

LEGIONELLOSIS

Legionellosis is an acute bacterial disease caused by the bacterium *Legionella pneumophila*. It has two recognised distinct clinical and epidemiological manifestations: Legionnaires' disease and Pontiac fever. Both conditions are characterised by fever, chills, anorexia, malaise, myalgia and headache, but only Legionnaires' disease is associated with pneumonia. The chest X-ray for a patient with Legionnaires' disease may reveal patchy or focal areas of consolidation. The mode of transmission is airborne and includes aspiration of aerosolised water containing the bacteria.

A total of 16 cases of laboratory confirmed legionellosis were reported in 2020, compared to 23 cases reported in 2019 (Figure 6.1). Of the 23 confirmed cases reported in 2019, 22 cases had confirmed Legionnaires' disease, while one case had presumptive Pontiac fever, while all 16 cases in 2020 had confirmed Legionnaires' disease (Table 6.1). Nine and two cases had acquired the infection overseas in 2019 and 2020 respectively (Table 6.2). No legionellosis death was reported in 2019 and 2020.

Figure 6.1
Weekly distribution of reported legionellosis cases, 2019-2020

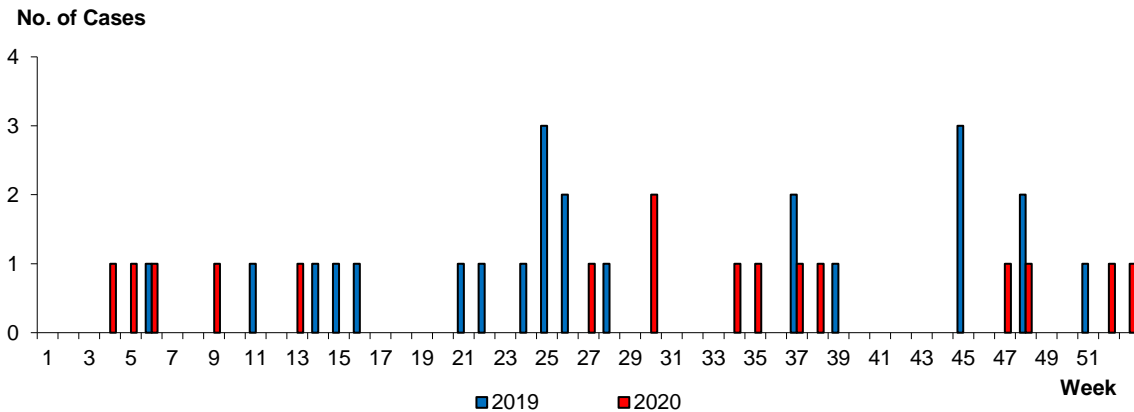


Table 6.1
Classification of reported legionellosis cases, 2019 - 2020

Classification	2019		2020	
	Pontiac fever	Legionnaires' disease	Pontiac fever	Legionnaires' disease
Confirmed cases	0	22	0	16
Presumptive cases	1	0	0	0
Total	1	22	0	16

Table 6.2
Total number of notifications* received for legionellosis cases, 2016-2020

Age group	2016		2017		2018		2019		2020	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	0	0	0	0	0	0	0	0	0
5-9	0	0	0	0	0	0	0	0	0	0
10-14	0	0	0	0	0	0	0	0	0	0
15-24	0	0	0	0	0	0	0	0	0	0
25-34	0	0	0	0	0	0	0	0	0	0
35-44	1	0	2	0	0	1	0	0	0	0
45-54	1	0	2	0	1	1	1	1	4	0
55-64	2	1	2	1	2	5	3	5	3	0
65+	4	0	7	2	6	3	9	3	6	2
Total	8	1	13	3	9	10	13	9	13	2

*Excluded tourists and foreigners seeking medical treatment in Singapore.

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In both 2019 and 2020, the resident incidence rate was highest among the 65+ years age group (Tables 6.3 and 6.4). Among the three major ethnic groups, Chinese had the highest incidence rate of 0.7 per 100,000 population in 2019 (Table 6.5) and Indians had the highest incidence rate of 0.6 per 100,000 population in 2020 (Table 6.6) respectively.

Table 6.3
Age-sex distribution and age-specific resident incidence rate of reported legionellosis cases[^], 2019

Age group	Number of notifications				Incidence rate per 100,000 resident population*
	Male	Female	Total	%	
0-4	0	0	0	0	0.0
5-14	0	0	0	0	0.0
15-24	0	0	0	0	0.0
25-34	0	0	0	0	0.0
35-44	0	0	0	0	0.0
45-54	2	0	2	9.1	0.3
55-64	8	0	8	36.4	1.4
65+	9	3	12	54.5	2.1
Total	19	3	22	100	-

[^]Excluded one tourist.

*Rates are based on 2019 estimated mid-year population.
(Source: Singapore Department of Statistics)

Table 6.4
Age-sex distribution and age-specific resident incidence rate of reported legionellosis cases[^], 2020

Age group	Number of notifications				Incidence rate per 100,000 resident population*
	Male	Female	Total	%	
0-4	0	0	0	0	0.0
5-14	0	0	0	0	0.0
15-24	0	0	0	0	0.0
25-34	0	0	0	0	0.0
35-44	0	0	0	0	0.0
45-54	2	2	4	26.7	0.7
55-64	3	0	3	20.0	0.5
65+	5	3	8	53.3	1.1
Total	10	5	15	100	-

[^]Excluded one foreigner seeking medical treatment in Singapore.

*Rates are based on 2020 estimated mid-year population.
(Source: Singapore Department of Statistics)

Table 6.5
Ethnic-sex distribution and ethnic-specific incidence rate of reported legionellosis cases[^], 2019

	Male	Female	Total	%	Incidence rate per 100,000 population*
Singapore residents					
Chinese	17	3	20	90.9	0.7
Malay	0	0	0	0	0.0
Indian	2	0	2	9.1	0.6
Others	0	0	0	0	0.0
Foreign residents	0	0	0	0	0.0
Total	19	3	22	100	0.4

[^] Excluded one tourist.

*Rates are based on 2019 estimated mid-year population.
(Source: Singapore Department of Statistics)

Table 6.6
Ethnic-sex distribution and ethnic-specific incidence rate of reported legionellosis cases[^], 2020

	Male	Female	Total	%	Incidence rate per 100,000 population*
Singapore residents					
Chinese	8	2	10	66.7	0.3
Malay	0	0	0	0	0.0
Indian	1	1	2	13.3	0.6
Others	1	1	2	13.3	1.5
Foreign residents	0	1	1	6.7	0.1
Total	10	5	15	100	0.3

[^] Excluded one foreigner seeking medical treatment in Singapore.

*Rates are based on 2020 estimated mid-year population.

(Source: Singapore Department of Statistics)

LEPROSY

Leprosy is a chronic bacterial disease of the skin, peripheral nerves and the upper airway (in lepromatous patients) by *Mycobacterium leprae*. The manifestations of the disease vary in a continuous spectrum between the two polar forms, lepromatous and tuberculoid leprosy. It can present as hypopigmented patches with diminished sensation, multiple raised plaques, thickened nerves or neuritis. Diagnosis can be made through clinical features, a slit skin smear or skin biopsy for histological examination.

In the past, leprosy was regarded as a highly contagious, mutilating and incurable disease leading to social stigma associated with the disease and the people afflicted with it. Modern treatment for leprosy was introduced in 1941 when dapsone and its derivatives were used. With effective chemotherapy, leprosy is curable today. Currently, the Cutaneous Infection Unit of the National Skin Centre manages leprosy cases based on the WHO guidelines for therapy.

The distribution of leprosy notifications among Singapore residents and non-residents from 2011 to 2020 is shown in Table 6.7.

Table 6.7
Leprosy notifications among Singapore residents and non-residents, 2011-2020

Year	Number of cases (%)		
	Resident	Non-resident	Total
2011	5 (31.2)	11 (68.8)	16
2012	5 (33.3)	10 (66.7)	15
2013	3 (25.0)	9 (75.0)	12
2014	1 (16.7)	5 (83.3)	6
2015	1 (33.3)	2 (66.7)	3
2016	2 (28.6)	5 (71.4)	7
2017	0 (0)	6 (100)	6
2018	2 (33.3)	4 (66.7)	6
2019	1 (25)	3 (75)	4
2020	3 (100)	0 (0)	3

Leprosy in Singapore residents

The incidence rate of leprosy among Singapore residents has declined over the past six decades, from 21.3 per 100,000 population in 1960 to 0.1 per 100,000 population in 2020. In 2019, one Singapore resident with leprosy was notified; in 2020, three Singapore residents with leprosy were notified (Table 6.8). Leprosy patients are classified into multibacillary and paucibacillary types of infection (Table 6.9).

