Mathematical analysis of Covid-19 in the union territory of Jammu and Kashmir

Arif Rashid[1], Bhawna Agrawal[2]

[1] M.Phil Research Scholar, Department of Mathematics, Rabindranath Tagore University, Madhya Pradesh, India
[2] Associate Professor, Department of Mathematics, Rabindranath Tagore University, Madhya Pradesh, India

Corresponding Author: **Arif rashid**

Abstract

Coronavirus- A deadly continuous spreading virus (Covid 19) engulfing almost all the nations of the world and is effecting human life and economy adversely. In the context of UT Jammu & Kashmir here are some mathematical models that can be used to show suspected, recovered and deceased coronavirus patients, as well as can be found how many peoples have been tested. Through various models, i,e SEQIR model, Susceptible–Infectious–Recovered (SIR), the dynamics model, deterministic compartmental model etc, different scenarios have been explored to understand the transmission of COVID-19, structures, and features, basic reproductive number, case-fatality rate, duration of epidemic, and significance of various prevention and intervention measures among the population and one of the most useful model is Susceptible–Infectious–Recovered (SIR), which are relevant for the containment, risk analysis, and features of COVID-19. The dynamics model of infectious diseases and the time series model is used to predict the trend and short-term prediction of the transmission of COVID-19, which will be conducive to the intervention and prevention of COVID-19 by departments at all levels in mainland China and buy more time for clinical trials. Deterministic compartmental model is used to study the spreading of COVID-19 and estimated the model parameters by fitting the model with reported data of ongoing pandemic in India.

In this research paper, we will briefly review some of the main above said models for mathematical planning, will also analyses Mathematically the present situation in the Union Territory of Jammu and Kashmir for confirming, active, recovered, and death cases with the aid of available data, and will focus on the infected people in the UT. Also, predict infected people in that UT in the next 30 days. The impact of preventive measures on daily infected-rate is discussed in the UT. We discuss a predictive mathematical model that can give us some idea of the fate of the virus indicative data, and future projections to understand the further course this pandemic can take the data can be used by the health care agencies, Government Organizations and the Planning Commission make suitable arrangements fight the pandemic. To manage the health care system in the present scenario of the mathematical model is preliminary at the regional level. Our finding shows that human-to-human contact is the potential cause of outbreaks of COVID-19. Thus, a reduction can be found by isolation of the infected human from the COVID-19 spread. Some effective cum preventive measures and their impact have also been studied. Predictions are given on the future trends of the virus transmission under some control measures. Finally, the positive measures to control the disease have been summarized in the conclusion section.

1. Introduction

Since the creation of humans on the face of soil, it has been their continuos endeavour to make the life comfortable and easy on one hand and haleand hearty on the other hand. Either individually or collectively man had to face life risks. To come out of that particular risk. The world has witnessed many pandemic and epidemic diseases too. But by virtue of his potentialities and the power of resistance he could defeat the disease and left room for others to survive and enjoy the bounties of life. Nowadays, the whole world is facing the same problem which was in last December 19 termed as COVID-19 (corona virus disease broke out in 2019). The disease has so far consumed almost more than 6 million people across the world.

The whole world is facing the problem since December 2019 till date. World health organization has confirmed around 4,634,152 cases from almost all the countries and territories of globe. The disease was first detected in around 1.3 billion people from India, on 30 January 2020.

The symptoms of all coronavirus patients are "suffering from a respiratory problem, fever, dry cough, etc. The disease is spreading mainly through air-travel mode. To control the disease spreading, screening of people at both ends: exit and the entry of every country is coducted.

Research teams including biologists, virologists, biotechnologists, and medical practitioners all over the world are trying to understand the biology, etiology, and epidemiology of the diseases. Mathematicians, data scientists, and statisticians have also contributed by proposing various models to predict the behavior of the epidemic in various environments. We used the software Mathematical to do predictive modelling based on the data that is presently available on the mortality due to the Pandemic Spread by Covid-19.

Mathematical science is an important tool in exploring the nature and impact of the spread of the Covid-19. Researchers are very relevant to the current situation. Against large-scale infectious diseases like COVID-19 mathematical epidemiology is playing an important role. This kind of research can forecast the progression of diseases, and can tease out the consequences of public health interventions. Researchers have statistical techniques to forecast the progression of diseases and to find "the probability of how fast the disease will spread."

The model Rempala and Tien have used for the COVID-19 pandemic. That model is called the SIR model (susceptible-infectious- recovered).

An SIR model gives data about disease and the reason behind its spread. But for the new disease, it sometimes fails. Around the COVID-19 pandemic foundation of calculus, statistics, and probability theory built by mathematical models which have been one of the driving forces behind policies.

A Mathematician Joe Tien said that "The hospitals need to know, roughly, do we have enough beds, do we have enough ventilators, and if we don't have some estimate of that we are really playing with fire. A virus had already spread out in China, Italy, South Korea, and other places by the time it reached the United States, the modelers had some clues.

Impala said one cannot calculate the total number of infected people in Ohio, but one can help the state plan or predictions can be done for hospital beds requirement in the emergency cases. In early March, when COVID-19 figured into their equations, there were no social distancing measures. Schools, restaurants, and hair salons were still open. Initially, models showed very high numbers of COVID-19 patients than after a policymaker propounded to stay-at-home, closed schools, and many businesses.

Mathematical models explain the transmission dynamics of COVID-19 and finding in the containment, risk analysis, and search for its cure. Some of the study models for the growth of COVID-19 in India have already been done such as Exponential Model and Logistic Model. While the calculation of basic-reproduction numbers has also been tried using the Susceptible-Infected-Recovered Model.

In this paper, we have tried briefly to review the SIR Epidemic Model to the Indian population to predict the future trend, the total number of possible infections in India in absence of any immunization/vaccination, and the time of peak infections in India. Also, to analyses the trajectory of total tests conducted in totally confirmed cases, total active cases, and total recoveries in India, the data is plotted into various line graphs.

Whereas this article aims to through light on the present situation in the Union Territory of Jammu and Kashmir and supports the action plan of physical distancing. Still, further studies are required to fulfill major gaps in our knowledge of the origin, epidemiology, duration of human transmission, virus evolution, and clinical spectrum and to predict the future trend, the total number of possible infections in the Union Territory of Jammu and Kashmir in absence of any immunization/vaccination, and the time of peak infections in India. Also, to analyse the trajectory of total tests conducted in aggregate confirmed cases, total active cases, and total recoveries in India, the data is plotted into various line graphs.

