COVID-19 Symptoms Analysis and Comparison

ANS MUNIR (MSDS20033)
ITU Lahore

I. ABSTRACT

COVID-19 is a new disease that has become the pandemic and cause large scale destruction. As it is caused by a new virus therefore we do not know much about this virus. We have seen that some people face much severe symptoms while others observe less symptoms.

In this analysis we have observed that what are the common symptoms observed by COVID-19 patients. We have also analyzed and compare symptoms in Males and Females. We have also analyze loss of senses and gastrointestinal symptoms in both men and women. We have found that females were more affected by COVID-19 than males.

We also analyze and compare symptoms in Pakistani and USA patients. We have observed that Pakistani patients observe less symptoms than USA patients.

II. INTRODUCTION

COVID-19 is caused by SARS-CoV2 virus. COVID-19. COVID-19 stands for coronavirus disease of 2019. COVID-19 effect different people in a different way. Some people seriously effected by it and observe very severe symptoms and need to be admitted to the hospitals while others just observe minor symptoms. There are some factors that have a lot of contribution in the severity of symptoms that appears to the COVID patients.

Immune System of children and adults behave differently towards COVID-19. Furthermore, in adults it also behaves differently among different age groups and also among different gender.

There are many studies that have been done before on COVID-19 and especially on symptoms of COVID-19. Some studies have shown its symptoms on the basis of ages and gender while others have shown general and most frequent symptoms caused by COVID-19. There are also some other studies that have shown less frequent symptoms that are observed in small number of patients. But these symptoms have not been studied with other factors. These factors include how previous diseases contribute towards severity of COVID-19, how temperature effects in its severity i.e. Is there any difference in symptoms of COVID-19 when temperature is high and when it is low?

We have also shown that what is the effect of COVID-19 on people who do smoking. Are they observing more severe symptoms than those who do not smoking because COVID-19 mostly effect respiratory track and there is a hypothesis that it effects people more who do smoke?

We have also analyzed that how people got treated when they effected with it. Did they take any medicine from doctor and stayed home or did they admitted to the hospital for their treatment, or did they stay home for all of the time? It will help us to see what is the preference of people for their treatment after becoming ill.

Similarly, we have discussed in this paper that when people got infected with COVID-19, did other people at their home also infected with it or not? If other people also infected at that time did they infected before them or after them. So that we can see what percentage of people have infected their home members when they got infected.

In this paper we have also compared symptoms of Pakistani COVID-19 patients with International COVID-19 patients to see if there is any difference in their symptoms.

III. LITERATURE REVIEW

COVID-19 has been widely spread around the globe. It has been showing different behaviour among different people. Some are more effected with this disease while others are less effected with it. There are some conditions that plays important role in severity of COVID-19 symptoms.

As this is a new disease therefore we do not know much about it and research is being conducted around the globe. So far there are some facts that has been published about COVID-19.

A meta analysis has been done[1] to evaluate the risk factors of COVID-19. Medline, SinoMed, EMBASE, and

Cochrane Library were searched for clinical and epidemiological studies on confirmed cases of COVID-19. The incidence of fever, cough and fatigue symptoms were 85.6%, 65.7% and 21.4% respectively. The prevalence of diabetes was 7.7% , hypertension was 15.6%, cardiovascular disease was 4.7% , and malignancy was 1.2%. It has been found that the most common symptom in patients with COVID-19 IS Fever. It has also been assumed that hypertension and diabetes are associated with the severity of COVID-19.

Loss of smell and taste is also among those symptoms that are reported by a large number percentage of people among COVID-19 positive patients. A study has been done on people of the UK and the USA[2]. App has been used to get data of lab tested COVID-19 patients. 6452 patients were of the UK and 726 were of the USA. 64.76% people suffered from loss of smell and taste in the UK and 67.49% patients suffered from loss of smell and taste in the USA.42.03% people in the UK and 47.25% people in the USA also report skipped meals.

Among common COVID-19 symptoms such as fever, shortness of breadth and cough there are some gastrointestinal symptoms that are appear in adults as well. A retrospective cohort study conducted [3] in a cohort of COVID-19 patients who were admitted to the Brookdale University Hospital Medical Center (BHMCNY), a tertiary care academic medical center in Brooklyn, New York. Those all are patients more than 18 years old. Total 150 were studied and among 150, 31(20.6%) were reported with gastrointestinal symptoms.