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Table 6.8
Distribution of leprosy notifications among Singapore residents by sex, 2011-2020

Year	Number of cases		
	Male	Female	Total
2011	2	3	5
2012	4	1	5
2013	1	2	3
2014	1	0	1
2015	0	1	1
2016	2	0	2
2017	0	0	0
2018	2	0	2
2019	1	0	1
2020	2	1	3

Table 6.9
Distribution of leprosy notifications among Singapore residents by type of infection, 2011-2020

Year	Number of cases		
	Multibacillary	Paucibacillary	Total
2011	3	2	5
2012	5	0	5
2013	2	1	3
2014	1	0	1
2015	1	0	1
2016	1	1	2
2017	0	0	0
2018	1	1	2
2019	1	0	1
2020	2	1	3

Leprosy in non-residents

The number of leprosy cases in non-residents fluctuated over the years. In 2019, three cases of leprosy in non-residents were notified (Table 6.10), all of whom had multibacillary infections (Table 6.11). In 2020, there were no cases of leprosy among non-residents.

Table 6.10
Distribution of leprosy notifications among non-residents by sex, 2011-2020

Year	Number of cases		
	Male	Female	Total
2011	7	4	11
2012	7	3	10
2013	6	3	9
2014	2	3	5
2015	1	1	2
2016	4	1	5
2017	5	1	6
2018	2	2	4
2019	1	2	3
2020	0	0	0

Table 6.11
Distribution of leprosy notifications among non-residents by type of infection, 2011-2020

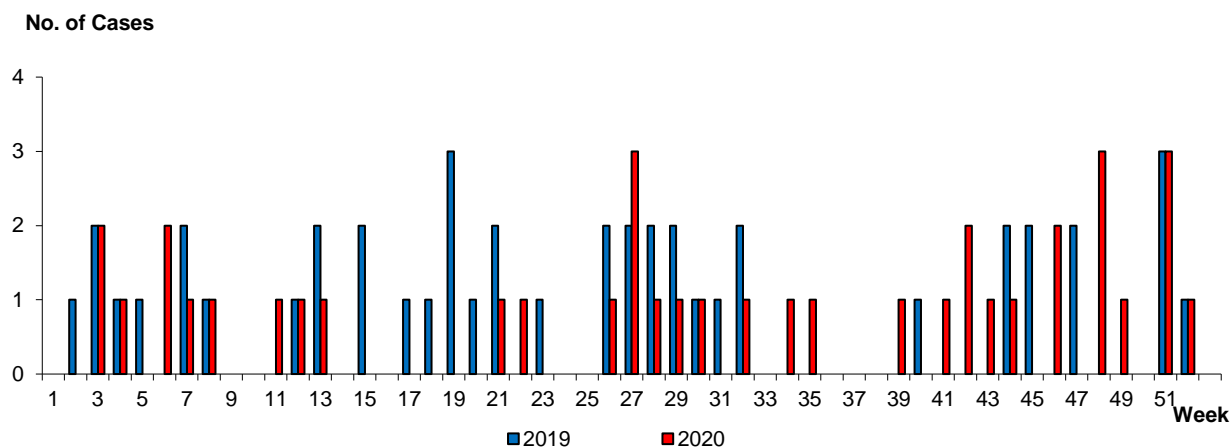
Year	Number of cases			
	Multibacillary	Paucibacillary	Unknown	Total
2011	9	2	0	11
2012	6	4	0	10
2013	6	2	1	9
2014	2	2	1	5
2015	0	2	0	2
2016	2	3	0	5
2017	4	1	1	6
2018	3	0	1	4
2019	3	0	0	3
2020	0	0	0	0

MELIOIDOSIS

Melioidosis is a bacterial infection with a wide spectrum of clinical manifestations, ranging from pulmonary consolidation to localised cutaneous or visceral abscesses, and necrotising pneumonia with or without septicaemia. The infectious agent is *Burkholderia pseudomallei*. The mode of transmission is by contact with contaminated soil or water through overt or inapparent skin lesions. It can also be transmitted by aspiration or ingestion of contaminated water or inhalation of dust from contaminated soil.

A total of 38 cases of laboratory confirmed melioidosis were reported in 2020, compared to 45 cases reported in 2019 (Figure 6.2). Of the 45 confirmed cases reported in 2019, 42 were classified as local cases and three as imported cases. The latter involved one Singapore resident, and two foreigners seeking medical treatment in Singapore. All 38 cases in 2020 were local cases (Table 6.12).

Figure 6.2
Weekly distribution of reported melioidosis cases, 2019-2020



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Table 6.12
Total number of notifications* received for reported melioidosis cases, 2016-2020

Age group	2016		2017		2018		2019		2020	
	Local	Imported	Local	Imported	Local	Imported	Local	Imported	Local	Imported
0-4	0	0	0	0	0	0	0	0	0	0
5-9	0	0	0	0	1	0	0	0	0	0
10-14	1	0	1	0	1	0	0	0	1	0
15-24	2	0	2	0	2	0	0	0	0	0
25-34	1	0	2	0	3	0	2	1	1	0
35-44	7	0	3	0	2	0	4	0	2	0
45-54	9	0	13	0	7	0	15	0	5	0
55-64	18	2	7	1	9	1	13	0	18	0
65+	15	1	19	0	7	0	8	0	11	0
Total	53	3	47	1	32	1	42	1	38	0

*Excluded tourists and foreigners seeking medical treatment in Singapore.

In both 2019 and 2020, the resident incidence rate was highest among the 55-64 years age group (Tables 6.13 and 6.14). Among the three major ethnic groups, Malay had the highest incidence rate in 2019 and 2020 (Tables 6.15 and 6.16).

Table 6.13
Age-sex distribution and age-specific resident incidence rate of reported melioidosis cases[^], 2019

Age group	Number of notifications				Incidence rate per 100,000 resident population*
	Male	Female	Total	%	
0-4	0	0	0	0	0.0
5-14	0	0	0	0	0.0
15-24	0	0	0	0	0.0
25-34	3	0	3	7.0	0.0
35-44	4	0	4	9.3	0.5
45-54	14	1	15	34.9	1.8
55-64	13	0	13	30.2	2.2
65+	6	2	8	18.6	1.4
Total	40	3	43	100	-

[^]Excluded two foreigners seeking medical treatment in Singapore.

*Rates are based on 2019 estimated mid-year population.
(Source: Singapore Department of Statistics)

Table 6.14
Age-sex distribution and age-specific resident incidence rate of reported melioidosis cases, 2020

Age group	Number of notifications				Incidence rate per 100,000 resident population*
	Male	Female	Total	%	
0-4	0	0	0	0	0.0
5-14	0	1	1	2.6	0.2
15-24	0	0	0	0	0.0
25-34	1	0	1	2.6	0.2
35-44	2	0	2	5.3	0.0
45-54	4	1	5	13.2	0.5
55-64	14	4	18	47.4	3.0
65+	11	0	11	28.9	1.8
Total	32	6	38	100	-

*Rates are based on 2020 estimated mid-year population.
(Source: Singapore Department of Statistics)

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Table 6.15
Ethnic distribution and ethnic-specific incidence rate of reported melioidosis cases[^], 2019

Ethnic group	Male	Female	Total	%	Incidence rate per 100,000 population*
Singapore residents					
Chinese	13	3	16	37.2	0.5
Malay	12	0	12	27.9	2.2
Indian	7	0	7	16.3	1.9
Others	0	0	0	0	0.0
Foreign residents	8	0	8	18.6	0.5
Total	40	3	43	100	0.8

[^] Excluded two foreigners seeking medical treatment in Singapore.

*Rates are based on 2019 estimated mid-year population.

(Source: Singapore Department of Statistics)

Table 6.16
Ethnic distribution and ethnic-specific incidence rate of reported melioidosis cases, 2020

Ethnic group	Male	Female	Total	%	Incidence rate per 100,000 population*
Singapore residents					
Chinese	13	5	18	47.4	0.6
Malay	11	0	11	28.9	2.0
Indian	3	1	4	10.5	1.1
Others	1	0	1	2.6	0.8
Foreign residents	4	0	4	10.5	0.2
Total	32	6	38	100	0.7

*Rates are based on 2020 estimated mid-year population.

