The epidemiology of rubella and congenital rubella in Australia, 1992 to 1997

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Abstract

Selective rubella vaccination of schoolgirls commenced in 1971 and was followed by a significant reduction in congenital rubella. Infant vaccination with MMR was introduced in 1989 to interrupt circulation of the virus in young children, and in 1994/95 the adolescent school based rubella vaccination program was changed to MMR for both boys and girls. This report reviews the epidemiology of rubella and congenital rubella between 1992 and 1997 using reports to the National Notifiable Diseases Surveillance System (NNDSS) and the Australian Paediatric Surveillance Unit (APSU). Notification rates for rubella exceeded 20 per 100,000 in 1992, 1993 and 1995 and declined to 7.2 per 100,000 in 1997. Sixty-one per cent of notifications occurred between September and December and 68% occurred in males. The incidence rate in males aged 15–22 years peaked at 152.6 per 100,000 in 1995 reflecting the lack of immunisation in this cohort. From 1993 to 1997, 19 children were reported with congenital rubella syndrome, representing 1 in 67,000 live births. Of these, 17 had multiple defects (4 died) and 2 had deafness only. There were also 5 infants with congenital rubella infection but no defects. Australia's rate of congenital rubella syndrome exceeded that of the United Kingdom and the United States of America but this may be partly attributable to differences in reporting practices. The impact of changing the second dose of MMR vaccine to 4 years of age in 1998 will require careful monitoring. *Commun Dis Intell* 1999;23:209-214.

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Introduction

In 1971, Australia commenced selective vaccination of 10–14 year old girls to prevent congenital rubella. By the mid-1980s this had significantly reduced the occurrence of congenital rubella from approximately 120 to fewer than 20 cases per year.[1,2] However, to eliminate rubella in pregnancy, the United States (US) strategy of interrupting the circulation of virus through vaccinating young children (the primary transmission group), was required.[3] A combined infant and adolescent strategy was adopted in Australia in 1989 when measles-mumps-rubella vaccine (MMR1) was introduced for infants at 12 months of age. Further revision was made to the immunisation schedule in 1994/95 when selective rubella immunisation of schoolgirls ceased and a second dose of MMR (MMR2) was recommended for both boys and girls aged 10–16 years.

Rubella vaccination policy has changed once more. In response to the longer-term plan to eliminate measles, the Australian Technical Advisory Group on Immunisation recommended that, as part of the 1998 National Measles Control Campaign, the existing MMR school based program cease and the second dose of MMR be given at 4 years of age to coincide with school entry diphtheria-tetanus-pertussis (DTP) and oral polio (OPV) vaccinations. Changing the schedule will lengthen the time between MMR2 vaccination and pregnancy. The impact of this change on population susceptibility to rubella infection and on immunity during pregnancy will require careful monitoring.

This report describes the epidemiology of rubella and congenital rubella cases notified to the National Notifiable Diseases Surveillance System (NNDSS) and the Australian Paediatric Surveillance Unit (APSU) between 1992 and 1997.

Methods

Data sources

Under the Public Health legislation of each State and Territory, medical practitioners (except in New South Wales; NSW) and laboratories (except in Western Australia; WA) are required to notify rubella; congenital rubella is mandatorily notifiable only in 5 of the 8 States and Territories. Since 1991 these data have been collated nationally by the NNDSS. This report includes NNDSS rubella data with a stated onset of disease between 1 January 1992 and 31 December 1997. Australian Bureau of Statistics mid-year population estimates for each year (1992–1997) were used to calculate age-specific and crude notification rates. Seasonal trends were reported by month of disease onset.

Congenital rubella data were derived from the APSU, which has maintained a national system of active surveillance since 1993. Analysis of congenital rubella cases relate to children born in Australia between January 1993 and December 1997.

Surveillance case definitions

Rubella

Rubella is defined by the National Health and Medical Research Council (NHMRC) (1994) as:

(a) a generalised maculopapular rash and a fever, and one or more of: arthralgia, arthritis or lymphadenopathy or conjunctivitis and an epidemiological link to a confirmed case; or

(b) demonstration of rubella-specific IgM antibody, except following immunisation; or

(c) a fourfold or greater change in rubella antibody titre between acute and convalescent phase sera obtained at least 2 weeks apart; or

(d) isolation of the virus from a clinical specimen. [4]

Congenital rubella infection

A case of congenital rubella infection is defined as an infant with no rubella defects, but with congenital infection confirmed by isolation of virus, or detection of IgM or persistent IgG rubella antibody in the infant.

