Air-/Droplet-Borne Diseases

Vector-Borne/ Zoonotic Diseases

Food-/Water-Borne Diseases

Blood-Borne Diseases

Environmental-Related Diseases

HIV/AIDS, STIs, Tuberculosis & Leprosy

Childhood Immunisation

VII
CHILDHOOD IMMUNISATION

NATIONAL CHILDHOOD IMMUNISATION PROGRAMME IN 2012

The National Childhood Immunisation Programme (NCIP) in Singapore covers vaccination against tuberculosis; hepatitis B; diphtheria, pertussis and tetanus (DPT); poliomyelitis; measles, mumps and rubella (MMR); pneumococcal disease; and human papillomavirus. Only diphtheria and measles immunisations are compulsory by law. Since 1st January 1990, the monovalent measles vaccine given to one-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 began in mid 1950s in Singapore as part of the NCIP. 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. BCG was discontinued for Mantoux non-reactors and BCG booster was also discontinued on 1 July 2001. 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 NCIP 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.

The NCIP was reviewed by the Expert Committee on Immunisation and a revised schedule was implemented in 2011. With the change in the immunisation schedule, both doses of measles, mumps and rubella would be brought forward to 12 months and 15-18 months respectively. School Health Services will continue to provide the second dose to primary one (6-7 years old) children.

Pneumococcal conjugate vaccine (PCV) was included as the 10th vaccine in the NCIP in 2009 to reduce morbidity and mortality of invasive pneumococcal diseases in Singapore. The ECI recommended a schedule of two doses for the primary series and one booster dose (2+1 schedule). The two doses in the primary series are to be given at age 3 and 5 months respectively and the booster dose at age 12-24 months. After the introduction of PCV to NCIP, immunisation coverage for pneumococcal vaccination increased from 20% in 2009 to 60% for children aged one year who received two doses of PCV in 2012

IMPLEMENTATION OF THE IMMUNISATION PROGRAMME

The vaccination programme is carried out by:

(a) National Healthcare Group (NHG) polyclinics and SingHealth (SH) polyclinics
(b) Youth Health Division (YHD) of the Health Promotion Board (HPB)
(c) Private medical practitioners

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

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

Table 7.1
Singapore National Childhood Immunisation Schedule, 2012

Vaccination against	Birth	1 month	3 months	4 months	5 months	6 months	12 months	15 months	18 months	6-7 years^	10-11 years^^
Tuberculosis	BCG										
Hepatitis B	HepB (D1)	HepB (D2)				HepB (D3)#					
Diphtheria, Tetanus, Pertussis			DTaP (D1)	DTaP (D2)	DTaP (D3)				DTaP (B1)		Tdap (B2)
Poliovirus			OPV (D1)	OPV (D2)	OPV (D3)				OPV (B1)	OPV (B2)	OPV (B3)
Measles, Mumps, Rubella							MMR (D1)	MMR (D2)##			
Pneumococcal Disease			PCV (D1)		PCV (D2)		PCV (B1)				
Human Papillomavirus	*Recommended for females 9 to 26 years; three doses are required at intervals of 0, 2, 6 months*										

Notes:

Human Papillomavirus - *Recommended for females 9 to 26 years; three doses are required at intervals of 0, 2, 6 months*

BCG	Bacillus Calmette-Guérin
HepB	Hepatitis B vaccine
DTaP	Paediatric diphtheria tetanus toxoid and acellular pertussis vaccine
Tdap	Tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine
MMR	Measles, mumps, and rubella vaccine
OPV	Oral polio vaccine
PCV	Pneumococcal conjugate vaccine
D1/D2/D3	1st dose, 2nd diose, 3rd dose
B1/B2/B3	1st booster, 2nd booster, 3rd booster
^	Primary 1
^^	Primary 5

#	3rd dose of HepB can be given with the 3rd dose of DTaP and OPV for the convenience of parents.
##	2nd dose of MMR can be given between 15-18 months

Table 7.2
BCG vaccination of infants in Singapore in public and private sectors, 1981 – 2012