(Source: Singapore Department of Statistics)

Burkholderia pseudomallei were detected from the blood samples in more than 60% of the cases in 2019 and 2020 (Table 6.17). Those who presented with bacteraemia comprised 74.4% and 78.9% of the cases in 2019 and 2020 respectively (Table 6.18).

Table 6.17
Types of laboratory sample of reported melioidosis cases[^], 2019 and 2020

Types of laboratory sample	2019		2020	
	No. of cases	%	No. of cases	%
Blood	27	62.8	24	63.2
Bronchial alveolar lavage	1	2.3	3	7.9
Pus	3	7.0	2	5.3
Sputum	4	9.3	1	2.6
Swabs	0	0	1	2.6
Urine	0	0	1	2.6
Others	8	18.6	6	15.8
Total	43	100	38	100

[^] Excluded foreigners seeking medical treatment in Singapore.

Table 6.18
Cases of melioidosis presenting with bacteraemia and abscesses, 2016–2020

Year	Cases [^]	Bacteraemia		Abscesses			
		No.	%	All Abscesses		Cutaneous	
				No.	%	No.	%
2016	56	37	66.1	19	33.9	12	21.4
2017	48	34	70.8	14	29.2	10	20.8
2018	33	17	51.5	16	48.5	12	36.4
2019	43	32	74.4	11	25.6	6	14.0
2020	38	30	78.9	8	21.1	6	15.8

[^] Excluded tourists and foreigners seeking medical treatment in Singapore.

TUBERCULOSIS

Tuberculosis (TB) is a mycobacterial disease that is a major cause of death and disability in many parts of the world, especially in developing countries. Initial tuberculosis infection is typically asymptomatic and is known as latent TB infection (LTBI). About 10% of immunocompetent adults with LTBI will eventually progress to active disease, and half of them will do so in the first two years following infection. The risk of progression to active disease is increased in immunosuppressed persons and in children under five years of age.

The National TB Control Programme was established in the late 1950s with the set-up of the TB Control Unit and a National TB registry. The programme was enhanced with the launch of the National TB Programme (NTBP) in 1997. The main aim of STEP is to eliminate TB in Singapore by detecting, diagnosing and treating all infectious TB cases, identifying and treating infected TB contacts, and preventing the emergence of multidrug-resistant TB (MDR-TB).

A total of 2,629 cases of TB were notified in 2020, compared to 2,798 cases notified in 2019. The 2,798 cases in 2019 comprised of 1,398 new and 93 relapse cases among Singapore residents (citizens and PRs) and 1,254 new and 53 relapse cases among non-residents (long- and short-staying foreigners). Of the 2,626 cases in 2020, there were 1,360 new and 102 relapse cases among Singapore residents (citizens and PRs) and 1,122 new and 45 relapse cases among non-residents (long- and short-staying foreigners).

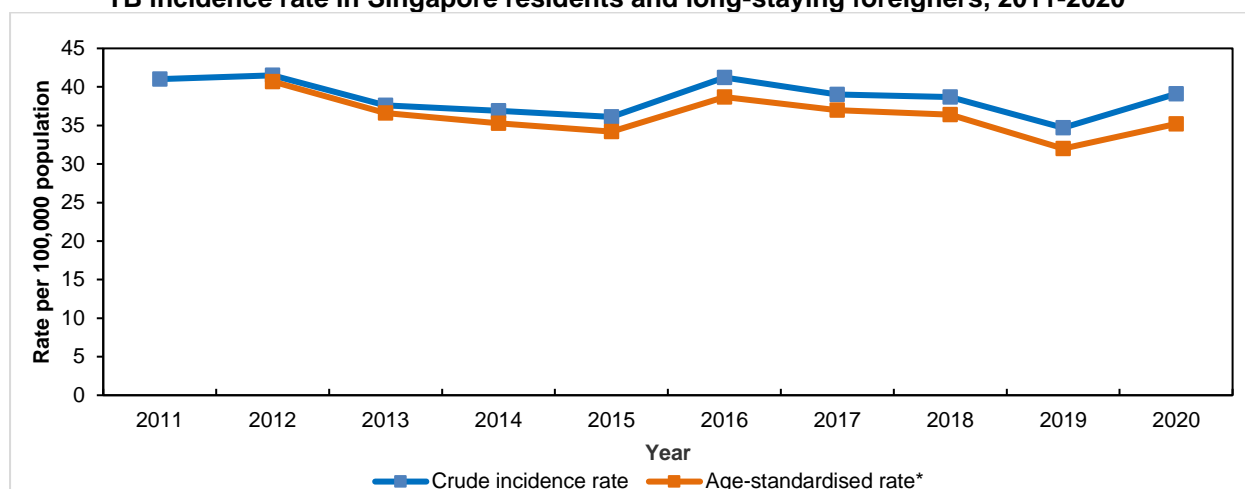
Incidence and site of disease in total population (Singapore residents, long-staying foreigners)

The total number of new TB cases notified among Singapore residents and long-staying foreigners was 1,978 in 2019 and 2,225 in 2020.

The crude incidence rate of TB was 34.7 per 100,000 population in 2019 and 39.1 per 100,000 population in 2020, while the age-standardised incidence rate of TB was 32.0 per 100,000 population in 2019 and 35.2 per 100,000 population in 2020 (Figure 6.3).

The majority of cases had pulmonary TB with or without extra-pulmonary involvement (83.9% in 2019 and 81.1% in 2020), while the remainder had exclusively extra-pulmonary TB (16.1% in 2019 and 18.9% in 2020) (Table 6.19).

Figure 6.3
TB incidence rate in Singapore residents and long-staying foreigners, 2011-2020



*Age-standardised rate using 2010 mid-year Singapore resident population.
(Source: Singapore Department of Statistics)

Table 6.19
New TB cases by site of disease in Singapore residents and long-staying foreigners, 2011-2020

Year	New cases			Incidence rate per 100,000 population		
	Pulmonary ¹	Extra-pulmonary	Total	Pulmonary ¹	Extra-pulmonary	Total
2011	1,811	315	2,126	34.9	6.1	41.0
2012	1,897	306	2,203	35.7	5.8	41.5
2013	1,750	278	2,028	32.4	5.1	37.6
2014	1,705	313	2,018	31.2	5.7	36.9
2015	1,691	309	2,000	30.6	5.6	36.1
2016	1,930	380	2,310	34.4	6.8	41.2
2017	1,871	320	2,191	33.3	5.7	39.0
2018	1,858	324	2,182	33.0	5.7	38.7
2019	1,660	318	1,978	29.1	5.6	34.7
2020	1,805	420	2,225	31.7	7.4	39.1

¹ Pulmonary TB refers to TB of the lung parenchyma and included cases that had both pulmonary and extra-pulmonary TB.

The proportion of new pulmonary TB cases in Singapore residents and long-staying foreigners with bacteriological tests done were 96.6% in 2019 and 97.6% in 2020. The proportion found to have demonstrable bacillary disease were 64.3% in 2019 and 60.1% in 2020 (Table 6.20).

Table 6.20
Bacillary status of new pulmonary TB cases in Singapore residents and long-staying foreigners, 2011-2020

Year	No. tested for bacillary disease	% of notified pulmonary cases tested	No. of pulmonary cases with bacillary disease	% of pulmonary cases tested positive	Incidence rate per 100,000 population
2011	1,770	97.7	1,259	71.1	24.3
2012	1,816	95.7	1,213	66.8	22.8
2013	1,669	95.4	1,084	64.9	20.1
2014	1,621	95.1	1,033	63.7	18.9
2015	1,646	97.3	1,060	64.4	19.2
2016	1,831	94.9	1,187	64.8	21.1
2017	1,823	97.4	1,131	62.0	20.2
2018	1,808	97.3	1,119	61.9	19.8
2019	1,604	96.6	1,032	64.3	18.1
2020	1,761	97.6	1,059	60.1	18.6

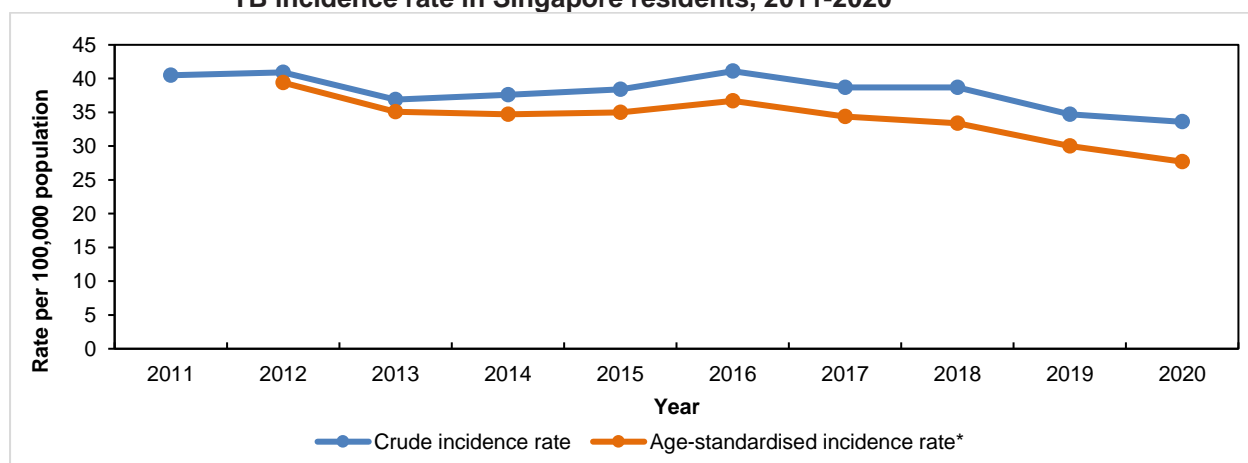
The table included only bacteriological investigations (smear and/or culture) done from three months before to two weeks after the date of notification or date of starting treatment, whichever earlier.