Congenital rubella syndrome

A case of congenital rubella syndrome is defined by the NHMRC (1994) as a live or stillborn infant with clinically compatible defects and at least one of the following:

(a) isolation of rubella virus from a clinical specimen from the infant; or

(b) demonstration of rubella-specific IgM antibody in the infant's serum; or

(c) persistence of rubella-specific IgG antibody titre higher than expected from passive transfer of maternal antibody; or

(d) laboratory confirmed maternal rubella in the first trimester of pregnancy. [4]

Results

Rubella, 1992-1997

Between January 1992 and December 1997, a total of 19,599 cases of rubella were reported to the NNDSS. Notifications remained elevated between 1992 and 1995, with rates of infection ranging between 18.9 to 25.4 per 100,000 population. The incidence of notified rubella subsequently declined to 7.2 per 100,000 population in 1997. Both rates of infection and the time at which disease activity peaked varied by State (Table 1). Overall, Queensland reported 35.4% of notifications, Victoria 27.6% and NSW 14.6%. Western Australian data were absent for 1992, while Tasmania reported no cases of rubella until 1995. Seasonal fluctuation was evident, with 61% of all notifications occurring between the months of September and December (Figure 1).

On average, males accounted for 68% of rubella notifications reported annually, with individuals aged 15–22 years most frequently affected. Age-specific notification rates for this cohort (15–22 years) ranged from 113.5 per 100,000 population in 1992 rising to a peak of 152.6 cases per 100,000 population in 1995 and falling to 35.7 per 100,000 in 1997. Figures 2,3 and 4 show the age and sex distribution for those years. Table 2 gives the overall rates for all years 1992 to 1997.

The incidence of notified disease in females of an equivalent age (15–22 years) was considerably lower (Table 2). In 1992, the notification rate was 16.7 per 100,000 population (Figure 2) increasing to 22–23 per 100,000 between 1993 and 1995 (Figure 3)before declining to 9.2 per 100,000 in 1997 (Figure 4). In 1992 and 1995 when notified disease activity was at its highest, the male:female ratio was 7:1, falling to 4:1 in 1997.

Table 1. National rubella notifications and notification rates by State, 1992–1997

State	Notifications						Rate per 100,000 population					
	1992	1993	1994	1995	1996	1997	1992	1993	1994	1995	1996	1997
ACT	609	127	49	173	70	32	206.6	42.4	16.2	56.7	22.7	10.3
NSW	339	812	113	1,213	254	142	5.7	13.5	1.9	19.8	9.7	2.3
NT	NN	(18)*	(45)*	10	7	7	-	-	-	5.6	3.8	3.7
Qld	788	1,404	2,148	1,073	979	539	7.5	45.1	67.4	32.9	29.3	15.8
SA	121	275	75	87	382	184	8.3	18.8	5.1	5.9	25.9	12.4
Tas	NN	NN	NN	169	32	18	-	-	-	35.6	6.7	3.8
Vic	2,230	491	211	1,468	667	337	50.0	10.9	4.7	32.5	14.6	7.3
WA	1	509	730	396	161	84	0.06	30.3	42.9	22.8	9.1	4.5
Aust	4,088	3,636	3,371	4,589	2,552	1,343	23.4	20.6	18.9	25.4	13.9	7.2

NN Not Notifiable.

* Rubella was not notifiable in NT until December 1994.

Figure 1. Notifications of rubella, Australia, January 1992 to December 1997, by month of onset

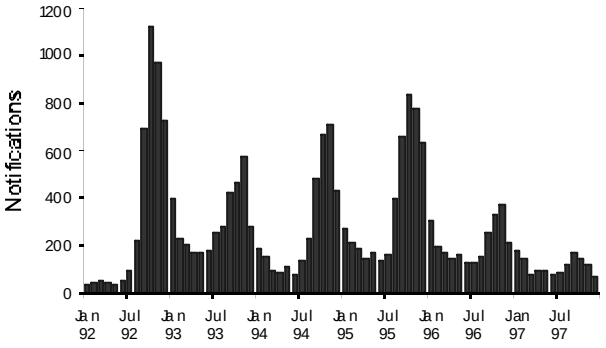

Figure 2. Notification rates per 100,000 population for rubella, Australia, 1992, by age and sex

