

HAS THE POPULATION LEVEL MORTALITY EXPERIENCE CHANGED AFTER COVID 19 PANDEMIC?

Meenachi S ⁽¹⁾, Golden Sheeba ⁽¹⁾

(1) - Directorate of Public Health & Preventive Medicine

Abstract

INTRODUCTION : Human history suggested that different diseases had influenced the mortality patterns of population. Analysing the mortality data could bring out valuable insights regarding the influence of COVID 19 in the population. Hence we conducted this study to determine whether there was any difference in all-cause mortality in Pre COVID and Post COVID Time; whether there is any difference in mortality among various age groups and for important causes of death

METHODS : We did a secondary data analysis by obtaining data from Civil Registration System software of Kanyakumari district pertaining to April to September of 2019 (Pre COVID) and 2022 (Post COVID). We calculated mortality rates with confidence intervals for total population, both genders, different age groups and causes.

RESULTS : In comparison to Pre COVID period, mortality rate during Post COVID period had increased (statistically significant) in the following groups: total population, females, above 60 years; cause specific mortality rates had increased for heart disease & heart attacks and senility and decreased for bronchial asthma and pneumonia; gender wise analysis for heart disease revealed that increase among females were statistically significant; for senility statistically significant increase was noted in both genders

CONCLUSION : Mortality experience of Kanyakumari District had a significant change in post COVID period; old age population and females had been dying more; heart disease deaths had been noted higher in post COVID period especially for females; death due to bronchial asthma and pneumonia had decreased. We recommended further studies before attributing the difference in mortality experience to COVID 19 exposure of population such as similar study in different population & different data periods of same population; studies to identify factors associated with increase in mortality among female in Post COVID period; to identify factors associated with increased cardiovascular mortality among females; studies to identify factors contributing to decrease in mortality due to pneumonia and bronchial asthma after COVID 19 Pandemic.

KEYWORDS : COVID 19, death, cause of death, heart diseases

INTRODUCTION

Mortality experience of population used to vary between geographic regions; same region may have different mortality experience during different time periods. Human history reveals that different diseases have influenced the mortality patterns of population.¹ COVID 19 is the emerging infection of this decade. The pandemic started during end of 2019 at China and still continues to torment the world.²

India's first reported case was a woman returnee of Kerala from Wuhan, China on January 27th, 2020.³ Tamil Nadu had its first confirmed COVID-19 case on March 7, 2020.⁴ As per data available at office of Deputy Director of Health Services, Kanniyakumari district of Tamil Nadu, this district had its first case reported on 31st march 2020; first wave of COVID pandemic went on till January 2021. After that, Kanniyakumari district had met another two COVID waves during middle and last part of 2021. After February 2022, cases were getting reported in a low level.

Literature review suggested that studies examining the mortality patterns in pre and post COVID period were scarce. One Japanese study had analysed that in Japanese and

immigrant population.⁵ As different races could respond in a different manner towards a new microbe, study of mortality pattern in our region could well be different. Analysing that would help us by giving valuable insights for shaping the future public health interventions. Hence we conducted this study with following objectives.

OBJECTIVES

To determine whether there is any difference in all-cause mortality between Pre COVID and Post COVID times among total population

To determine whether there is any difference in mortality among different age groups and two genders between Pre COVID and Post COVID times

To determine whether there is any difference in any of



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Corresponding Author : Meenachi S

e-mail: mph5cmeena@gmail.com

important Cause Specific Mortality Rates between Pre and Post COVID Times

METHODS

STUDY POPULATION AND STUDY DATA PERIOD :

Our Study population was all reported deaths in Civil Registration System (CRS) of Kanniyakumari District. We considered data of two six months period for analysis- April to September of 2019 (as Pre COVID period) and April to September of 2022 (as Post COVID period). We analysed both period data sets in a cross sectional manner.

