Why COVID 19 İs Milder İn Women Than Men- A Systematic Mathematical Study

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Abstract

Importance: There is limited information describing the presenting characteristics and outcomes of men and women affected by the coronavirus disease 2019 (COVID-19) in the world.

Objective: To describe the effect and outcomes of patients, both men and women with COVID-19.

Design, Setting, and Participants: The data collected in different parts of the world, who are affected with COVID-19 US, Germany, Italy, India, Spain Health system. The study included the total population of the countries, the total number of people affected in that particular company, the total number of men affected by the corona, the total number of women affected by the disease between the start of the virus effect till 29th of April 2020, inclusive of these dates.

Exposures: Confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection by positive result, testing of a nasopharyngeal sample among patients requiring admission both men and women.

Main Outcomes and Measures: Clinically tested positive cases who are hospitalized between the start of the virus effect till April 29, 2020, results were also collected.

Results: Two samples were taken for the test. A total of 11,31,800 patients were included (both men and women) from a population of 33.1 crore in United states and another total of 2,07,428 patients were taken form a population of 6.0019 crore. The most common thing was both samples are considered because they were affected by the corona virus, more or less equally. During Hospitalization, 53,195 were male which was 4.7% and 31,690 are female which was 2.8% in United states. Whereas 16,594 were male which was 8% and 10,371 were female which was 5%.

Conclusions and Relevance: This case study on testing of hypothesis using two big samples from the population provides the result that in the bigger population also men are affected more the women with confirmed COVID-19.

Keypoints: Question: Why Men are affected more than women in the world and what is the reason behind this effect with coronavirus disease 2020 (COVID-19) in the world?

Findings: A total of 11,31,800 patients were included (both men and women) from a population of 33.1 crore in United states and another total of 2,07,428 patients were taken form a population of 6.0019 crore. The most common thing was both samples are considered because they were affected by the corona virus, more or less equally. During hospitalization, 53,195 were male which was 4.7% and 31,690 are female which was 2.8% in United states. Whereas 16,594 were male which was 8% and 10,371 were female which was5%.

Meaning: This study provides the outcome that men are affected more than women, not only in the samples studied but also in the entire world by COVID-19

1 Introduction:

On January 31, 2020, the first recorded case of corona virus disease in the US (COVID-19) was reported from Washington State.[1] Soon after, outbreaks were reported from Washington and California, and cases in the US had exceeded the total reported cases in both Italy and China[2] The incidence of infections in New York, with its high population density, surpassed any other state and, as of April 20, 2020.

There was insufficient information available to identify the clinical features and results of patients needing hospitalization with this disease. In a retrospective longitudinal study from China, hospitalized patients were primarily men with a median age of 56 years; 26 per cent needed intensive care unit (ICU) treatment, and a mortality rate of 28 per cent was observed between China and the US in population.[7]

This study describes the sex difference seen in the effect of corona virus among men and women in different parts of the world with COVID-19.

Such sexual discrepancies with COVID19 aren't unexpected. Other coronaviral outbreaks, including SARS outbreaks in 2003 and Middle East Respiratory Syndrome (MERS) in 2012, had higher fatalities in men than in women, according to the WJEM editorial. For example, 2016 study found that men had a 40% higher chance of dying from MERS than women did.

Also "man flu" is so named comically branded because men appear to have a poorer immune response to respiratory viruses that cause pneumonia and common cold.As a result, men tend to have more severe symptoms of these viruses than women do, a 2017 BMJ review was found. The review pinned these results on the differences in sexdependent hormones in both men and women.

A mouse experiment offers clues about this hormonal mystery; according to a 2017 study published in The Journal of Immunology, when scientists infected male and female mice of different ages with SARS, male mice were more susceptible to the infection than females of the same age.

However, when the female mice had their ovaries that produced estrogen removed or treated with an estrogenreceptor blocker, they died at higher rates than those with normal ovaries and estrogen working.

"These data indicate that sex hormones produced in females [mice] may help defend against coronaviruses such as SARS and SARS-CoV2," said Akiko Iwasaki,
Professor of immunobiology at the Yale University School of Medicine, who was not involved in the study.There is another way to look at the sex disparity in COVID-19; maybe the X chromosome is defensive since it contains more immune-related genes than the Y chromosome does. This may also clarify why women are more likely to develop autoimmune disorders than men, the writers of the WJEM editorial noted.

2 Data Collected

Since the first confirmed case of COVID-19 was identified in China late last year, several reports have shown that the disease appears to be more severe and lethal in men than in women.

