

## **Covid-19: An Evaluative Study with Specific Reference to Andhra Pradesh**

**SriViraja Rani. J\*, Babavali. N\*\*, Siva Rama Krishna.B\*\*\***

\*Research Assistant, Centre for Study of Social Exclusion and Inclusive Policy, Andhra University, Visakhapatnam-530 003

\*\* Research Assistant, Centre for Study of Social Exclusion and Inclusive Policy, Andhra University, Visakhapatnam-530 003

\*\*\*Assistant Director, Centre for Study of Social Exclusion and Inclusive Policy, Andhra University, Visakhapatnam-530 003

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**Abstract:** Coronavirus (COVID-19) is an infectious disease caused by severe acute respiratory syndrome identified in December 2019 in China. The World Health Organization declared this newly identified pathogen in humans in the 21<sup>st</sup> century as a global pandemic. This disease has a devastating effect on human lives, socially, economically, and psychologically with a greater impact on women, children, the elderly and informal workers and their families. The incidence varies with age, sex, health condition, immunity level, residence and density. The first case of coronavirus in India was reported on 30<sup>th</sup> January, 2020 in Kerala and the number of infections had grown rapidly with an exponential rise in testing facilities. India is the second most affected coronavirus nation in the world. The secondary data revealed that, about three-fifths of COVID cases in India have come from five states, namely, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, and Uttar Pradesh. Andhra Pradesh stands in second position in respect of Covid cases (7,10,119) and the number deaths reported were 5941 as on 3<sup>rd</sup> October,2020. This paper discusses the COVID-19 situation across the world, India in general and the State of Andhra Pradesh in particular. The paper is based on the secondary data from the WHO, government websites like Ministry of Health and Family Welfare GOI, Ministry of Health and Family Welfare, Andhra Pradesh, articles in dailies, scientific and other academic sources. The Government of India and state governments had initiated several measures such as lockdown, physical distancing, personal hygiene, sanitation, self isolation and quarantine to mitigate the disease burden. The other measures taken by the government include establishment of testing facilities, COVID care centers with all facilities, distribution of free ration to poor families and financial assistance to eligible below poverty line families and financial aid setting up of special shelters in urban areas, farmers' markets and ambulance services.

**Keywords:** Andhra Pradesh , Case Fatality rate ,Coronavirus, , Doubling Time, Positivity Rate, Recovery rate.

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### **I. Introduction**

Coronavirus (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was first identified in December 2019 in Wuhan in China, and has been declared as a Global Pandemic by the World Health Organization [1]. It is a newly identified pathogen; had not previously been identified in humans, and there is no known pre-existing immunity in humans. The people are unknown about its epidemiology, clinical features and diagnosis, risk factors, prevention and control measures. In February 2020, the International Committee on Taxonomy of Viruses and the World Health Organization announced official names for both the virus and the disease it causes: SARS-CoV-2 and COVID-19, respectively. The name of the disease is derived from the words *corona*, *virus*, and *disease*, while the number 19 represents the year that it emerged. Coronaviruses are a group of viruses that can be categorized into four genera namely,  $\alpha$ -,  $\beta$ -,  $\gamma$ -, and  $\delta$ . SARS-CoV-2 belongs to  $\beta$  corona viruses. Symptoms of COVID-19 resemble that of the common cold, with fever, coughing, sputum production, and shortness of breath spread via cough and sneezing of droplets expelled into the air by infected persons. In the twentieth century, the human civilization has experienced five pandemics namely, H1N1 in 2009, Polio in 2014, Ebola (outbreak in West Africa in 2014), Zika (2016) and Ebola (Democratic Republic of Congo in 2019). Subsequently, COVID-19 outbreak has been declared as the sixth public health emergency of international concern on 30<sup>th</sup> January 2020 by the WHO. These worldwide outbreaks triggered a large number of fatalities, morbidities, and cost billions of dollars [2],[3]. Compared to other diseases and their respective burdens, COVID-19 is likely to cause greater

human suffering than other contagious diseases in the world. This disease has a devastating effect on human activities, socially, economically, and psychologically with a greater impact on women children, the elderly and informal workers and their families. The incidence varies with age, sex, health condition, immunity level, residence and density. The governments across the world have found the measures such as lockdown, physical distancing, personal hygiene, sanitation, self-isolation and quarantine to mitigate the disease burden.

In the present paper, we aim to discuss the COVID-19 situation with reference to some countries across the globe, India in general and Andhra Pradesh state in specific. An attempt has also been made to discuss the preventive measures taken by state of Andhra Pradesh (AP). This paper is based on secondary data that has been collected from WHO, and Government websites like Ministry of Health and Family welfare, Government of India (GOI), Government of AP and articles from several academic/non-academic sources including news websites etc.

## II. Covid-19 In The World

As of October 3rd, 2020, the outbreak had spread to six continents, and approximately 215 countries and territories worldwide have been affected by the COVID-19. The virus had infected over 34 million people worldwide, and 1,025,729 million people had died after contracting the respiratory disease. The virus is highly transmissible, and thousands of new cases are being reported around the world each day. The most severely affected countries include the U.S., India, Brazil, and Mexico.