INCLUSION AND EXCLUSION CRITERIA :

We included all deaths reported in Civil Registration System during the two (data) periods. We had planned to exclude deaths with incomplete data regarding age/ sex/ cause of death during protocol stage

OPERATIONAL DEFINITIONS :

We defined all-cause mortality rate as deaths during data period (six months) due to all causes divided by total population

We defined gender specific mortality rate as deaths during data period (six months) due to all causes of the particular gender divided by population of the same gender

We defined age group specific mortality rate as deaths during data period (six months) due to all causes of the particular age group divided by population of the same age group

We defined cause specific mortality rate as deaths during data period (six months) due to the particular cause divided by total population; defined gender wise cause specific mortality rate as deaths during data period (six months) due to the particular cause among the specific gender divided by population of the same gender

We defined cause of death as that mentioned in Civil Registration System software based on the report given by the physician who treated the individual before death either as outpatient or inpatient

We defined Pre COVID period as the six months period of April 2019 to September 2019

We defined the Post COVID period as the six months period of April 2022 to September 2022. (This period was taken as it was the one following the third wave of COVID 19 epidemic touched the baseline in the District; to nullify the effect of month specific events in the mortality data, similar six months periods were taken).

SAMPLING PROCEDURE AND SAMPLE SIZE :

We considered all deaths reported during the study data periods for analysis.

DATA COLLECTION PROCEDURE :

We collected the mortality data from Civil Registration System software & population data maintained at statistical division of Public Health Department (Office of Deputy Director of Health services) of Kanniyakumari District.

ANALYSIS :

We considered following age groups for analysis: 0 to 18, 19 to 30, 31 to 45, 46 to 60 and above 60. In Tamil Nadu, Makkalai Thedi Maruthuvam program is being implemented since September 2021. It is a population based Non Communicable Diseases (NCD) screening programme with a component of distribution of NCD medicines at home for above 45 years population. Screening for Hypertension starts at completion of 18 years and screening for Diabetes risk factors at completion of 18 years and blood sugar testing by glucometer at completion of 30 years. This was the rationale behind dividing the age group in the above manner. This could facilitate use of results by Tamil Nadu Public Health Department. As generally above 60 are being considered as old age and this age group was prioritised during COVID vaccination, we considered above 60 as the high end age group.

We calculated all-cause mortality, cause wise & Age group wise mortality for the two six months periods; we calculated proportions with confidence intervals for each category of mortality; we examined the confidence intervals for comparison of mortality rates of the two data periods; we considered the mortality rates of two periods as having statistically significant difference when the confidence interval were not overlapping. We used Excel software and open epi online software for analysis

HUMAN SUBJECT PROTECTION :

Our study got approved by Institutional Ethics Committee of Tamil Nadu Public Health department; we maintained privacy and confidentiality in such a way that no personal data was used or revealed during analysis or report preparation & presentation

RESULTS

There were 7931 death records (line lists) for the period April to September 2019 and 8665 records for the period April to September 2022. All records had the information regarding age, sex and cause of death. So we considered all records for analysis.

All-cause mortality rate of total population was 3.97 per 1000 population during Pre COVID period and 4.28 per 1000 during the Post COVID period; the increase was statistically significant. All-cause mortality of male gender

was 4.52 per 1000 & 4.78 per 1000 during Pre COVID and Post COVID period respectively and the increase was not statistically significant. All-cause mortality of females was 3.40 & 3.79 per 1000 during the Pre and Post COVID periods respectively and the increase was statistically significant. (Table 1)

Table 1: All-cause mortality of total population and both genders during Pre COVID (April to September 2019) and Post COVID (April to September 2022) periods, Kanniyakumari District

Population type	2019				2022			
	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval
Total	7931	1999032	3.97	3.88 to 4.05	8665	2022817	4.28	4.20 to 4.38
Male	4549	1005617	4.52	4.39 to 4.66	4847	1014373	4.78	4.65 to 4.91
Female	3382	993415	3.40	3.29 to 3.52	3818	1008444	3.79	3.67 to 3.91