There also be possible that COVID-19 patients only suffer with digestive symptoms and not other common symptoms such as fever, cough or shortness of breadth. A study was performed at Union Hospital, Tongji Medical College (Wuhan, China), which was a designated hospital to manage patients with COVID-19[4]. There were 206 patients with low severity COVID-19. Among those 206 patients 48 were only have digestive symptoms that include Poor appetite in 31 patients (64.6%), Low appetite in 15 patients (31.3%), Vomit in 7 patients (14.6%), Diarrhea in 23 patients (47.9%) and Abdominal pain in 2 (4.2%). This study showed that it is also possible that COVID-19 patients can only suffer through digestive symptoms and not a single respiratory symptom.

Another study has been done in which 1141 COVID-19 patients were evaluated[5]. Among those 1141 patients 183 (16%) were presented with digestive symptoms only. Men slightly outnumbered women, and the most common gastrointestinal symptom was loss of appetite, followed by nausea and vomiting.

Another study showed that digestive intestinal symptoms are more common in patients less than 18 years as compared to adult patients[6]. On the other hand, common symptoms such as cough, fever and shortness of breath are less in young patients as compared to adult patients. Centers for Disease Control and Prevention of USA (CDC) used an optional questionnaire to collect detailed information on a convenience sample of COVID-19 patients from participating states. Total 164 patients were observed. Among those 164 patients 9 were under age of 18. It has been studied that common symptoms like fever, cough and shortness of breath were less in those 9 patients as compared to other 155 adult patients. On the other hand, gastrointestinal symptoms that include diarrhea, vomiting, nausea, or abdominal pain were more in 9 patients aged less than 18 as compared to adult patients. Therefore it has been shown that common symptoms were more apparent in adults as compared to young ones while gastrointestinal symptoms are more apparent in young patients as compared to adults patients.

COVID-19 has effected different age groups differently. Mortality rate increases as the age increases. A study has been done on Data on COVID-19 cases and deaths were obtained for outbreaks in China, Italy and New York City[7]. It has been observed that mortality rate is high in people with more age as compared to young people. It has also been found that mortality is high in all ages of men as compared to those of women.

It has been also observed that COVID-19 effected more to aged people than those who are young. A study has been performed in this regard[8]. Patients from nine Seattle-area hospitals who were admitted to the intensive care unit (ICU) with confirmed infection with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) were studied. Clinical data were obtained through review of medical records. The data reported here are those available through March 23, 2020. Each patient had at least 14 days of follow-up. They identified 24 patients with confirmed Covid-19. The mean (±SD) age of the patients was 64±18 years. 75% (18 patients) needed mechanical ventilation. Half the patients (12) died between ICU day 1 and day 18. Of the 12 surviving patients, 5 were discharged home, 4 were discharged from the ICU but remained in the hospital, and 3 continued to receive mechanical ventilation in the ICU.

COVID-19 effects more to those who are already effected with other severe diseases. A survey has been done in this regard[9]. PRE-ONCOVID-19 is a retrospective study of cancer patients presenting to the Comprehensive Cancer Center of Lyon (Centre Leon Berard, CLB) with a suspicion of COVID-19 from March 1st to April 15th 2020. Patient cases were collected using a web-based tool, enabling the collection of clinical information integrated to the electronic patient record. It has been found that cancer patients have more mortality rate than those patients who are without cancer.

COVID-19 usually effects lungs. As smoking also effects lungs therefore it has been considered that smokers have more effected by COVID-19 than those who are non-smokers. A study has been done in this regard[10]. COVID-19-infected in- and outpatients in a large French university hospital between February 28, 2020 and March 30, 2020 for outpatients and from March 23, till April 9, 2020 were interviewed. This cross-sectional study in both COVID-19 out- and inpatients shows that daily smoker's rate in patients with symptomatic COVID-19 is lower as compared to the

general population

Most of previous studies has been done on single or two factors. However my study will combine all of these factors and will relate each of them. I will analyze symptoms of COVID-19 in different age groups with different factors. Also I will compare symptoms of Pakistani patients with the patients around the globe is will see whether COVID-19 have same effects on each part of world or is there any differences.

IV. DATA COLLECTION

As this paper is about analyzing symptoms of COVID-19 patients therefore we required data from people who have been recovered from COVID-19. To collect data from COVID-19 patients we developed a survey form. There are many groups and pages on the Facebook that has been developed by COVID-19 recovered patients to give firsthand knowledge about COVID-19 to newly effected people and to general public.

They are also helping researchers in doing research on COVID-19 by providing them data they need about COVID-19. We have also requested them to fill our survey form. We have shared our survey form in those groups. Most of people have been recovered from COVID-19 and some people are still recovering from it at the time of filling this form. This method has enabled us to get data from International COVID-19 recovered people that we then compared with Pakistani COVID-19 recovered people. Data of Pakistani recovered people has also collected through online surveys.