**Table: 1 COVID-19 pandemic top ten countries in the World (as on 3.10.2020)**

Name of the Country	Population	Total infections	Cases cumulative total per 1million population	Deaths	Deaths cumulative total per 1million population	Crude Case fatality Rate (CFR)	Transmission classification
Total (worldwide)	7,794,798,739	34,495,176	4,418.33	1,025,729	131.397	2.97	
USA	331,002,651	7,206,769	21,772.54	206,558	624.04	2.86	Community transmission
India	1,380,004,385	6,473,544	4,690.96	100,842	73.07	1.55	Clusters of cases
Brazil	212,559,417	4,847,092	22,803.47	144,680	680.66	2.98	Community transmission
Russia	145,934,462	1,204,502	8,253.72	21,251	145.62	1.76	Clusters of cases
Colombia	50,882,891	835,339	16,416.89	26,196	514.83	3.13	Community transmission
Peru	32,971,854	818,297	24,818.05	32,535	986.75	3.97	Community transmission
Spain	46,754,778	789,932	16,926.41	32,086	686.26	4.06	Clusters of cases
Argentina	45,195,774	765,002	16,926.41	20,288	448.89	2.65	Community transmission
Mexico	128,932,753	748,315	5,803.92	78,078	605.57	10.43	Community transmission
South Africa	59,308,690	677,833	11,429.9	16,909	285.1	2.49	Community transmission

Source: [4]

The US accounted for the world’s highest number of cases and deaths at 7,206,769 and 206,558 respectively as on 3.10.2020. India is now the second most corona-affected country with its total corona cases standing at 6,473,544 and 100,842 deaths(see Table 1). Third, in the list of worst affected countries is Brazil which has 4,847,092 confirmed cases and 144,680 deaths due to coronavirus. Russia reported 1,204,502 cases of coronavirus infections and 21,251 deaths. Colombia crossed the 835,339 cases and the death toll is 26,196. Peru reported 818,297 total COVID cases and death toll due to coronavirus stands at 32,535. Spain is now

seventh in the line of worst affected countries with 789,932 confirmed cases and 32,086 deaths. Argentina's total active infections stood at 765,002 and the death toll rose to 20,288. Mexico is now ninth in the line of worst affected countries. There have been 748,315 confirmed cases and 78,078 deaths of coronavirus. South Africa has a total of 677,833 confirmed cases and 16,909 deaths. Globally, the Crude Case Fatality Rate (CFR) stands at 2.97% as on 3.10.2020. Comparative data found that the CFR of India is 1.55% followed by Russia (1.76%), Argentina (2.65%), South Africa (2.49%) and USA (2.86%). Brazil (2.98%) stands lower than the world average. While countries like Mexico (10.43%), Spain (4.06%), Peru (3.97%) and Colombia (3.13%) have recorded CFR above global average. However, 51.68% global deaths come from America (20.13%), Brazil (14.10%), India (9.83%), and Mexico (7.61%). The deaths per million population in the world is 131.39, while India and Russia reported 73.07 and 145.62 deaths per million populations. The comparative figure for Peru, Spain, Brazil and USA is 986.75, 686.26, 680.66 and 624.04 deaths per million populations, respectively. Among top 10 case load countries in the world, cluster of cases were identified in India, Russia, and Spain while remaining countries had reported community spread as reported by World Health Organization.

### III. Covid-19 In India

India witnessed an outbreak of COVID-19 on 30<sup>th</sup> January 2020 in Kerala, originating from China. Subsequently, the number of infections increased rapidly since March, 15, 2020. India is now the second most corona-affected country in the world. To mitigate the spread of novel coronavirus and to impose social distancing, Government of India announced 21 days sudden lockdown.1 on 24<sup>th</sup> March, 19 days lockdown.2 on 14<sup>th</sup> April, and 15 days lockdown.3 on May 3<sup>rd</sup> 2020 in view of the country's high population, increasing infections, and lower GDP spending on public health. According to the Ministry of Health, Govt. of India, 6549373 cases of coronavirus infections including 937625 active cases(14.32%), 5509966 recovered cases (84.13%) and 101782 deaths(1.55%) in the country so far on 3.10.2020. As of October 3<sup>rd</sup>, 2020, 1101 government laboratories, and 772 private laboratories across the country were involved in SARS-CoV-2 testing. As per ICMR report, 7,89,92,534 were tested as on 3<sup>rd</sup> October, 2020. These include antigen tests, RTPCR, CBNAAT and True Nat. India's COVID-19 had crossed the 20-lakh mark on August 7<sup>th</sup>, 30 lakh on August 23<sup>rd</sup>, 40 lakh on September 5<sup>th</sup> and it went past 50 lakh on September 16<sup>th</sup> and 60 lakh on September 27<sup>th</sup> 2020.

Nearly three-fifths (56.9%) of cases in India have come from five states namely Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, and Uttar Pradesh. Maharashtra is the most-affected state from Covid-19 with 13,93,103 cases of infection including 1134555 recoveries, 258548 active cases and death toll rose to 37758 as on October 3<sup>rd</sup>, 2020. Andhra Pradesh is the second most state affected by Covid-19 with 7,07,073 cases of Covid-19 infection including 6,51791 recoveries, and 55,282 active cases. The death toll stood at 5,941. Karnataka was the third worst affected state, the total cases stood at 6,21,297 infections including 5,08,495 recoveries, and 1,12,802 active cases and the death toll was 9,219. Tamil Nadu crossed the 6,04,789 Covid-19 cases and death toll was 9,718. The number of active cases in the state was 46,255 while recoveries stood at 5,58,534. Uttar Pradesh was the fifth worst affected state in the country. There have been 4,04,649 confirmed cases including 3,56,826 recoveries and 47,823 active cases with a death toll of 5,977 [5].

