

Report on excess mortality during the COVID-19 pandemic up to June 2022

Ministry of Health Singapore

September 2022



MINISTRY OF HEALTH
SINGAPORE

TABLE OF CONTENTS

Summary	iii
1. Introduction.....	1
2. Mortality trends during COVID-19 pandemic.....	2
3. Possible reasons for the excess deaths	5
4. International comparisons	7
5. Conclusion.....	7
6. Appendix A.....	8
7. Appendix B – Glossary of Terms.....	12

Summary

While Singapore has one of the lowest COVID-19 death rates in the world, we nevertheless experienced increased deaths during the pandemic. During the pandemic period of January 2020 to June 2022, the age-standardised death rate in Singapore residents increased from 525.0 in 2019 to 549.9 per 100,000 person-years, which is close to the level in 2018. This translates to an estimated 2,490 excess deaths over the two-and-a-half-year period, using the pre-COVID year of 2019 as a baseline.

As at end June 2022, our official death toll for COVID-19 was 1,403 for Singapore residents. This accounts for around three-fifths of the excess deaths of 2,490, where the cause of death could be directly attributed to COVID-19. The remainder can be explained by patients who passed away from other illnesses within 90 days after being infected with COVID-19. In other words, COVID-19 aggravated existing illnesses, resulting in further mortalities. In a secondary analysis of persons without recent infection, no additional excess deaths were found.

There was an over-representation of persons who were not fully vaccinated, with 28% of COVID-19 deaths occurring in persons who were not fully vaccinated in the first half of 2022, even though only about 5% of the eligible population were not fully vaccinated in mid-March 2022.

Although our public hospitals were strained while coping with the pandemic, Singapore has been able to operate such that hospital and ICU beds were able to support patients with urgent medical needs. Key indicators such as the rates of death within 30 days of presenting with a heart attack or stroke at our public hospitals in years 2020 to 2021 were comparable to rates seen in the previous years.

Compared to many other countries, both regionally and internationally, Singapore has been able to avoid a large number of deaths. This has been through our overall pandemic response, and also the high COVID-19 vaccine and booster coverage. This has only been possible with the collective effort and hard work from all Singaporeans.

1. Introduction

Tracking the number of deaths against historical data provides an indication of excess deaths that may have occurred. It helps reflect the impact of the pandemic by capturing deaths directly and indirectly attributable to COVID-19.

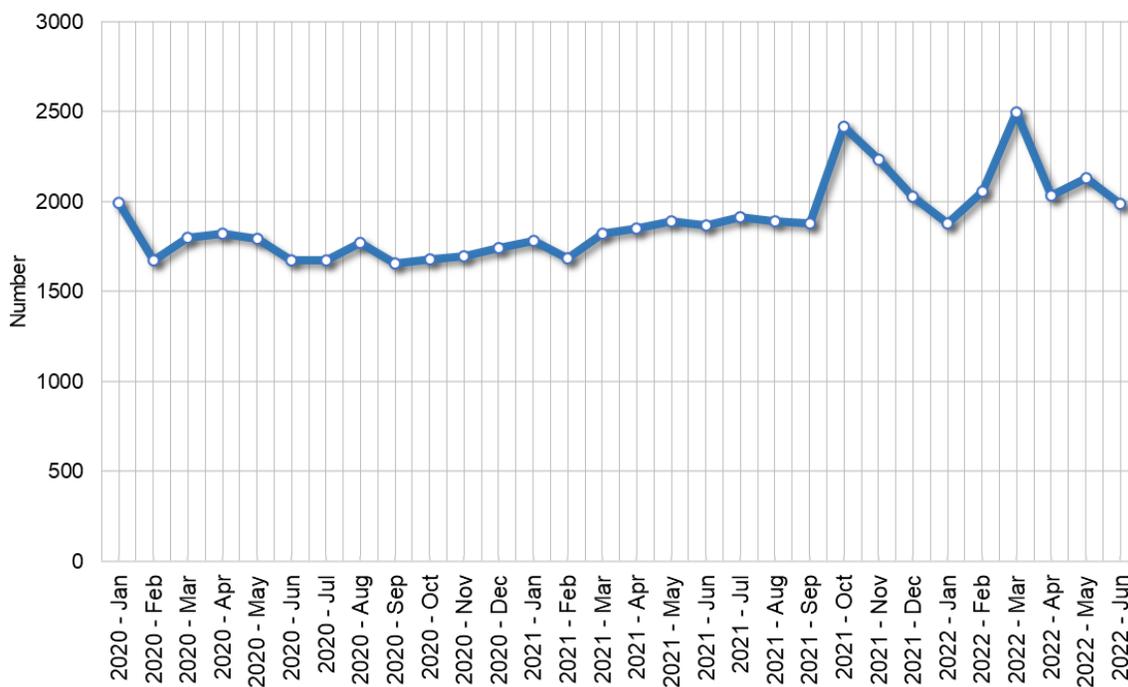
Singapore's overall death rate has increased during the pandemic period of January 2020 to June 2022, and this was mainly due to the higher number of deaths occurring during the peak of the Delta and Omicron waves.