The survey form contains questions about Country name, City name(optional), Whether they performed COVID-19 test or not, Symptoms they suffered when they were infected with COVID-19, their age, Do they have any previous diseases, Whether other people also effected from COVID-19 at their home when they were effected, If other people at their home also effected at that time where they effected before them or after them, Whether they stay home or wen to hospital for their treatment, Whether they use any kind of home remedy for their treatment, Whether they treated by ventilator or not, What was the average temperature at the time when they effected (optional), Do they smoking or not.

This is the survey form that we were requested to fill to COVID-19 recovered patients. Then we analyzed the data collected through this survey form.

V. METHODOLOGY & EXPERIMENTS

Data we got from our survey was in the form of .csv file. We have used Python and Pandas for its analysis. We read our data from csv file with help of pandas and store it to pandas DataFrame. We then do analysis of our data. We checked about the countries of peoples who have filled our survey form. Our next question was about City but its optional. Most people responded to it as well. We also checked and counted number of different cities.

Then we checked and analyzed what are the tests performed by people by which they come to know that they have COVID-19. Next we analyzed the symptoms that are has been observed by patients. We have asked about Fever, Dry cough, Tiredness, Aches and pains, Sore throat, Difficulty breathing or shortness of breath, Chest pain or pressure, Loss of speech or movement, Loss in hearing, Loss in taste, Loss of smell, No loss of any sense, Vomiting, Diarrhea, Nausea, Abdominal pain. People also responded some other symptoms that they have observed.

We next analyzed age of people. Age is an important factor regarding symptoms. As it has been assumed that young people get less symptoms and older people get more symptoms. We have a column in our dataframe named age that contains the age data. After age we analyzed gender of people. We have a gender column in our dataframe that contains the gender of people. We use pandas value_counts function to count gender of people who has been filled our survey form.

We have also a data in our dataframe which has the records of previous diseases of patients. We analyzed those diseases to see what are the effects of previous diseases to the COVID-19 patients. Are previous diseases causes more symptoms or they aren't have any effect. We analyzed this. We also analyzed that are people taking any precautions before they got effected. We have asked them whether they were using masks, sanitizers and social distance at the time they got effected. We counted the peoples who said that they were taking precautions and also who were not taking any precautions. We then also count how many people were using masks and sanitizers and also keeping social distance at the time when they got effected. We asked people and did this experiment in order to check what is the effect of precautions on spread of COVID-19.

We also had data about views of people that what they thought that how they got virus. We group it to main categories like Work place, Family Gathering and from home. We then asked them how they treated when they were effected by COVID-19. We give them options such as Stayed home all the time and took medicine from doctor, Admitted to hospital for most of the time, Stayed home for most of the time but admitted to hospital for few days, Stayed home and didn't take any medicine. We have these columns in our pandas dataframe. We used count_values to count above values and analyzed it.

Our next step were to analyze what is the percentage of people who were treated by ventilator. We had a column in our dataframe where we had asked whether they were treated by ventilator or not. We counted its number of count_values function of pandas. Then we analyzed about how people were using home remedies when they were infected by COVID-19. We had a data containing different opinions of people. We did some preprocessing on data like make all data small and also remove punctuation's. It is because different people write same thing differently. So in order to analyze it we did some preproscessing.

We then analyzed about average temperature of the city of patient at the time when they were effected. Some people wrote temperature in Celsius and some wrote temperature in

Fahrenheit. So we treated them accordingly. Some people neither wrote Celsius nor Fahrenheit. After it we analyzed data about smoking. We had a column of smoking where people mentioned that whether they do smoking or not. We have analyzed both temperature and smoking column with symptoms to check what is the effect of temperature and smoking on severity of symptoms. As it is hypothesis that in high temperature COVID-19 has less severity than low temperature. Similarly it is also assumed that people who do smoking is also face severe symptoms than those who do not smoking.

We analyzed gender with symptoms to see are both male and female faced same symptoms or was there any difference in symptoms faced by each gender. We then analyzed and compared age with symptoms. As it is an hypothesis that people with less age face less symptoms as compared to more age people.

Similarly we also analyzed symptoms faced by patients with respect to previous diseases they had. We analyzed how severe symptoms observed by patients who had Asthma. As COVID-19 majorly effects lungs and respiratory track, Asthma patients already has respiratory problems and their respiratory symptom is already weak. So we observed how Asthma patients observe symptoms. Then we also analyzed what is the severity of symptoms in people with blood pressure and diabetes.

