

Air-/Droplet-
Borne
Diseases

Vector-Borne/
Zoonotic
Diseases

Food-/Water-
Borne
Diseases

Blood-Borne
Diseases

Environment-
Related
Diseases

HIV/AIDS, STIs,
Tuberculosis
& Leprosy

Childhood
Immunisation

VII CHILDHOOD IMMUNISATION

IMMUNISATION PROGRAMME IN 2005

The childhood immunisation programme in Singapore offers vaccination against tuberculosis; hepatitis B; diphtheria, pertussis and tetanus (DPT); poliomyelitis; and measles, mumps and rubella (MMR). Only diphtheria and measles immunisations are compulsory by law. Since 1st January 1990, the monovalent measles vaccine given to 1-year-old children was replaced by the trivalent MMR vaccine. As of 1st January 1998, the monovalent rubella vaccine given to primary school leavers was also replaced by the second dose of MMR vaccine (Table 7.1).

BCG vaccination was started in mid 1950s in Singapore as part of the childhood immunisation programme. All new-borns were vaccinated at birth and although parental consent is required, acceptances have been high and close to 100% of children have been vaccinated in the last decade (Table 7.2). The BCG immunisation

programme has contributed significantly to the near eradication of tuberculous meningitis in young children. As of 1st July 2001, BCG revaccination by the School Health Service was discontinued. The BCG vaccination coverage of infants and new-borns has been over 97% annually since 1987.

Hepatitis B vaccination for infants born to carrier mothers was incorporated into the national childhood immunisation programme in October 1985. This was extended to all newborns since 1st September 1987. To protect those born before 1987, a 4-year hepatitis B immunisation programme was implemented for students in secondary 3, junior college year 2, centralised institute year 3, institutes of technical education (ITE), polytechnics and universities in January 2001. In addition, full-time national servicemen who were non-immune were offered hepatitis B immunisation.

IMPLEMENTATION OF THE IMMUNISATION PROGRAMME

The vaccination programme was carried out by:

- (a) National Healthcare Group (NHG) polyclinics and SingHealth (SH) polyclinics
- (b) School Health Service Division (SHS) of the Health Promotion Board (HPB)
- (c) Private medical practitioners

Immunisation of pre-school children was carried out at the polyclinics and by private medical practitioners. The target population was based on notification of births obtained from the Registry of Births and Deaths.

Immunisation of school children was carried out by SHS. The target population was based on student population data from the Ministry of Education.

Table 7.1
National childhood immunisation programme in Singapore, 2005

Immunisation against	Primary Course		Booster Doses	
	Infants (< 1 years)	Pre-school children (1 – 5 years)	Primary school students (6 – 12 years)	Secondary school students (12 – 15 years)
Tuberculosis	Birth - BCG with- out Mantoux test	Direct BCG if no previous vaccination	Discontinued in 2001. If no evidence of BCG vaccination, to refer to TBCU for further action.	
Diphtheria* Pertussis Tetanus	3 months DPT (1st Dose) 4 months DPT (2nd Dose) 5 months DPT (3rd Dose)	18 months DPT (1st Booster)	6 – 7 years (Primary school entrants) DT (2nd Booster) 11 – 12 years (Primary school leavers) DT (3rd Booster)	
Poliomyelitis*	3 months (Types I, II + III) 4 months (Types I, II + III) 5 months (Types I, II + III)	18 months 1st Booster (Types I, II + III)	6+ years (Primary school entrants) Either: (a) Primary course for those who have never been vaccinated; or (b) 2nd Booster (Types I, II + III) for those who had been vaccinated. 11 – 12 years (Primary school leavers) 3rd Booster (Types I, II + III)	
Measles/Mumps/ Rubella#		1 year (1 dose)	11 – 12 years (Primary school leavers) 1 dose	
Hepatitis B	Birth*, 1, 6 months		4-year (2001 – 2004) hepatitis B immunisation programme for Sec 3, JC year 2, centralised institutes year 3, ITEs, polytechnics and universities	

* When the recommended time schedule is not followed, then the time interval between the different doses should be adhered to. Interrupting the recommended schedule or delaying subsequent doses does not reduce the ultimate immunity. There is no need to restart a series regardless of the time elapsed between doses. However, to help ensure sero-conversion, completion of the primary series of three doses is recommended.