India's positivity rate as on 3<sup>rd</sup> October, 2020 stood at about 6.9% (79,476 new cases/1142131 tests), while the cumulative positivity rate was 8.2 % (6549373 cases/78992534 tests on 3<sup>rd</sup> October). The average positive percentage has dropped from 9.4% on 15 August to 7.9% by the 31<sup>st</sup>. However, there has been a steady decline in the positivity rate of COVID-19 despite an exponential increase in testing. Higher testing has also been one of the key reasons for this rapid rise in cases throughout the country. COVID-19 testing capacity has increased significantly, from 10 tests per day on January 30, 2020 touching 1 million tests per day and this trend is continuously increasing. Since 9<sup>th</sup> April 2020 to 2<sup>nd</sup> October 2020, 76,717.73 cumulative samples were tested by government to diagnose for infection. (See Table 2)[6]

**Table: 2 Cumulative number of sample tested for the Coronavirus across India from April to October (in 1000's)**

Date	Tests
Oct,2	76,717.73
Sep,4	46,679.15
Aug,3	20,864.75
July,1	9,056.17
June 3 <sup>rd</sup>	4,103.23
May 1	902.65
April, 9	130.79

Source: [6]

On 3<sup>rd</sup> October, 2020, India's Crude Case Fatality Rate (CFR) from Covid-19 stood at an impressively low figure of 1.55%. This is far lower than the world average (2.97%), indicating that the severity of outbreak may be decrease due to "timely and effective clinical management of the patients in critical care" according to Ministry of Health and Family Welfare GOI,2020. Experts also suggest certain demographic and geographic reasons for low CFR in India- a large young population, exposure to BCG vaccine, low population density in villages, a different strain of the virus in the country and genetics of the South Asian people.[7].However, 70 per cent of the deaths in India occurred due to co-morbidities that include hypertension, diabetes, liver disease, heart disease, asthma, chronic renal disease, and chronic obstructive pulmonary disease (COPD), low immunity, malignancy, bronchitis and chronic neuromuscular disease among others. Recovery rate of COVID positive cases increased from 49.47% in June, to 62.72% in July 20<sup>th</sup>, 71.9% on Aug 17<sup>th</sup>, 82% on 26<sup>th</sup> September and further increased to 84.13% on 3.10.2020. India had a doubling time of 10 days in April and May, 2020. It has improved to 20 days in July, 21 days in August and 45 days in September.

#### IV. Covid-19 In Andhra Pradesh

The first case of the COVID-19 in Andhra Pradesh was reported in Nellore on 12 March 2020 and it has the second highest coronavirus caseload in the country. As on 3<sup>rd</sup> October, 2020, the Andhra Pradesh Health Department has confirmed a total of 7, 10,119 cases, which is 1.33% of 5.34 crore population (see Table 3). The death toll is 5,941 (0.83%) and 6, 48,896 recoveries (91.37%), as of 3<sup>rd</sup> October, 2020 [8]. The virus had spread in 13 districts of the State, of which East Godavari reported the highest number of cases (99,959) which constitutes 1.89% of district population and the death toll was 537. West Godavari was the second most infected district with 69,280 cases i.e. 1.73% of district population, and 458 deaths. Chittoor is the third worst affected district with 64498 infections which accounts for 1.54% of district population and 670 deaths. Anantapur crossed the 58,323 cases which was 1.43% of district population with death toll 497. Kurnool is fifth in the line of worst affected district with 56, 852 confirmed cases which is equal to 1.40% of district population and 469 deaths. Guntur total infections stood at 56,226, which is 1.15% of district population and death toll is 540. Nellore reported 53851 infected cases, which constitutes 1.81% of district population and 450 deaths. Visakhapatnam has total confirmed cases of 50,827(1.18% of district population) and 444 deaths. Prakasam's total infections stood at 50,319(1.48% of district population) and death toll is 495. Kadapa reported 45,048 of corona virus infections which are equal to 1.56% of district population and 380 deaths. Srikakulam is now eleventh in the worst affected district with 40317 infections which constitutes 1.49% of district population and 324 deaths followed Vizianagaram and Krishna district with 35902(0.63% of district population) and 28717 cases(1.53% of district population) and 218 and 458 deaths. As per Ministry of Health and Family Welfare of AP, 60,21,395 tests were conducted till date (3.10.2020). These include antigen tests, RTPCR, CBNAAT and True Nat. In all 2,461 people from other states and 434 foreign returnees tested positive for coronavirus after Unlock 1.0. The state so far completed 60,21,395 sample tests for coronavirus and the current cumulative positivity rate stood at 11.79 per cent against the national average of 8.2 per cent. The recovery rate improved significantly in the last few days and reached 91.3% per cent, better than the national average of 84.13 per cent. The mortality rate was 0.83 per cent, against the national average of 1.55 per cent. The number of active cases declined to 88,197 as on September 17 and further decline to 55,282 as on 3.10.2020.