1.   1. In an overview of 5,700 COVID-19 patients hospitalized in New York City, for example, just over 60 per cent were people, according to a report reported in JAMA on April 22. In addition, "mortality rates were higher for males relative to females at a 10-year age span of more than 20 years," the

researchers wrote in the report. In addition, 66.5 percent of the 373 patients who ended up in intensive care units were males, according to the JAMA report.

2.   Once the WJEM editorial was released in early April, the critics reported that between 51 percent and 66.7 percent of hospitalized patients were male in Wuhan, China; 58 percent were male in Italy; and 70 percent were male in all COVID-related deaths worldwide. In a large survey of more than 44,600 people living with COVID-19 in China, 2.8% of men died compared to only 1.7% of women.

3.   In India 1550 men are affected and 750 women are affected as on 29 April 2020

3 Testing of Hypothesis

The Hypothesis Test is a statistical test used to assess whether or not the hypothesized conclusion for the data set is valid for the whole population. The hypothesis is essentially a supposition that is checked to establish the association between two data sets.

Why to perform hypothesis checks

➢   State the hypotheses: Any test for hypothesis involves that the researcher state a null hypothesis and an alternate hypothesis.
➢   Formulate a Strategy for Review. The study strategy explains how experimental evidence should be used to consider or deny the null hypothesis. .
➢   Analyze data from experiments. ...
➢   An explanation of the performance.

This test is to check whether men are affected than women by corona virus in the world

World is taken as the population where the entire number of people living in the world is approximately equal to 778 crores.

- •   The number of men 393.2 crores (50.4%)
- •   The number of women 383,3 crores (49.5%)

To study and decide about the world we taken two samples out of it, get all the required data needed and study about these two samples, after studying about the population we can talk about the population

Samples that is taken are

o   Sample 1: United states
o   Sample 2: Italy

The reason to choose these two as samples are, they are the most affected countries

Sample 1: United states

✓   Populations size $n_1 = 33.1$ crores
✓   Total number of men =16.47 crores (49.4%)
✓   Total number of women16.89 crores (50.6)
✓   Total affected by corona virus = 11,31,800
✓   Total death = 65782
✓   Total men affected =4.7% = 53,195

✓   Total women affected =2.8 %= 31,690

The **median age** in Italy is **47.3 years**.

Density 206(36 P/km^2)

Sample 2: Italy

- ✓   Populations size $n_{2} = 6.0019$ crores
- ✓   Total number of men =2.93 (49%)
- ✓   Total number of women= 3.06 (50%)
- ✓   Sex ratio: 0.96
- ✓   Total affected by corona virus =2,07,428
- ✓   Total death= 28236
- ✓   Total men affected = 8%=16,594
- ✓   Total women affected= 5%= 10,371

The **median age** in Italy is **47.3 years**.

Density 206(206 P/km^2)

Since the sample sizes n_1 and n_2 are greater than 30, it is taken as large samples. So normal distribution table "Z" is used for the hypothesis test

➤   The Null Hypothesis H_0: The number of men and women are equally affected by the corono virus
➤   The alternative Hypothesis H_1: the number of men affected by corona virus is **more than** the number of women affected by corona virus (two tailed test)

The test statistics $z = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}}$ = 9.028 (Calculated values)

Tabulated values at 5% level for a single tailed test is = 1.625(Tabulated value)

Finding from the hypothesis test is as follows.

The calculated value is Greater than tabulated values, so accept H_1 and reject H_0

Therefore, the finding is that

The number of men affected by corona virus is more than the number of women affected.

Since the testing of hypothesis proves that the men are affected more then women in both the sample of US and Italy, it is obvious that the same condition will exist in the entire world too.

The same pattern has been mirrored in France, Spain, Germany, Iran, South Korea, United Kingdom and India.   Since it is proved that men are affected more than women, our next work is to find out why men are affected more than women.

4 Reasons for this sex difference in the effect of corona virus

4.1 Men and women are biologically different

The sex chromosomes in men and girls and therefore the genes that exist on them vary. girls have 2 copies of a body of medium size (known because the X). we have a tendency to do have one X chromosome, and atiny low sex chromosome with many chromosomes. one in all these Y-genes (SRY) drives the embryo to become male by kick-starting check development in associate embryo of XY.The testes manufacture hormones for males and therefore the hormones manufacture the baby grow sort of a boy kid. associate ovary develops within the absence of SRY, that permits female hormones. it's the hormones that regulate abundant of the apparent noticeable distinctions in men and girls — genitalia and breasts, type of hair and body — and considerably impact behavior.