MMR replaced measles vaccination in January 1990.

+ HBIG (0.5 ml) given at the same time as the first dose of vaccine only for babies born to HBeAg (hepatitis B “e” antigen)- positive mothers.
An additional dose for babies born to HBsAg-positive mothers at 12 month-old.

Table 7.2
BCG vaccination of Infants in Singapore in public and private sectors 1981 – 2005

Year	Government & Restructured Hospital (%)	Government Clinic (%)	Private Sector (%)	Total (%)	Coverage ¹ for children at 2 years of age
1981	33,917 (96.4)	1,260 (3.6)	-	35,177 (100)	83.3
1982	28,270 (76.4)	5,863 (15.8)	2,923 (7.8)	37,056 (100)	86.9
1983	27,019 (80.6)	4,377 (13.1)	2,106 (6.3)	33,502 (100)	82.5
1984	26,528 (68.4)	4,102 (10.6)	8,165 (21.0)	38,795 (100)	93.4
1985	26,740 (67.5)	4,018 (10.1)	8,882 (22.4)	39,640 (100)	93.3
1986	20,991 (58.1)	2,781 (7.7)	12,328 (34.2)	36,100 (100)	94.1
1987	20,242 (47.5)	2,991 (7.0)	19,359 (45.5)	42,592 (100)	97.7
1988	26,771 (51.6)	3,049 (5.9)	22,001 (42.5)	51,821 (100)	97.9
1989	22,545 (47.7)	2,921 (6.2)	21,772 (46.1)	47,238 (100)	99.1
1990	21,419 (42.3)	2,789 (5.5)	26,381 (52.2)	50,589 (100)	98.9
1991	20,704 (42.5)	2,029 (4.2)	25,948 (53.3)	48,681 (100)	99.1
1992	21,948 (44.7)	1,479 (3.0)	25,651 (52.3)	49,078 (100)	99.3
1993	22,093 (45.0)	1,611 (3.3)	25,436 (51.7)	49,140 (100)	97.8
1994	20,918 (43.5)	1,251 (2.6)	25,933 (53.9)	48,102 (100)	97.1
1995	18,614 (39.3)	1,312 (2.8)	27,392 (57.9)	47,318 (100)	97.3
1996	19,240 (37.2)	1,208 (2.3)	31,231 (60.4)	51,679 (100)	98.1
1997	20,001 (39.5)	1,257 (2.5)	29,290 (57.9)	50,548 (100)	98.0
1998	18,984 (38.9)	1,307 (2.8)	26,276 (56.4)	46,567 (100)	98.4
1999	19,007 (40.2)	1,261 (2.8)	24,669 (54.9)	44,937 (100)	99.1
2000	18,415 (35.9)	1,191(2.5)	28,825 (59.5)	48,431 (100)	98.9
2001	19,124 (43.6)	495 (1.2)	22,907 (53.9)	42,526 (100)	98.4
2002	19,295 (46.4)	285 (0.7)	22,034 (52.9)	41,614 (100)	97.7
2003	16,839 (44.1)	291 (0.8)	21,063 (55.1)	38,193 (100)	99.3
2004	16,966 (44.1)	307 (0.8)	21,173 (55.1)	38,446 (100)	99.2
2005	16,090 (42.8)	205 (0.5)	21,334 (56.7)	37,629 (100)	97.8

¹Data refer to immunisation given to all Singaporean and Singapore-PR children

Notification of Immunisation

The data utilised in this report was based on:

- (a) notifications of all immunisations carried out in pre-school children by healthcare institutions in both the public and private sectors to the National Immunisation Registry (NIR) at HPB. (Note: notifications of diphtheria and measles immunisation are compulsory.)
- (b) immunisation records kept by SHS (immunisations administered in schools and at the Immunisation Clinic, Student Health Centre of the Health Promotion Board).