Incidence and site of disease in Singapore residents

The crude incidence rate of TB declined from 307 per 100,000 population in 1960 to 56.3 per 100,000 population in 1987, then to between 37 and 41 per 100,000 population since 2009 to 2018. The crude incidence rate decreased to 34.7 per 100,000 population in 2019 and to 33.6 cases per 100,000 population in 2020. In contrast, the age-standardised incidence rate of TB was 30.0 per 100,000 population in 2019 and 27.7 per 100,000 population in 2020 (Figure 6.4).

Of the new TB cases notified among Singapore residents, the proportion of pulmonary TB was 84.7% in 2019 and 82.1% in 2020, while the proportion of exclusively extra-pulmonary TB was 15.3% in 2019 and 17.9% in 2020 (Table 6.21). Of those with pulmonary TB, 13.0% had extra-pulmonary involvement in 2019 and 15.7% had extra-pulmonary involvement in 2020. In 2019, the most common site of extra-pulmonary TB among new cases (368) was the pleura (122), followed by the lymphatic (115), while in 2020, the most common site of extra-pulmonary TB among new cases (418) was lymphatic (141), followed by the pleura (128).

Figure 6.4
TB incidence rate in Singapore residents, 2011-2020



*Age-standardised rate using 2010 mid-year Singapore resident population.
(Source: Singapore Department of Statistics)

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Table 6.21
Distribution of new TB cases by site of disease in Singapore residents, 2011-2020

Year	New Cases			Incidence rate per 100,000 population		
	Pulmonary*	Extra-pulmonary^	Total	Pulmonary*	Extra-pulmonary^	Total
2011	1,309	224	1,533	34.5	5.9	40.5
2012	1,359	201	1,560	35.6	5.3	40.9
2013	1,249	171	1,420	32.5	4.4	36.9
2014	1,220	234	1,454	31.5	6.0	37.6
2015	1,271	227	1,498	32.6	5.8	38.4
2016	1,353	264	1,617	34.4	6.7	41.1
2017	1,302	234	1,536	32.8	5.9	38.7
2018	1,309	238	1,547	32.8	6.0	38.7
2019	1,184	214	1,398	29.4	5.3	34.7
2020	1,117	243	1,360	27.6	6.0	33.6

* Pulmonary TB refers to TB of the lung parenchyma and included cases that had both pulmonary and extra-pulmonary TB.

^ Refers to cases that had only extra-pulmonary TB.

Distribution by age and sex

As in previous years, the highest incidence of TB in Singapore residents was in older males (Tables 6.22 and 6.23).

The TB incidence rate among males decreased from 47.2 per 100,100 population in 2019 to 44.7 per 100,000 population in 2020 whereas the rate among females was 22.8 per 100,000 population in 2019 and 23.1 per 100,000 population in 2020.

Table 6.22
Age-sex distribution and incidence rate of TB in Singapore residents, 2019

Age group	Male	Female	Total	%	Incidence rate per 100,000 population*		
					Male	Female	Total
0-4	3	2	5	0.4	3.2	2.2	2.7
5-9	0	0	0	0.0	0.0	0.0	0.0
10-14	3	4	7	0.5	2.8	3.9	3.4
15-19	14	13	27	1.9	12.3	12.0	12.2
20-29	43	42	85	6.1	16.0	15.7	15.8
30-39	72	73	145	10.4	25.5	23.4	24.4
40-49	91	66	157	11.2	30.8	20.8	25.6
50-59	230	84	314	22.5	76.0	27.5	51.6
60-69	213	83	296	21.2	86.2	32.8	59.2
70-79	146	63	209	14.9	128.7	48.0	85.4
80+	114	39	153	10.9	256.9	54.7	132.3
Total	929	469	1,398	100.0	47.2	22.8	34.7

* Rates are based on 2019 estimated mid-year population.
(Source: Singapore Department of statistics)

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Table 6.23
Age-sex distribution and incidence rate of TB in Singapore residents, 2020

Age group	Male	Female	Total	%	Incidence rate per 100,000 population*		
					Male	Female	Total
0-4	2	1	3	0.2	2.1	1.1	1.6
5-9	0	2	2	0.1	0.0	2.1	1.0
10-14	1	2	3	0.2	1.0	2.0	1.5
15-19	13	14	27	2.0	11.8	13.3	12.5
20-29	38	36	74	5.4	14.2	13.6	13.9
30-39	59	59	118	8.7	20.7	18.9	19.8
40-49	82	74	156	11.5	27.8	23.4	25.5
50-59	150	73	223	16.4	50.3	24.0	37.0
60-69	266	85	351	25.8	104.7	32.7	68.3
70-79	155	75	230	16.9	127.5	53.8	88.1
80+	117	56	173	12.7	245.2	73.4	139.5
Total	883	477	1,360	100.0	44.7	23.1	33.6

* Rates are based on 2020 estimated mid-year population.
(Source: Singapore Department of statistics)

Ethnic distribution

In both 2019 and 2020, Malays had the highest TB incidence among the three main ethnic groups (Tables 6.24 and 6.25).

Table 6.24
Ethnic-sex distribution and ethnic-specific incidence rate of TB in Singapore residents, 2019

Ethnic group	Male	Female	Total	%	Incidence rate per 100,000 population*
Chinese	691	295	986	70.5	32.9
Malay	159	110	269	19.2	49.7
Indian	53	35	88	6.3	24.3
Others	26	29	55	3.9	42.6
Total	929	469	1,398	100.0	34.7

* Rates are based on 2019 estimated mid-year population.
(Source: Singapore Department of Statistics)

Table 6.25
Ethnic-sex distribution and ethnic-specific incidence rate of TB in Singapore residents, 2020

Ethnic group	Male	Female	Total	%	Incidence rate per 100,000 population*
Chinese	651	285	936	68.8	31.1
Malay	146	120	266	19.6	48.8
Indian	60	45	105	7.7	29.0
Others	26	27	53	3.9	40.9
Total	883	477	1,360	100.0	33.6

* Rates are based on 2020 estimated mid-year population.
(Source: Singapore Department of Statistics)

Clinical presentation and bacteriological status

In both 2019 and 2020, the proportion of new pulmonary TB cases in Singapore residents with bacteriological tests done was 98.0%. The proportion found to have demonstrable bacillary disease was 68.9% in 2019 and 66.8% in 2020 (Table 6.26).

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Table 6.26
Bacillary status of new pulmonary TB cases in Singapore residents, 2011-2020

Year	No. tested for bacillary disease	% of notified pulmonary cases tested	No. of pulmonary cases with bacillary disease	% of pulmonary cases tested positive	Incidence rate per 100,000 population
2011	1,276	97.5	977	76.6	25.8
2012	1,321	97.2	981	74.3	25.7
2013	1,207	96.6	879	72.8	22.9
2014	1,183	97.0	858	72.5	22.2
2015	1,249	98.3	887	71.0	22.7
2016	1,304	96.3	931	71.3	23.7
2017	1,277	98.1	878	68.8	22.1
2018	1,289	98.4	894	69.3	22.4
2019	1,160	98.0	799	68.9	19.8
2020	1,095	98.0	731	66.8	18.1

Relapse TB cases

There were 93 and 102 relapse TB cases notified among Singapore residents in 2019 and 2020 respectively. These accounted for 6.2% and 7.0% of all cases (new and relapse) among Singapore residents in 2019 and in 2020 respectively (Table 6.27).