This report summarises the mortality trends in the different segments of the population, including the cumulative number of deaths during the period of the pandemic up to June 2022, compared to the previous years.

2. Mortality trends during COVID-19 pandemic

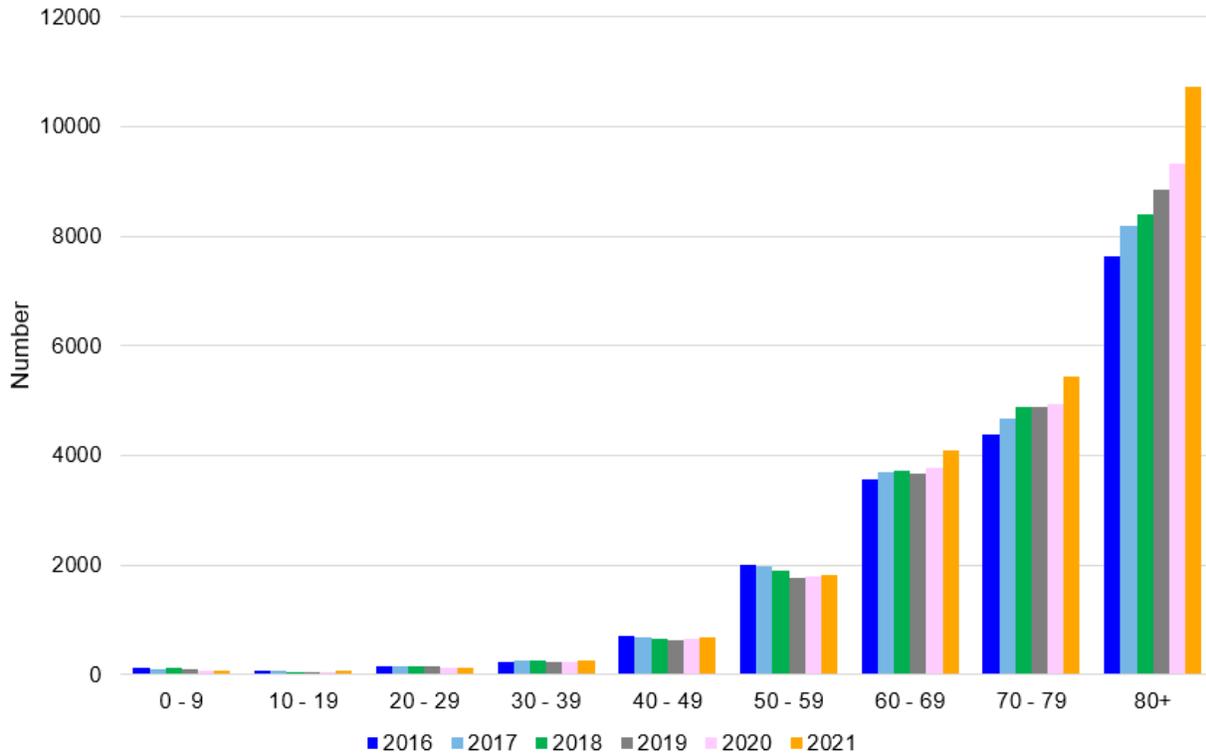
Chart 1 shows the monthly total of resident death rates during the COVID-19 pandemic. In 2021, we observed a higher number of deaths in the months of October and November because of the Delta infection wave. In early 2022, we saw a similar increase in number of deaths due to the Omicron BA.1/BA.2 wave. COVID-19 was ranked as one of the top 10 causes of death for 2021 (Appendix A, Table A1).