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	16,352 (42.4)	208 (0.5)	22,010 (57.1)	38,570 (100)	97.8
2006	15,904 (41.3)	177 (0.5)	22,412 (58.2)	38,493 (100)	98.3
2007	16,399 (43.8)	205 (0.5)	20,796 (55.6)	37,400 (100)	99.4
2008	16,120 (42.1)	176 (0.5)	21,963 (57.4)	38,259 (100)	99.5
2009	15,967 (41.7)	123 (0.3)	22,228 (58.0)	38,318 (100)	99.3
2010	13,878 (42.6)	85 (0.3)	18,623 (57.2)	33,454 (100)	98.9
2011	13,123 (41.8)	67 (0.2)	18,172 (57.9)	31,362 (100)	99.6
2012	12,145 (41.2)	110 (0.4)	17,225 (58.4)	29,480 (100)	99.2

[1] Data 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 immunisation 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 YHD (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 28,776 children in 2012 giving an estimated coverage of 96.7% (Table 7.3). Booster doses were given to 27,196 pre-school children under 2 years of age (91.4%) under the first booster programme.

Table 7.3
Diphtheria, Pertussis and Tetanus immunsations, 2003 – 2012

Year	Coverage[1] for children at 2 years of age			
	Completed primary course		Boosters given	
	No.	Coverage (%)	No.	Coverage (%)
2003	38,064	96.0	33,389	84.0
2004	36,587	94.6	34,740	89.9
2005	34,030	96.1	32,205	91.0
2006	31,948	95.4	30,138	90.0
2007	31,778	96.6	29,050	88.3
2008	30,975	96.9	27,888	87.3
2009	34,481	96.8	32,431	91.0
2010	32,523	96.1	30,377	89.8
2011	30,242	96.0	28,642	90.9
2012	28,776	96.7	27,196	91.4

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

School children

In 2012, Tdap boosters were given to 40,079 (92.0%) primary 5 students (Table 7.4)

Table 7.4
Diphtheria, tetanus and pertussis boosters given to primary 5 students (10 – 11 years of age), 2008 – 2012

Year	Total No. of primary 5 students	Booster given[#]	
		No.	Coverage (%)
2008	49,126	47,146	96.0
2009	45,498	43,240	95.0
2010	45,555	43,238	94.9
2011	49,071	45,848	93.4
2012	43,579	40,079	92.0

[#] Coverage by YHD does not include booster immunisations done by private practitioners

Immunisation against Poliomyelitis

Infants and pre-school children

Primary poliomyelitis immunisation was completed in 28,767 giving coverage of 96.6% (Table 7.5).

A total of 27,159 polio boosters were given to children under the first booster programme (91.2% coverage).

School children

In 2012, 36,782(92.7%) school entrants were given boosters (Table 7.5). In 2011, 3,172 (7.9%) of the school entrants missed their booster doses. Of these children, 2,097 (66.1%) were immunised in 2012 (Table 7.6).

During the year, 42,091 (96.6%) primary 5 students (Table 7.7) received booster doses.

Table 7.5
Poliomyelitis immunisation of infants, pre-school and school children, 2003 –2012

	Coverage[1] for children at 2 years of age				School Children		
	Completed primary polio course		Boosters given		Boosters given #		
Year	No.	Coverage %	No.	Coverage %	School entrants	No.#	Coverage %
2003	38,010	95.9	33,026	83.0	49,788	46,506	93.0
2004	36,548	94.5	34,211	88.5	47,918	45,085	94.0
2005	33,997	96.0	32,070	90.6	44,110	41,478	94.0
2006	31,935	95.4	30,009	89.7	44,572	41,312	93.0
2007	31,768	96.6	28,909	87.9	48,122	44,380	92.0
2008	30,964	96.9	27,679	86.6	43,548	40,055	92.0
2009	34,466	96.7	32,272	90.6	43,142	39,752	92.1
2010	32,496	96.0	30,299	89.5	39,465	37,037	93.8
2011	30,230	95.9	28,597	90.8	39,886	36,714	92.1
2012	28,767	96.6	27,159	91.2	39,682	36,782	92.7

Coverage by YHD does not include booster immunisations done by private practitioners
1 Data refers to immunisation given to all Singaporean and Singapore PR children

Table 7.6
Poliomyelitis boosters given to missed vaccinees in the following year 2003 – 2011