Table 6.27
Age-sex distribution of relapse TB cases in Singapore residents, 2016-2020

Age group	2016		2017		2018		2019		2020	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-9	0	0	0	0	0	0	0	0	0	0
10-19	0	0	1	1	0	0	1	0	0	0
20-29	0	3	1	3	1	1	1	1	0	1
30-39	3	5	2	2	3	5	2	4	1	5
40-49	8	3	8	6	5	3	2	3	2	2
50-59	16	8	21	2	23	12	18	4	16	6
60-69	38	8	34	8	23	2	17	3	18	7
70+	42	8	32	3	42	6	28	9	36	8
Sub Total	107	35	99	25	97	29	69	24	73	29
Total	142		124		126		93		102	

TB cases in Singapore residents by country of birth

Among Singapore residents, the proportion of Singapore-born new cases was 78.3% in 2019 and 79.6% in 2020, while that of foreign-born new cases was 21.7% in 2019 and 20.4% in 2020. Of the relapse TB cases notified among Singapore residents, 87.0% in 2019 and 79.4% in 2020 were Singapore-born while 13.0% in 2019 and 20.6% in 2020 were foreign-born (Table 6.28).

Table 6.28
Distribution of TB cases by age group and country of birth in Singapore residents, 2019-2020

Age group	New cases				Relapse cases			
	2019		2020		2019		2020	
	S'pore born	Foreign born	S'pore born	Foreign born	S'pore born	Foreign born	S'pore born	Foreign born
0-9	5	0	5	0	0	0	0	0
10-19	28	6	20	10	1	0	0	0
20-29	64	21	59	15	2	0	0	1
30-39	94	51	71	47	3	3	1	5
40-49	111	46	105	51	3	2	2	2
50-59	257	57	193	30	19	3	18	4
60-69	259	37	305	46	20	0	23	2
70+	277	85	324	79	33	4	37	7
Total	1,095	303	1,082	278	81	12	81	21

TB-HIV co-infection in residents

People living with HIV (PLHIV) are known to be particularly susceptible to TB, both from the reactivation of latent infection and from new infection with rapid progression to active disease. PLHIV are about 26 to 31 times more likely to develop TB disease than those who are HIV-negative worldwide. According to the 2020 WHO Global TB Report¹, people living with HIV accounted for 0.82 million (8.2%) of all new TB cases worldwide in 2019. Among TB deaths (1.4 million), 14.7% were HIV positive¹.

Of the 1,491 and 1,462 notified cases of TB (both new and relapse cases) among Singapore residents in 2019 and 2020 respectively, the proportion of TB cases who had a documented HIV status at the time of TB diagnosis² was 87.1% in 2019 and 86.7% in 2020.

In 2019, the proportion of TB-HIV co-infection among TB cases with a documented HIV status was 2.6% (34 cases), of whom 22 were diagnosed with HIV infection within three months of TB diagnosis. In 2020, the prevalence of TB-HIV co-infection among TB cases with a documented HIV status was 1.4% (18 cases), of whom 11 were diagnosed to be HIV positive within three months of TB diagnosis.

The prevalence of TB-HIV co-infection among the new and relapse TB cases were 2.4% (29 out of 1,217 cases) and 6.1% (5 out of 82 cases) respectively in 2019. The prevalence of TB-HIV co-infection among the new and relapse TB cases were 1.4% (17 out of 1,182 cases) and 1.2% (one out of 85 cases) respectively in 2020.

In both 2019 and 2020, the highest TB-HIV co-infection rate among new and relapse TB cases were observed among males aged 50-59 years (Tables 6.29 and 6.30). By ethnic group, Indians and Malays had the highest TB-HIV co-infection rate in 2019 and in 2020 respectively (Tables 6.31 and 6.32).

¹ Global tuberculosis report 2020, WHO. Pg 32

² This refers to notified TB cases who were previously documented to be HIV-positive before TB diagnosis or had undergone HIV testing within three months of TB diagnosis.

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Table 6.29
Age-sex distribution of new and relapse cases with TB-HIV co-infection in Singapore residents, 2019

Age group	New and relapse cases				TB-HIV co-infection rate per 100,000 population*		
	Male	Female	Total	(%)	Male	Female	Total
0-14	0	0	0	0.0	0.0	0.0	0.0
15-19	0	0	0	0.0	0.0	0.0	0.0
20-29	0	1	1	2.9	0.0	0.4	0.2
30-39	2	2	4	11.8	0.7	0.6	0.7
40-49	7	0	7	20.6	2.4	0.0	1.1
50-59	15	2	17	50.0	5.0	0.7	2.8
60+	5	0	5	14.7	1.2	0.0	0.6
Total	29	5	34	100	-	-	-
Age-standardised rate (per 100,000 population)					1.4	0.3	0.8
Crude Rate (per 100,000 population)					1.5	0.2	0.8

*Rates are based on 2019 estimated mid-year Singapore resident population and standardised population for age-standardised rate using 2010 mid-year Singapore resident population.
(Source: Singapore Department of Statistics).

Table 6.30
Age-sex distribution of new and relapse cases with TB-HIV co-infection in Singapore residents, 2020

Age group	New and relapse cases				TB-HIV co-infection rate per 100,000 population*		
	Male	Female	Total	(%)	Male	Female	Total
0-14	0	0	0	0	0	0	0
15-19	0	0	0	0	0	0	0
20-29	0	0	0	0	0	0	0
30-39	2	0	2	11.1	0.7	0	0.3
40-49	1	1	2	11.1	0.3	0.3	0.3
50-59	6	3	9	50.0	2.0	1.0	1.5
60+	5	0	5	27.8	1.2	0	0.6
Total	14	4	18	100	-	-	-
Age-standardised rate (per 100,000 population)					0.6	0.2	0.4
Crude Rate (per 100,000 population)					0.7	0.2	0.4

*Rates are based on 2020 estimated mid-year Singapore resident population and standardised population for age-standardised rate using 2010 mid-year Singapore resident population.
(Source: Singapore Department of Statistics).

Table 6.31
Ethnic-sex distribution of new and relapse cases with TB-HIV co-infection in Singapore residents, 2019

Ethnic group	New and relapse cases				TB-HIV co-infection rate per 100,000 population*		
	Male	Female	Total	%	Male	Female	Total
Chinese	20	3	23	67.6	1.4	0.2	0.8
Malay	2	0	2	5.9	0.7	0.0	0.4
Indian	6	2	8	23.5	3.2	1.1	2.2
Others	1	0	1	2.9	1.7	0.0	0.8
Total	29	5	34	100	1.5	0.2	0.8

*Rates are based on 2019 estimated mid-year Singapore resident population.
(Source: Singapore Department of Statistics).

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Table 6.32
Ethnic-sex distribution of new and relapse cases with TB-HIV co-infection in Singapore residents, 2020

Ethnic group	New and relapse cases				TB-HIV co-infection rate per 100,000 population*		
	Male	Female	Total	%	Male	Female	Total
Chinese	10	4	14	77.8	0.7	0.3	0.5
Malay	4	0	4	22.2	1.5	0	0.7
Indian	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0
Total	14	4	18	100	0.7	0.2	0.4

*Rates are based on 2020 estimated mid-year Singapore resident population.
(Source: Singapore Department of Statistics).

TB cases in non-residents

There were 1,254 and 1,122 new TB cases notified among non-residents in Singapore in 2019 and 2020 respectively (Table 6.33). Short-staying foreigners accounted for 25.4% and 10.4% of all new cases notified in 2019 and 2020 respectively, while long-staying foreign workers accounted for 21.9% and 34.9% of all new cases notified in 2019 and 2020 respectively (Tables 6.34 and 6.35).

Table 6.33
New TB cases by pass category/status in non-residents, 2016-2020

	2016	2017	2018	2019	2020
Long-staying foreigners					
Work Permit Holders	473	446	402	384	612
Employment Pass Holder	44	40	53	48	63
Other Pass Holders*	176	169	180	148	190
Sub-total	693	655	635	580	865
Short-staying foreigners					
Work Permit Applicants	370	425	382	332	139
Visitors**	233	202	173	170	51
Others***	187	169	163	172	67
Sub-total	790	796	718	674	257
Total	1,483	1,451	1,353	1,254	1,122

* Includes dependent pass holder, long-term social visit pass holder, student pass holder and S pass holder.