In the present sense, the Indian population can be divided into three large classes;
$I(t)$: The number of infectives
$S(t)$: The number of susceptible
$R(t)$: The number recovered (recovered, died, or naturally immune to the disease)

Clearly, $I(t)+S(t)+R(t) = N$,

Where *N is the population of India as a whole (*N itself is a variable but in this model is viewed as a constant due to the fact that the epidemic is short as a person's lifespan). This can be seen as a tri-compartment model (Figures 1 and 2). In the prevailing circumstances, our interest is to have a minimum $I(t)$.
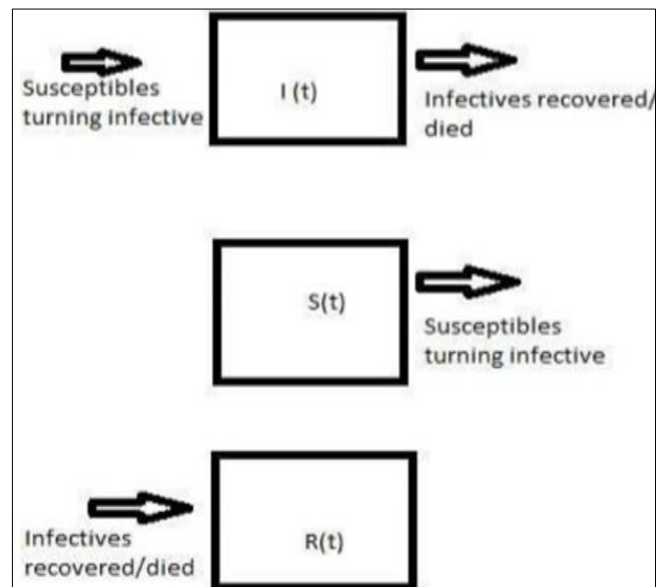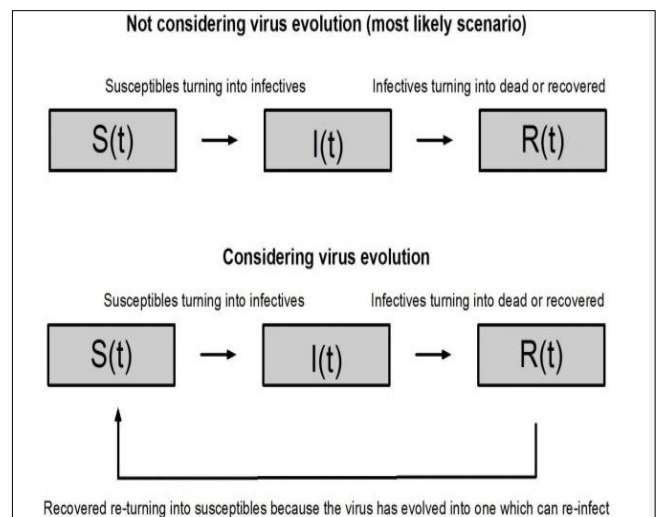

Fig 1

Fig 2

What is known about corona viruses indicates that the per capita rates of increase in the number of infectives are directly proportionate to the numbers of infestations that are prone to disease close the infectious one and that, thus, the overall intake in the first segment seems to be(kS) I.; where k signifies the rate of transmission indicated by the average number of people who will catch the virus from one infected person.

2. Mathematical models
(Panovska - Griffiths, 2020; Revathi & Rangnathan, 2020) in his research says Mathematical models helps in writing down a set of equations and also solving for specific values of the parameters within the equations. Whereas (Panovska - Griffiths, 2020) states that mathematical modeling simplifies reality and answers questions using subsets of data. Predictive mathematical models are essential for understanding the course of an epidemic. (Giordano *et al*., 2020) have written that Susceptible Infectious Recovered (SIR) models for the human-to-human transmission are the most commonly used models. (Nandal, 2020) told that modelers need to acquire at least one dataset with relevant data points. Where (Jewell, Lewnard, & Jewell, 2020) Predictive models could be problematic for large countries because they aggregate heterogeneous sub - epidemics. Thus Various factors affect model prediction (Jewell *et al*., 2020).

3. Mathematical formulation and analysis
Considering three growth models, namely, the logistic, the exponential, and the susceptible-infectious-susceptible (SIS) models, and finally develop a data-driven ensemble of predictions from the logistic and the exponential models. A model-free maximum daily infection-rate (DIR) is used over the last two weeks as weights.. To measure the success of the nationwide lockdown, the DIR is used. We jointly interpret the results from all model recent DIR values for each state and categorize the state as severe, moderate, or controlled.
Collection of epidemic data on COVID-19 predicts the epidemic situation, its effective control, also prevention methods. To study the law of infectious disease transmission, generally, three kinds of methods are used a dynamic model of infectious diseases, statistical modeling and time series analysis. To obtain information about data mining technology is used. This paper mainly compares the prediction effects of these mathematical models on the spread of the COVID-19 epidemic. In the spread of 2019-to to this stage, the dynamics model built is more suitable. Time series analysis is estimated to predict the development trend of an epidemic, peak size, etc. In the short-term statistical modeling is more accurately predict the value of data.

3.1 SEIR model
To analyze the epidemic models and predict, mathematics is considered as an essential tool. Presently susceptible - exposed-infectious-recovered (SEIR) model is one of the well-known models to exemplify the evolution of the deadly coronavirus [21, 22]. N is classified into four compartments are susceptible (S(t)), exposed (E(t)), infective (I(t)), and recovered (R(t)) peoples with coronavirus at time t.
Now, we have

$$\frac{dS(t)}{dt} = \mu S(t)I(t)$$

$$\frac{dE(t)}{dt} = \mu S(t)l(t) - \rho E(t)$$

$$\frac{dI(t)}{dt} = \rho E(t) - \iota I(t) \tag{1}$$

4. Statistical Models
At the UT level, in this research, we have shortly considered the exponential model, the logistic model and the Susceptible-Infectious-Susceptible (SIS) model for COVID-19 pandemic prediction. To predict epidemics of COVID-19 around the world, including China, Ebola outbreak in Bomi, Liberia models have already been used in (2014) [19, 20, 21].

4.1 Using the models in the State-level data:
The above three models will provide different prediction perspective for each state. The Cumulative number of infected peoples in the next 30 days, can be identified by the exponential model-based predictions. We can be forecasting from the exponential model as an estimate of the upper bound of the total number of infected people in the next 30 days. The forecast based on the logistic model would capture the impact of the preventive steps already taken by the respective state governments as well as the central government. The infection rate will be slow down in the future with an overall "S" type growth curve is detected by the assumption of the logistic model, whereas to reflect the effect of a major preventive SIS model is used to measures like the nation-wide 21-day lockdown from 25 March to 14 April 2020. The lockdown has been extended in two phases, first, till 3 May and then 17 May 2020 with some relaxation [22, 23]. The infection-rate parameter (β) can be the SIS model. The infection-rate parameter (β) is defined as the number of people infected per unit of time from an infected person. The effect of lockdown and other preventive measures to ensure social distancing this parameter is subject to change. When people are at home, the infection-rate is expected to be on the lower side.

