

Mumps in the Kimberley:
an epidemiological
journey.



Background

- March 2007: the first case of a subsequent outbreak of mumps notified in Northern Territory
- July 2007: recognition of a mumps outbreak in WA (Kimberley); public health action implemented
- January 2008: Kimberley mumps outbreak shows no signs of abating



Objectives of this analysis

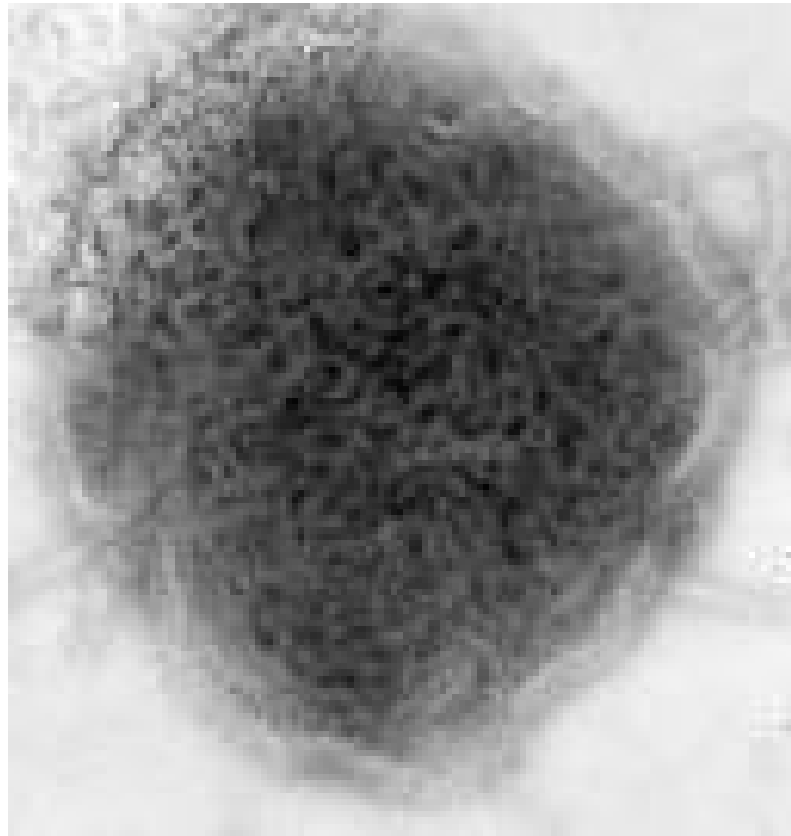
- Who is getting the disease?
- Where are the patients located?
- What is the time frame of the outbreak?
- Why are public health measures not controlling the disease?
- What other measures should be undertaken (short and long term)?



Mumps: the disease

- Parotitis and orchitis described by Hippocrates in 5th century BC—an old disease!
- An acute viral illness
- Respiratory transmission (airborne, droplet, saliva)
- 20-30% asymptomatic

Mumps virus



Mumps: the virus



- Paramyxovirus (like para influenzas)
- One antigenic type (serotype)
- Many genotypes (12 identified to date)
- Genotyping based on nucleotide sequence of the small hydrophobic gene