** Short term social visitor.

*** Professional visit pass applicant, dependent pass applicant, long-term social visit pass applicant, student pass applicant, employment pass applicant, S pass applicant, illegal immigrant and other pass applicants.

Table 6.34
New TB cases by site of disease in short-staying foreigners, 2011-2020

Year	Pulmonary		Extra-pulmonary		Total	
	No.	% of total new cases notified	No.	% of total new cases notified	No.	% of total new cases notified
2011	833	27.4	73	2.4	906	29.9
2012	832	26.7	85	2.7	917	29.4
2013	678	24.2	95	3.4	773	27.6
2014	641	23.4	82	3.0	723	26.3
2015	620	22.9	84	3.1	704	26.0
2016	690	22.3	100	3.2	790	25.5
2017	723	24.2	73	2.4	796	26.6
2018	649	22.4	69	2.4	718	24.8
2019	602	22.7	72	2.7	674	25.4
2020	230	9.3	27	1.1	257	10.4

Table 6.35
New TB cases by site of disease in long-staying foreigners, 2011-2020

Year	Pulmonary		Extra-pulmonary		Total	
	No.	% of total new cases notified	No.	% of total new cases notified	No.	% of total new cases notified
2011	502	16.5	91	3.0	593	19.6
2012	538	17.2	105	3.4	643	20.6
2013	501	17.9	107	3.8	608	21.7
2014	485	17.7	79	2.9	564	20.6
2015	420	15.5	82	3.0	502	18.6
2016	577	18.6	116	3.7	693	22.4
2017	569	19.0	86	2.9	655	21.9
2018	549	18.9	86	3.0	635	21.9
2019	476	17.9	104	3.9	580	21.9
2020	688	27.7	177	7.1	865	34.9

TB drug resistance

In this section, analyses related to TB drug resistance for Singapore residents would be presented separately amongst those who are Singapore-born and foreign-born. With the exception of MDR-TB cases, the data presented was based on the drug susceptibility testing (DST) result of mycobacterial cultures taken at baseline (from three months before to two weeks after the date of notification or date of starting treatment, whichever earlier).

Singapore-born residents

Drug resistance was detected in 7.1% and 8.0% new pulmonary TB cases among Singapore-born residents in whom DST was performed in 2019 and 2020, respectively (Table 6.36). Isoniazid resistance was detected in 22 cases (3.4%) in 2019 and 27 cases (4.7%) in 2020 while MDR-TB was detected in two cases (0.3%) in both 2019 and 2020.

Of the 45 and 29 relapse pulmonary TB cases with DST performed in 2019 and 2020, drug resistance was detected in 13.3% and 6.9% of cases tested for DST respectively. Isoniazid resistance was detected in three cases 6.7% in 2019 and two cases (6.9%) in 2020 and no MDR-TB was detected in both 2019 and 2020.

There were no cases of pre-XDR (MDR/RR-TB and resistant to any fluoroquinolone) or XDR-TB (MDR-TB with resistance to any fluoroquinolone and at least one additional Group A drug) among Singapore-born TB cases in both 2019 and 2020.

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Table 6.36
***Mycobacterium tuberculosis* drug susceptibility in Singapore-born residents with pulmonary TB, 2017-2020**

Sensitivity result of sputum examination*	2017		2018		2019		2020	
	No.	%	No.	%	No.	%	No.	%
New cases								
Sensitive to: Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	634	92.4	689	93.5	591	92.9	527	92.0
Resistant to:								
Single drug	43	6.3	36	4.9	35	5.5	36	6.3
More than 1 drug	9	1.3	12	1.6	10	1.6	10	1.7
Total	686	100	737	100	636	100	573	100
**Resistant to Isoniazid	14	2.0	22	3.0	22	3.4	27	4.7
***Phenotypic MDR	2	0.3	2	0.3	2	0.3	2	0.3
****Genotypic MDR	0	0	0	0	0	0	0	0
Total MDR	2	0.3	2	0.3	2	0.3	2	0.3
Relapse cases								
Sensitive to: Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	55	93.2	46	90.2	39	86.7	27	93.1
Resistant to:								
Single drug	2	3.4	3	5.9	5	11.1	2	6.9
More than 1 drug	2	3.4	2	3.9	1	2.2	0	0
Total	59	100	51	100	45	100	29	100
**Resistant to Isoniazid	2	3.4	2	3.9	3	6.7	2	6.9
***Phenotypic MDR	0	0	1	2.0	0	0	0	0
****Genotypic MDR	0	0	0	0	0	0	0	0
Total MDR	0	0	1	2.0	0	0	0	0

* In the case of dual lesions, the sensitivity result recorded was that of organisms cultured from sputum.

**Any isoniazid resistance, excluding MDR.

*** Defined as cases which showed resistance to both rifampicin and isoniazid on DST.

****Defined as cases which showed rifampicin resistance on genotypic test and isoniazid resistance on DST.

Note: Extra-pulmonary MDR-TB was detected in one new case among Singapore-born residents in 2020.

Foreign-born residents

Drug resistance was detected in 8.5% and 11.3% of new pulmonary TB cases among foreign-born residents in whom DST was performed in 2019 and 2020 respectively (Table 6.37). Isoniazid resistance was detected in nine cases (5.9%) in 2019 and eight cases (5.6%) in 2020 while MDR-TB was detected in one case (0.7%) in 2019.

No case of drug resistance was detected among the two relapse pulmonary TB cases in foreign-born residents with DST performed in 2019 while two out of seven such relapse cases (28.6%) in 2020 were drug resistant. Isoniazid resistance was detected in one case (14.3%) and there were no cases of MDR or pre-XDR or XDR-TB detected among foreign-born TB cases in 2020.

Table 6.37
***Mycobacterium tuberculosis* drug susceptibility in foreign-born residents with pulmonary TB, 2017-2020**

Sensitivity result of sputum examination *	2017		2018		2019		2020	
	No.	%	No.	%	No.	%	No.	%
New cases								
Sensitive to: Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	149	91.4	120	85.7	140	91.5	126	88.7
Resistant to:								
Single drug	9	5.5	15	10.7	10	6.5	14	9.9
More than 1 drug	5	3.1	5	3.6	3	2.0	2	1.4
Total	163	100	140	100	153	100	142	100
**Resistant to Isoniazid	8	4.9	10	7.1	9	5.9	8	5.6
***Phenotypic MDR	3	1.8	2	1.4	1	0.7	0	0
****Genotypic MDR	0	0	0	0	0	0	0	0
Total MDR	3	1.8	2	1.4	1	0	0	0
Relapse cases								
Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	8	88.9	5	83.3	2	100	5	71.4
Resistant to:								
Single drug	0	0	1	16.7	0	0	1	14.3
More than 1 drug	1	11.1	0	0	0	0	1	14.3
Total	9	100	6	100	2	100	7	100
**Resistant to Isoniazid	0	0	0	0	0	0	1	14.3
***Phenotypic MDR	1	11.1	0	0	0	0	0	0
****Genotypic MDR	0	0	0	0	0	0	0	0
Total MDR	1	11.1	0	0	0	0	0	0

* In the case of dual lesions, the sensitivity result recorded was that of organisms cultured from sputum.

** Any of isoniazid resistance, excluding MDR.

*** Defined as cases which showed resistance to both rifampicin and isoniazid on DST.

**** Defined as cases which showed Rifampicin resistance on genotypic test and Isoniazid resistance on DST.

Note: Extra-pulmonary MDR-TB was detected in one relapse case and two new cases among foreign-born residents in 2019 and in 2020 respectively.

Non-residents

Drug resistance was detected in 17.6% and 14.7% of the new pulmonary TB cases among non-residents in whom DST was performed in 2019 and 2020 respectively (Table 6.38). Isoniazid resistance was detected in 41 cases (10.4%) in 2019 and 33 cases (8.5%) in 2020 while MDR-TB was detected in 11 cases (2.8%) in 2019 and nine cases (2.3%) in 2020, including two cases of pre-XDR-TB for both 2019 and 2020.

Drug resistance was detected in 8.3% and 45.4% among the relapse pulmonary TB cases with DST performed in 2019 and 2020. There were no MDR-TB cases detected in 2019 while one MDR-TB case was detected in 2020.