Immunisation against Diphtheria, Pertussis and Tetanus

Infants and pre-school children

The primary immunisation course was completed in 34,030 children in 2005 giving an estimated coverage of 94% (Table 7.3). Booster doses were given to 32,205

pre-school children under 2 years of age (91%) under the first booster programme.

Table 7.3
Diphtheria immunisation, 2001 – 2005

Year	Coverage ¹ for children at 2 years of age				School children [#]		
	Completed primary course		Boosters given		School entrants	Boosters given	
	No.	Coverage (%)	No.	Coverage (%)		No.	Coverage (%)
2001	40,244	96	37,423	89	50,459	46,725	93
2002	43,260	94	40,194	87	49,657	46,244	93
2003	38,064	96	33,389	84	49,788	46,747	94
2004	36,587	95	34,740	90	47,918	45,040	94
2005	34,030	96	32,205	91	44,110	41,437	94

[#] Coverage by School Health Service may not include all booster immunisations done by private practitioners

¹ Data refers to immunisation given to all Singaporean and Singapore PR children

School children

In 2005, a total of 41,437 doses of DT vaccine were given to those who had received a booster more than two years before school entry or who had never received a booster. During the year, 94% of school entrants received boosters (Table 7.3). For school entrants who had never been immunised, a primary course of two doses of diphtheria/tetanus (DT) vaccine was scheduled.

There were 2,878 (6%) missed vaccinees among school entrants in 2004. 973 (34%) of these students were given boosters in 2005 (Table 7.4).

DT boosters were given to 49,725 (96%) of primary school leavers in 2005 (Table 7.5).

Table 7.4
Coverage of missed primary 1 vaccinees followed up in primary 2 for vaccination against diphtheria, 2001 – 2004

Year	No. of missed vaccinees among school entrants	% of missed vaccinees over total new school entrants	No. given boosters in the following year [#]	% of missed vaccinees covered
2001	3,734	7	761	20
2002	3,413	7	791	23
2003	3,040	6	889	29
2004	2,878	6	973	34

[#] Coverage by School Health Service may not include all booster immunisations done by private practitioners

Table 7.5
Diphtheria and tetanus boosters given to primary school leavers 11 - 12 years of age, 2001 - 2005

Year	Total No. of primary school leavers	Booster given [#]	
		No.	Coverage (%)
2001	50,987	47,455	93
2002	53,258	50,991	96
2003	52,177	49,482	95
2004	51,694	49,169	95
2005	51,908	49,725	96

[#] Coverage by School Health Service does not include booster immunisations done by private practitioners

Immunisation against Poliomyelitis

Infants and pre-school children

Primary poliomyelitis immunisation was completed in 33,997 children giving coverage of 96% (Table 7.6).

A total of 32,070 polio boosters were given to children under the first booster programme (91% coverage).

School children

In 2005, 41,478 (94%) school entrants were given boosters (Table 7.6). In 2004, 2,833 (6%) of the school entrants missed their booster doses. Of these children,

974 (34%) were immunised in 2005 (Table 7.7).

During the year, 49,730 (96%) primary school leavers received booster doses (Table 7.8).

Table 7.6
Poliomyelitis immunisation of infants, pre-school and school children, 2000 – 2005

Year	Coverage ¹ for children at 2 years of age				School Children	
	Completed primary course		Boosters given		School entrants	Boosters given [#]
	No.	Coverage %	No.	Coverage %	No.#	Coverage %
2001	40,185	95	37,083	88	50,459	46,527
2002	43,227	94	39,887	87	49,657	46,052
2003	38,010	96	33,026	83	49,788	46,506
2004	36,548	95	34,211	88	47,918	45,085
2005	33,997	96	32,070	91	44,110	41,478

