ghafoor, Zakir Hussian ,Mumtaz Ali Khan, Jamil Ahmad Ansari, Asif Sayed, et al. Mortality Analysis of COVID-19 confirmed cases in Pakistan.[posted June09,2020] https://www.medrxiv.org/content/10.1101/2020.06.07.20121939v1

5. Rishabh Tyagi, Laxmi Kant Dwivedi, Ashutosh Sanzgiri. Estimation of Effective Reproduction Numbers for COVID-19 using Real-Time Bayesian Method for India and its states. [May20, 2020] https://iipsindia.ac.in/sites/default/files/iips_coivd19_eern.pdf

6. William Joe, Abhishek Kumar, Sunil Rajpal, U.S.Mishra ,S.V.Subramanian. Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India. [Published online Jun02, 2020] https://e-jghs.org/DOIx.php?id=10.35500/jghs.2020.2.e17

7. Shamika Ravi, Mudit Kapoor. COVID-19 trends from Germany show different impacts by gender and age [May1,2020] https://www.brookings.edu/blog/techtank/2020/05/01/covid-19-trends-from-germany-show-different-impacts-by-gender-and-age/

8. Primavera A. Spagnolo, JoAnn E.Manson, et al. Sex and Gender Differences in Health: What the COVID-19 Pandemic Can Teach Us. https://doi.org/10.7326/M20-1941

9. Garima Sharma, Annabelle Santos Vlogman , Erin D. Michos. Sex Differences in Mortality From COVID-19 Pandemic: Are Men Vulnerable and Women Protected? JACC :Case Reports ,Volume 2, Issue 9, 15 july 2020, Pages 1407-1410 https://doi.org/10.1016/j.jaccas.2020.04.027

10. Garima Sharma, Annabelle Santos Vlogman , Erin D. Michos. Sex Differences in Mortality From COVID-19 Pandemic: Are Men Vulnerable and Women Protected? JACC :Case Reports ,Volume 2, Issue 9, 15 july 2020, Pages 1407-1410 https://doi.org/10.1016/j.jaccas.2020.04.027

11. William Joe, Abhishek Kumar, Sunil Rajpal, U.S.Mishra ,S.V.Subramanian. Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India. [Published online Jun02, 2020] https://e-jghs.org/DOIx.php?id=10.35500/jghs.2020.2.e17

12. William Joe, Abhishek Kumar, Sunil Rajpal, U.S.Mishra ,S.V.Subramanian. Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India. [Published online Jun02, 2020] https://e-jghs.org/DOIx.php?id=10.35500/jghs.2020.2.e17

13. Primavera A. Spagnolo, JoAnn E.Manson, et al. Sex and Gender Differences in Health: What the COVID-19 Pandemic Can Teach Us. https://doi.org/10.7326/M20-1941

14. Graziano Onder ,Giovanni Rezza , Silvio Brusaferro. Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. [Posted on March 23,2020] *JAMA.* 2020;323(18):1775-1776. doi:10.1001/jama.2020.4683

15. Graziano Onder ,Giovanni Rezza , Silvio Brusaferro. Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. [Posted on March 23,2020] JAMA. 2020;323(18):1775-1776. https://jamanetwork.com/journals/jama/fullarticle/2763667

16. Graziano Onder ,Giovanni Rezza , Silvio Brusaferro. Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. [Posted on March 23,2020] *JAMA.* 2020;323(18):1775-1776. doi:10.1001/jama.2020.4683

17. William Joe, Abhishek Kumar, Sunil Rajpal, U.S.Mishra ,S.V.Subramanian. Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India. [Published online Jun02, 2020] https://e-jghs.org/DOIx.php?id=10.35500/jghs.2020.2.e17

18. William Joe, Abhishek Kumar, Sunil Rajpal, U.S.Mishra ,S.V.Subramanian. Equal risk, unequal burden? Gender differentials in COVID-19 mortality in India. [Published online Jun02, 2020] https://e-jghs.org/DOIx.php?id=10.35500/jghs.2020.2.e17

19. Shamika Ravi, Mudit Kapoor. COVID-19 trends from Germany show different impacts by gender and age [May1,2020] https://www.brookings.edu/blog/techtank/2020/05/01/covid-19-trends-from-germany-show-different-impacts-by-gender-and-age/

20. Shamika Ravi, Mudit Kapoor. COVID-19 trends from Germany show different impacts by gender and age [May1,2020] https://www.brookings.edu/blog/techtank/2020/05/01/covid-19-trends-from-germany-show-different-impacts-by-gender-and-age/

21. Paula Moraga, David I. Ketcheson, Herenando C. Ombao, Carlos M. Duarte. Assessing the age-and gender-dependence of the severity and case fatality rates of COVID-19 disease in Spain [version 1; peer review: 1 apporoved] Latest published: 02 Jun, 2020, 5 :117 https://doi.org/10.12688/wellcomeopenres.15996.1

22. Ambreen Chaudhary, Aamer Ikram, Mirza Amir Baig, Muhammad Salman,Tamkeen Ghafoor, Zakir Hussian ,Mumtaz Ali Khan, Jamil Ahmad Ansari, Asif Sayed, et al. Mortality Analysis of COVID-19 confirmed cases in Pakistan.[posted June09,2020] https://www.medrxiv.org/content/10.1101/2020.06.07.20121939v1

23. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020 Feb 15;395(10223):507–13.