Chart 1: Monthly total number of resident deaths, January 2020 - June 2022



Our crude death rate has been on a rising trend. This is because our population is ageing. Across the years, more than 80% of the resident deaths occurred in persons aged 60 and above. However, in 2021, there was an increase in deaths seen in this age group that is greater than can be explained by the rising population of seniors (Chart 2).

Chart 2: Number of resident deaths by age groups, 2016-2021



If we look at the age-standardised death rate (Table 1), a summary indicator that removes differences in the population age structure when comparing between years, our death rate has decreased from 563.4 per 100,000 person-years in 2017 to 525.0 per 100,000 person-years in 2019. However, during the pandemic period of January 2020 to June 2022, the rate increased to 549.9 per 100,000 person-years, slightly higher than the average rate from 2017-2019, at 545.3 per 100,000 person-years.

Table 1: Crude Death Rates (CDR) and Age-Standardised Death rates (ADR) per 100,000 person-years, January 2016 – June 2022

Year / Period	CDR	ADR
2016	479.4	560.4
2017	498.3	563.4
2018	503.1	547.6
2019	503.9	525.0
2020 - June 2022	566.7	549.9

Taking ageing into account, the age-standardised excess deaths during the COVID-19 pandemic period being studied (from January 2020 to June 2022) is 2,490. Our official death toll due to COVID-19 in Singapore residents as at end-June 2022 is 1,403, which is about three-fifths of this total number. The next section explains why there is a difference between the official COVID-19 death and estimated excess deaths numbers.

3. Possible reasons for the excess deaths

One immediate reason is that some excess deaths not attributable to a documented COVID-19 infection could partly reflect undiagnosed COVID-19. Further, COVID-19 may have also changed health behaviours and health-seeking behaviours of the population, for example, putting off health screening and medication for chronic illnesses, and this may have contributed to some of the excess deaths.

The likely and more significant explanation is death due to underlying medical conditions, but made worse by COVID-19 infections. The gap between official death toll and estimated excess deaths can be explained by deaths in patients recently infected with COVID-19 in the past 90 days. In a secondary analysis of persons without recent infection, no additional excess deaths were found.

This could be contributed by a known phenomenon in an epidemic, called mortality displacement. It is also not unusual that one of the effects of viral infections such as influenza, is that they aggravate pre-existing conditions. The same applies to COVID-19. Although it directly resulted in a substantial proportion of total excess deaths, it would have also indirectly resulted in some other non-COVID-19 deaths by worsening underlying medical conditions after infection.

In particular, COVID-19 has also been shown to increase the risks of developing medical conditions such as heart attacks and stroke, and could have contributed to deaths from these conditions in persons with past infections. As such, we observed an increase in death rates due to ischaemic heart disease (Table 2) during the study period. However, there was no clear evidence of increased deaths due to stroke.

Table 2: Crude Death Rates (CDR) and Age-Standardised Death Rates (ADR) per 100,000 person-years for ischaemic heart disease & stroke, January 2016 to June 2022

Year / Period	Ischaemic heart disease		Stroke	
	CDR	ADR	CDR	ADR
2016	81.2	94.9	31.9	37.6
2017	91.5	103.4	31.1	35.5
2018	90.2	98.1	30.1	33.0
2019	93.6	97.5	29.3	30.6
2020- June 2022	114.2	110.8	33.9	32.9

Of the COVID-19 deaths in 2021 and first half of 2022, there was an over-representation of persons who were not fully vaccinated. In the first half of 2022, 28% of such deaths were not fully vaccinated, even though only about 5% of the eligible population were not fully vaccinated in mid-March 2022. This highlights the importance of the elderly getting vaccinated and boosted to protect them from COVID-19 and its complications.