[#]Coverage by School Health Service may not include booster immunisations done by private practitioners

¹ Data refers to immunisation given to all Singaporean and Singapore PR children

Table 7.7
Poliomyelitis boosters given to missed vaccinees in the following year 2001 – 2004

Year	No. of missed vaccinees among school entrants	% of missed vaccinees over total new school entrants	No. given boosters in the following year [#]	% of missed vaccinees covered
2001	3,734	7	755	21
2002	3,605	7	791	22
2003	3,282	7	912	28
2004	2,833	6	974	34

[#]Coverage by School Health Service does not include booster immunisations done by private practitioners

Table 7.8
Poliomyelitis boosters given to primary school leavers 11 – 12 years of age, 2001 – 2005

Year	Total no. of school leavers	Booster given #	
		No	Coverage (%)
2001	50,987	47,270	93
2002	53,258	50,905	96
2003	52,177	49,329	95
2004	51,694	49,109	95
2005	51,908	49,730	96

#Coverage by School Health Service does not include booster immunisations done by private practitioners

Immunisation against Measles, Mumps and Rubella

Infants and pre-school children

In 2005, a total of 33,843 children were immunised against measles, mumps and rubella by 2 years of age, giving

coverage of 96% (Table 7.9). Most of the immunisations were carried out by doctors at the polyclinics.

School children

The second dose MMR vaccine was given to 49,415

(95%) primary school leavers in 2005.

Table 7.9
Measles, mumps and rubella immunisations, 2001 – 2005

Year	Infants and pre-school children ¹			School children	
	Completed primary course by age 2 years		No. of primary 6 students #	Second dose MMR given	
	No.	Coverage %		No.	Coverage %
2001	39,875	95	50,987	47,465	93
2002	43,159	94	53,258	50,700	95
2003	36,956	93	52,177	48,938	94
2004	36,845	95	51,694	48,945	95
2005	33,843	96	51,908	49,415	95

#Coverage by School Health Service does not include booster immunisations done by private practitioners

¹ Data refers to immunisation given to all Singaporean and Singapore PR children

Immunisation against Hepatitis B

A total of 14,969 blood samples from antenatal women were screened at the KK Women's and Children's Hospital for HBsAg and HBeAg in 2005. Of these, 336 (2.2%) were HBsAg positive and 76 (0.5%) were HBeAg positive.

In 2005, the primary course of hepatitis B immunisation was completed in 33,873 infants. The overall coverage rate for babies who have completed the full course of vaccination under two year of age remained high at 96% (Table 7.10).

Table 7.10
Hepatitis B immunisation, 2001 – 2005

Full course of Hepatitis B vaccination completed by age 2 years		
Year	No.	Coverage ¹ (%)
2001	40,234	95
2002	43,658	95
2003	37,787	95
2004	36,156	94
2005	33,873	96

¹Data refers to immunisation given to all Singaporean and Singapore PR children.

Special programme

A four-year Hepatitis B catch-up immunisation programme which covered secondary schools, ITEs and institutes of higher learning was completed in 2004. Consent was obtained from parents for pre-immunisation blood screening for each participating student. Each school

was visited four times within the calendar year for blood screening and immunisation. Students who missed the blood screening and immunisation were referred to the Student Health Centre at HPB.

EFFECTIVENESS OF THE IMMUNISATION PROGRAMME

The effectiveness of the childhood immunisation programme against poliomyelitis and diphtheria is shown in Figures 7.1 and 7.2. In 2005, no indigenous case of diphtheria, poliomyelitis and neonatal tetanus was reported.

With the implementation of the 'catch-up' measles vaccination programme using the MMR vaccine in 1997, and the introduction of the second dose of MMR vaccine to all primary six school children in 1998, the incidence of measles decreased sharply from 1,413 cases in 1997 to 33 in 2005 (Figure 7.3).

Rubella incidence remained low with 141 cases in 2004 and 139 in 2005. No outbreak was reported. There was one case of congenital rubella but no termination of pregnancy was carried out on account of rubella infection (Table 7.11).