We also analyzed severity of symptoms by combining different parameters. Like we analyzed the symptoms faced by patients who were young, had no other previous disease and had high temperature and compare them with those who were also young and no previous disease but has low temperature to check the effect of temperature on symptoms. Similarly, we also checked elderly people who are male and compared them with females of same age in order to check how COVID-19 behaves in different genders. Another comparison were to analyzed and compared young males who do smoking and young females who do smoking to check effect of smoking and gender.

We had data about symptoms with which we compare and check the severity of disease. Those who faced more symptoms are considered to be more effected by COVID-19. On the other hand those who faced less symptoms are considered to be less effected by COVID-19.

VI. RESULTS

The graph of overall symptoms of all patients are:

This graph shows that most common symptoms are Fever, tiredness and pains. Next graph is of people who have loss their senses i.e. loss of smell or loss of taste and others. It include all people including male and females and belongs to many countries including Pakistan.

It can be seen from above graph that mostly people loss their smell and taste. And few people loss both. Next graph is about gastrointestinal symptoms COVID-19 patients face.

Diarrhea and Nausea are the most common gastrointestinal symptoms according to above graph.Next is the graph of

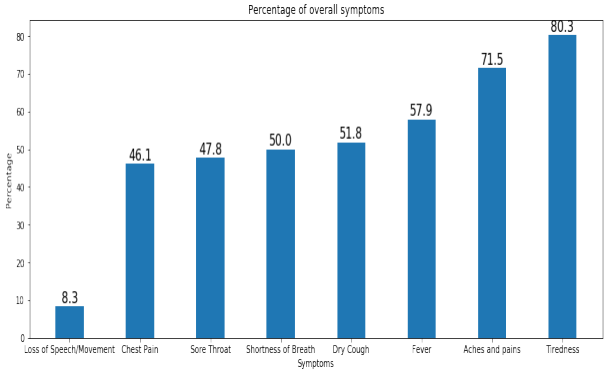

FIGURE 1. Graph containing symptoms of overall patients

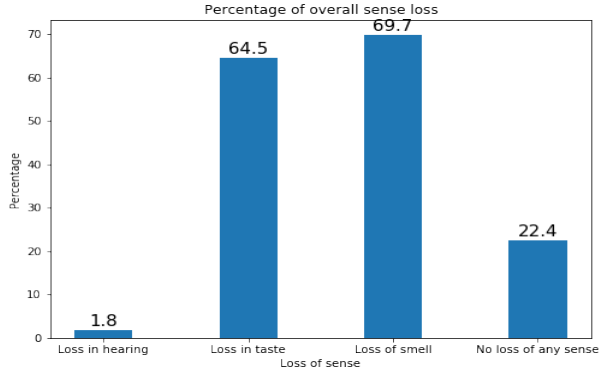

FIGURE 2. Graph containing Percentage of patients who loss their sense

symptoms that are observed only in men around the globe mostly from Pakistan and USA.

It can be seen from above graph that symptoms has been changed from last graph that contains symptoms of both male and female. Next graph shows the percentage of symptoms that has been faced by females. By comparing male and female graph we can see the difference.

Next are two charts that shows loss of sense of males and females respectively from around the globe.

It can be seen from the above charts figure 6 and figure 7 that women face more loss of smell and taste than males. It can also be seen that males has more percentage of no loss of any sense while females has less percentage of no loss of any sense.

Next is the graph of gastrointestinal symptoms of men and women respectively. In these charts we have been compared gastrointestinal symptoms of both men and women. How percentage of these symptoms are different in males and females.

It can be seen when we compare gastrointestinal symptoms of both male and females that females face more gastrointestinal symptoms than males. Like 47% of males observe diarrhea while females observe 54.2% diarrhea. Similarly only 8% males observe nausea while 46.3% females observe nausea. More males observe no gastrointestinal symptoms than females.

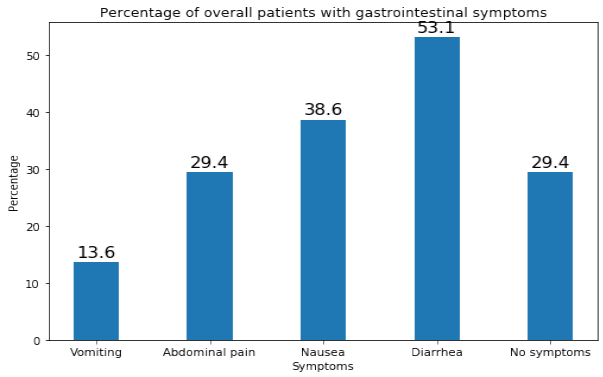

FIGURE 3. Graph containing Percentage of patients who face gastrointestinal symptoms