Age group specific mortality of 0 to 18 years was 0.23 per 1000 & 0.21 per 1000, that of 19 to 30 years was 0.49 & 0.44 per 1000, that of 31 to 45 years had been 1.19 & 1.08 per 1000 and that of 46 to 60 years was 4.31 & 4.42 per 1000 during Pre and Post COVID periods respectively. The noted differences were not statistically significant for the above four age groups. Above 60 years specific mortality was 26.10 per 1000 during pre COVID period and 29.27 per 1000 during Post COVID period; the increase was statistically significant. (Table 2)

Table 2: Mortality rate among various age groups during Pre COVID (April to September 2019) and Post COVID (April to September 2022) periods, Kanniyakumari District

Mortality of	2019				2022			
	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval
0-18 Years	131	573922	0.23	0.19 to 0.27	120	580751	0.21	0.17 to 0.25
19-30 Years	202	413800	0.49	0.43 to 0.56	186	418723	0.44	0.38 to 0.51
31-45 Years	545	458578	1.19	1.09 to 1.29	500	464034	1.08	0.99 to 1.18
46-60 Years	1460	338436	4.31	4.1 to 4.54	1512	342463	4.42	4.20 to 4.64
Above 60 Years	5593	214296	26.10	25.43 to 26.78	6347	216846	29.27	28.57 to 29.99

Cause specific mortality rate due to heart disease and heart attacks was 1.35 & 1.48 per 1000 during Pre and Post COVID periods respectively; that due to senility was 0.46 & 0.66 per 1000 during Pre and Post COVID periods respectively. Above two cause specific mortality rates had statistically significant increase during Post COVID period. Bronchial asthma specific mortality rate was 0.29 & 0.18

per 1000 during Pre and Post COVID Periods respectively. Mortality rate due to pneumonia was 0.05 & 0.02 per 1000 during Pre and Post COVID periods. The decrease noted in Post COVID period mortality rates due to above two causes was statistically significant. Cause specific mortality rates due to other common causes such as chronic liver disease & cirrhosis, suicide, cerebrovascular accidents, Diabetes Mellitus, traffic accidents and Tuberculosis were not having any statistically significant difference between Pre and Post COVID periods. (Table 3)

Table 3: Cause Specific Mortality Rates during Pre COVID (April to September 2019) and Post COVID (April to September 2022) periods, Kanniyakumari District

Mortality due to	2019				2022			
	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval
Bronchitis Asthma	574	1999032	0.287	0.26 to 0.31	364	2022817	0.180	0.16 to 0.20
Pneumonia	103	1999032	0.052	0.04 to 0.06	35	2022817	0.017	0.01 to 0.02
Heart Disease and Heart Attacks	2697	1999032	1.349	1.30 to 1.40	3001	2022817	1.484	1.43 to 1.54
Senility	913	1999032	0.457	0.43 to 0.49	1335	2022817	0.660	0.63 to 0.70
Chronic Liver disease and Cirrhosis	176	1999032	0.088	0.08 to 0.10	223	2022817	0.11	0.10 to 0.13
Suicide	170	1999032	0.085	0.07 to 0.10	234	2022817	0.116	0.10 to 0.13
Cancer	383	1999032	0.192	0.17 to 0.21	447	2022817	0.221	0.20 to 0.24
Cerebro Vascular accidents	414	1999032	0.207	0.19 to 0.23	487	2022817	0.241	0.22 to 0.26
Diabetes Mellitus	613	1999032	0.307	0.28 to 0.33	692	2022817	0.342	0.32 to 0.37
Transport (Traffic) accidents	188	1999032	0.094	0.08 to 0.11	148	2022817	0.073	0.06 to 0.09
Tuberculosis	25	1999032	0.013	0.008 to 0.018	31	2022817	0.015	0.011 to 0.022

Cause specific mortality rate due to heart disease and heart attacks in males was 1.59 and 1.70 per 1000 during the two study periods; but the increase in Post COVID period was not statistically significant; the same analysis in females showed a statistically significant increase during Post COVID period; the statistics was 1.11 and 1.27 per 1000 respectively. Mortality rate due to senility among males was 0.43 & 0.56 and that among females was 0.48 & 0.76 during Pre & Post COVID periods respectively. Senility specific mortality rates had a statistically significant increase during Post COVID period in both genders. (Table 4)

