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# Impression of COVID-19 on the Life Years of Inhabitants in Tamil Nadu, India

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## Abstract

COVID-19 posed a threat to humankind's ability to live and survive. The excessive infection and fatality would result in a fall in life expectancy. The pioneer study in India concluded that the lagged case fatality rate was fluctuating in the early days of infection. It was projected that if infection reaches 0.5 percent by the end of 2020, the longevity reduction would be 0.8 years (Mohanty et al., 2020). As of December 26th, 2021 Tamil Nadu stood fourth with the most epidemic cases in the country. COVID-19 has an estimated incidence rate of 25 per 1000 in India. Tamil Nadu was one of the states registering an incidence rate higher than the national average (36 per 1000). The paper examines the effect of COVID-19 on life expectancy. The infection rate of the disease was higher among the males (59%) than the females (41%). The high old-age dependency ratio in the state has resulted in high fatalities among the elderly.

**Keywords:** Life Expectancy, Case Fatality Ratio, Years of Potential Life Lost

## Introduction

The threat posed by COVID-19 to the survival and continued existence of humanity was apparent. If infection rates were prevalent more than the cutoff point, then the uncertain fatality rates would cause life expectancy to continue to decline further. With a 10% prevalence rate, American and European nations were likely to see a drop in life expectancy of more than a year. An infection rate of 15 to 25% would result in a one-year loss of life in south east Asian and African nations. With a very high prevalence rate of 70%, the loss would range from 4 to 11 life years in nations with a longer life expectancy (Marois et al., 2020). Despite having a low fatality rate, India ranks second place in confirmed pandemic cases worldwide. Age-specific mortality was confirmed to increase more quickly for males than for females (Yadav et al., 2021). In India, it has been demonstrated that public health spending directly and significantly contributes to the reduction of mortality (Balakrishnan & Nambodhary, 2021). The initial study conducted in India came to the conclusion that the lagged case fatality rate varied during the initial stages of infection. All the states implemented severe mitigating strategies. The levels were lowest in Bihar and Kerala. While West Bengal, Gujarat, and Maharashtra registered the highest rates. It was predicted that the decline in longevity would be 0.8 years if infection rates reached 0.5 percent by the end of 2020. Three life years would be lost for every 2% infection rate (Mohanty et al., 2020). In Maharashtra, the crude fatality rate from COVID has gone up from 7 to 7.4 per thousand. Due to the widespread infection, the risk of death has increased for people between the ages of 45 and 70.

The state's mortality rate has decreased by 0.8 life years. The estimated epidemic-adjusted loss was 6.1 per thousand individuals (Vasishtha et al., 2021). In India, the incidence rate of COVID-19 was assessed to be 25 per 1000. The top three states in terms of the number of confirmed cases in the country were Maharashtra, Kerala, and Karnataka. Tamil Nadu, a state with improved health outcomes, had the highest epidemic infection rate of all cases in the nation as of December 26, 2021, that placed it fourth overall. The incidence rate was greater than the national average (36 per 1000). The case fatality ratio in Tamil Nadu was 1.34 lesser than the anticipated ratio for the nation (1.39). The paper examines the effect of COVID-19 on life expectancy.

### Objectives of the Study

- To examine the mortality pattern of COVID 19 in Tamil Nadu from April 2020 to May 2021
- To analyse the influence of the pandemic on the loss of life expectancy and years of potential life lost

### Data and Methodology

The Medical and Family Welfare Department, Government of Tamil Nadu portal was used to acquire and compile daily information on confirmed COVID-19 cases, active cases, and fatalities till June 2021 (<https://stopcorona.tn.gov.in/daily-bulletin/>).

The case fatality ratio is the proportion of number of COVID-19 deaths to the total number of confirmed cases per 100.

### Assumptions (Mohanty et al., 2020)

- Deaths attributable to COVID-19 were additional population deaths that would have been avoided had the outbreak not materialised
- It was assumed that the age-specific mortality found in SRS 2014–18 without a pandemic would continue during the pandemic year 2020

Age-Specific Death Rates were gathered from the corresponding years' statistics reports of the Sample Registration System. Abridged life tables were created for the state total and sex-wise with the

- Average of age-specific death rates from 2014–2018.
- COVID deaths were included in the age-specific death rate

In order to assess the impact of the pandemic, the constructed expectation of life years ( $e_0$ ) for pandemic and non-pandemic years was compared. The Report of the Technical Group on Population forecasts for India and States 2011–2036 served as the source for the population forecasts for 2021. The expected life years were found using the Chiang method.