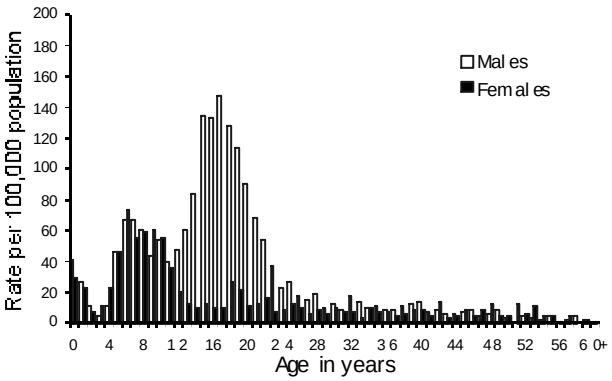

Figure 3. Notification rates per 100,000 population for rubella, Australia, 1995, by age and sex

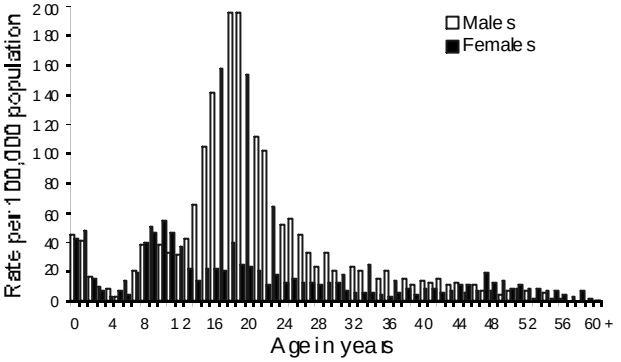

Figure 4. Notification rates per 100,000 population for rubella, Australia, 1997, by age and sex

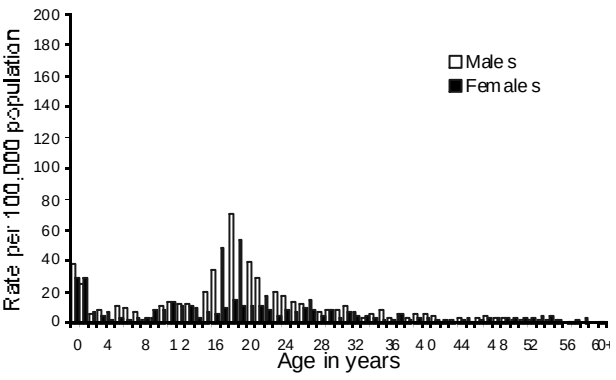

Table 2. National rubella notification rates per 100,000 population in Australia, 1992–1997, by age group and sex

	2–14 years		15–22 years		All ages	
Year	Male	Female	Male	Female	Male	Female
1992	48.7	39.4	113.5	16.7	31.5	14.3
1993	29.6	27.9	98.2	21.7	26.5	14.3
1994	22.2	20.4	99.9	21.7	25.0	12.1
1995	31.6	26.7	152.6	23.2	36.2	13.6
1996	13.3	14.0	81.3	16.1	18.8	8.9
1997	8.2	5.9	35.7	9.2	9.6	4.9

Table 3. Congenital rubella births in Australia per year, 1993–1997

Year of birth	Live births*	Congenital rubella syndrome	Birth incidence per 10,000 live births
1993	258,626	4	0.15
1994	258,426	5	0.19
1995	254,942	4	0.15
1996	251,000	5	0.20
1997	253,673	1	0.04

* Australian Bureau of Statistics

For women of childbearing age (15–44 years) the incidence of rubella notifications remained around 12 cases per 100,000 population between 1992 and 1993 (Figure 2), declining to 5.6 per 100,000 in 1997 (Figure 4). As a proportion of total notifications (2,660 /20,286), the rate in this age group remained fairly constant at around 14% of annual notifications.

For children aged 2 to 14 years the incidence of disease fell progressively from 42 per 100,000 population in 1992 to 7 per 100,000 in 1997.