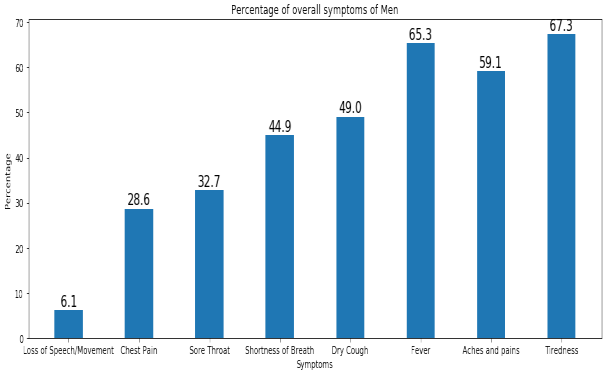

FIGURE 4. Graph containing Percentage of symptoms male patients face

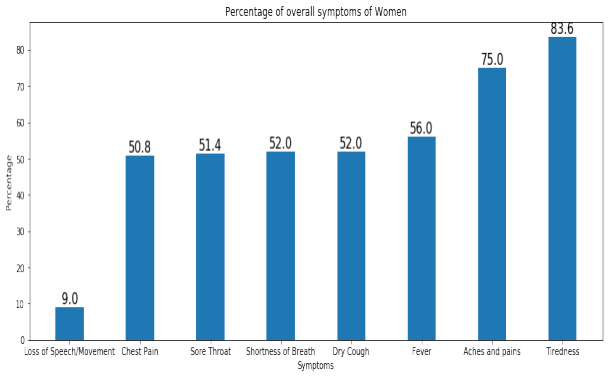

FIGURE 5. Chart counting percentage of symptoms female patients face.

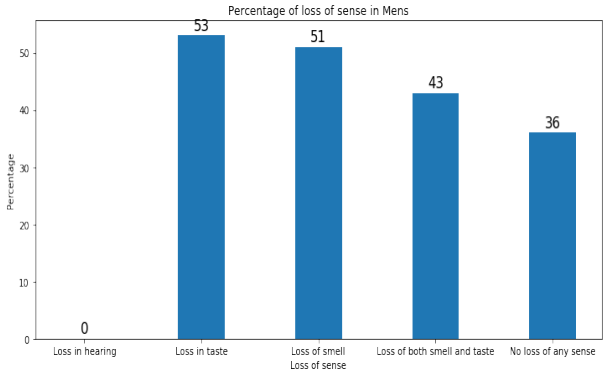

FIGURE 6. Chart counting percentage of loss of sense of male patients

Next is the chart that shows symptoms in men and women who previously has high blood pressure.

It can be seen from above two charts that if men who previously has high blood pressure observe more percentage of fever than women. On the other hand, women face more percentage of pains, tiredness and shortness of breath than males.

Next are the charts that contains symptoms in men and women who previously has diabetes.

From above charts figure 12 and figure 13 we can see that male patients who previously has diabetes face more fever while females with diabetes observe more tiredness, dry cough and pains.

Next is the chart of women patients (figure 14) who previously has Asthma. We can see that those who have Asthma previously observe more shortness of breath.

Next is the percentage of male and female figure 15 and figure 16 patients who has not any previous disease.

It can be seen from above images that females who no previous disease face more symptoms than those of males. However, still their percentage is less than those who previously has some disease.

Next we will compare symptoms of patients of Pakistan and United States of America in figure 17 and figure 18. There are two charts of symptoms of Pakistani patients and USA patients respectively.

Pakistani patients include both males and females. Similarly USA patients also include both males and females. It can be seen that some symptoms are more common in Pakistani patients while some symptoms are more common in USA patients.

Next are again two charts of Pakistani and USA patients respectively including both males and females.

It can be seen from two charts figure 19 and figure 20 that USA patients face more loss in sense than those of Pakistani patients. More Pakistani patients observe no loss of any sense but less number of people observe no loss of any sense.

Next are two charts of gastrointestinal symptoms of Pakistani patients and USA patients respectively.

It can be seen from above two graphs figure 21 and figure 22 that Pakistani patients observe less gastrointestinal symptoms than that of USA patients.

VII. CONCLUSIONS

It has been observed that females face more symptoms and hence more effected than males when both were infected by COVID. Fever has been observed more in males than females. Dry cough, tiredness and pain has been observed more in females than males.