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Table 6.38
***Mycobacterium tuberculosis* drug susceptibility in non-residents with pulmonary TB, 2017-2020**

Sensitivity result of sputum examination*	2017		2018		2019		2020	
	No.	%	No.	%	No.	%	No.	%
New cases								
Sensitive to: Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	355	84.7	327	86.0	324	82.4	331	85.3
Resistant to:								
Single drug	42	10.0	30	7.9	49	12.5	42	10.8
More than 1 drug	22	5.3	23	6.1	20	5.1	15	3.9
Total	419	100	380	100	393	100	388	100
**Resistant to Isoniazid	27	6.4	27	7.1	41	10.4	33	8.5
***Phenotypic MDR	14 [#]	3.3	11	2.9	11	2.8	9 ^{##}	2.3
****Genotypic MDR	3	0.7	1 ^{##}	0.3	0	0	0	0
Total MDR	17	4.1	12	3.2	11	2.8	9	2.3
Relapse cases								
Sensitive to: Isoniazid, Rifampicin, Ethambutol & Streptomycin/PZA	11	84.6	12	70.6	11	91.7	6	54.5
Resistant to:								
Single drug	0	0	3	17.6	1	8.3	2	18.2
More than 1 drug	2	15.4	2	11.8	0	0	3	27.3
Total	13	100	17	100	12	100	11	100
**Resistant to Isoniazid	0	0	2	11.8	1	8.3	4	36.4
***Phenotypic MDR	2	15.4	1	5.9	0	0	0	0
****Genotypic MDR	0	0	0	0	0	0	1	9.1
Total MDR	2	15.4	1	5.9	0	0	1	9.1

* In the case of dual lesions, the sensitivity result recorded was that of organisms cultured from sputum.

**Any of isoniazid resistance, excluding MDR.

*** Defined as cases which showed resistance to both rifampicin and isoniazid on DST.

****Defined as cases which showed rifampicin resistance on genotypic test and isoniazid resistance on DST.

Included two MDR-TB cases that were notified as both pulmonary and extra-pulmonary TB, but where the MDR result was from the extra- pulmonary specimen only.

One MDR-TB case was notified as both pulmonary and extra-pulmonary TB, but MDR result was from the extra-pulmonary specimen only.

Note: Extra-pulmonary MDR-TB was detected in one new case among non-residents in both 2017 and 2019, and three new cases among non-residents in 2020.

One culture negative case with pulmonary and extra-pulmonary TB was treated as MDR-TB based on RpoB mutation detected via GeneXpert from extra-pulmonary specimen in 2020.

TB mortality

There were 19 deaths from TB among Singapore residents in 2019, giving a mortality rate of 0.5 case per 100,000 population, similar to 2020 (Tables 6.39 and 6.40). The majority were males (78.9% in 2019 and 68.4% in 2020) and those aged 70 years and above (63.2 in 2019 and 84.2% in 2020).

Table 6.39
Age-sex distribution and age-specific mortality rate of TB, 2019

Age group	Male	Female	Total	%	Mortality rate per 100,000 population*
0–9	0	0	0	0	0
10–19	0	0	0	0	0
20–29	0	0	0	0	0
30–39	1	0	1	5.3	0.2
40–49	1	1	2	10.5	0.3
50–59	1	0	1	5.3	0.2
60–69	2	1	3	15.8	0.6
70+	10	2	12	63.1	4.9
Total	15	4	19	100	0.5

* Rates are based on 2019 estimated mid-year resident population.
(Source: Singapore Department of Statistics, Registry of Births and Deaths)

Table 6.40
Age-sex distribution and age-specific mortality rate of TB, 2020

Age group	Male	Female	Total	%	Mortality rate per 100,000 population*
0–9	0	0	0	0	0
10–19	0	0	0	0	0
20–29	0	0	0	0	0
30–39	0	0	0	0	0
40–49	0	1	1	5.3	0.2
50–59	0	0	0	0	0
60–69	2	0	2	10.5	0.4
70+	11	5	16	84.2	6.1
Total	13	6	19	100	0.5

* Rates are based on 2020 estimated mid-year resident population.
(Source: Singapore Department of Statistics, Registry of Births and Deaths)

HEALTHCARE-ASSOCIATED OUTBREAKS

Healthcare-associated outbreaks are defined as clusters of infections in healthcare settings related in time and place, and occurring above a baseline or threshold level for a facility, specific unit, or ward. Healthcare settings include public and private hospitals, nursing homes, welfare homes and day-care centres.

Suspected clusters of healthcare-associated infections (HAIs) are reported to MOH for surveillance and to enable early detection of outbreaks for timely dissemination of advice on perspectives that extend beyond individual hospitals. In 2019 and 2020, a total of 54 and 16 healthcare-associated outbreaks were reported respectively by the hospitals and institution-based care facilities (Table 6.41). Tables 6.42 and 6.43 showed the number of healthcare associated outbreaks by disease conditions in 2019 and 2020 respectively.

Table 6.41
Number of reported outbreaks in hospitals and institution-based care facilities, 2019 and 2020

Type of institution	Number of outbreaks	
	2019	2020
Hospitals (private and public)	15	6
Community Hospitals	2	2
Institution-based care facilities	37	8
Total	54	16

Table 6.42
Healthcare-associated outbreaks by disease condition, 2019

Institution type/ Disease Condition	No. of incidents	Total no. of cases (range in no. of cases per incident)
Hospital (15)		
Respiratory	0	-
Gastrointestinal	1	14
Skin	0	-
Multi-drug resistant organisms (MDRO)	12	13 (1-2)
Others	2 (Group B Streptococcus, <i>Fusarium</i>)	11 (8 & 3)
Community Hospitals (2)		
Respiratory	1	10
Gastrointestinal	1	22
Skin	0	-
MDRO	0	-
Others	0	-
Institution-based care facilities (37)		
Respiratory	25	710 (8-66)
Gastrointestinal	10	309 (12-59)
Skin	1 (Varicella)	2
MDRO	0	-
Others	1 (Conjunctivitis)	14

Table 6.43
Healthcare-associated outbreaks by disease condition, 2020

Institution type/ Disease Condition	No. of incidents	Total no. of cases (range in no. of cases per incident)
Hospital (6)		
Respiratory	0	-
Gastrointestinal	2	13 (3 & 10)
Skin	0	-
Multi-drug resistant organisms (MDRO)	4	4
Others	0	-
Community Hospitals (2)		
Respiratory	2	268 (71 & 197)
Gastrointestinal	0	-
Skin	0	-
MDRO	0	-
Others	0	-
Institution-based care facilities (8)		
Respiratory	5	104 (13-38)
Gastrointestinal	1	14
Skin	2 (chickenpox & skin rash)	43 (11 & 32)
MDRO	0	-
Others	0	-

SEVERE ILLNESS AND DEATH FROM POSSIBLY INFECTIOUS CAUSES

The SIDPIC (Severe Illness and Death from Possibly Infectious Causes) programme is a hospital-based sentinel surveillance programme which reviews cases of unexplained deaths and critical illnesses to identify possible emerging infections caused by novel pathogens. It aims to reduce delays in recognising

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emerging infections of public health importance. The project is operational in eight public hospitals with programmes in TTSH, NUH, SGH, KKH, CGH, NTFGH, and SKH with recent extension to KTPH (since 1 January 2020).

A total of 366 and 246 cases were recruited under the SIDPIC programme in 2019 and 2020 respectively (Tables 6.44 and 6.45).

Of the 366 cases recruited in 2019, an alternate aetiology that could explain the illness was identified in 233 (63.7%) cases. Of these 233 cases, a causative pathogen was subsequently identified by laboratory testing in 118 (50.6%) cases. Respiratory viruses constituted the majority (33.6%) of all pathogens identified, with respiratory syncytial virus (33.3%), enterovirus/rhinovirus (22.2%) and influenza viruses (16.7%) being the most commonly detected respiratory viruses.

Of the 246 cases recruited in 2020, an alternate aetiology, that could explain the illness was identified in 140 (56.9%) cases. Of these 140 cases, a causative pathogen was subsequently identified by laboratory testing in 51 (36.4%) cases. Respiratory viruses constituted majority (57.8%) of all pathogens identified, with enterovirus/rhinovirus (53.8%), respiratory syncytial virus (11.5%) and influenza viruses (11.5%) being the most commonly detected respiratory viruses.

Table 6.46 provides the distribution of recruited cases by syndrome classification and table 6.47 lists the pathogens which may be tested for under the SIDPIC programme.