4.2 Calculation using daily infection-rate and SIS Model during lockdown
We consider here two approaches to study the effect of lockdown and other preventive measures jointly in each state. Firstly plot the daily infection-rates for each state. The daily infection-rate (DIR) for a given day is defined as
DIR = Total active cases in the given day - Total active cases in the previous day
Total active cases in the previous day
A DIR value can be more than 1 also, particularly during the initial days of infection in a state. For instance, if the total number of active cases increases from 5 yesterday to 20 today, then (20-5)/5 = 3 is the DIR value. Whether the COVID-19 situation is under control or not in a specific state is by visual trends in infection rates. A condition in which infection rates have decreased over the last few days shows that the situation is improving. Infection rates could warn us that there could be under-reported instances of COVID-19. We need to search as soon as possible for infected-clusters. By using the SIS model only, we have considered four projected line-graphs of actively infected patients with different infection rates. For the estimation of the 25th, 50th, 75th, and 80th percentiles of the observed infection rates, the SIS model uses four distinct infection rates. The observed active infected patients over time can be plotted. A decreasing line-graph (red-line) of observed active infected patients can ensure that when all infected cases are reported/tested, interventions such as lockdown and social distance working can be assured. The numerous predicted lines may serve as reference frames, using the SIS model. Now to indicate whether the Government needs to enforce the social distancing more stringently. For example, actively infected patients are shown above the 75th percentile by the red-line shown in the plotted graph then there may need to

increase the lockdown period in a state.

5. Statistical Data

From 27 December 2020, in the last 24 hours of the Union Territory of Jammu and Kashmir, the officials told GNS, 10 new COVID 19 visitors were registered. Amongst them, the number of cases reached 120293, 81 of them from Kashmir Valley and 65 from Jammu Division. Srinagar has been registered in 34 cases: Baramulla 8, Budgam 12, Kupwara 14, Pulwama 8, Anantnag 4, Ganderbal 4, Kulgam 1, Shopian 1, Jammu 56, Udhampur 3, Rajouri 0, Doda 0. In addition, they reported that 275 more COVID-19 patients recovered and discharged 155 from Jammu Division and 120 from Kashmir from different hospitals. (GNS)

District wise Covid-19 cases in the Union Territory of Jammu and Kashmir, India as of December 27, 2020

Recoveries   Deaths   Active cases

District	Total Cases	Recoveries	Death	Active
Anantnag	4765	4575	83	107
Bandipora	4633	4495	60	78
Baramulla	7916	7613	171	132
Badgam	7555	7277	107	171
Doda	3377	3249	62	66
Ganderbal	4452	4303	43	106
Jammu	23528	22276	353	899
Kathua	3166	3056	48	62
Kishtwar	2717	2667	21	29
Kulgam	2655	2532	53	70
Kupwara	5499	5274	90	135
Poonch	2439	2391	23	25
Pulwama	5502	5237	88	177
Rajouri	3827	3566	54	207
Ramban	2094	2043	21	30
Reasi	1622	1559	14	49
Samba	2720	2462	38	220
Shopian	2488	2347	37	104
Srinagar	25114	24133	446	535
Udhampur	4068	3931	57	80
Total	120137	114986	1869	3282

Fig 3: Union Territory of Jammu and Kashmir scenario in India as on December 27, 2020 is as under
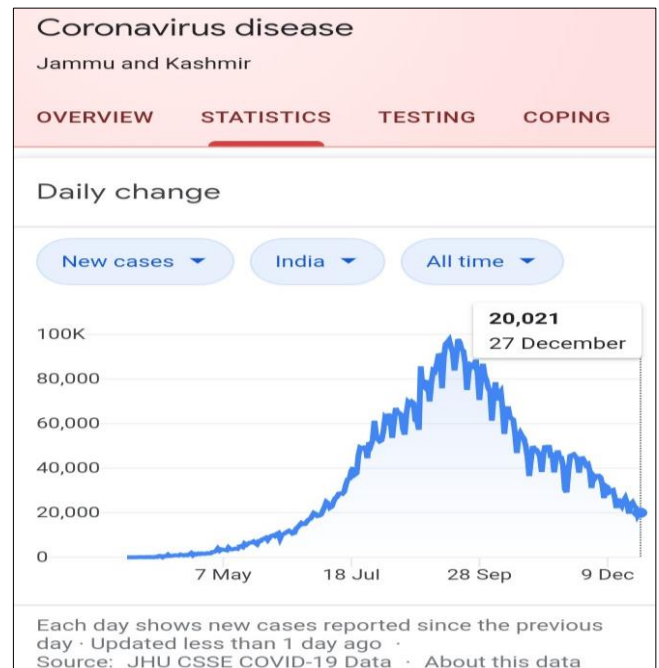

Fig 4: Total number of new cases Sofar

Fig 5: Total number of deaths so far

Fig 6: Total number of cases, recovered and deaths in the Union Territory of Jammu and Kashmir

6. Results and Analysis

We find about the UT namely the Union Territory of Jammu and Kashmir, we also tabulate actual predicted numbers from various models for the UT. All the R2 values corresponding to the logistic and the exponential models are above 0.90, indicating a reasonable goodness of fit.

6.1 Covid-19 cases in the union territory of Jammu and Kashmir

On 30 January 2020, first case of the COVID-19 pandemic was reported in India, which was originated from China. Then after Slowly, the pandemic gets spread to various states and union territories. Even the COVID-19 pandemic get to spread the union territory of Jammu & Kashmir. Initially,

only 02 suspected cases with high virus load were detected. Both the cases were isolated on 4 March in Government Medical College, Jammu. On 9 March 2020, the first confirmed positive case was declared. Both of them had a travel history to Iran [1].

The harmfulness of COVID-19 is so high that up to 11th May, 2020 nearly forty two lacks people have been infected among which 2,87,131 are died all over the world [21]. As the disease is spreading through interaction and no proper medicine is available till now, so maintaining social distancing and reducing interaction among the people is the only way to control the spreading of the disease. To maintain interaction among the people China Government adopted the lock-down policy and is able to control the spreading of the disease [22, 23]. Following China almost every country has been now adopting this policy. The quarantine is another step to manage this infection. The best measure for containing the outbreak is quarantine. If any COVID-19 positive case is identified then that person should be immediately hospitalized and his family members should be immediately quarantined along with their COVID-19 testing. Moreover, all the persons who have come to the infected person should also be home quarantined for at least 14 days to avoid spreading of the disease.