**Table: 3 COVID-19 pandemic in Andhra Pradesh by district(as on 3.10.2020)**

District	Population (2011 census)	Total Positive cases	Active	discharged	deceased
Anantapur	40,81,148	58323	1406	56420	497
Chittoor -	41,74,064	64498	6232	57596	670
East Godavari -	52,85,824	99959	9243	90179	537
Guntur -	48,87,813	56226	5301	50385	540
Kadapa -	28,82,469	45048	3794	40874	380
Krishna -	45,17,398	28717	2822	25437	458
Kurnool -	40,53,463	56852	1796	54587	469
Nellore -	29,63,557	53851	2652	50749	450
Prakasam -	33,97,448	50319	6191	43633	495
Srikakulam	27,03,114	40317	3389	36604	324
Visakhapatnam	42,90,589	50827	3421	46962	444

Vizianagaram	23,44,474	35902	2504	33179	219
Westgodavari	39,95,742	69280	6531	62291	458
<b>AP</b>		<b>710119(11.79%)</b>	<b>55282(7.78)</b>	<b>648896(91.37)</b>	<b>5941(0.83)</b>
Others states		2461		2461	0
Other countries		434		434	0
<b>Total</b>		<b>713014</b>		<b>651791</b>	<b>5941</b>

Source:[8]

However, the State of Andhra Pradesh reached the first 10,000 COVID-19 confirmed cases on June 24<sup>th</sup>, one- lakh on July 27<sup>th</sup>, two- lakh on August 7<sup>th</sup>, 2020 three-lakh mark on August 18 , four- lakh on the 28<sup>th</sup>, five- lakh on September 7<sup>th</sup>, 2020 and six- lakh on September 17<sup>th</sup> , 2020 . On October 1<sup>st</sup>, 2020, the State reported seven lakh Covid-19 cases. It took 200 days for the State to go from just one case to seven lakh cases after the first person tested positive on March 12. Six- lakh positive cases were recorded in just 90 days period i.e. July 27 to October 1<sup>st</sup> 2020 which is a matter of concern. The Government of AP attributed the exponential surge in Covid-19 virulence in AP to those coming from other states and countries after Unlock 1.0 and number of tests improved significantly. As on August 24<sup>th</sup> 2020, Andhra Pradesh has 6762 cases per million people is high.

#### 4.1 COVID-19 TESTING

The first sample in Andhra Pradesh was tested and diagnosed at the National Institute of Virology (NIV) in Pune because Andhra Pradesh did not have any laboratory to carry out the COVID-19 test. Later, few samples were sent to Gandhi Medical College in Hyderabad until the state got its first lab ready in Tirupati, followed by Vijayawada and other districts. Now, AP state has 78 government labs, 31 private labs, and 4 non-governmental organizations conducting tests across 13 districts. Since February 1<sup>st</sup>, 2020 to October 3, 2020, the Andhra Pradesh state has tested 60,21,395 samples, which is equal to 11.28% of the State’s 5.34 crore population

**Table:4 Month-wise Number of samples tested for the Coronavirus in Andhra Pradesh from June 11<sup>th</sup> to October 2<sup>nd</sup>, 2020**

Date	Tests	Cases
June 11-July1	419713	9983
July 2-July29	901670	105138
July 30-August 19	1199287	195613
Aug 20 –Aug31	703616	118776
Sep 1-Sep18	1236169	174787
Sep19-29	847477	83956
Sep 30- October-2	214837	19530
Total	5522769	707783

Source:[9]

According to the Government data, in March, 2020, only 948 samples were tested. Whereas, in the month of April, 2022, the number of samples tested shot up to over one lakh (1,01,550). Around 2.8 lakh samples (2,80,817) have been tested in the month of May, and more than 4 lakh samples were tested during June 11<sup>th</sup> -July 1<sup>st</sup> 2020 (see table 4). From July 2<sup>nd</sup> to July 29<sup>th</sup> 9,01,670 samples were tested and between July 30<sup>th</sup> - August 19<sup>th</sup> 2020, 11,99,287 samples have been tested in Andhra Pradesh(see Table 4). From August 20<sup>th</sup> -31<sup>st</sup> , 7,03,616 samples were tested and from September 1<sup>st</sup> to October 2<sup>nd</sup> , 2020, 22,98,483 samples were tested by government to diagnose for infection.

#### 4.2 POSITIVITY RATE

Positivity test is an indicator of the prevalence of Covid-19 infection in the community. Positivity rate reflects the proportion of people who test positive among those who are tested. A declining positivity rate would mean that a lesser number of people are being found infected for the same number of tests being carried out. However, there has been a steady decline in the positivity rate of COVID-19 in India in general and Andhra Pradesh in specific despite an exponential increase in testing. The cumulative positivity rate was at 11.79%, and the tests per million ratio was 1,12,760, highest among States with a huge number of COVID cases. However,

Andhra Pradesh has a steady decline in COVID-19 positivity rate since September, 2020. While it peaked to an average 16.6% in August and it has declined to 12.8% in September and 11.79% on 3<sup>rd</sup> October 2020 against the national average of 8.2 per cent. Of the 13 districts in the state, East Godavari, the state topper, had a cumulative positivity rate of 1.66% (99959 / 6021395) ( see table 3) followed by West Godavari(1.15%), Chittoor (1.07%), Anantapur (0.96%), Kurnool (0.94%), Guntur (0.93%), Nellore (0.89%), Visakhapatnam (0.84%) and Prakasam (0.83%), respectively. Vizianagaram, which was the last district in the state to report a Covid-19 case, had the cumulative positivity rate is 0.59%, while Krishna district had lowest cumulative prevalence rate of 0.47%.(see Table 3)

**4.3 RECOVERY RATE**

In India, as in most parts of the world, the recovery period from COVID infection is between 14 and 21 days period. The median time from onset to clinical recovery for mild cases is approximately 2 weeks and is 3-6 weeks for patients with severe or critical disease. The percentage of people recovering from coronavirus infection in the Andhra Pradesh state is increasing significantly due to the detection of the virus at an early stage, which would help in the fast recovery of the infected persons. According to AP State Health Ministry’s dashboard, 91.37% of infected people were recovered from COVID as on 3<sup>rd</sup> October,2020 while the recovery rate in India is 84.13%. The comparative figures for Maharastra is 83.84%, Karnataka 87.35%, Tamil Nadu 91.10%, Uttar Pradesh 87.80%, and Telangana 86.30%, respectively.