24. Sex, gender and COVID-19 [Published 17 Apr 2020] Coronavirus: the science explained- UKRI https://coronavirusexplained.ukri.org/en/article/cad0007/

25. J. Karlberg, D.S.Y. Chong, W.Y.Y.Lai . Do Men Have a Higher Case Fatality Rate of Severe Acute Respiratory Syndrome than Women Do? [Published-01February 2004] American Journal of Epidemiology, *Volume 159, Issue 3, 1 February 2004, Pages 229–231, https://doi.org/10.1093/aje/kwh056*

26. Chen X, Chughtai AA , Dyda A, Maclntyre CR, Comparative epidemiology of Middle East respiratory syndrome coronavirus (MERS-CoV) in Saudi Arabia and South Korea. PMID: 28588290 https://europepmc.org/article/MED/28588290

27. Sex, gender and COVID-19 [Published 17 Apr 2020] Coronavirus: the science explained- UKRI https://coronavirusexplained.ukri.org/en/article/cad0007/

28. Sex, gender and COVID-19 [Published 17 Apr 2020] Coronavirus: the science explained- UKRI https://coronavirusexplained.ukri.org/en/article/cad0007/

29. Bianchi I, Lleo A, Gershwin ME, Invernizzi P . The X chromosome and immune associated genes. [16 Dec,2011] PMID: 22178198 DOI: https://doi.org/10.1016/j.jaut.2011.11.012

30. Klein SL, Flanagan KL. Sex differences in immune responses. 22 Aug 2016, 16(10):626-638 DOI: https://doi.org/10.1038/nri.2016.90

PART- 2

ONLINE COURSE

LEADING CHANGE IN HEALTH INFORMATICS

- **Acknowledgements** – "Leading Change In Health Informatics" Course is available at online education platform "Coursera". This course is designed by Johns Hopkins University. I am thankful to John Hopkins University ,as well as to Coursera for providing such a required and practical course.

- **Contents –**

- **Description -**

This overall course is divided into four modules –

1) **Leading Change In Health Informatics** – This module gives a board understanding about role of leadership, teamwork, and governance in health informatics. Also it gives detailed knowledge about Kotter's 8-step process for successfully leading change. Orientation about purpose of Organizational Readiness Assessment. Patient portals for clinical trial recruitment: Resistance to change, also it provides learning about the role of Clinical Governance in health IT and the role it plays in designing and optimizing clinical decision support system.

2) **Introduction To Project Management / Project Management for Health Informatics** – Knowing how to manage projects effectively is an essential skill for health Informaticians. So, this module gives depth knowledge about standard terminology in project management. Defining about what is a project and explaining the phases of a project life cycle in the context of health IT. Role of a work breakdown structure, Gantt Charts, and process maps is also a part of this module. Gives example of common project related pitfalls such as Groupthink, Scope creep.

3) **Strategic Planning In health IT** – This module introduces about the importance of strategic planning when leading healthcare transformation efforts. Case studies on the role of strategic planning in mHealth, Hospital acquisitions and various telemedicine initiatives are woven in throughout the course with interviews of subject matter experts. Common strategic planning tools such as SWOT and scenario planning. Orientation about commonly used terms in procurement such as RFIs, RFPs, TCO and ROI. Knowledge about Vendor evaluation and financial considerations.

4) **Change Managemment** – In this module it's covering complexities of change management in health information systems. Introducing PDSA (Plan Do Study Act)

cycle. Demonstrating the value of taking into account the current clinical workflow and how any intervention will impact it. Change management in EHR implementation is explained here . Challenges associated with usability and workarounds with health information systems are explored. This module covers practices in change management and the need for proper documentation and effective communication of changes.

- Objectives Of the Course –

i. Building up the concepts of Health informatics , Health IT, Electronic Health Record adoption, Change Management.

ii. To give understanding of Strategies for successfully leading change in health informatics.

iii. To understand kotter's 8 step process for Leading Change and how to implement it.

iv. To provide knowledge about Tools for successful implementation of information system.

v. To give depth knowledge for how to conduct Organizational Readiness Assessment and to analyse the results.

vi. To know about the project planning and tools of it.

vii. To understand concepts of Strategic Planning tool.