On whether strained healthcare capacity may have led to excess death, many other countries experienced large COVID-19 waves that overwhelmed healthcare systems and this affected quality of care. However, Singapore has been able to operate such that hospital and ICU beds were able to support patients with urgent medical needs.

Based on data available up to year 2021, quality of care in our public hospitals was broadly maintained. Key mortality indicators such as the rates of death within 30 days of developing a heart attack (Acute Myocardial Infarction) (Appendix A, Chart A1) and stroke (Appendix A, Chart A2 & A3) during the period of years 2020 to 2021 were similar to the rates in the previous years. The risk of being re-admitted to hospital within 30 days after discharge also remained comparable to pre-COVID years (Appendix A, Chart A4).

Nevertheless, we must always be mindful that when healthcare capacity is overburdened during a pandemic, it will have very adverse impact on health outcomes from other diseases. As such, preserving healthcare capacity and ensuring that our healthcare workers are well-resourced remain priorities.

4. International comparisons

While Singapore has experienced excess deaths during the pandemic, the excess mortality rate is substantially lower than that of many other countries, especially compared to those which have opened up and living with COVID-19 normally. The World Health Organization estimated the excess mortality for Singapore to be 26 per 100,000 for the year 2021 and is among the lowest among countries who have chosen to live with COVID-19 in 2021 (Appendix A, Table A2).

5. Conclusion

Overall, COVID-19 has resulted in an increase in deaths in the pandemic period up to June 2022, attributable in large part to the surge in cases from the Delta and Omicron BA.1/BA.2 variants. However, the rate of excess deaths was relatively low compared to many other countries, and indicates that Singapore has been able to avoid a large number of deaths through our overall effective pandemic response and also high COVID-19 vaccine and booster coverage. This has only been possible with the collective effort and hard work from all Singaporeans. As we continue our journey towards achieving COVID-19 resiliency, we must remain vigilant, and continue to urge everyone to exercise personal protection and social responsibility.

6. Appendix A

Table A1: Top 10 causes of death (% of total resident deaths), 2020-1H2022

	Cause of death	2020	Cause of death	2021	2022 (January to June)
1	Cancers (ICD: C00-C97)	28.9	Cancers (ICD: C00-C97)	26.6	23.6
2	Ischaemic heart diseases (ICD: I20-I25)	20.3	Ischaemic heart diseases (ICD: I20-I25)	19.9	20.2
3	Pneumonia (ICD: J12-J18)	19.3	Pneumonia (ICD: J12-J18)	18.7	19.8
4	Cerebrovascular diseases (ICD: I60-I69)	6.0	Cerebrovascular diseases (ICD: I60-I69)	6.1	5.8
5	Nephritis, nephrotic syndrome and nephrosis (ICD: N00-N07, N17-N19, N25-N27)	3.3	COVID-19 (ICD: B342)	3.5	5.5
6	External causes of morbidity and mortality (V01-Y89)	3.1	Hypertensive diseases (incl hypertensive heart disease) (ICD: I10-I15)	3.3	3.2
7	Hypertensive diseases (incl hypertensive heart disease) (ICD: I10-I15)	2.8	External causes of morbidity and mortality (V01-Y89)	2.9	-
8	Urinary tract infection (ICD: N39.0)	2.1	Nephritis, nephrotic syndrome and nephrosis (ICD: N00-N07, N17-N19, N25-N27)	2.7	2.9
9	Other heart diseases (ICD: I00-I09, I26-I51)	2.1	Urinary tract infection (ICD: N39.0)	2.3	2.4
10	Diabetes Mellitus (ICD: E10-E14)	1.3	Other heart diseases (ICD: I00-I09, I26-I51)	2.2	2.1