The resurgence of mumps which began in 1998, continued until the year 2002. The resurgence was due to poor protection conferred by the Rubini strain of the MMR vaccine which was subsequently de-registered in 1999. Since then, the incidence of mumps has declined

steadily from 1,399 clinical cases in 2001 to 1,004 cases in 2005 (Table 7.12).

The incidence of indigenous acute hepatitis B has declined from 243 cases (9.5 per 100,000 population) in 1985 to 83 cases (1.9 per 100,000 population) in 2005 (Figure 7.4). During the same period, the reported number of cases in children below 15 years of age plummeted from 10 to 0 (Table 7.12).

The national sero-prevalence survey on vaccine-preventable diseases conducted in 2005 showed an overall sero-prevalence of 96.7% for measles, 78.9% for mumps and 87.4% for rubella in those aged 18 - 74 years. A considerable proportion (12%) of females aged 18 - 44 years remained susceptible to rubella infection. 42.2% of Singapore residents aged 18 - 74 years possessed immunity against hepatitis B virus (anti-HBs ≥ 10 mIU/ml). The overall prevalence of HBsAg in the population aged 18 - 69 years was 2.7%, a significant decline from similar study done in 1999 (4.1%). This has confirmed the effectiveness of the national hepatitis B vaccination programme in primary prevention of hepatitis B virus infection and chronic carriage of hepatitis B virus.

Figure 7.1
Incidence per 100,000 population from poliomyelitis and immunisation coverage rates in Singapore, 1946 – 2005