6.2 Symptoms of Corona Virus

Union Territory of Jammu and Kashmir, like the rest of the world, is impacted by the Covid-19 pandemic and is under lockdown. The first COVID-19 positive case in the Union Territory of Jammu and Kashmir was reported on Mar 18, 2020. Its symptoms may cause fever, cough and shortness of breath besides fatigue, dizziness and nausea. It weakness the entire immune system of humans and turned into pneumonia or bronchitis. The cases are found in all genders irrespective of ages-old adults and children have been infected. Through contact from an infected person to a healthy one, can spread COVID-19. It is to be confirmed that animals have any role in its spread. It is said to spread through.

1. The contact with certain bodily fluids, such as droplets in a cough.
2. Touching body parts like nose ear or eyes after coming in contact with anything touched by an infected person.

6.3 Model prediction and some preventive measures

In this section we will discuss the Indian model prediction and look at the preventive step to monitor COVID-19 in India. The model parameter d indicates the share of the population that holds the social distance from others (or stay at home in safe). We estimate that 67.38% of the population retain the social distance in the lockdown era from other individuals. On the fig.8. We have presented the predicted model of the total outcome and the pandemic high prevalence of d for the entire prevalence period. It is evident from the figures that the disease can be managed easily if 80% of people follow the lockdown model effect. Therefore, the management should be strict to properly impose the lockdown to contain the disease. Because only 20% or less of people do not obey the lockout, the disease can be regulated according to our Model Prediction. Therefore, only people with administrative facilities, food and medication will leave the lockdown.
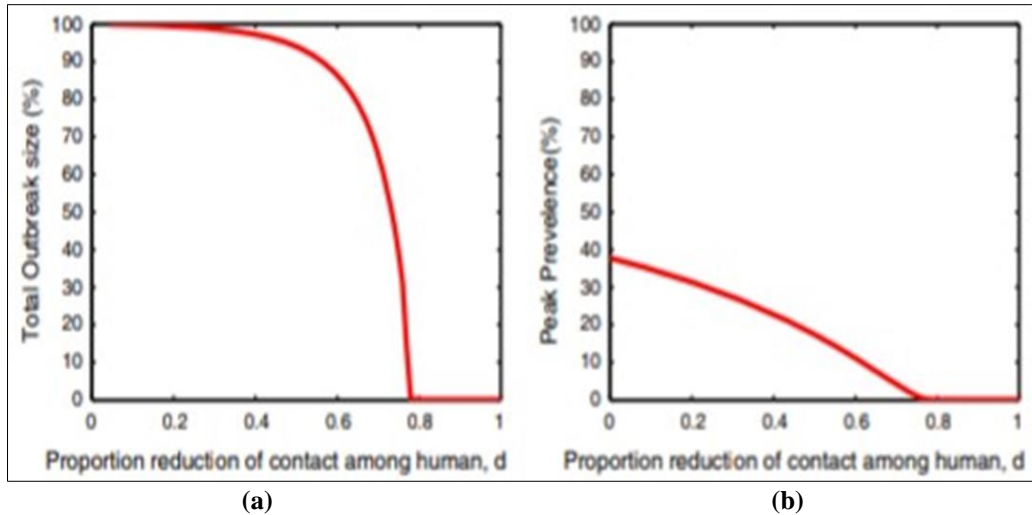
(a) **(b)**

Fig 7: (a) Total outbreak size and (b) Peak prevalence during the pandemic predicted by the model versus the lock-down parameter d.

6.4 Programme for maintaining safe distancing and successful lock-down

On Mar 19, 2020, lockdown was imposed in many parts of Kashmir. As per the latest information by the Govt. of Jammu and Kashmirabat, 844 confirmed cases, 400 recoveries and 9 deaths of the coronavirus disease were found till 12 May 2020. More in Kashmir valley is effected by coronavirus disease.

WHO provided an advisory to all the countries regarding "COVID 19 is a new disease, still learning how it spreads. Infection of the respiratory virus may occur through touch (direct or indirect), droplet spray (short-range transmission), aerosol spray (long-range transmission). Firstly, the administration has released Rs.27 crore under the State Disaster Response Fund (SDRF) for COVID-19 relief. The government has declared to convert 11 major hospitals into COVID-19 sanatorium.

6.5 Analysis of the Union Territory of Jammu and Kashmir and prediction report

Three hundred cumulative cases of infection were found so far in the northernmost state of Jammu and Kashmir. The line graph of active, infected patients observed (red line, 4th panel) was well below 75% of regular infected patients observed ($\beta = 0.35$). The regular rate of infection seems to decrease after 9 April. DIR values are sometimes influenced by certain spikes. This may be due to many unreported cases which even in the lock down period allow infection to spread. The daily rate of infection in the last two weeks is between -0.02 and 0.09.