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
2003	3,282	7.0	912	28.0
2004	2,833	6.0	974	34.0
2005	2,632	6.0	1,282	49.0
2006	3,260	7.0	1,594	49.0
2007	3,742	8.0	2,185	58.0
2008	3,493	8.0	2,127	60.9
2009	3,390	7.9	2,182	64.4
2010	2,428	6.2	2,022	83.3
2011	3,172	7.9	2,097	66.1

Coverage by YHD does not include booster immunisations done by private practitioners

Table 7.7
Poliomyelitis boosters given to primary 5 students (10 – 11 years of age), 2008 - 2012

Year	Total No. of primary 5 students	Booster given #	
		No	Coverage (%)
2008	49,126	47,314	96.0
2009	45,498	43,895	96.5
2010	45,555	44,286	97.2
2011	49,071	47,531	96.9
2012	43,579	42,091	96.6

Coverage by YHD does not include booster immunisations done by private practitioners

Immunisation against Measles, Mumps and Rubella

Infants and pre-school children

In 2012, a total of 28,320 children were immunised against measles, mumps and rubella by 2 years of age, giving coverage of 95.1% (Table 7.8).

Table 7.8
Measles, mumps and rubella immunisations, 2003 – 2012

Infants and pre-school children [1]		
No. Completed first dose by age 2 years		
Year	No.	Coverage %
2003	36,956	93.2
2004	36,845	95.3
2005	33,843	95.6
2006	31,638	94.5
2007	31,217	95.0
2008	30,352	94.9
2009	34,057	95.2
2010	32,165	95.1
2011	29,992	95.2
2012	28,320	95.1

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

School children

The MMR vaccine was given to 36,341 (91.6%) school entrants in 2012 (Table 7.9).

Table 7.9
2nd dose of measles, mumps and rubella immunisations, 2012

	Total No.	No. given	Coverage# (%)
School Entrants	39,682	36,341	91.6

Coverage by YHD does not include booster immunisations done by private practitioners

In 2011, 3,338 (8.4%) school entrants missed their 2nd dose MMR. 1,396 (41.8%) were immunised in 2012 (Table 7.10).

Table 7.10
2nd dose of MMR given to missed vaccinees in the following year 2011

Year	No. of missed vaccinees among school entrants	% of missed vaccinees over total new school entrants	No. given in the following year #	% of missed vaccinees covered
2011	3,338	8.4	1,396	41.8

 # Coverage by YHD does not include booster immunisations done by private practitioners

Immunisation against Hepatitis B

A total of 18,570 blood samples were screened at the KK Women's and Children's Hospital for HBsAg and HBeAg in 2012. Of these, 425 (2.2%) were HBsAg positive and 132 (0.7%) were HBeAg positive.

In 2012, the primary course of hepatitis B immunisation was completed in 28,730 infants. The overall coverage rate for babies who have completed the full course of vaccination under two years of age remained high at 96.5% (Table 7.11).

Table 7.11
Hepatitis B immunisation, 2003 – 2012

	Full course of Hepatitis B vaccination completed by age 2 years	
Year	No.	Coverage[1] (%)
2003	37,787	95.3
2004	36,156	93.5
2005	33,873	95.3
2006	31,662	94.6
2007	31,449	95.6
2008	30,924	96.8
2009	34,341	96.4
2010	32,376	95.7
2011	30,159	95.7
2012	28,730	96.5

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

Immunisation against Pneumococcal Disease

In 2012, a total of 18,361 children received at least two doses of PCV by the age of one, giving an estimated coverage of 60.0%. (Table 7.12)

Table 7.12
Pneumococcal Vaccination, 2009 – 2012

Infants[1]		
No. completed two doses by age 1 year		
Year	No.	Coverage %
2009	7,063	21.6
2010	12,897	41.0
2011	15,800	53.1
2012	18,361	60.0

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

EFFECTIVENESS OF THE IMMUNISATION PROGRAMME

The effectiveness of the childhood immunisation programme against poliomyelitis and diphtheria is shown in Figure 7.1 and 7.2. In 2012, 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 and primary one school children with effect from 2008, the incidence of measles decreased sharply from 1,413 cases in 1997 to 38 in 2012 (Figure 7.3).

Rubella incidence decreased from 110 cases in 2011 to 64 in 2012. There were two reported cases of congenital rubella and one termination of pregnancy carried out in 2012 due to rubella infection (Table 7.13).