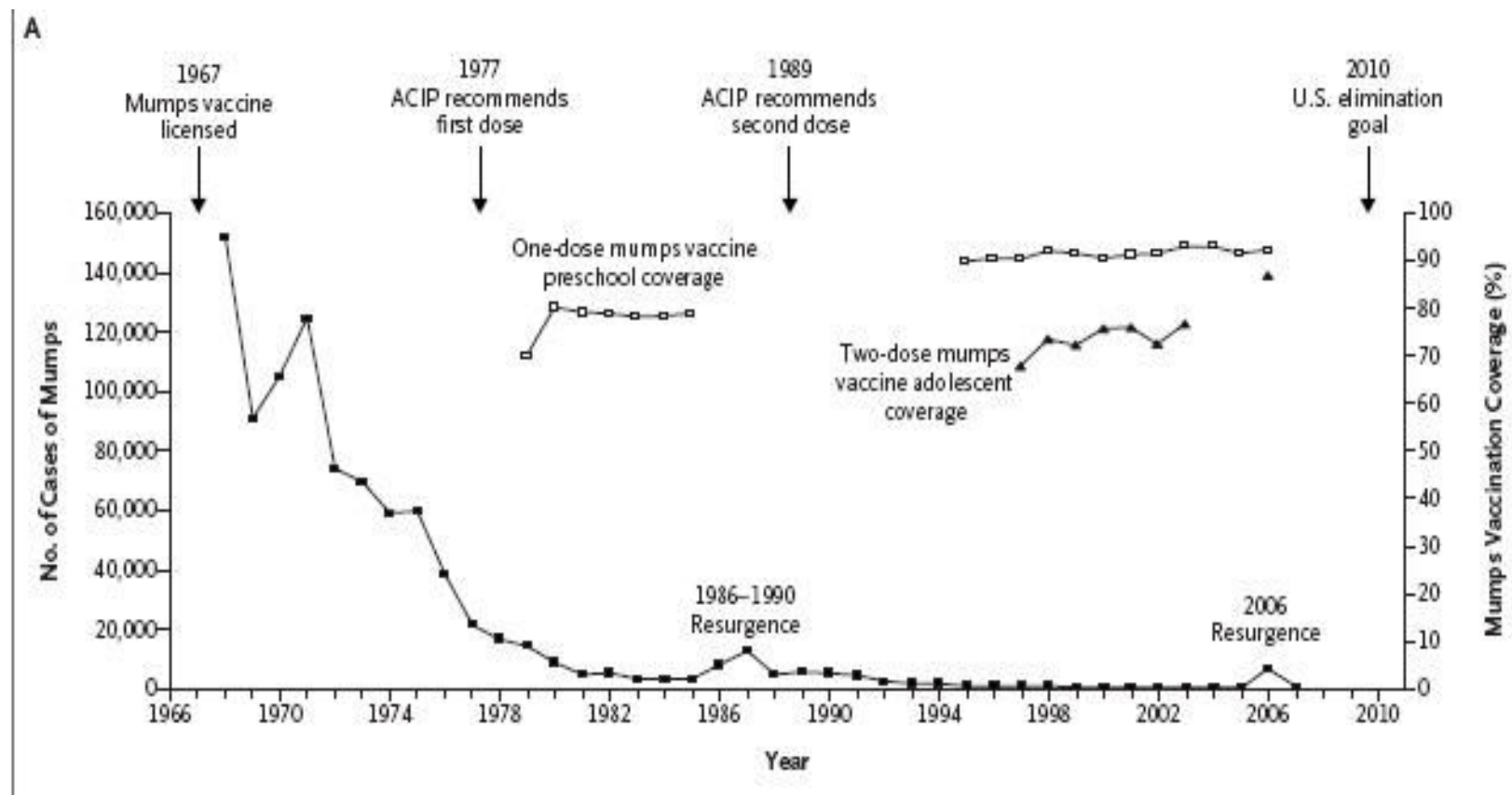


Mumps: the vaccine

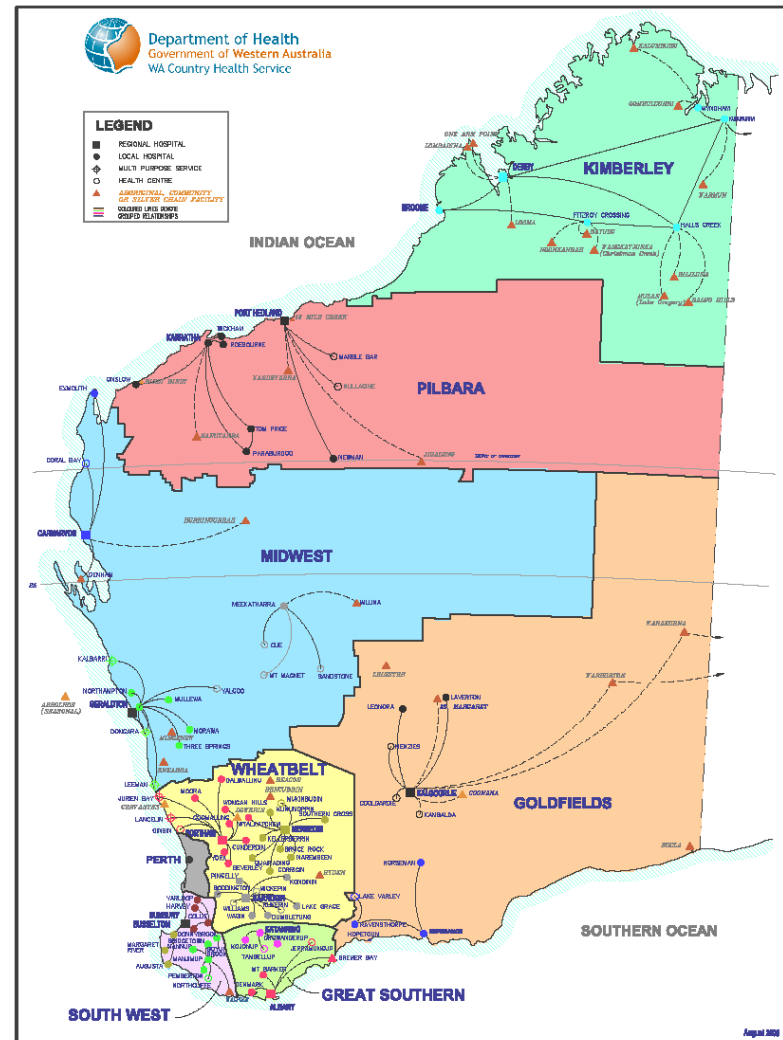
- Vaccine strain (Jeryl Lynn) is genotype A
- Live vaccine, prepared in chick embryo fibroblasts
- Effectiveness: variable reports (80-95%)