In this portion, we depend on exponential, logistic and SIS inputs along with regular state infection rates. Recalling the famous statistician George Box's word, "All models are false, but some are useful," we jointly interpret the findings from various models. The state with at least 300 total infected cases is considered. We display four graphs for the state. Until 1 May 2020, we used the government info. The first and second diagrams are based on the logistic and the exponential models, with the forecasts for the following 30 days. The third diagram is the diagram of a regular condition. Finally, the fourth graph shows the development of active patients with SIS ("pred") model prediction and active patients observed.
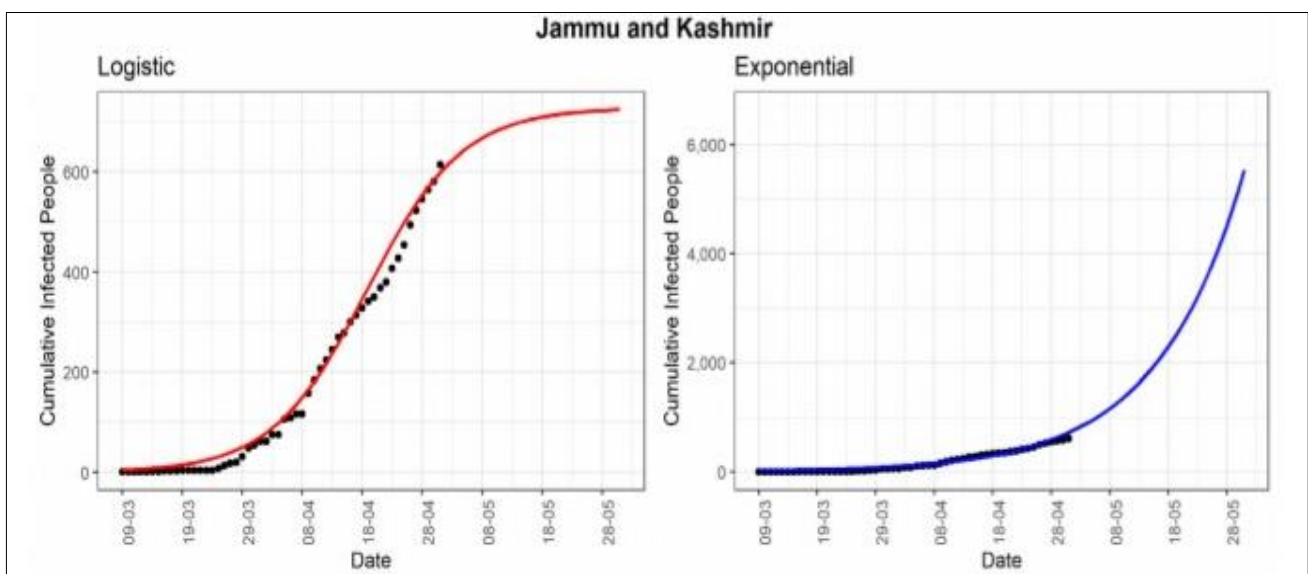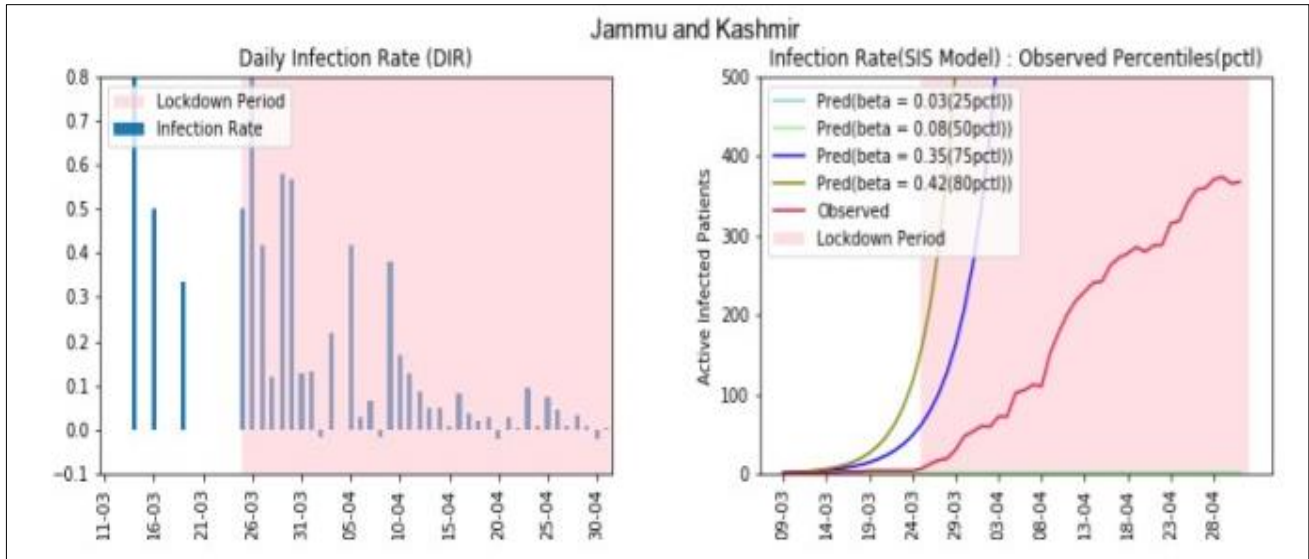
Fig 8: UT of Jammu and Kashmir, with a nearly declining DIR trend. UT with non-decreasing DIRs need to do even more urgently to tackle the COVID-19 pandemic in terms of preventive steps.

Flattening the curve
The dramatic rise in the number of cases per daily has shown a rapidly increasing epidemic. Efforts to minimise the spread, by slowing transmission, of the disease lead to a more gradual increase in the number of cases, a plateau period, and finally a decline in the number of cases reported daily. If so many people seek medical services at once, the capability of the health system can be overwhelmed. It is also necessary to note that each of us has a role to play in flattening the curve.

Given these impressions from all over the world, it is worth investigating where Cashmir was in the outbreak of COVID-19.
The following is a map contrasting Kashmir with some countries leading positively to COVID-19. Since every area is divided differently in the outbreak, the graph below only allows us to look at the situation more broadly and offers no detail about a region that is more likely than others.
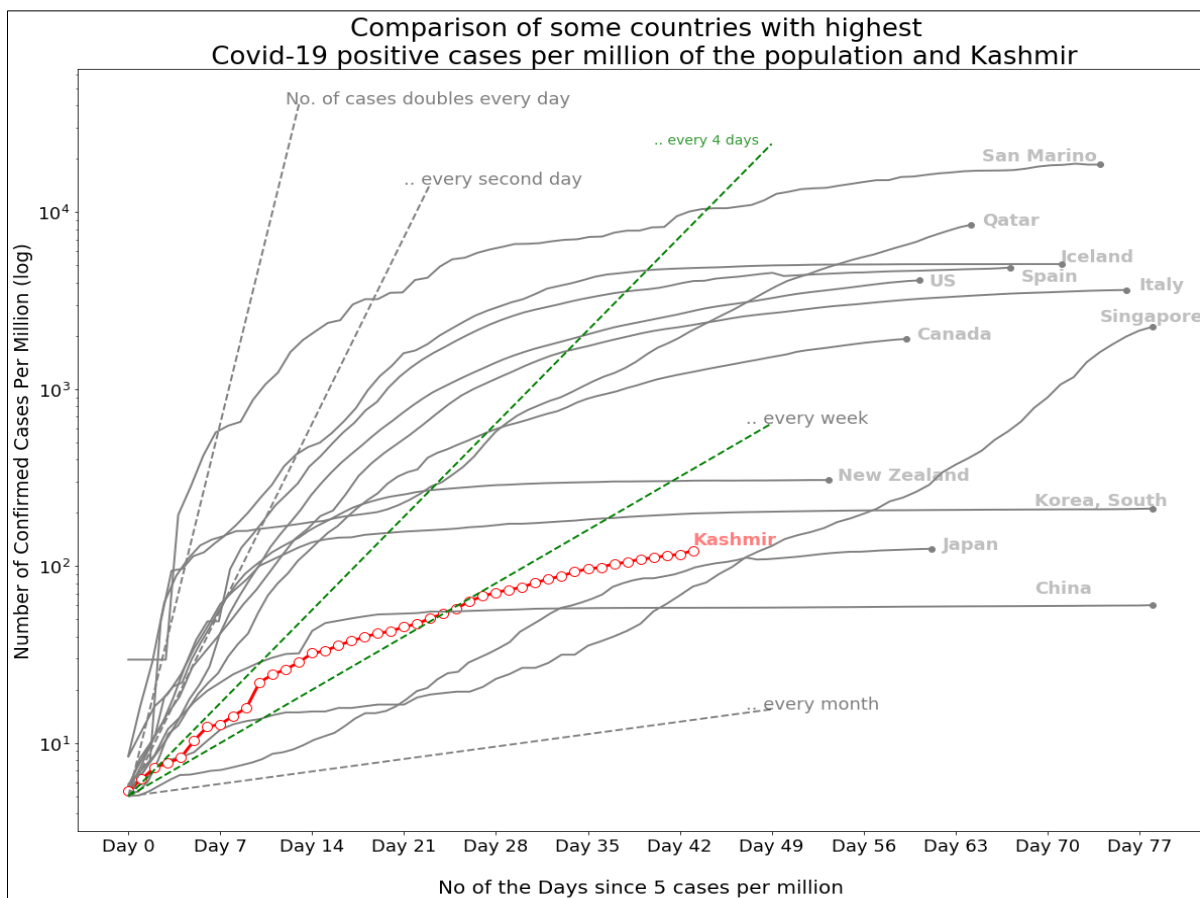
Data Source: Global COVID-19 data — The Johns Hopkins University of Medicine COVID-19 data repository, Kashmir COVID-19 data — Department of Information and Public Relations, Govt of Jammu & Kashmir (downloaded using covid kashmir.org's API); Data up to date till May 12, 2020