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. The incidence of mumps has increased from 501 cases in 2011 to 521 cases in 2012 (Table 7.14).

The incidence of indigenous acute hepatitis B has declined from 243 cases (9.5 per 100,000 population) in 1985 to 57 cases (1.1 per 100,000 population) in 2012 (Figure 7.4). During the same period, the reported number of cases in children <15 years plummeted from 10 to 0 (Table 7.14).

A national sero-prevalence survey was conducted in 2012 to determine the prevalence of antibody against vaccine preventable diseases and other diseases of public health importance in the adult Singapore resident population aged 18 – 79 years using residual sera from the National Health Survey 2010. The overall sero-prevalence was 85.0% for rubella in those aged 18 – 79 years. 11.1% of women 18 – 44 years of age remained susceptible to rubella infection. About 43.9% of Singapore residents aged 18 – 79 years possessed immunity against hepatitis B virus (anti-HBs ≥10 mIU/mL). The overall prevalence of HBsAg in the population was 3.6%.

PUBLIC EDUCATION AND PROGRAMMES

The Health Promotion Board educates parents on the importance of childhood immunisations through educational materials such as "Childhood Immunisations: Give Your Child The Best Protection" and "Protect your child against Measles, Mumps and Rubella with the MMR vaccination". These are distributed in the polyclinics and other healthcare institutions. Under the Healthier Child, Brighter Future initiative, the "Healthy Start For Your Baby" guide also contains a chapter on childhood immunisations. This educates parents the importance of immunisation and to immunise their children according to the recommended National Childhood Immunisation Schedule. The guide is distributed to mothers who have delivered and before they are discharged from the maternity hospitals.

Figure 7.1
Incidence per 100,000 population from poliomyelitis and immunisation coverage rates in Singapore, 1946-2012

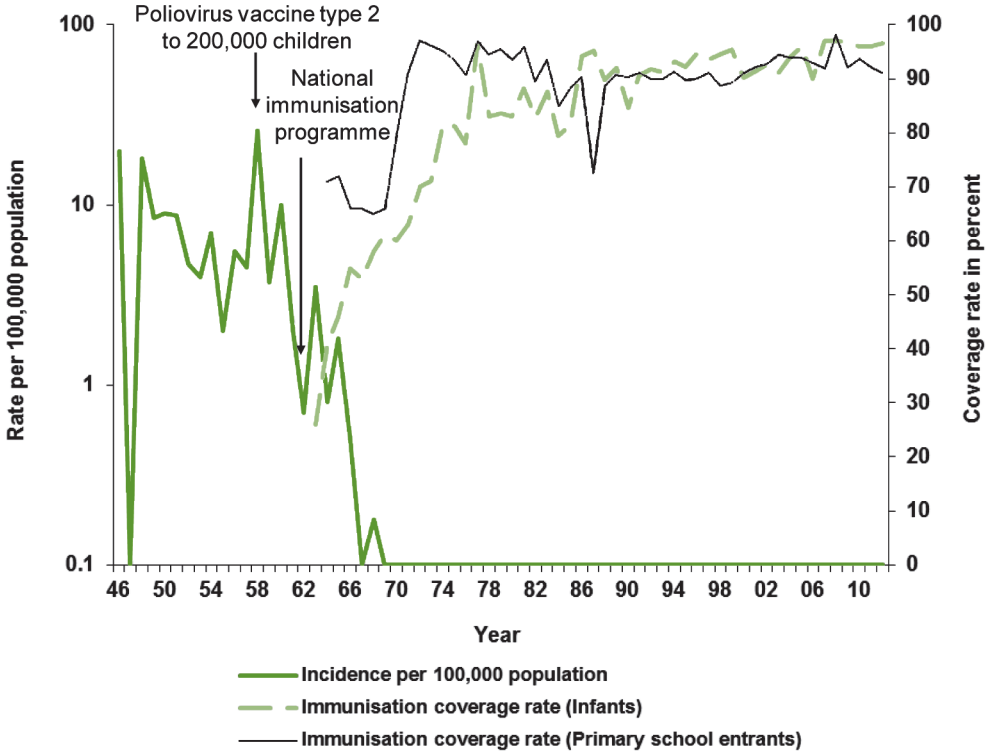


Figure 7.2
Incidence per 100,000 population from diphtheria and immunisation coverage rates in Singapore, 1946-2012