4.2 The Y chromosome and hormones

There square measure barely any genes aside from SRY within the sex chromosome, however it's jam-packed with recurrent sequences ("junk DNA"). Perhaps, throughout aging, a "toxic Y" could lose its management. it would exacerbate man aging and render him additional liable to the virus. nevertheless the male hormones free by SRY intervention become an even bigger issue for males. Niveaus of androgen square measure concerned in several diseases, particularly cardiovascular disease, and may have an effect on period. Men also are weakened by their low sex hormone levels that shield girls against several diseases, as well as cardiovascular disease. Male hormones influence behaviour, too. androgen rates are related to major variations in unhealthy habits, like smoking and drinking an excessive amount of alcohol, still as failure to heed safety warnings and request medical help. Extreme disparities in smoking rates between men and ladies in China (nearly 1/2 men smoke and simply a pair of of women) will facilitate to account for his or her terribly high range of male deaths (more than double females). Smoking isn't solely a major risk issue for any disease, however additionally causes carcinoma, an extra risk issue. Smoking rates in several different countries square measure lower and not as sex-based, therefore unhealthy behaviour cannot justify the gender gap in COVID-19 deaths by itself. perhaps sex chromosomes produce other consequences.

4.3 Two X chromosomes are better than one

The X chromosome contains over one,000 genes with roles altogether manner of things like daily digestion, blood clotting and brain growth. In XX females, the presence of 2 X chromosomes creates a protection if a sequence is flawed on one allelomorph. XY males lack support for this X chromosome. that is why boys suffer from sure sexually transmitted disorders like blood disease (poor blood clotting). the quantity of X chromosomes additionally has major effects on several of the metabolic traits that area unit divisible from the consequences of sex hormones, as shown by mice experiments. Not solely will females have a double dose of sure X sequences however they will additionally gain from 2 separate copies of every gene. This X impact goes a protracted approach in understanding why males die at the next rate than females at any age from birth. one more downside for man is that the system. For a protracted time, we've better-known ladies have an improved system than men. this can be not all positive, as a result of it leaves folks a lot of liable to reaction disorders like lupus and disseminated sclerosis. Yet, as several experiments in mice and humans demonstrate, this offers folks a position once it involves resistance to viruses. It helps to know why several viruses, together with respiratory illness and MERS, area unit a lot of liable to folks. The X chromosome contains a minimum of sixty immunologic response genes and it suggests that a bigger indefinite quantity and 2 separate variants of those offer folks a broader vary of defences.

4.4 Sex differences in diseases – the big picture

Gender variations have long been recognized within the period, extent and effectiveness of identification for several diseases. COVID-19 is a component of a broader trend wherever males lose – in the slightest degree ages. this is often true of most mammals, not simply humans. area unit sex variations in vulnerability to sickness simply a by-catch of variations between genes and hormones? Or have they been picked otherwise in males and females due to variations in life policy, like such a large amount of different traits? it's planned that by winning contests for partners, male mammals disperse their genes, thus secretion regulation of risky behavior may be a bonus for males. feminine mammals also are planned to be chosen for options that improve their ability to worry for kids, therefore their stronger system. for many mammals this created sense through the years. So, the sex difference in COVID-19 deaths is a component of so much} broader image – and a far older image – with gender variations in DNA, chromosomes, and hormones that contribute to terribly totally different reactions to all or any sorts of diseases, as well as COVID-19.

5 Discussion and conclusion

The data collected in different parts of the world, who are affected with COVID-19 US, Germany, Italy, India, Spain Health system. The study included the total population of the countries, the total number of people affected in that particular company, the total number of men affected by the corona, the total number of women affected by the disease between the start of the virus effect till 29th of April 2020, inclusive of these dates. Confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection by positive result, testing of a nasopharyngeal sample among patients requiring admission both men and women. Clinically tested positive cases who are hospitalized between the start of the virus effect till April 29, 2020, results were also collected. Two samples were taken for the test. A total of 11,31,800 patients were included (both men and women) from a population of 33.1 crore in United states and another total of 2,07,428 patients were taken form a population of 6.0019 crore. The most common thing was both samples are considered because they were affected by the corona virus, more or less equally. During hospitalization, 53,195 were male which was 4.7% and 31,690 are female which was 2.8% in United states. Whereas 16,594 were male which was 8% and 10,371 were female which was 5%.. This case study on testing of hypothesis using two big samples from the population provides the result that in the bigger population also men are affected more the women with confirmed COVID-19. To our knowledge, this study represents the first large case of men affected by corona virus is more than the women with confirmed COVID-19 in the US and Italy.

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