The recovery rate in AP was 51.49 % on May 12<sup>th</sup> and it improved to 54.37% on June 14<sup>th</sup>, 70.7% on August 17<sup>th</sup> and 87.97% on September 23,2020. Further, the recovery rate in 8 of 13 districts in the State of Andhra Pradesh was above 90% namely Ananthapur(96%),Kurnool(96.01%),Nellore(94.23%),Vizianagaram(92.41%), Visakhapatnam(92.3%), Srikakulam(90.7%), Kadapa(90.7%) and East Godavari(90.21%). No district in the State has more than 10,000 active cases and Anathapur recorded the lowest number of 1406 active cases(see Table 3).

**4.4 CASE FATALITY RATE (CFR)**

It is defined as the ratio between the number of "confirmed" cases and the number of “confirmed” deaths and the measures the rate of mortality of the disease. It is not constant; it reflects the severity of disease in a particular context, at a particular time and in a particular population. The probability of someone dying of COVID not only depends upon the disease but also on the treatment they receive and the persons own ability to fight the virus. On October 3<sup>rd</sup>, Andhra Pradesh case fatality rate from Covid-19 stood at 0.83%(see Table 3) significantly lower than national average (1.55%).

Of total 5941 deaths as on 3<sup>rd</sup> October 2020, 31 persons lost their lives in the month of April due to infection and it jumped to 125 in June 2020. It further increased to 1162 as on July 2020 (see table 5) . An increase of 2620 deaths was reported in the month of August 2020. The death toll further increased to 1859 in the month of September, 2020 .The rise in death rate has been proportional to the rate of increase in case load. However from last week of September the state witnessed a steady decline of cases and death toll.

**Table: 5 Month wise Covid infections and deaths in Andhra Pradesh**

Month	Cases	Deaths
March	44	0
April	1359	31
May	2168	31
June	11024	125
July	126338	1162
August	293838	2620
September	258713	1859
Total	6934284	5828

Source : [10]

As on 3<sup>rd</sup> October, 2020, the most fatalities in the state have been reported from Chittoor (11.27%), Guntur (9.08%), East Godavari (9.03%), Prakasam (8.33%)and Ananantapur (8.3%)(see Table 3). With regard to district wise case fatality rate, Krishna district stands at the top with 1.59% followed by Chittoor (1.03%), Prakasam (0.98%), Guntur(0.96%), Visakhapatnam(0.87%), Ananthapur (0.85%), Kadapa(0.84%), Nellore(0.835), Kurnool(0.82%) Srikakulam (0.80%), West Godavari (0.66%) and Vizianagram districts (0.605), respectively. Surprisingly, East Godavari district stands state topper in positivity rate and case load but had low case fatality rate (0.53%).

**4.5 DOUBLING TIME**

Doubling time is the number of days required for the number of cases in an epidemic to double, based on the rate of cumulative increase in number of cases. The doubling time is a crude estimate of the current rate of spread of the virus. It is comparable across time as well as countries at different stages of spread. A higher doubling time means it is taking longer for the cases to double and indicates that the infection is spreading slower. Conversely, a lower doubling time suggests a faster spread of infection. For an infection growing at a constant exponential rate, the doubling time is constant. However, as observed in the COVID-19 situation, due to interventions like social distancing, lockdown and containment of hotspots of infection, the doubling time fluctuates and is a function of time. It also varies between districts, states, and countries which may be in different stages of infection [11]. At the time the lockdowns were imposed, i.e. in April and May months, Andhra Pradesh had the doubling time of COVID-19 infection at the average of 2 days and 11 days respectively and it further increased to 20 days in the month of June indicating that the number of cases are increasing very slowly. After lockdown relaxations, it went down to 12 days in July and further decreased to 9 days in August. It indicated a faster rate of spread of infection. After August, 2020, the doubling time improved /increased gradually and the doubling time was 30 days on September 6<sup>th</sup> and it was 58 days on September 24<sup>th</sup> 2020. [12].

However, because of the differential growth rates, the doubling times in state vary widely. According to AP Ministry of Health and Family Welfare, Kurnool has the highest doubling rate of 181 days, followed by Anantapur (92), Prakasam (51), Krishna and West Godavari (52 each).[13].

**4.6 TOP 5 CASE LOAD DISTRICTS IN AP**

In initial stages of COVID outbreak, 11 out of 13 districts of AP have reported COVID-19 cases except Srikakulam and Vizianagram districts. Zero positive cases were reported from Vizianagram and Srikakulam districts. On April 25, Srikakulam district recorded three positive cases from persons who had come from Delhi. On May 5<sup>th</sup> 2020, Vizianagram district recorded first positive case. More than three-fifths of confirmed cases (65%) were reported from Kurnool Guntur, and Krishna districts in the state up to June.