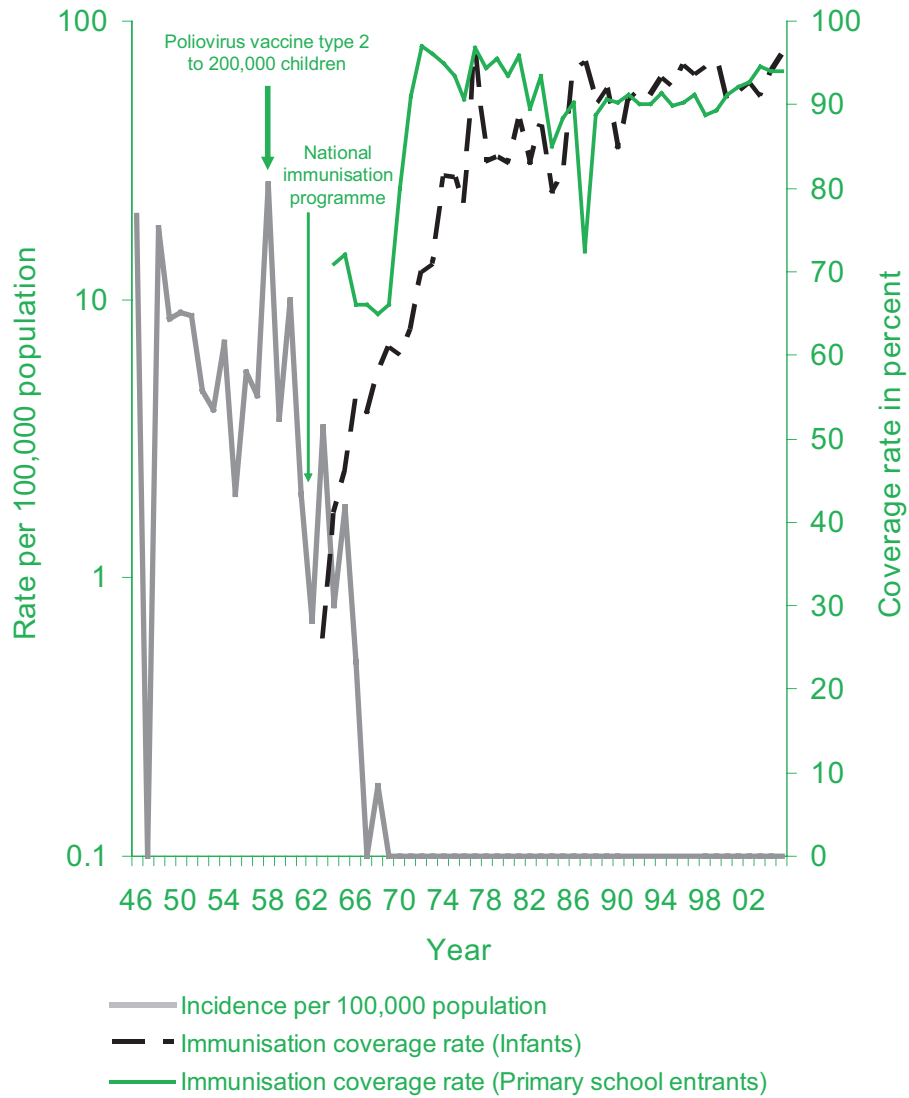


Figure 7.2
Incidence per 100,000 population from diphtheria and immunisation coverage rates in Singapore, 1946 – 2005

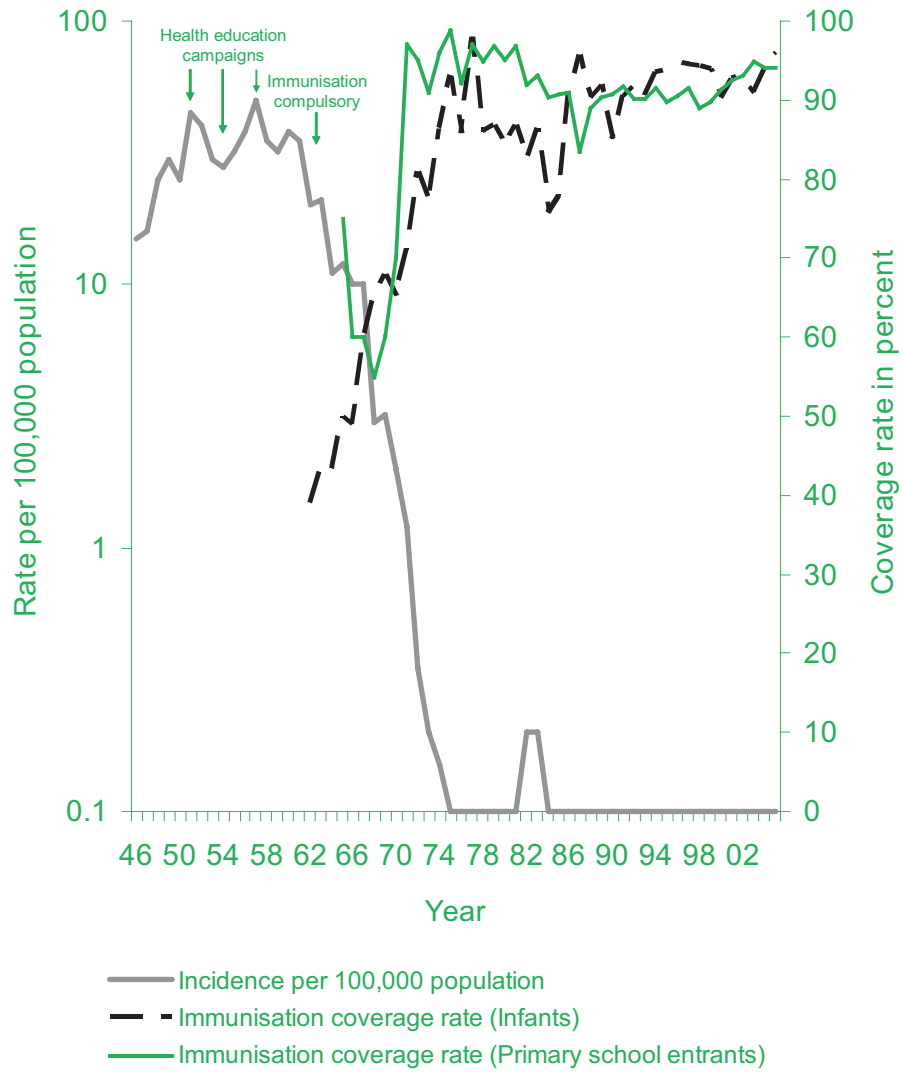


Figure 7.3

Impact of the “catch-up” MMR vaccination programme and introduction of second dose of MMR vaccine on the incidence of reported measles cases in Singapore, 1997 – 2005