Fig 9

Technical details about the plot
1. X-Axis: No of days after of country 5 positive cases per million inhabitants.
2. Log scale (y-axis): No of the positive COVID-19 cases per million.

This chart shows the pattern of outbreaks in different regions in regular new COVID-19 cases. For each area, the data point begins with the total dailies of COVID-19 positive cases per million crossed five and continues to the most recent data. In the case of Kashmir, for example, the data will start on 30 March 2020 (first reported COVID-19 positive cases per million > 5) and end on 12 May 2020.

Key Takeaways
1. Positive cases per million are still rising. The initial trend wasn't as steep as many other regions (or it could also be that enough testing wasn't happening, or testing wasn't hitting the right target population-more on this in later sections).
2. Even if there wasn't a steep trend in the number of positive cases per million initially, the number has increased nearly 1.4 times (87.97 cases per million on May 2, 2020, to 122.52 cases per million on May 12, 2020). And has nearly doubled since April 24, 2020 (57.63 cases per million on April 24, 2020, to 122.52 cases per million on May 12, 2020).
3. As the number of new regular cases identified starts to decrease steadily, the curve for Kashmir will "flatten." For the new cases found every day, there are actually erroneous numbers between 15-45.
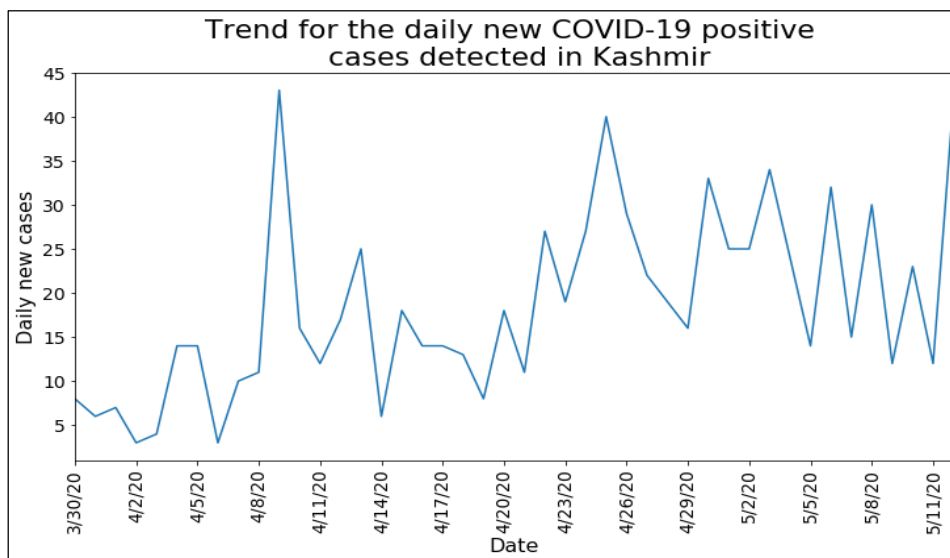
Data Source: Department of Information and Public Relations, Govt of Jammu & Kashmir, downloaded using covid kashmir.org's API. Data up to date till May 12, 2020

Fig 10

However, more cases are not inherently equal to higher risks for any field alone. It means that the assessments are more open or more detailed. Instead, the key is to decrease the infection rate (RO) and ultimately the number of cases reported everyday. This results in a plateau phase.

6.6 Testing
Note: There are no research data available for the Kashmir Valley alone. The numbers mentioned in this section are therefore collectively for Jammu & Kashmir unless otherwise specified.
At the opening address on 16 March 2020 at the COVID-19 briefing in the media, the Director-General confirmed that the COVID-19 response is backed by a rapid escalation of social distance, testing, isolation and contact tracking.
Untested or unaware of who is contaminated, the pathogens will spread to the health system, which would undetected