Years of potential life lost (YPLL) is a measure of premature mortality that determines the age at which a person would have reached if he or she had not passed away too soon (Vasishtha et al., 2021).

$$YPLL = \sum_{i=0}^{\infty} d_i * L_i$$

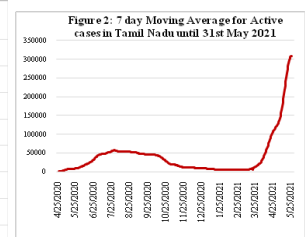
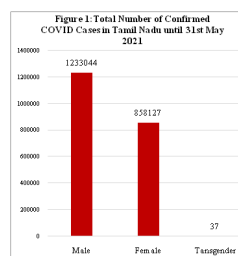
$L_i$ – life expectancy at age  $i$  and

$d_i$ – number of deaths at age  $i$

The deaths at each age were weighted by age-specific life expectancy.

### COVID in Tamil Nadu

On March 7, 2020, Tamil Nadu filed the principal COVID-19 case in Chennai. Figure 1 demonstrated that males (59%) had a greater infection rate than females (41%). The reference period span was from the beginning of the infection until May 2021, when the first wave has been completed and the peak of the second wave has occurred in the state (Figure 2). The first wave's greatest new case count was recorded in July 2020. The epidemic was only beginning its second wave in May 2021. Government testing facilities were more numerous in the beginning (11) than private testing facilities (6). As of May 31<sup>st</sup>, there were 200 private testing facilities and 69 government centres.



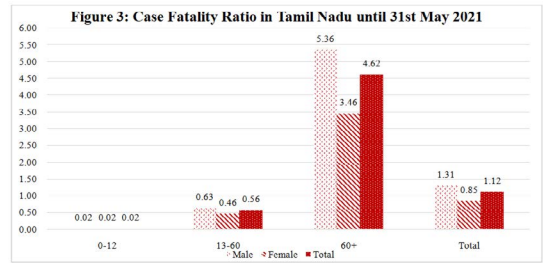
Source: Computed with data from <https://stopcorona.tn.gov.in/daily-bulletin/>

### Case Fatality Ratio

The accessibility of healthcare delivery systems within a country affects the epidemic-related mortality rate. If hospitals were overcrowded and understaffed, it could be high (Medford & Trias-Llimos 2020). The delay between testing, detection, and hospitalisation increased the risk of death. Overall, 31% of the women and 69% of the men died from COVID in Tamil Nadu. The state’s estimated case fatality rate is depicted in Figure 3. The disaggregated age-wise deaths were also categorised in the same manner because the data on the number of confirmed cases was available in three groups (0-12, 13-60, and 60+). Regardless of sex differences, the case-fatality ratio for the reference period was less than 1%. The adult group also exhibited this tendency. The elderly has been seen to be more susceptible to the outbreak. With the exception of children, it was higher among men than women. Male seniors outnumbered female seniors. The explanations could be that, firstly, because 31% of adult men in the state smoke, compared to 9% of adult women though lesser than the national level (Global Adult Tobacco Survey 2016–17). Secondly, estrogen has been shown to positively stimulate immunity (Kopel et al., 2020), therefore a woman with a longer life expectancy was less likely to contract an infection or die from it. Thirdly, according to socio economic perspectives, lockdowns and school closings had a positive impact on women’s roles and informal childcare for their close families. Women served as safety nets by juggling many responsibilities while working from home.