Table 4: Gender wise Cause Specific Mortality Rates for selected diseases during Pre COVID (April to September 2019) and Post COVID (April to September 2022) periods, Kanniyakumari District

Mortality due to	2019				2022			
	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval	Deaths	Population	Mortality rate per 1000 for six months	Confidence Interval
Heart disease and Heart Attacks in males	1599	1005617	1.59	1.51 to 1.67	1724	1014373	1.70	1.62 to 1.78
Heart disease and Heart Attacks in females	1098	993415	1.11	1.04 to 1.17	1277	1008444	1.27	1.20 to 1.34
Senility in males	435	1005617	0.43	0.39 to 0.48	573	1014373	0.56	0.52 to 0.61
Senility in females	478	993415	0.48	0.44 to 0.53	762	1008444	0.76	0.71 to 0.81

DISCUSSION

In comparison to pre COVID period, all-cause mortality rate of total population and all age group female

population had a statistically significant increase in the Post COVID period; mortality rate of males had also increased in Post COVID period, but there was a mild overlapping of confidence intervals of mortality rates of two periods. Comparison of various age group specific mortality rates indicated that there was a statistically significant increase in the mortality rate of above 60 years age group in the Post COVID period. Comparison of cause specific mortality rates of two periods brought forth a statistically significant increase in the Post COVID period mortality rates for the following causes: heart disease & heart attacks and senility; there was a statistically significant decrease of mortality rates due to bronchial asthma and pneumonia. Gender wise analysis for heart disease & heart attacks revealed that increase among females was statistically significant; for the cause mentioned as senility, statistically significant increase was found in both genders.

Lee et al had done a study in United States in which they did estimation of deaths happening in excess of expected seasonal range. That study had showed an increase in all-cause mortality and mortality due to causes like respiratory diseases and cardiac diseases in their latter part of period. The study period was March 2020 to April 2021 which was the time in which COVID Pandemic was in full blown scale.⁶ Ayoubkhani et al had conducted a study in United Kingdom to know the rates of post COVID syndrome among discharged patients who were treated for COVID 19. Their results showed that in a period of nearly five months period, more than 10 per cent of them had died.⁷ Above studies supported the view that COVID viral influence could have increased population mortality.

Review article by Gao et al mentioned that women used to have a higher level of mortality and poor prognosis following acute cardiovascular events; this study had been published at the end of 2019.⁸ This study supported the view that increase in female mortality could have happened even if there was no COVID Pandemic. Lopez and Adair had documented an increase in cardio vascular deaths among US males and females and Canada females in a vital statistics based study done in 2017.⁹ Special article by Timmis et al had discussed that Cardio vascular disease burden was greater and procedure rates were lower in middle income countries.¹⁰ The above points had been cautioning us against causal attribution of increased mortality especially mortality due to cardio vascular causes to COVID Pandemic alone; it could have happened even otherwise

Our study clearly showed some changes in mortality experience of study population after COVID pandemic; but

with available data, the seen change in mortality could not be causally attributed to the COVID 19 viral influence in the biology of population.

The study had suggested following research questions:

1. Could the increase in mortality of study population have happened in the absence of COVID Pandemic too?
2. Could same change be seen in mortality experience of some other study population also?
3. Why mortality rate of females had increased after COVID Pandemic?
4. Why heart disease specific mortality rate had increased in females after COVID Pandemic?
5. What are all the factors contributing to the increase in death due to senility?
6. What are the factors contributing to the decrease in mortality rate due to pneumonia and bronchial asthma?

CONCLUSIONS & RECOMMENDATIONS

All-cause Mortality had a significant increase in post COVID period; old age population and females had been dying more in post COVID period. Mortality due to heart disease and heart attacks had been higher in post COVID period. Mortality due to bronchial asthma and pneumonia had decreased in post COVID period. We recommended further studies before attributing the difference in mortality experience to COVID 19 exposure of population.

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