eventually.
Is the test data accessible in various regions comparable?
The incoherence and unreliability of the information cannot provide us with the exact picture of the disease spread or of the test situation, as mentioned above. The study in this section is only carried out to enhance the comprehension of the test numbers only for Union Territory of Jammu and Kashmir and for the rest of the world. The study can also lead us to understand whether J&K has taken sufficient testing actions and whether testing needs to be expanded immediately.
This study aims to focus on a fascinating connection when we take South Korea, New Zealand, and Iceland as exemplary regions, with a good flattening of their curves — in positive cases so far and in the quantity of research, how do J&K apply this to these regions?
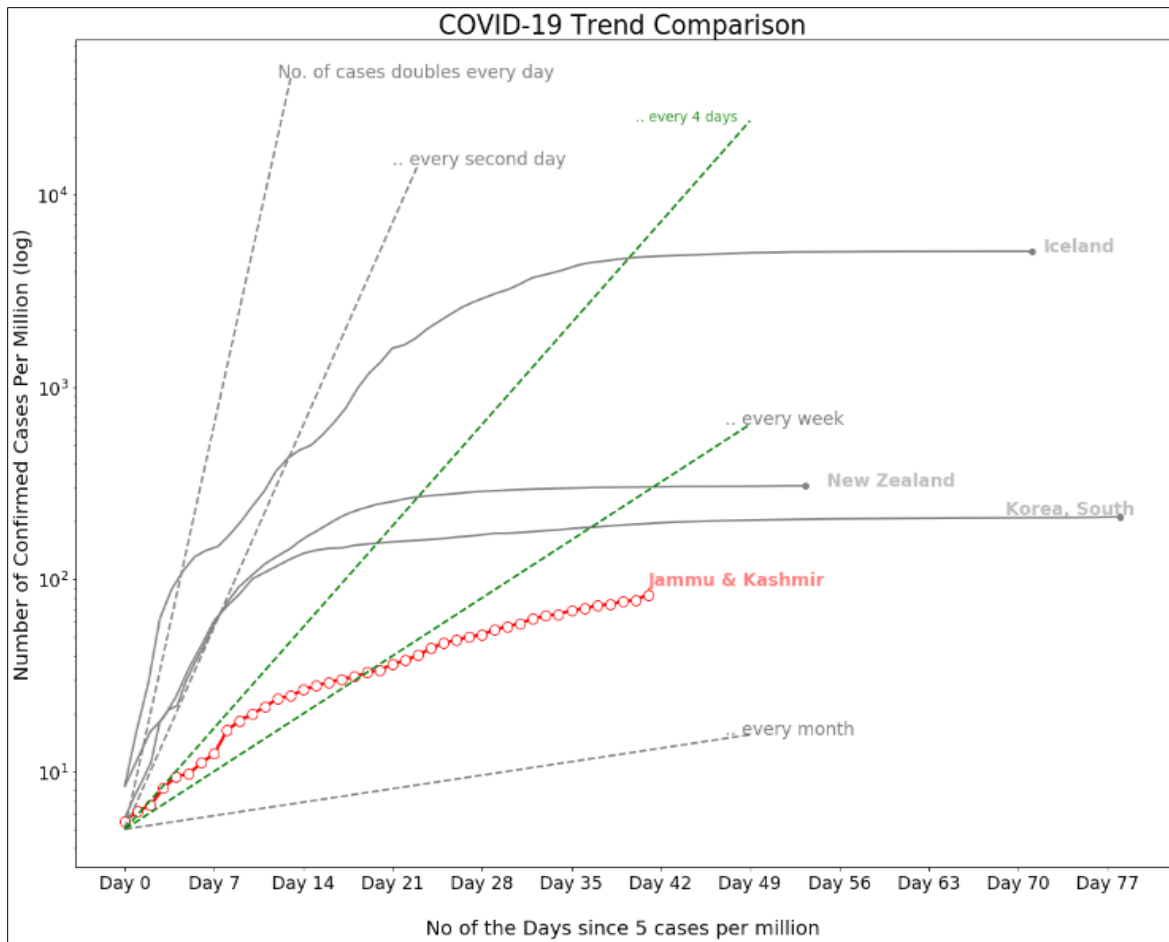
Data Source: Global COVID-19 data — The Johns Hopkins University of Medicine COVID-19 data repository, Kashmir COVID-19 data-Department of Information and Public Relations, Govt of Jammu & Kashmir (downloaded using covidkashmir.org's API); Data up to date till May 12, 2020.

Fig 11

From this graph

The new COVID-19 cases of J&K appear to be still on a steady rise every day.

In any given day the total number of COVID-19 cases is lower than the other regions shown, which is good. However, this is only known in cases tested and reported to date.

The pandemic was relatively early in South Korea and New Zealander. As of May 12, 2020, COVID-19 case per million in J&K is 82.90 and whether the trend will move towards a flatter path or whether the cases will continue to rise remains to be seen.

The number of tests conducted is an important point which the above plot doesn't reveal. particularly in the early stage of the outbreak (since the spread is exponential, and once the initial window of mass testing and isolation is lost, the outbreak numbers rise in no time).
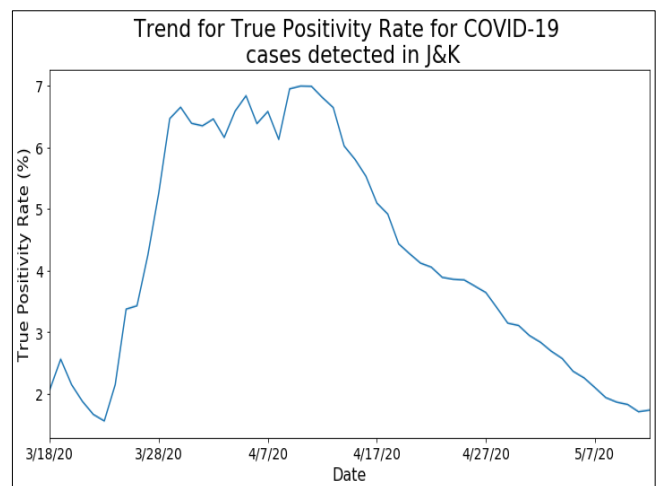
True Positivity Rate

As per the latest data from the Govt. of J&K, a total of 53726 samples have been collected, out of which 52792 are negative and 934 are positive in J&K.

True positivity rate = total positive / total tested * 100 = 1.74%.

In other words, nearly one in 57 people who were tested for

the novel coronavirus till May 12, 2020, in J&K was found to have it.

Data Source: Department of Information and Public Relations, Govt of Jammu & Kashmir, downloaded using covidkashmir.org's API. Data up to date till May 12, 2020

Fig 12

The true positive rate (TPR) has been consistently declining as the testing in J&K has escalated. On 12 May 2020, the real positive rate of 1.74% is relatively low and either suggests:

- Low level of outbreak COVID-19
- False individuals are tested
- The quality test is not good (or the sampling technique)

The true positivity rate in any field is however different from the percentage of the positive COVID-19 cases. A predominance metric is used to track the actual no of cases. Since tests cannot maintain the spread of the virus, many positive cases remain undetected and remain active carriers. Increased numbers of people are infected from these undetected cases and the prevalent population is thus growing.

J&K conducted 4.77 tests per thousand people with an actual positive rate of 1.74% by 12 May 2020. The region can quickly stop the spread of the virus if the population is tested and if these hypotheses and trends are continued to be true for future testing. However, if the population tested lacks active carriers, the new cases will continue daily.

In a summary, for the metrics, such as total detected cases, total detected cases per million, total tests, total tests per million or the test positivity rate at a given moment, a region with a high or low risk or a good/bad response to the virus may not necessarily be indicated. Instead, in a certain region, a test pool is a better indicator of good virus reaction that targets the prevalence that equals at the same time.

6.7 Coronavirus testing facilities in the Union Territory of Jammu and Kashmir

With almost 3,500 being tests per day, the Jammu and Kashmir administration has expanded its sampling and testing facilities. A combination of containment and mitigation measures have been taken by the administration to stop the spread of the COVID-19 pandemic through contact tracking and travel restriction and quarantining. The administration ensures that every person who comes back from other states is tested and quarantined in their home district in a designated quarantine centre. To facilitate testing, the government has already created test laboratories in several places including: SKIMS Soura, Srinagar, 92 Base Hospital, Badami Bagh, GMC Srinagar, CD Hospital Dalgate, District Hospital Shopian, Command Hospital (NC) Udhampur and GMC Jammu, District Hospital Kulgam, GMC Rajouri, GMC Anantnag, District Hospital Ramban, Department of Laboratory Medicine, Narayana Vaishno Devi Superspeciality Hospital, Military Command Hospital Udhampur, GMC Doda, GMC Udhampur, Composite Hospital Department of Pathology.