Most observable difference in symptoms is in loss of sense. Females has been observed more loss of sense than males around the globe. Similarly females also observe more

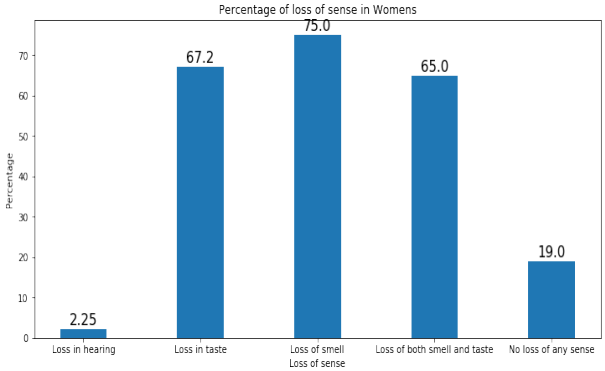

FIGURE 7. Chart counting percentage of loss of sense of female patients

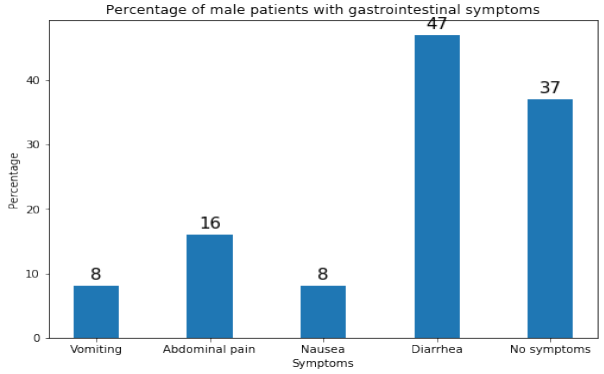

FIGURE 8. Chart counting percentage of male patients with gastrointestinal symptoms

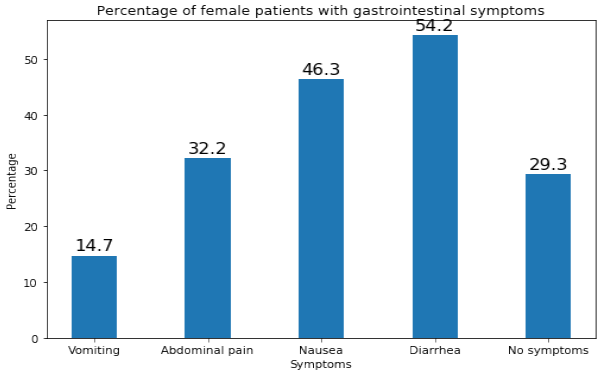

FIGURE 9. Chart counting percentage of female patients with gastrointestinal symptoms

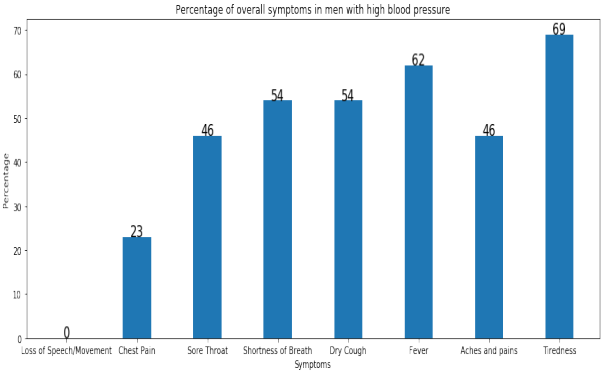

FIGURE 10. Chart counting percentage of symptoms in male patients who previously has high blood pressure

gastrointestinal symptoms than males.

If we compare both patients in USA and Pakistan then fever and sore throat has been more in Pakistani patients than USA patients. On the other hand loss of sense and gastrointestinal symptoms are more in USA patients than Pakistani patients.

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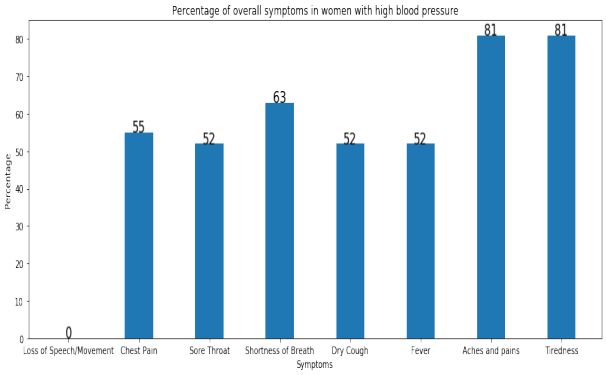

FIGURE 11. Chart counting percentage of symptoms in female patients who previously has high blood pressure