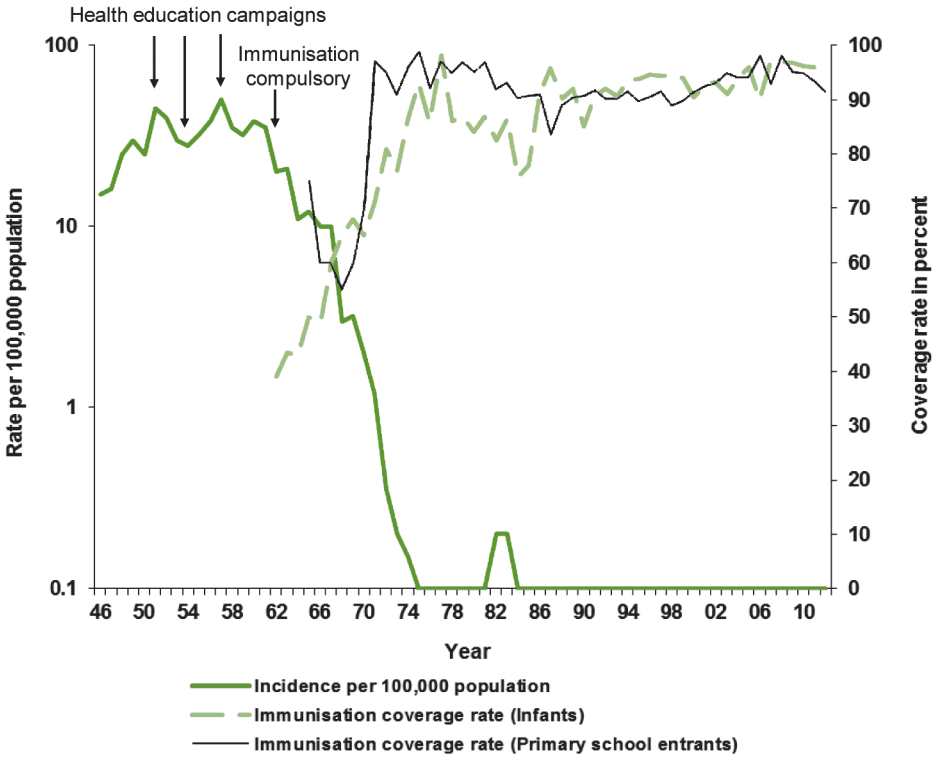
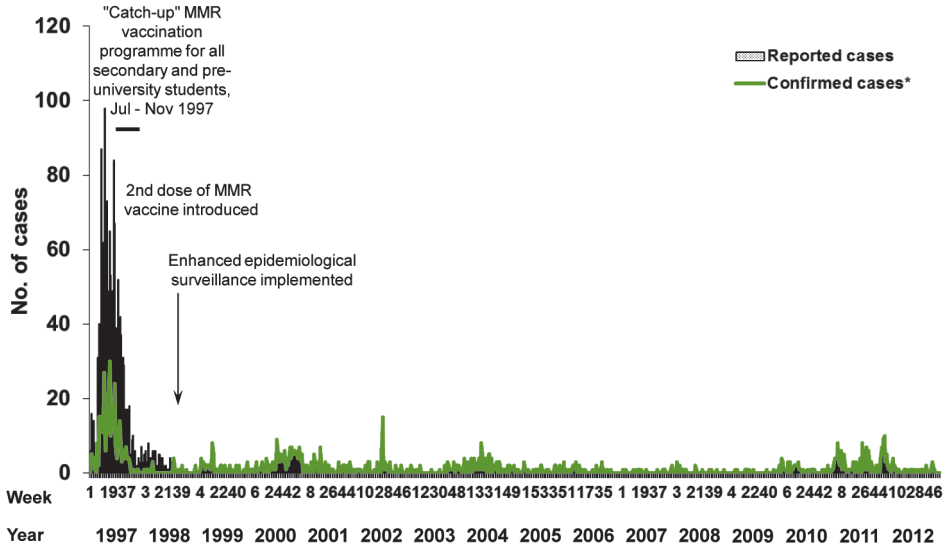
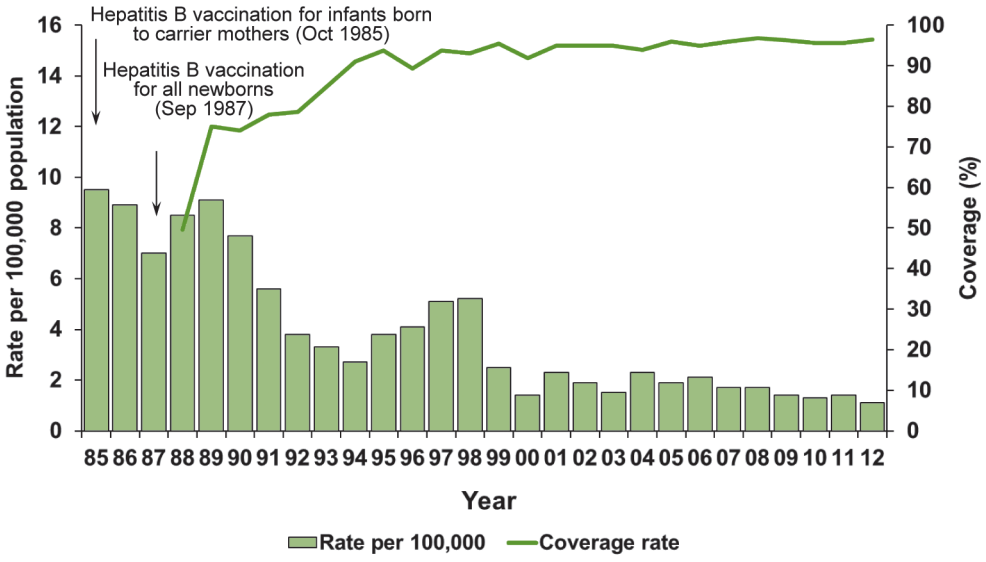