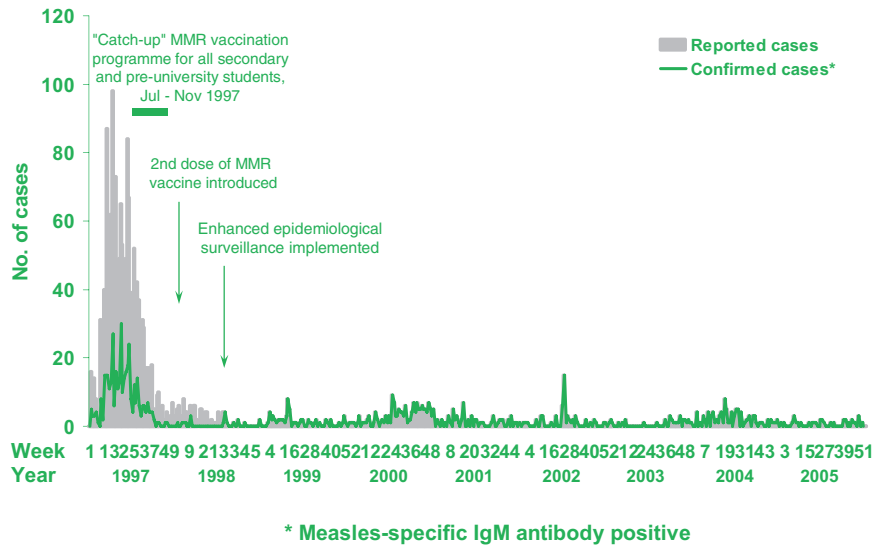


Figure 7.4

Incidence per 100,000 population from hepatitis B+ and immunisation coverage rates* in Singapore, 1985 – 2005

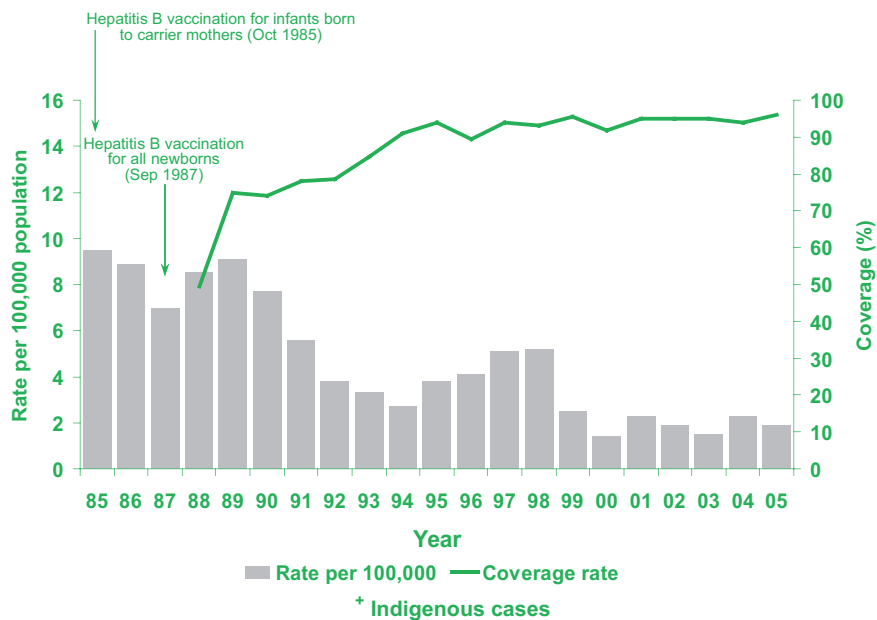


Table 7.11
No. of therapeutic abortions performed for rubella infection, 1983 – 2005