Note: ~3% of the deaths in 2022 have yet to be coded

Chart A1

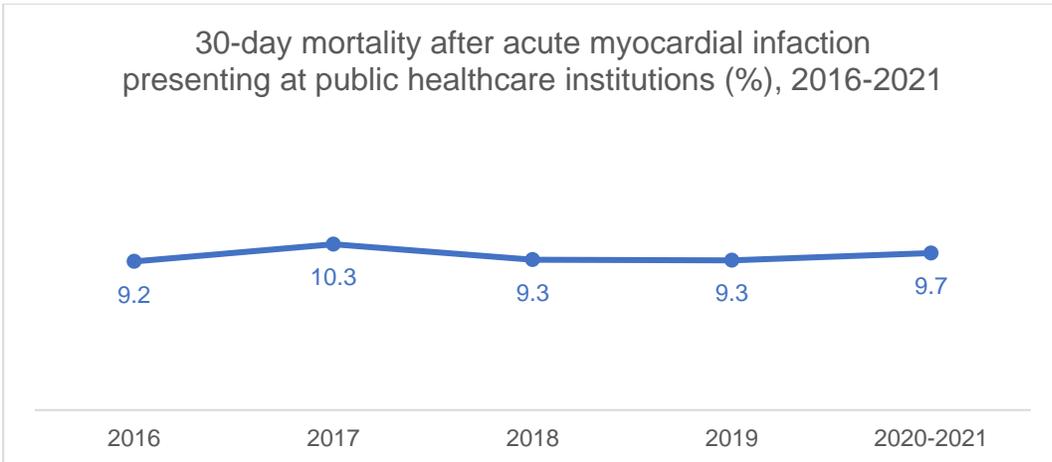


Chart A2

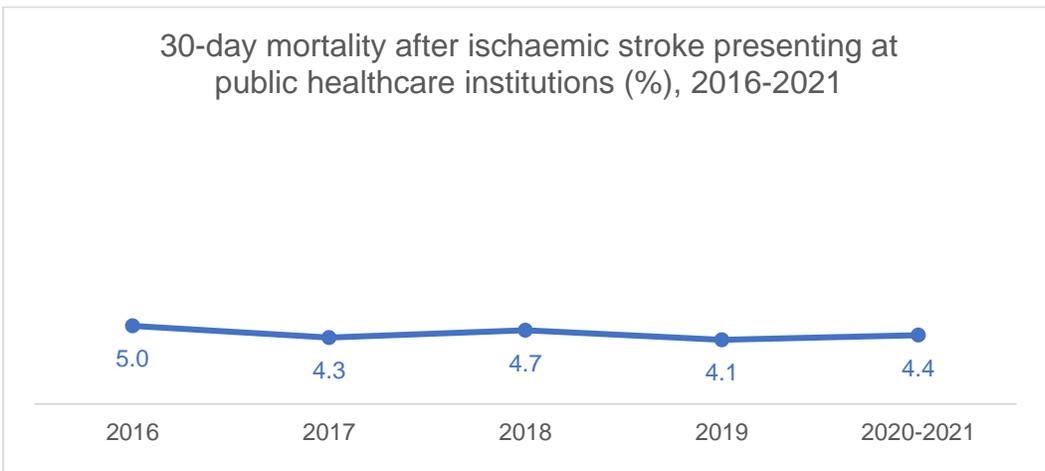
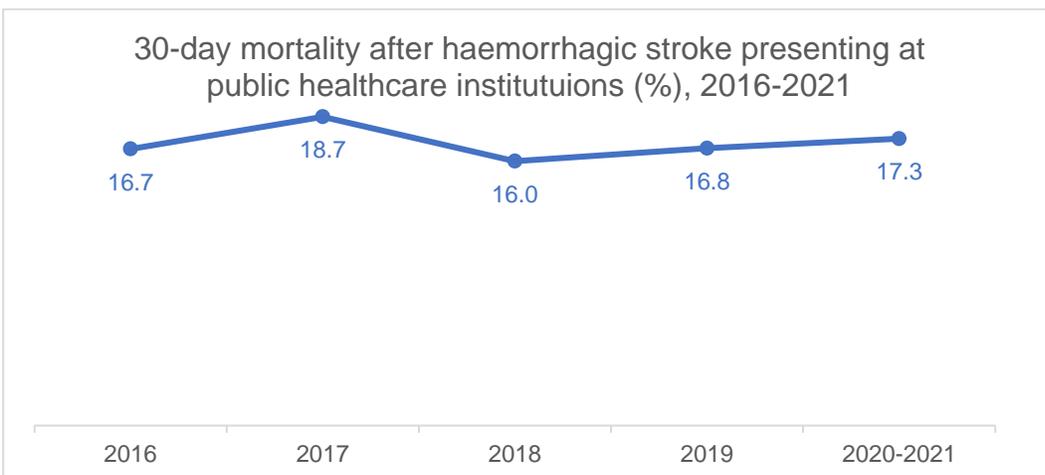