The decline in the childhood incidence of notified disease is more apparent when the proportion of cases reported in children aged 2–14 years is compared over time with other selected age groups. The proportion of notified disease in males aged 2–14 years and 15–22 years has changed as notification of infection in younger males declined from 30% in 1992 to 16% in 1997. Over the same period, the proportion of notified cases reported in the 15–22 year old cohort remained at around 47%. The trend in the female population has also changed, with the proportion of reported cases in 2–14 year olds falling by 29% to 21% by 1997, equating to that of females aged 15–22 years.

Congenital rubella syndrome, 1993–1997

From 1993 to 1997, 24 children born in Australia with congenital rubella were reported to the APSU; 19 had congenital rubella syndrome and 5 were congenitally infected but had no defects; only 1 of these 5 children was exposed in the first 16 weeks of gestation. In 1997 only 1 case of congenital rubella syndrome was reported to the APSU. This figure may be an underestimate of the true incidence since not all cases may yet (at 30 July 1999) have been identified although all cases but one were reported to the APSU within the first year of life. Incidence at birth is shown in Table 3. Over the same period only 8 cases of congenital rubella were notified to the NNDSS, all from NSW.

APSU records indicate that over this 5 year period 13 (54%) children with congenital rubella with or without defects were born in NSW, with the remainder born in Queensland 6 (25%), the Australian Capital Territory (ACT) 2 (8%) and Victoria 3 (13%). No cases were reported in the NT, South Australia (SA) or WA during this period. The ratio between congenital rubella births and reports of rubella in women of childbearing age varied markedly between States reporting cases (Table 4).

Multiple defects were reported in 17 of 19 (90%) defective children (4 died, 1 from sudden infant death syndrome), while deafness, reported as a single defect, was diagnosed in 2 (10%) children (Table 5). A further 5 children demonstrated rubella specific IgM positivity neonatally but showed no evidence of defects.

Fourteen of the 24 mothers (58%) whose infants had congenital rubella infection were born in Australia; 8 mothers were born elsewhere, and the place of birth was not recorded for two. Maternal age ranged from 16 to 42 years. Six women gave a history of rubella vaccination. During the first trimester of pregnancy 15 women reported either being aware of a rash or rubella-like illness, having come in contact with a person with rubella or having serological confirmation of rubella. Sixteen infants were the outcome of a first pregnancy, 4 of a second, 3 of a third, and 1 of a fourth pregnancy.

Discussion

Between 1992 and 1997 the striking features of the epidemiology of rubella in Australia were the seasonality (peaking in spring), the low reported incidence in 1997, and the high notification rates in adolescent males compared with adolescent females. This difference between adolescent males and females appears to reflect the fact that males were not included in the adolescent vaccination program until 1994/95. It is likely that outbreaks will continue to occur in males aged around

Table 4. Ratio of congenital rubella cases to the number of rubella cases reported in women aged 15–44 years, by State, Australia, 1993–1997

State	Rubella notifications*	Rubella notificati ons in women 15–44 years. Number (% of total)		Congenitally infected infants. Number (number without defects)	Ratio of congenital rubella infection to reported infection in women 15–44 years
ACT	1,057	94	(8.9%)	2	1:47
NSW	2,873	376	(13.1%)	13 (4)	1:29
Qld	6,931	1,553	(22.4%)	6 (1)	1:259
Vic	5,404	327	(6.0%)	3	1:109

* Notification of rubella cases to NNDSS

17–24 years until younger immunised males reach this age or until immunisation coverage of younger children is sufficiently high to interrupt rubella transmission.

The occurrence of at least 2,660 cases of rubella in women of childbearing age resulted in the birth of 24 infants with congenital rubella (19 with defects). APSU data indicated that missed opportunities to immunise and failure to confirm apparent infection in pregnancy were major contributing factors to this outcome.[5] The fact that 8 of the mothers had been born overseas (7 in countries currently without rubella vaccination programs) was also important.