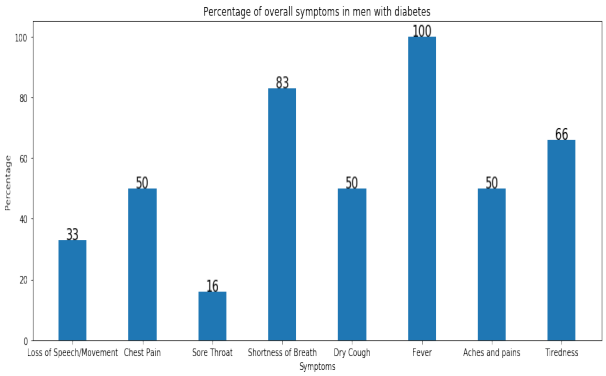

FIGURE 12. Chart counting percentage of symptoms in male patients who previously has diabetes

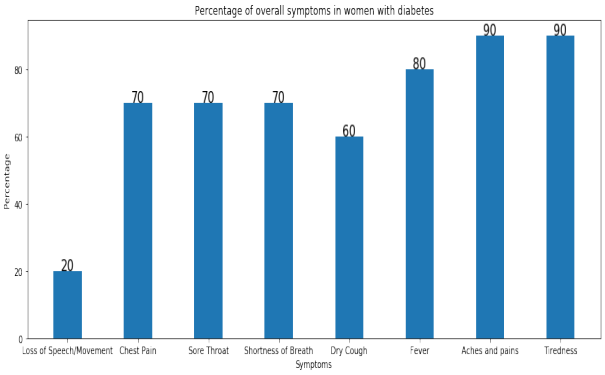

FIGURE 13. Chart counting percentage of symptoms in female patients who previously has diabetes

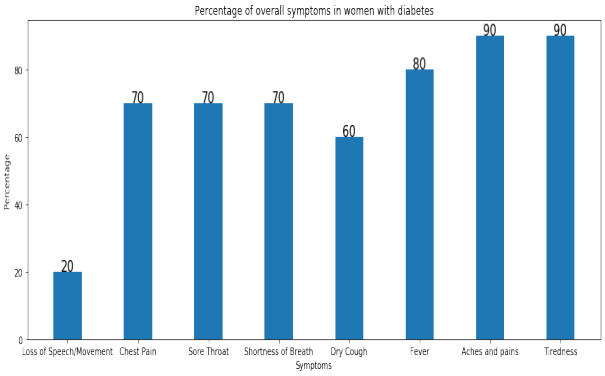

FIGURE 14. Chart counting percentage of symptoms in female patients who previously has asthma

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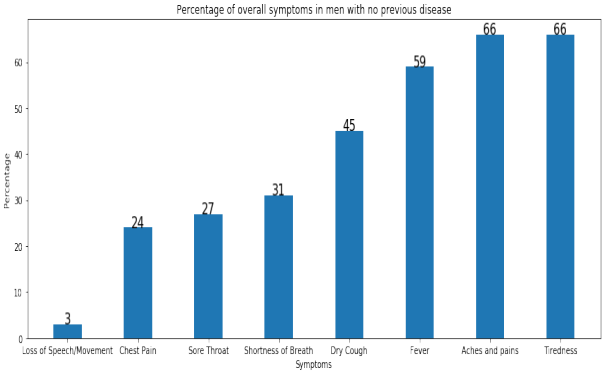

FIGURE 15. Chart counting percentage of symptoms in male patients who previously has no previous disease

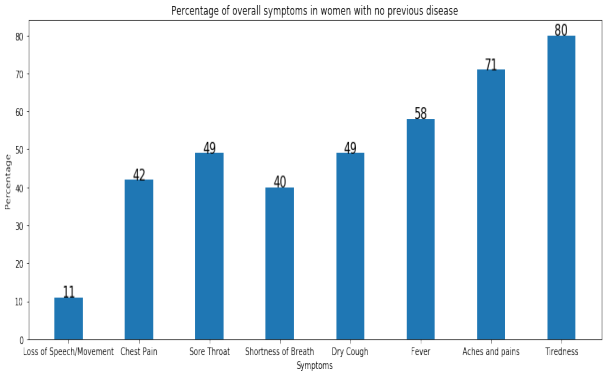

FIGURE 16. Chart counting percentage of symptoms in female patients who previously has no previous disease