The measures taken by the government of J&K (UT) to deal with and prevent the disease are as follows:
1. Implement lock down in letter and spirit.
2. Setting up of isolation wards.
3. Deputing rapid response teams in all districts.
4. To make adequate availability of mask and personal protection equipments.
5. Gearing up the health machinery especially doctors, paramedics and associated staff whose contribution is immense.
6. And setting up of calls centres (Covid-19, Centres) in all districts.

6.8 How to tackle Covid-19

Below are the points that can be taken into account.
1. Maintaining personal hygiene which includes sanitizing hands with soaps and running water, avoid touching things unnecessarily not to spit in public places
2. Persons suffering from influenza & Common Cold like illness should consult doctors immediately duly covering their nose, mouth with mask
3. Covering of nose and mouth with tissue paper when coughing and sneezing.
4. Some body in close contact with person suspected with corona virus or have just returned from foreign countries or place inflicted with virus, needs home isolation
5. Dispose of used tissue paper in a closed dust bin and avoid crowded atmosphere
6. Avoid meeting people having cough fever and avoid touching body parts such as eyes, nose or mouth with untidy hands
7. Personal Protection Equipment (PPE) kits are must for person dealing with the patients
8. Avoid unnecessarily travel and as far as possible confine to homes.

A rapid process worldwide is underway to identify the vaccine that could be used to cure the new disease - Covid 19.The possible vaccine is developing a protocol that can be summed up in ten steps.
1. Research
2. Pre- Clinical Pilot Survey
3. Phase one trail-Test on a few people.
4. Phase two –Test on few hundred
5. Phase three-Trail on thousands
6. Creating Infrastructure
7. Manufacturing
8. Approval from Food and Drug Administration (FDA)
9. Distribution
10. Final Immuni
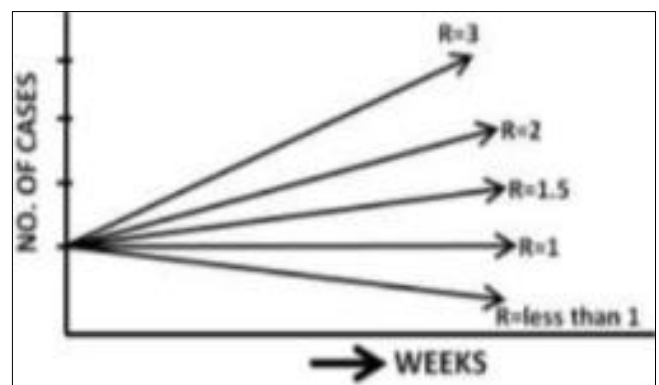
Source: New York Times

Fig 13

In his NDTV interview, Prof. Sitabhra Sinha stated, that R factor has got to manage, where R is the average number of people infected by one person, until the vaccine is ready. The measures are precautionary. Roy M Anderson and Robert May [9] say if May (1991)
R>1 more gets infectious
R=1 the control
R<1 is disease enhancement.

R allows us to decide when immunity of the herd is reached. (R-1)/R is the proportion of people who have to be infected to achieve herd immunity within the population.
The experts think it would have been more than forty times higher without lockdown of the Corona Virus cases. Dr. J Shah's expert opinion indicates that state government, union

territory particularly and the whole country needs a detailed and intelligent overall strategy, otherwise we will have a 12 to 18 month Corona virus. The government should take many holistic initiatives and announce important plans to improve the morale and economic burden of the masses.

7. Conclusion
The COVID-19 pandemic is a global threat to the general public and health workers. However, there is still little information about this new virus, but substantial progress is currently being made in research worldwide.

The government asked the authorities not to generate fear among the people and further demanded that they deal with the COVID-19 cases as a first priority. Initially, the government set up district level call centres to disseminate information on suspected patients with the corona virus. Besides this, through electronic media, the government can announce some big plans to raise their morale and relieve them from any kind of stress. The government has also taken steps to set up research centres and designated hospital isolation blocks. For individuals who are not pursuing the Advisory Government, stringent sanctions have been declared. The moral of frontline employees (such as medical and paramedics professionals, nursing personnel, cleaning staff and hospitals and centres of healthcare) who communicate directly with patients must be strengthened.

In this survey we analyse the brief evolution and development of COVID-19 particularly within UT of J&K, India, in order to demonstrate the exponential increase in this crucial period. An extent to understand developments and anticipate their growth in Union Territory of Jammu and Kashmir, India, is shown in some interesting and simulatory details about COVID-19. The bar sections are drowned to show how many people have been reported, involved, recuperated and death with the latest virus contagion in the current situation and epidemiology in the Union Territory of Jammu and Kashmir, India. In order for us to understand the present day-to-day satiation, an exponential increase in reported, recovered and deaths from 27 December are captured.

By 11 May 2020, almost 40 two people were not contaminated, 2.87,131 of whom have died worldwide [21], the dangerous existence of COVID-19 is so huge.

J&K had 82.90 COVID-19 positive cases for every million people by 12 May 2020.

The ability of testing increases daily, and the true positive rate is constantly diminishing. However, there has been no downward trend in the overall number of new positive cases that are registered, essential to flatten up the curve.

It looks like the Union Territory of Jammu and Kashmir have done a good job to control the proliferation of the latest coronavirus, according to the population recorded and checked on 12 May 2020! But every day is a new fight and every time the curve is up. Increased research will therefore assess in the coming weeks the situation for shifting the paradigm towards a sustained flattening of the curve, with a fair decline in the number of new/active cases.

Finally, the COVID-19 effect might not be the most significant to analyse in our analysis. Prior studies on students who were displaced by Hurricane Katrina found that the months following the hurricane showed trouble focusing and also showed depressive symptoms. It will be important to consider these consequences and how best to support the social and emotional needs of students after the huge interruption of COVID-19. Many students may experience increased food insecurity, loss of family income, losses of coronavirus members and the fear of capturing the virus.

Interdisciplinary teams should work together to establish a clear plan for this reason. Vaccines for which funding, infrastructure and appropriate facilities are required must be established by research teams. Covid-19 thus recalls that science cannot sit back and medical treatment, education and research should always be at the top of our agenda. Trust in science and scientists and optimism at this point is necessary for India to emerge as a winner in the war.

By continuing its study, J&K had reached a total number of 120293 by December 27, 2020.

It is still too early to tell how COVID-19 would impact new mathematical findings. However, improvements are inevitable in an environment that values social contact so much.

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