Chart A3



Chat A4

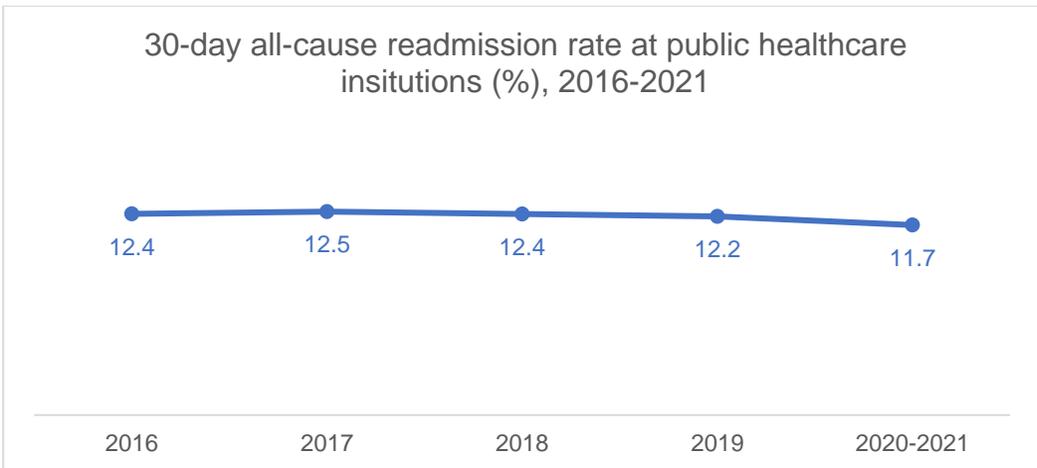


Table A2: WHO estimates of excess mortality associated with COVID-19 pandemic by Country in 2021

Country	All-cause excess deaths per 100,000 (95% confidence interval)
Australia [^]	-26 (-38, -14)
New Zealand [^]	-13 (-20, -5)
China [*]	2 (1, 3)
Japan [^]	8 (-1, 18)
Republic of Korea [^]	12 (4, 19)
Canada	14 (-21, 53)
Singapore	26 (19, 32)
Sweden	27 (17, 38)
Israel	43 (34,51)
Thailand	44 (26, 62)
France	50 (37, 63)
Vietnam	53 (-138, 287)
Denmark	56 (41, 72)
Spain	67 (52, 84)
Malaysia	69 (39, 101)
Cambodia	70 (21, 122)
Myanmar	79 (17, 146)
Netherlands	86 (73, 98)
United Kingdom	93 (78, 109)
Italy	100 (81, 120)
United States of America	140 (129, 151)
Germany	153 (120, 185)
Philippines	203 (185, 223)
Indonesia	243 (183, 303)
India	280 (192, 395)

[^]Countries which opened up later and recorded higher death tolls that were not included in the study

^{*}Countries yet to fully opened up

Note: only indicative countries are represented in the table.

Source: Estimates of Excess Mortality Associated with COVID-19 Pandemic (as of 25 March 2022). Geneva: World Health Organization, 2022.

7. Appendix B – Glossary of Terms

Term	Description
Age-standardised death rate	The age-standardised death rate (ADR) provides a summary indicator that removes the influence of the population age structure. It is derived by multiplying the age-specific death rates of the reference population by the proportion of the corresponding age group out of a “standard” population.
Excess deaths	The difference between actual deaths from all-causes since the pandemic began and the expected deaths in the absence of COVID-19.