**Table: 6 Month wise Top five case load districts in Andhra Pradesh**

Ra nk	18 <sup>th</sup> May	28 <sup>th</sup> June	15 <sup>th</sup> July	21 <sup>st</sup> July	12 <sup>th</sup> August	3 <sup>rd</sup> Septembe r	3 <sup>rd</sup> October
1.	Kurnool	Kurnool	Kurnool	East Godavari	East Godavari	East Godavari	East Godavar
2.	Guntur	Ananthapur	Guntur	Kurnool	Kurnool	Kurnool	West Godavar
3.	Krishna	Guntur	Ananthapur	Guntur	Ananthapur	Ananthapur	Chittoor
4.	Chittoor	East Godavari	East Godavari	Ananthapur	Guntur	West Godavari	Anathapur
5.	Nellore	Chittoor	Chittoor	Chittoor	Visakhapatnam	Chittoor	Kurnool

Source: [8]

Of the 13 districts in the State, Kurnool district continues to top the list in the state up to July 15<sup>th</sup> (see Table 6) . From July 21<sup>st</sup> onwards East Godavari topping the chart and worst affected district in the State and one of the highest infected district in the country. The month of July, 2020 turned out to be the state’s worst, and by the start of August, the State recorded around 9,000 cases per day. The month of August has seen AP produce daily COVID-19 totals approaching those of Maharashtra, India’s worst affected state. From the last week of August to mid of September, 2020, Andhra Pradesh was the only state which had contributed more than 10,000 cases every day, apart from Maharashtra, which has reported more than 20,000 infections every day for two weeks.

**4.7 URBAN- RURAL COVID INFECTIONS**

In Andhra Pradesh, the coronavirus outbreak was predominantly limited to urban areas until August, 2020 and 90% cases were reported from urban areas. From August onwards, more cases emerged from rural areas of the Andhra Pradesh. Some infections were also reported from interior tribal pockets of AP. According to first phase of sero survey, the urban population of Andhra Pradesh is more exposed to the novel coronavirus

than the rural population. Among four districts, Krishna district has maximum sero prevalence among the urban population (35.2 per cent), followed by Anantapur (28.8 per cent), East Godavari (19.5 per cent) and Nellore (13.8 per cent). Seroprevalence in the rural areas of Krishna is 14.8 per cent, followed by Anantapur at 12.3 per cent, and East Godavari and Nellore at 11.7 per cent and 5.7 per cent, respectively.[14]. In AP, between 1<sup>st</sup> August and 14<sup>th</sup> September there was 282 % spurt in cases in rural areas[15]. From 6<sup>th</sup> September -12<sup>th</sup> September, 2020, 67,920 cases were reported from 13 districts in Andhra Pradesh(see Table 7). Of the total cases, 39% of infections were reported from urban areas while 61% of confirmed cases emerged from rural areas.

**Table :7 District wise reported COVID infection from Rural in Andhra Pradesh**

	District	Total cases	Cases from rural
1.	Srikakulam	4246	3318 (78%)
2.	Vizanagram	3441	2594(75%)
3.	East Godavari	9860	5098(52%)
4.	West Godavari	7571	5105(67%)
5.	Krishna	2792	1718(62%)
6.	Guntur	5114	2730(53%)
7.	Prakasam	7368	4887(66%)
8.	Nellore	6096	4149(68%)
9.	Kadapa	4684	2811(60%)
10.	Ananthapur	4026	2982(74%)
11.	Kurnool	3239	1861(57%)
12.	Visakhapatnam	2646	691(26%)
13.	Chittoor	6837	3218(47%)
	Total	67920	

source : Eenadu daily Telugu news paper, September 21<sup>st</sup> ,2020

Of the 13 districts in the state, 11 districts reported more cases from rural than urban except Visakhapatnam and Chittoor districts where more cases were reported from urban. Among 11 districts, 78% cases are reported from rural areas of Srikakulam between 6<sup>th</sup> September to 12<sup>th</sup> September(see Table7) followed by Vizianagram(75%), Ananthapuram(74%), Nellore(68%), Prakasam(66%), West Godavari(67%), Krishna (62%),Kadapa (60%), Kurnool (57 %), Guntur(53%) and East Godavari (52%) respectively. The death toll stood at 491 between 6-12<sup>th</sup> September, of which 51% from rural and 49% from urban areas. Some infections are also reported from interior tribal pockets of AP. Around 1500, 106 and 200 cases were reported from Meleyaputti tribal mandal, Jantur and Chapara tribal villages of Srikakulam district. .(source : Eenadu daily Telugu news paper September 21<sup>st</sup> ,2020)

The attributed reasons for this spurt in rural areas are lack of awareness about COVID-19, mass gatherings, reluctant to wear masks, lack of physical distancing and easing of travel. According to the authorities, the easing of the lockdown and inter-state travel are the primary reasons that led to the spread of Covid cases in the rural belt. Another reason is lack of physical distancing. In villages, it is a cultural thing for groups of people to interact in the evenings.” [15].

According to Hindu calendar the months of mid-July and August is “Shravana Masam’, which is believed an auspicious period for weddings and housewarmings. So there was an increase in the number of weddings and public gatherings. During the festival of ‘Varalakshmi Vratam’ on 31<sup>st</sup> July, Temples were crowded; gatherings were held, without masks and distancing. This is indicated by the fact that after a family hosted a wedding reception in June 2020, in village Chelluru in East Godavari district 100 of 300 guests who attended the fuction were tested Postive. Another such an incident is that 20 people were tested positive after attending a wedding in nearby Gollala Mamidada village. The chain of infections from these villages has also touched neighbouring areas such as Ramachandrapuram, Anaparathi, Mandapeta and Rayavaram etc.