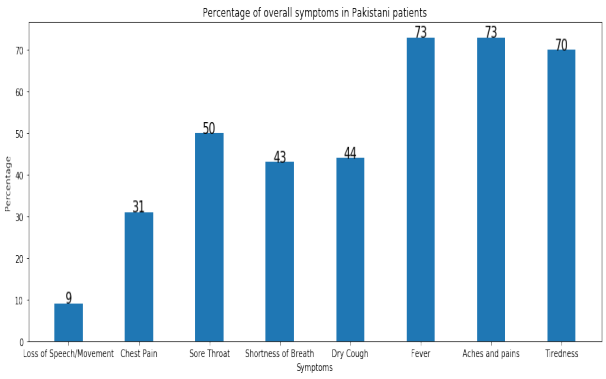

FIGURE 17. Chart counting percentage of symptoms of Pakistani patients

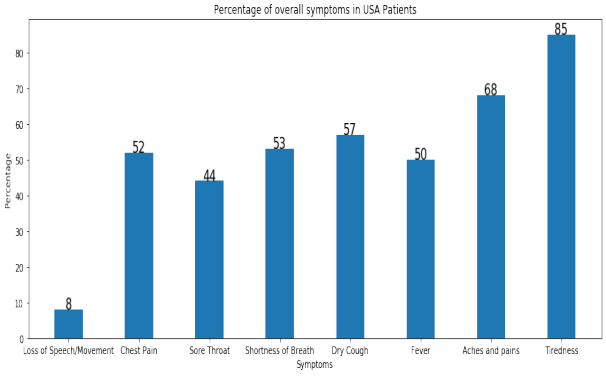

FIGURE 18. Chart counting percentage of symptoms of USA patients

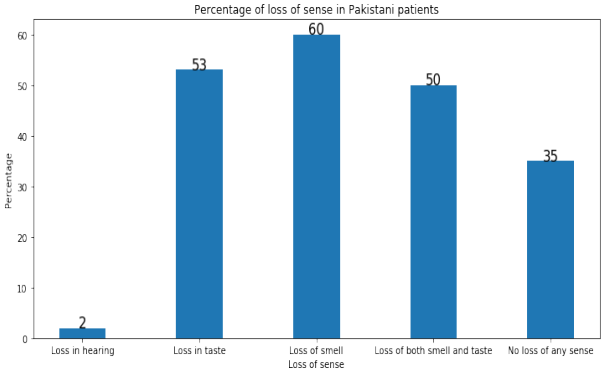

FIGURE 19. Chart showing loss of sense of Pakistani patients

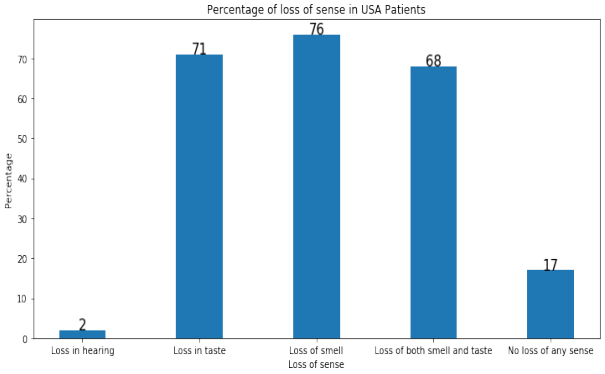

FIGURE 20. Chart showing loss of sense of USA patients

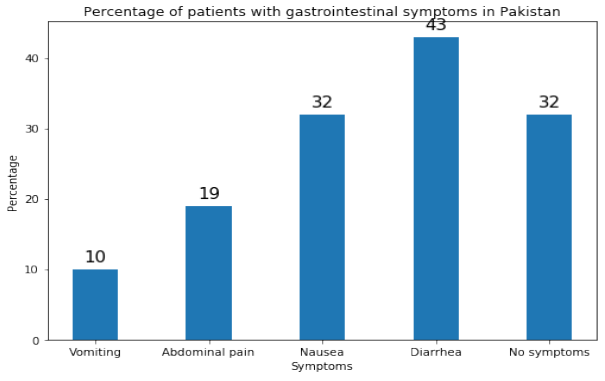

FIGURE 21. Chart showing gastrointestinal symptoms of Pakistani patients

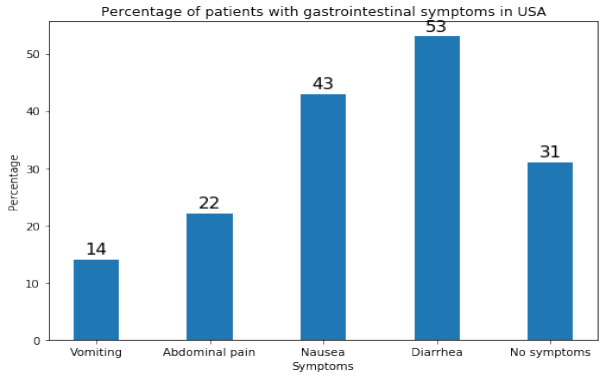

FIGURE 22. Chart showing gastrointestinal symptoms of USA patients