Comorbidities could lead to a higher number of fatalities than anticipated (Malik 2021). The state’s rates of chronic illness were twice higher than those of the nation. Using National Sample Survey Organisation 71<sup>st</sup> round unit data, it has been empirically demonstrated that the chronic illness rate in India among males and females was 42 and 55 per 1000, respectively. But the prevalence of chronic illness rate was 89 and 116 per 1000 among males and females, respectively (Devi Priya, 2017). More over 90% of those who died had comorbid conditions, as shown in Appendix 1, although during the second wave, even those without

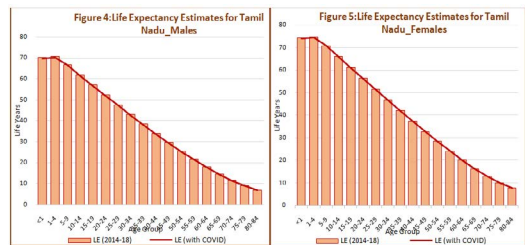
comorbid conditions had a higher share of mortality. This highlighted the severity of the infection.



Source: Same as Figure 1 & 2

### Loss in Life Years

In order to study the transitions in death, life expectancies at birth have been used (Arriaga 1984). Males and females in Tamil Nadu had birth expectancies of 72.2 and 74.2 years respectively, between 2014 and 2018. The expectation of life years in Figures 4 and 5 showed a decline across all age groups. Overall, the pandemic had caused the life expectancy at birth to drop from 72.1 to 71.7 years. Males experienced a 0.6-year decline in life years at birth, compared to a 0.3-year decline for females. The loss from coronavirus for males up to the age 44 was 0.6 years. The coronavirus-related loss for females up to the age of 54 was 0.3 years.



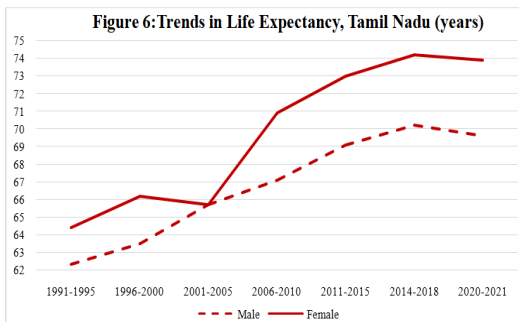
Source: Computed from Age Specific Death Rates 2014-18 and with COVID deaths

Table 1 Percentage Share Years of Potential Life Lost due to COVID in Tamil Nadu

Age Group	Overall	Males	Females
<1	0.11	0.12	0.10
1-4	0.08	0.07	0.10
5-9	0.06	0.00	0.19
10-14	0.15	0.15	0.17
15-19	0.24	0.18	0.40
20-24	0.73	0.61	1.04

25-29	2.18	1.88	2.99
30-34	3.63	3.85	3.45
35-39	5.60	6.13	4.88
40-44	7.51	7.85	7.32
45-49	9.48	9.68	9.65
50-54	12.98	13.05	13.60
55-59	13.92	13.59	15.37
60-64	14.16	14.26	14.71
65-69	11.67	11.90	11.73
70-74	8.90	9.44	8.12
75-79	4.43	4.67	3.97
80+	4.16	2.59	2.21
Total	100.00	100	100.00

**Source:** Computed from Age Specific Death Rates 2014-18 and with COVID deaths



**Source:** Compiled with data SRS Abridged Life Table 2014-18; 2020-2021 own calculations

According to Table 1, the state’s loss of life years up to age 24 was less than 1%. For those in the 25–49 age range, it was approximately 29%. Across all age groups, men lost more years than women did. The loss was largest for males and females in the age range 50-69, at 53% and 55%, respectively. The findings were supplemented by that study in the USA that COVID-19 had been the third leading cause of death for those between the ages of 45 and 84. Increased pandemic mortality rates beyond the cutoff point indicated that the disease was more fatal than heart disease and cancer (Woolf et al., 2021).

Figure 6 demonstrated that for men and women individually life expectancy increased from 1991 to 2018 by 8 and 10 years. The state had advanced significantly over the past three decades, with the exception of women from 2001 to 2005.

However, the state’s life expectancy has decreased as a result of the pandemic’s occurrence. If the third wave didn’t stop, civilization would experience an unprecedented convulsion on all fronts. Table 2 revealed that if the 3.68 percent of COVID fatalities increased even more, then the gain in life years would be lost.

Life expectancy increased by 21% (11 years) in low-income nations between 2000 and 2016, compared to 4% (3 years) in high-income countries (Thornton 2020).