#### **4.8 AGE -WISE COVID INFECTIONS**

The risk for severe illness from COVID-19 increases with age, with older adults at highest risk. Severe illness means that the person with COVID-19 may require hospitalization, intensive care, or a ventilator to help them breathe, or they may even die. People in the age group of 50 and above are at higher risk for severe illness than people in the age group of 40. Similarly, people in the age group of 60 or 70 are at higher risk for severe illness than people in the age group of 50. The greatest risk for severe illness from COVID-19 is among those aged 85 or older[16].

**Table: 8 Month and Age wise COVID cases in Andhra Pradesh**

Total COVID cases as of July 3 <sup>rd</sup> in AP:16,934 Source : Times of India ,July 5 <sup>th</sup> ,2020		Total COVID cases up to August mid in AP: 2,94,930 Source :Eenadu daily Telugu news paper, September 6 <sup>th</sup> ,2020		Total COVID cases from August 17-September-17 :2,96,151 Source :Eenadu daily Telugu news paper ,October 10 <sup>th</sup> 2020	
Age group	% of cases	Age group	% of cases	Age group	% of cases
0-15yrs	7.18	0-10	3.12	0-10	3.23
16-45yrs	62.52	11-20	8.34	11-20	21.79
46-60yrs	20.34	31-40	22.40	31-40	21.08
60+	9.96	41-50	21.47	41-50	18.24
		51-60	18.28	51-60	14.61
		61-70	14.56	61-70	8.47
		71-80	8.20	71-80	3.19
		80+	3.04	80+	0.58

Among total 16,934 infected cases (up to July 3<sup>rd</sup> 2020) in AP, 16-45 years age group is the most affected by COVID-19 comprising 62%, followed by 46-60 years age group accounting for 20%. (see Table 8). Children aged 15 year and below have tested positive is 7.18% and 10% of age 60 and above .Among total confirmed 2,94,930 cases (up to August mid), 33.86% infections have been reported in the age group of 0-40 years(see Table 8). While 21.47% affected persons in the age group of 41-50, 18.28% in the age group of 51-60 years, 14.56% in those fall under in the age group of 61-70 and around 11.73% positive cases are reported in the age group of 70 and above age group, respectively. Among 2,96,151 COVID positive cases reported from August 17 to September 17<sup>th</sup>, 2020, 46.1% affected persons in the age group of 0-40 years followed by 18.24% in the age group of 41-50, 14.61% in the age group of 51-60 years, 8.47% in those fall under in the age group of 61-70 and around 3.77% positives are reported in the age group of 70 and above age group respectively

#### **4.9 SEX WISE COVID INFECTIONS AND FATALITY**

Several studies have shown that there is an association between the sex of COVID-19 patients and fatality rates. Men are more exposed to severe symptoms and higher mortality than women as well as critically-ill status. Studies in China, South Korea, United States, and Italy have reported sex bias in fatality rates of COVID-19 patients, representing that case fatality rates are higher in male patients than in female patients [17-19]. Previous outbreaks of coronaviruses, namely Severe Acute Respiratory Syndrome (SARS), and the Middle East Respiratory Syndrome (MERS) have also reported same findings [20],[21]. The reasons for the higher male sex-specific COVID-19-related mortality are likely to be multi-fold, including differences in lifestyle (e.g., higher rates of tobacco smoking and alcohol consumption) and innate immunity.[22] .

In India as of April 6<sup>th</sup> 2020, 76% of patients were male. The share of males who tested positive decreased in May (64%) compared to April (76%)[23]. Whereas in the state of Andhra Pradesh, of total 6,147 cases as on June 25, 2020 , 3798 patients were male and 2349 are female. Infection is more prevalent among men than women in Andhra Pradesh[24] .

#### **V. Measures Taken By Government Of Andhra Pradesh**

To curb the spread of virus in the state, the Government has taken the following important measures

- The State has enforced restriction of movement of people by declaring complete lockdown by which all kinds of transport services came to a halt as the Central government has announced a 21-day country-wide lockdown on 24th March, 2020 starting from March 25 to April 14<sup>th</sup> , which it was further extended till May 3<sup>rd</sup> 2020.
- The Department of Health issued orders to close educational institutions, places of entertainment and non-essential commercial establishments.
- The State Government exempted certain essential commodities and services such as fruits, vegetables, milk, groceries, public distribution system through Fair Price Shops, and medicines, diagnostic and health services from lockdown.
- In view of the exogenous nature of the disease, the State had increased screening and testing of people returning to Andhra Pradesh from overseas since February 22<sup>nd</sup> 2020.