Table 6.44
SIDPIC performance indicators, 2019

Surveillance Indicators	No. of cases (%)							Total
	CGH	KKH	NUH	NTFGH	SGH	TTSH	SKH	
No. of cases screened*	4,470	977	5,142	20,63	7,359	6,062	3,998	30,071
Death	777 (17.4%)	84 (8.6%)	1,418 (27.6%)	99 (4.8%)	1,457 (19.8%)	2,686 (44.3%)	1,194 (29.9%)	7,715
Non-death	3,693 (82.6%)	893 (91.4%)	3,724 (72.4%)	1,964 (95.2%)	5,902 (80.2%)	3,76 (55.7%)	2,804 (70.1%)	22,356
No. of cases recruited under SIDPIC	7	56	131	42	30	94	6	366[^]
Aetiology Found	5 (71.4%)	23 (41.1%)	115 (87.8%)	26 (61.9%)	16 (53.3%)	46 (48.9%)	2 (33.3%)	233
Unknown Aetiology	2 (28.6%)	33 (58.9%)	16 (12.2%)	15 (35.7%)	12 (40.0%)	47 (50.0%)	4 (66.7%)	129
Co-morbidity Found	0	0	0	1	2	1	0	4
No. of missed cases[#]	0	0	0	0	0	0	0	0

* The total number of cases screened refers to the sum of ICU admissions and death certificates screened.

[^] Included eight duplicate cases who were transferred from one hospital to another.

[#] Based on surrogate indicator (invasive pneumococcal disease, IPD) notified to MOH that are not identified as SIDPIC cases.

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Table 6.45
SIDPIC performance indicators, 2020

Surveillance Indicators	No. of cases (%)							
	CGH	KKH	NUH	NTFGH	SGH	TTSH	SKH	Total
No. of cases screened*	4,152	707	4,986	1,254	6,238	5,180	4,334	26,851
Death	817 (19.7%)	85 (12.0%)	1,327 (26.6%)	51 (4.1%)	1,923 (30.8%)	2,445 (47.2%)	1,310 (30.2%)	7,958
Non-death	3,335 (80.3%)	622 (88.0%)	3,659 (73.4%)	1,203 (95.9%)	4,315 (69.2%)	2,735 (52.8%)	3,024 (69.8%)	18,893
No. of cases recruited under SIDPIC	3	44	93	31	7	64	4	246[^]
Aetiology Found	3 (100%)	25 (56.8%)	56 (60.2%)	21 (67.7%)	3 (42.9%)	29 (45.3%)	3 (75.0%)	140
Unknown Aetiology	0	19 (43.2%)	37 (39.8%)	7 (22.6%)	4 (57.1%)	33 (51.6%)	1 (25.0%)	101
Co-morbidity Found	0	0	0	3	0	2	0	5
No. of missed cases[#]	0	0	0	0	0	0	0	0

* The total number of cases screened refers to the sum of ICU admissions and death certificates screened.

[^] Included five duplicate cases who were transferred from one hospital to another.

[#] Based on surrogate indicator (invasive pneumococcal disease, IPD) notified to MOH that are not identified as SIDPIC cases.

Table 6.46
Distribution of recruited cases based on syndrome* classification, 2019-2020

Syndrome	No. of cases (%)					
	2019			2020		
	Aetiology Found	Unknown Aetiology	Total	Aetiology Found	Unknown Aetiology	Total
Cardiac	48 (20.7%)	16 (13.1%)	64 (18.1%)	23 (16.8%)	24 (24.2%)	47 (19.9%)
Gastrointestinal	13 (5.6%)	4 (3.3%)	17 (4.8%)	5 (3.7%)	5 (5.1%)	10 (4.2%)
Neurological	53 (22.8%)	23 (18.9%)	76 (21.5%)	35 (25.5%)	14 (14.1%)	49 (20.8%)
Respiratory	81 (34.9%)	46 (37.7%)	127 (35.9%)	48 (35.0%)	35 (35.4%)	83 (35.2%)
Others	6 (2.6%)	3 (2.4%)	9 (2.5%)	5 (3.7%)	0 (0%)	5 (2.1%)
Multisystem	31 (13.4%)	30 (24.6%)	61 (17.2%)	21 (15.3%)	21 (21.2%)	42 (17.8%)
Total[^]	232	122	354	137	99	236

[^] Excluded duplicate cases (eight in 2019 and five in 2020) and cases with comorbidity (four in 2019 and five in 2020) found after recruitment.

* Syndrome classification:

- Neurological – meningitis or encephalitis
- Cardiac – myocarditis, pericarditis, endocarditis
- Respiratory – pneumonia, acute respiratory distress syndrome (ARDS), respiratory failure
- Gastrointestinal – hepatitis, hepatic failure, severe diarrhoea
- Others – syndromes apart from the above four
- Multisystem – sepsis, haemorrhagic fever, rash, shock

Table 6.47
SIDPIC Lab Test Panels

	Pneumonia		Encephalitis		Viral Haemorrhagic Fever
First line panel*	Respiratory Samples Multiplex PCR, Influenza PCR, H5N1 PCR, SARS CoV-PCR, MERS-CoV PCR, TB PCR Blood Bacterial culture, <i>Mycoplasma</i> serology, <i>Legionella</i> serology, <i>Chlamydia</i> serology, H5N1 PCR, SARS CoV-PCR	Urine Urine culture, Pneumococcal Ag, <i>Legionella</i> Ag Other samples (e.g. lung tissue) PCP stain, Fungal stain	Cerebrospinal Fluid Bacterial culture, AFB PCR & culture, Fungal culture, Enterovirus PCR, HSV/ CMV/ VZV/ EBV PCR, Dengue PCR, JE IgM & PCR, WNV PCR, Nipah PCR Respiratory Samples EV PCR, Nipah PCR	Stool Enterovirus PCR, Poliovirus PCR Other samples (e.g. Brain tissue) Histopathology	Blood & Respiratory Samples Dengue PCR & serology, Chikungunya PCR & serology, Yellow fever PCR & serology, Lassa, Ebola, Marburg fever
Second line panel#	Blood <i>Brucella</i> serology Respiratory Samples Virus isolation, Hantaan virus PCR, Nipah PCR, Zikavirus (Micronesia area)		Cerebrospinal Fluid Viral isolation, also consider lymphocytic choriomeningitis virus, Rickettsial isolation, Kunjin, Chandipura, Measles, Polio, Rabies, and other viral encephalitides dependent on travel history, e.g. WEE, SLE, VEE, Kyasanur forest disease (India)	Toscana (from Europe/ Spain), Sindbis virus (Europe/ Australia/ Asia) Stool Virus isolation Other samples (e.g. Brain tissue) EM	Blood & Respiratory Samples VEE, CCHF, RVF and other South American arenaviruses, e.g. Junin, Machupo, Guanarito and Sabia viruses, depending on travel history, HFRS Virus isolation, EM
	Myocarditis		Gastrointestinal		
First line panel*	Blood EV71 PCR Stool Enterovirus PCR	Other samples (e.g. Cardiac tissue) Histopathology	Stool <i>Vibrio cholerae</i> , <i>E. coli</i> O157:H7	Other samples (e.g. Liver/ intestinal tissue) Histopathology, Special stains	Blood Bacterial culture, Yellow fever PCR & serology
Second line panel#	Blood Virus isolation	Other samples (e.g. Cardiac tissue) EM, Special stains	Stool Rotavirus, Astrovirus, Sapovirus, Adenovirus 40, 41, Norovirus PCR, Virus isolation	Other samples (e.g. Liver/ intestinal tissue) EM, Special stains	

* **First line panel:** These are the first-line tests which may be conducted after a check has been made to ensure that these pathogens have not already been tested for, as part of the patient's clinical management.

Second line panel: These tests may be conducted after the SIDPIC physician and the laboratory have evaluated the epidemiological and clinical features of the case.

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Legend:

AFB	= Acid-fast bacillus	SLE	= St Louis encephalitis
Ag	= Antigen	TB	= Tuberculosis
CCHF	= Crimean-Congo haemorrhagic fever	VEE	= Venezuelan equine encephalitis
CMV	= Cytomegalovirus	VZV	= Varicella zoster virus
<i>E. coli</i> O157:H7	= <i>Escherichia coli</i> serotype O157:H7	WEE	= Western equine encephalitis
EBV	= Epstein-Barr virus	WNV	= West Nile Virus
EM	= Electron microscopy		
EV	= Enterovirus		
EV71	= Enterovirus Type 71		
H5N1	= Influenza A virus subtype H5N1		
HFRS	= Haemorrhagic fever with renal syndrome		
HSV	= Herpes simplex virus		
JE IgM	= Japanese encephalitis immunoglobulin M		
MERS-CoV	= Middle East respiratory syndrome coronavirus		
PCP	= <i>Pneumocystis carinii</i> pneumonia		
PCR	= Polymerase chain reaction		
RVF	= Rift Valley fever		
SARS-CoV	= Severe acute respiratory syndrome coronavirus		