Figure 7.3
Impact of the "catch-up" MMR vaccination programme and introduction of second dose of MMR vaccine on the incidence of reported measles cases in Singapore, 1997-2012



* Measles-specific IgM antibody positive

Figure 7.4
Incidence per 100,000 population from acute hepatitis B+ and immunisation coverage rates, Singapore, 1985-2012



+ Indigenous cases

Table 7.13
No. of therapeutic abortions performed for rubella infection, 1984 – 2012

Year	Total no. of abortions	No. of therapeutic abortions performed for rubella infections	
		No.	(%)
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
2006	12,032	3	0.02
2007	11,933	1	0.01
2008	12,222	0	0.00
2009	12,316	0	0.00
2010	12,082	0	0.00
2011	11,940	0	0.00
2012	10, 624	1	0.01

Table 7.14
Reported diphtheria, poliomyelitis, measles, acute hepatitis B, neonatal tetanus, pertussis, congenital rubella and childhood tuberculous meningitis in Singapore, 1983 – 2012

Year	Diphtheria	Poliomyelitis	Measles	MumpsΦ	RubellaΦ	Acute hepatitis B@	Neonatal tetanus*	Pertussis@@	Congenital rubella#	Childhood tuberculous meningitis##
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++	1	0
2006	0	1(1)&	28++	844+	90+	0	0	3+++	0	0
2007	0	0	15++	780+	83+	0	0	38++	0	0
2008	0	0	18++	801+	180+	0	0	33++	2	0
2009	0	0	.....13++	...631+	178+	0	0	13	0	0
2010	0	0	49++	452+++	158+++	0	0	8++	2&	2
2011	0	0	148++	501+++	110+++	0	0	29++	2	0
2012	0	0	38++	521+++	64+++	0	0	24++	2&	0

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

( )	Imported cases.	++	Based on laboratory confirmed cases.
Φ	Notifiable with effect from April 1990.	+++	Based on laboratory confirmed and clinically diagnosed cases.
@	Indigenous cases below 15 years of age.	#	Cases diagnosed in KK Women's and Children's Hospital, Singapore General Hospital and National University Hospital.
@@	All pertussis cases reported prior to 1986 were based on clinically diagnosed cases seen at the Communicable Disease Centre.	##	Below 10 years of age
+	Based on clinically diagnosed cases	&	Foreigner who came for treatment