**Table 2 Summary of Population and COVID-19 in Tamil Nadu**

No.	Indicators	Tamil Nadu
1.	Projected Total Population (2021)	764,02,000
2.	Registered number of deaths without COVID (2019)	6,33,897
3.	Number of deaths with COVID-19 (until May 2021)	24,232
4.	Total death	6,58,129
5.	COVID death as a share of total death	3.68
6.	Case fatality ratio	1.16
7.	Confirmed cases	20,96,516
8.	Infection rate (per 1000 population until May 2021)	27.44

### Discussion

In terms of the elderly population (11%), Tamil Nadu stood next to Kerala as per the 2011 census. The state’s high old-age dependency ratio has led to a high elderly mortality rate. The effects of pandemic mortality in that age range were also influenced by the incidence of comorbidities. Similar findings were reported in a study on the pandemic burden in rural Tamil Nadu, including elevated risk among the elderly, men, those with chronic diabetes and those who attended social events (Issac et al., 2021). Even though COVID caused fewer deaths overall than in Maharashtra, the state must take rigorous and ongoing action.

Tamil Nadu’s digital health programme has been well-known among the states’ mitigating attempts to tackle the pandemic. The efficient application of technology in contact tracing and ePass systems

has prevented the infection from spreading further. GIS mapping made it easier to recover health infrastructure, containment zones, and hotspots (Prasad et al., 2020). The spread of the infection was stopped by using integrated technologies in the war room and a single command centre. Zone-wise data helped to identify the streets that needed to be confined strictly within the limited time.

According to the NITI Aayog's 2019 Sustainable Development Goals India Index, Tamil Nadu held third place. Gaining confidence in defeating the threat of the virus was aided by the state's amazing improvement in terms of clean water and sanitation (score increased from 66 in 2018 to 90 in 2019) and by sustaining the sustainable development goal index by 2019. These were stepping stones to developing confidence in resisting the virus's menace (Vijayakumar, 2019). Only when universal healthcare and public health were operational would the health management system be considered complete and capable (John, 2020). Utilising COVID tools to combat and resolve the global humanitarian issue, vaccines and medications must be both non-excludable and non-rival (Hein & Paschke, 2020). The Strategic Advisory Group of Experts on Immunisation advised that the principles for vaccinations for everyone in the world be human welfare, equal respect, global equality, national equity, reciprocity, and legitimacy (World Health Organisation, 2020). Tamil Nadu's growth in health and wellness facilities was supported by a doubling of budgetary commitments (Duggal, 2020). Thus, the pandemic was a reminder to the state to build a strong public health structure and not leave it in the hands of market forces (Economic and Political Weekly, 2009).

### Conclusion

COVID-19's impact on life expectancy was substantially determined by age-specific mortality rates. The decline in the accomplished mortality transition caused the decrease in predicted life years. Along with the use of vaccines, maintaining a social distance, washing one's hands often and adhering to normal operating procedures might help to stop the spread of confirmed and active cases. With the prior knowledge gained through managing disasters with

minimal human casualties, the third wave's severity was regulated.

### Appendix 1 Comorbidity among the COVID Deceased in Tamil Nadu until 31st May 2021

Month	Without Comorbidity	With Comorbidity	Total
May 2020	23 (16)	118 (84)	141
June 2020	142 (14)	887 (86)	1029
July 2020	205 (7)	2529 (93)	2734
August 2020	285 (8)	3102(92)	3387
September 2020	178 (8)	2030(92)	2208
October 2020	112 (7)	1490(93)	1602
November 2020	37 (6)	553 (94)	590
December 2020	25 (5)	385 (94)	410
January 2021	12 (5)	222 (95)	234
February 2021	18(13)	122 (87)	140
March 2021	20 (9)	203 (91)	223
April 2021	209 (16)	1118 (84)	1327
May 2021	2548 (25)	7638 (75)	10186
<b>Total</b>	<b>3814 (16)</b>	<b>20397 (84)</b>	<b>24211</b>

**Source:** Compiled with the data from <https://stopcorona.tn.gov.in/daily-bulletin/>

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