In comparison, from 1993 to 1996 (4 years) the British Paediatric Surveillance Unit and the National Congenital Rubella Surveillance Program in the United Kingdom (UK), which uses a definition consistent with that of the APSU, reported the birth of 20 infants with congenital rubella syndrome.[6] The mothers of 4 of these 30 cases acquired their infection abroad. The increase in cases of congenital rubella in 1996 in the UK followed a springtime outbreak among young men who had not been vaccinated.[7] The birth cohort in the UK is more than double that of Australia. Much lower congenital rubella syndrome rates were reported in the US (7 indigenous cases in the 3 years 1993 to 1996)[8] although previous rates were higher.[9] However, it is estimated that because a passive surveillance system is used, only 40%–70% of all US cases are detected.[8] Notwithstanding this, a much more restrictive case definition of congenital rubella syndrome is applied than that used in Australia or the UK and only 13 of the 19 Australian cases would fit the US definition.[10]

Of the 6,931 reports of rubella in Queensland, close to 1 in 4 cases occurred in women of childbearing age. In Victoria, which reported a total of 5,404 cases, the ratio was closer to 1:16, while in NSW, which reported 2,873 cases, the ratio was 1:7. The apparent disparity across States may be a consequence of differential reporting of rubella, variable immunisation coverage of women of childbearing age or use of laboratory diagnosis in women of this age. This may also account for the marked variation between States and Territories in the ratio of rubella reported in women of childbearing age and the occurrence of congenital rubella. In NSW, one congenital rubella birth occurred for every 29 women reported infected. All congenital rubella cases were reported from the more populous Eastern States and none from the NT, SA, Tasmania or WA.

Table 5. Clinical manifestations and deaths recorded in 19 cases of congenital rubella syndrome, 1993–1997*

Manifestation	Number of children	
Deaths		4
Deafness		11
Eye defects		10
cataract(s)	8	
retinopathy	2	
keratitis	1	
Central nervous system defects		8
microcephaly	4	
intracerebral calcification	6	
haemorrhage	1	
cerebral palsy	1	
Cardiovascular defects		11
patent ductus arteriosus	9	
pulmonary artery stenosis	2	
other	4	
Pneumonitis		2
Intrauterine growth retardation/ failure to thrive		9
Developmental delay		4
Other		12

*Not all infants had been fully assessed at the time of notification, so this may be an underestimation of the actual defects particularly deafness. Seventeen infants had more than one defect.

The absence of standardised surveillance methods across State and Territory health authorities may in part explain these disparities. At present neither the method of diagnosis (clinical, cultural or serological) nor the mechanism of notification (whether by doctor, hospital or laboratory) is specified on the database. Since an element

of bias is associated with each, and variation exists in the reporting requirements of each State, interpretation of and comparison between State and Territory data at a national level is difficult.

Pregnancy status at the time of infection and rubella-associated terminations of pregnancy are not monitored nationally, so the actual number of adverse outcomes associated with rubella infection in pregnancy is unknown and may be higher than current data suggest. Three first trimester terminations for rubella are known to have occurred in WA between 1993 and 1994.[1] In SA, it was reported that between two and four rubella-associated terminations were carried out each year,[11] but the last one was carried out in 1993.[2] In the UK, where rubella-associated pregnancies are notifiable, births of babies with congenital rubella and terminations associated with rubella disease or contact have both fallen between 1971 and 1996.[7]

Rubella surveillance is complicated by the nature of the disease itself, because up to 50% of infections occur without a recognised rash, and clinical diagnosis is unreliable.[12] While laboratory confirmation is recommended practice, reluctance on the part of many doctors to take blood from children means that an excess of laboratory confirmed cases in adults is likely to occur.[13] Conversely, it has been found that misdiagnoses in children may both distort age-specific incidence and increase background incidence between epidemic years, obscuring the true size of resurgence in disease activity when it does occur.[14]

In recognition of these limitations, efforts are in progress to develop uniform standards of communicable disease surveillance in Australia at the national level.[15] More specifically, in the light of the 1998 National Measles Control Campaign and the subsequent change to the childhood immunisation schedule, enhanced serosurveillance of measles and rubella susceptibility is being initiated by the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS). Modelled on the British system,[14] the NCIRS will monitor the effect of revised disease control strategies on rubella susceptibility in children and women of childbearing age through a national system of age-stratified serosurveillance.[16] Information derived from this source will also be used to construct mathematical models of rubella epidemiology for the purpose of predicting outbreaks. Collation of this information with immunisation coverage data derived from the Australian Childhood Immunisation Register, and from other surveillance systems such as NNDSS, APSU and LabVISE (the national sentinel Virology and Serology Reporting Scheme) will in the future provide a more accurate estimate of the effectiveness of rubella prevention and control strategies.

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