- The State adopted timely treatment strategies to fight COVID-19 by strengthening health infrastructure. For this purpose, the state identified government and private medical colleges, hospitals to provide treatment for COVID positive patients. The government had directed the private hospitals to equip themselves with isolation beds, critical care infrastructure which includes ICU beds, ventilator, protective gears – personal protective equipment (PPE) kits, N-95masks, etc.
- The State had made available 74 government labs, 6 private labs for testing, 38,607 isolation beds, 4,214 ICU beds, 1,620 ventilators, and 17,232 oxygen beds for COVID-19 patients as on August 10<sup>th</sup> 2020.
- To provide timely treatment to COVID patients, the State had recruited doctors, nurses and paramedical staff, etc and increased 108 and 104 ambulance services.
- The State had set up a 100-bed quarantine centre in every assembly constituency and 200-bed quarantine centre at the district level.
- The government issued an order prohibiting the use and spitting of smokeless tobacco or chewable tobacco/non-tobacco product, sputum in public places.
- The State extended free healthcare for COVID-19 treatment under Aarogyasri to BPL families in government and private hospitals.
- The State had adopted various innovative strategies such as screening every household, conducting a door-to-door survey through volunteers, to control further spread of the virus.
- The State had undertaken a mass awareness programmes on COVID-19 to educate the people on COVID-19 symptoms and measures through mass media. People are informed about testing and helpline numbers 8297104104 and created state control room number 0866-2410978.
- The frontline workers such as Anganwadi workers, healthcare workers like ASHAs and ANMs, gram/ward volunteers, sanitation workers, the Panchayat staff and the Police were made aware of the seriousness of the pandemic and the necessity of taking protective measures.
- Health surveys were conducted to assess the health conditions of people and also to generate awareness amongst them about their safety and necessary health care. Mid-day meals and food supply for pregnant and lactating mothers under ICDS were made directly to the beneficiaries at their homes.
- The State had arranged free transport for migrant workers from other states.
- Food counters were set up along the National highways near the checkpoints to give the passing migrant labour with necessary food and water.
- The Government introduced and encouraged virtual classes using Skype, Cisco, Team link, Google Meet, Microsoft Teams etc for students.
- For those who have no access to the online facility, lectures on various subjects are uploaded on YouTube and the links were shared to enable the students to reap the benefits. Lecture notes were shared through What's App and e-mail for the convenience of students. Universities encouraged students to enrol for free online courses from platforms like Udemy, Coursera, etc and utilize resources like MOOC, SWAYAM, and NPTEL too.
- Doordarshan had also telecasted the instruction for tenth class students daily for two hours in the morning and evening. Similarly, the lessons were aired through All India Radio on a daily basis. The state has also organised counselling sessions in some Universities with the support of their Psychology Departments.
- Free ration and other essential commodities such as rice and pulses were distributed to card holders from April to November 2020.
- A financial assistance of Rs.1000/- was provided to all eligible families during lockdown for buying essential commodities.
- A COVID allowance or cash support of Rs.2,000/- was provided to patients upon recovery from illness at the time of their discharge.

- A financial aid of Rs.15,000/ was announced for kin of persons who succumbed to COVID-19.
- Free ration which includes 10 kg of rice and one kg of red gram dal per resident was provided to NGOs running old age homes and child care institutions.
- The Government had setup an additional 471 temporary Rythu Bazars (farmer's market) in every corner of the state and also ensure that farmers get reasonable prices for their products and make the essentials available in abundance to citizens.
- The government directed private schools not to collect fee before the commencement of the new academic year.
- Deferment of payment of rent by tenants and payment of property and water taxes for three months.

## VI. CONCLUSION

The outbreak of Coronavirus disease (COVID-19), which originated in the city of Wuhan in China in 2019, spread to all the countries across the world had sent shock waves. India is the second most corona affected country in terms of total corona cases and fatalities, next only to U.S.A. It devastated human lives, caused suffering, misery, disease and resulted in large number of morbidities and deaths. Andhra Pradesh was the second most affected State in India by Covid-19 as on 3<sup>rd</sup> October, 2020. The first COVID-19 case was reported in Nellore on 12<sup>th</sup> March, 2020. The State of Andhra Pradesh reached first 10,000 COVID-19 confirmed cases on 24<sup>th</sup> June, 2020. The figure went up and reached seven lakh positive cases in three months, i.e. between July and October, 2020. This is due to increase in tests by the government to identify the patients and extend proper healthcare.

The disease had affected human relations and social networks due to imposition of phase-wise lockdown, and precautionary measures prescribed by the governments to avoid infliction of the disease. The measures of self isolation, quarantine were advised for Covid-19 victims or for those diagnosed with symptoms of the virus. It is considered as highly contagious and people were recommended to wear face masks, sanitize their hands frequently and maintain personal hygiene, social distance of 2 metres from each person, seeking medical advice for persons having symptoms of cold, cough, fever etc. The nations all over the world and scientific institutions with the encouragement of the governments had evinced keen interest to combat the COVID-19 pandemic and find a cure to save human lives. Several companies came forward to conduct experiments to manufacture safe, effective and potential vaccine that can provide a cure for the disease. The Government of India had given emergency approval to two vaccines, *Covishield* and *Covaxin* developed by NIV, Pune and Bharat Biotech Ltd., Hyderabad respectively and trials and dry run(s) were conducted to determine the efficacy of the vaccine before it was launched. Accordingly, the first biggest COVID-19 vaccination programme was launched in India on 16<sup>th</sup> January, 2021 to immunize 1.3 billion people and the first vaccine was administered to a health worker at All India Institute of Medical Sciences, New Delhi. It may be stated that the most affected by this virus were the people living below poverty line. It has changed their socio-economic conditions by loss of jobs, and also affected businesses and industries' production was reduced which consequently reported lower GDP at the State(s) and National level. In the light of the measures taken by the governments and the vaccination drive that is launched, it is expected that in due course, India will overcome from this pandemic situation.

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