- **Course Contents**

  The Overall Course is of 19 hours, Course is divided in 4modules and time for completion is 4 weeks.

1. **Leading Change In Health Informatics – (**1ST Week Module**)**
    - Leadership and Teams
    - The Critical Skills for Leading Major Change In America's Health System
    - Kotter's 8-step Process for Leading Change
    - Patient Portals for Clinical Trial Recruitment: Introducing Change
    - Patient Portals for Clinical Trial Recruitment: Overcoming Resistance to Change
    - The Patient and Family as Important Stakeholders (Interview with Industry Professional)
    - Creating a Sense of Urgency: Reflections with Dr. Marion Ball
    - Managing Change: An Overview
    - Organizational Readiness for Change
    - Organizational Readiness Assessment Toolkit
    - Vision and Communication
    - Importance of Interprofessional Collaboration: Reflections with Marion Ball
    - Enable Action and Generate Wins
    - Clinical Decision Support Governance
    - Clinical Decision Support: Case Study
    - Governance for Clinical Decision Support
    - What 21st Century Healthcare Should Learn from 20th Century Business
    - Organizational Readiness to Change Assessment (ORCA)

2. **Project Management for Health informaticists** – (2nd Week Module)
    A. Introduction to Project Management

- Project Management
- What is a Project?
- Project Planning
- Groupthink
- Case Study in Project Management

B. Tools of the Trade

- Role of the Work Breakdown Structure In Health IT
- Process Flow Charts
- What is a Flow Chart?
- Example of a Gantt Chart
- Quick Guide to Project Management

3.**Strategic Planning in Health IT** – (3rd Week Module)

A. Essentials of Strategic Planning for Health Information Systems

- Strategic Planning
- Case Study in Strategic Planning
- A strategic Acquisition
- Strategic Planning Tools
- Tele-Emergency Medicine: Interview with Junaid Ruzak
- Interview: Rebecca Canino and Dr. Ingrid Zimmer-Galler
- Medical second Opinion Program

B. Vendor Evaluation and Financial Considerations

- Vendor Evaluation Process
- Vendor Evaluation Matrix Tool
- What is ROI?
- Calculating Total Cost of Ownership
- Tableau Total Cost of Ownership
- Total Cost Of Ownership and Return on Investment
- EMRs and Capture Solutions: The Total Cost Of System Ownership.

4.**Change Management** – (4th Week Module)

- Change Management
- Managing Change: Analysis of a Hypothetical Case
- Push Vs. Pull
- Change Management in EHR Implementation
- Workflow Redesign / Reengineering
- Definitions and Guidelines
- Define the Problem

- Plan the Solution
- Implement
- Analyze and Iterate
- Key Takeways
- Workarounds Emerging From Electronic Health Record System Usage: Consequences for Patient Safety, Effectiveness of Care, and Efficiency Of Care.
- Workarounds
- Change Management in Software
- Managing Change: A Developer Perspective
- Closing Remarks
- Workflow Assessment for Health IT Toolkit
- Workflow Toolkit and Lessons in Users Centered Design
- The HITech Era and the Path Forward
- Ten Key Considerations for the Successful Optimization of Large Scale Health Information Technology

❖ **Learning Methodology Used in the Course**

1. WEEK 1 -13 Videos, 8readings, 4practice quizzes
2. WEEK2- 8 Videos,2 Readings, 2 practice quizzes
3. WEEK3- 10 Videos, 4 Readings, 2practice quizzes
4. WEEK4- 13Videos,7Readings, 1practice quiz

- **Key Learnings from the Course** –
  I. Key Steps in the process of successfully leading change in health information systems.
  II. Interpreting the results from an organizational readiness assessment.
  III. Describing the reasons why interprofessional collaboration is essential component of leading change efforts in health informatics.
  IV. Recognizing the role of the patient and family as important stakeholders in health informatics.
  V. Identifying the steps in the knowledge management lifecycle that are important for those involved with clinical Governance.
  VI. Difference between projects and ongoing operations in health IT
  VII. Examples of work performed by health informaticians during each of the five phases of a project.
  VIII. Selection of the right project management tool to use based on the needs of a given healthcare IT scenario.
  IX. Create a process map that correctly portrays the essential steps in a designated health IT Workflow.
  X. Identifying the common challenges encountered during health informatics projects and ways to overcome them.
  XI. Role of strategic planning from the perspective of at least three different health Information Systems.
  XII. Distinguish between the utility of commonly used strategic planning tools.
  XIII. Calculate total coat of ownership and return on investment
  XIV. Utilizing a vendor evaluation matrix tool to make a recommendation on purchasing.
  XV. Describing why workflow re-engineering is essential in healthcare.
  XVI. PDSA Cycle
  XVII. Recognizing the approach to workflow re-design when putting a health IT intervention into place.
  XVIII. Incorporating best practices in change management to mitigate risks.