Year	Total no. of abortions	No. of therapeutic abortions performed for rubella infections	
		No.	(%)
1983	19,100	68	0.36
1984	22,190	77	0.35
1985	23,512	46	0.20
1986	23,035	45	0.20
1987	21,226	55	0.26
1988	20,135	56	0.28
1989	20,619	76	0.37
1990	18,669	36	0.19
1991	17,798	30	0.17
1992	17,073	21	0.12
1993	16,476	8	0.05
1994	15,690	10	0.06
1995	14,504	9	0.06
1996	14,365	15	0.10
1997	13,827	5	0.04
1998	13,838	2	0.01
1999	13,753	6	0.04
2000	13,754	2	0.01
2001	13,140	3	0.02
2002	12,749	0	0.00
2003	12,272	0	0.00
2004	12,070	2	0.02
2005	11,482	0	0.00

Table 7.12
Reported diphtheria, poliomyelitis, measles, acute hepatitis B, neonatal tetanus, pertussis, congenital rubella
and childhood tuberculous meningitis in Singapore, 1982 – 2005

Year	Diphtheria	Poliomyelitis	Measles	Mumps ϕ	Rubella ϕ	Acute hepatitis B@	Neonatal tetanus*	Pertussis@@	Congenital rubella#	Childhood tuberculous meningitis##
1982	6 (2)	1 (1)	1,965	-	-	-	1	7	3	4
1983	4 (4)	2 (2)	677	-	-	10	3	7	10	1
1984	0	2 (2)	2,417	-	-	10	1	1	7	0
1985	0	0	136	-	-	7	0	0	3	1
1986	1	2 (2)	218	-	-	5	3	9++	3	1
1987	1 (1)	0	123	-	-	6	0	9++	2	1
1988	0	0	192	-	-	2	0	11++	0	0
1989	1 (1)	0	146	-	-	4	0	1++	2	0
1990	1	1 (1)	143	-	-	1	0	8+++	4	0
1991	1 (1)	0	216	636	51	3	0	5++	1	0
1992	1	0	606	1,981	370	3	0	14++	4	0
1993	0	0	665	1,962	423	2	0	1++	4	0
1994	0	0	159	1,636	299	2	1	2++	2	0
1995	0	0	185	786	326	0	0	1++	2*	2*
1996	1 (1)	0	308	765	487	3	0	4 (1)+++	2*	2*
1997	0	0	1,413	674	360	0	0	2++	0*	2*
1998	0	0	114	1,183	179	0	0	1+	0*	0
1999	0	0	65++	6,384 (28)	432	0	0	1++	2*	1*
2000	0	0	141++	5,981+	312+	0	0	2 (1)+++	0	1*
2001	0	0	61++	1,399+	242+	0	0	1+	2*	0
2002	0	0	57++	1,090+	152+	0	0	0	1	1
2003	0	0	33++	878+	88+	0	0	1+++	0	0
2004	0	0	96++	1,003+	141+	0	0	1+++	0	0
2005	0	0	33++	1,004+	139+	0	0	2++	0	0

* Source: Central Claims Processing System, Ministry of Health.

- () Imported cases.
- ϕ Notifiable with effect from April 1990.
- @ Indigenous cases below 15 years of age.
- @@ All pertussis cases reported prior to 1986 were based on clinically diagnosed cases seen at the Communicable Disease Centre.
- + Based on clinically diagnosed cases
- ++ Based on laboratory confirmed cases.
- +++ Based on laboratory confirmed and clinically diagnosed cases.
- # Cases diagnosed in Kandang Kerbau, Singapore General Hospital and National University Hospital.
- ## Below 10 years of age.