Mumps: the effect of vaccination

- Dayan, G et al. Recent resurgence of mumps in the United States. NEJM 2008. 358. 1580-9



Mumps in Western Australia

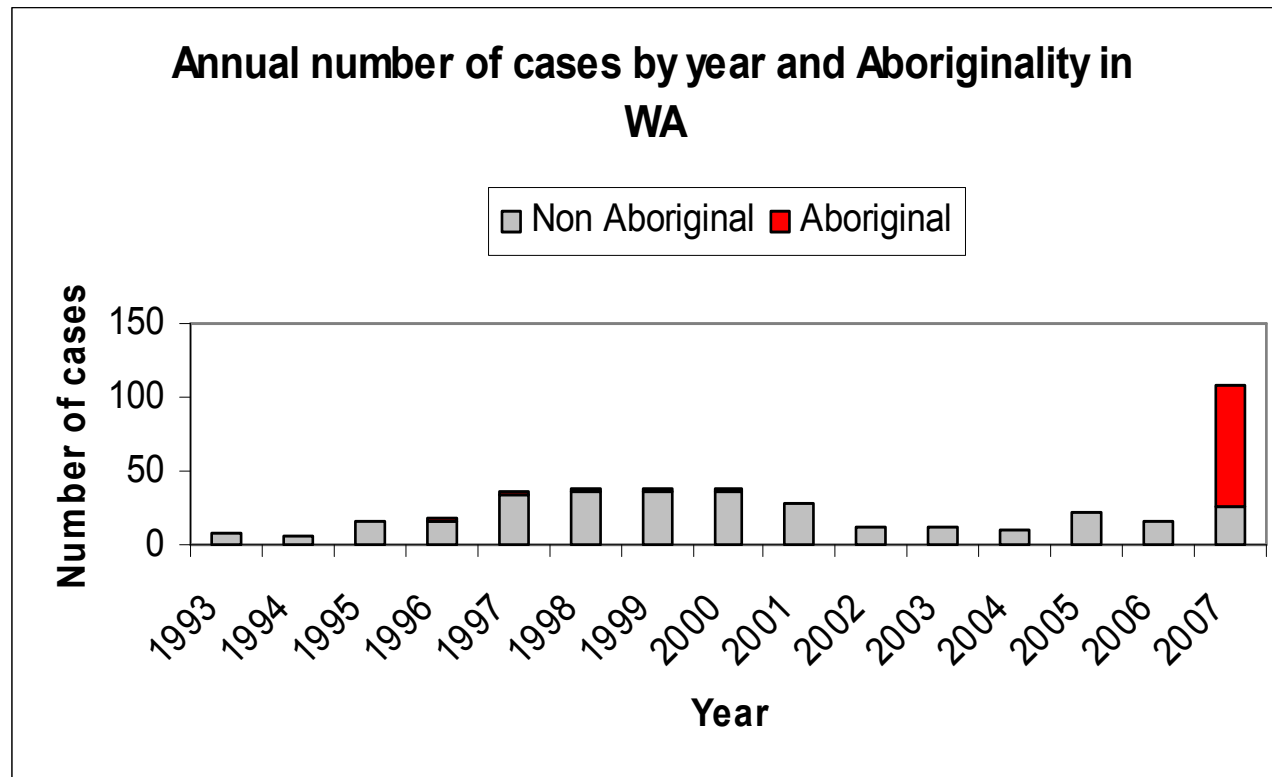


The Australian schedule

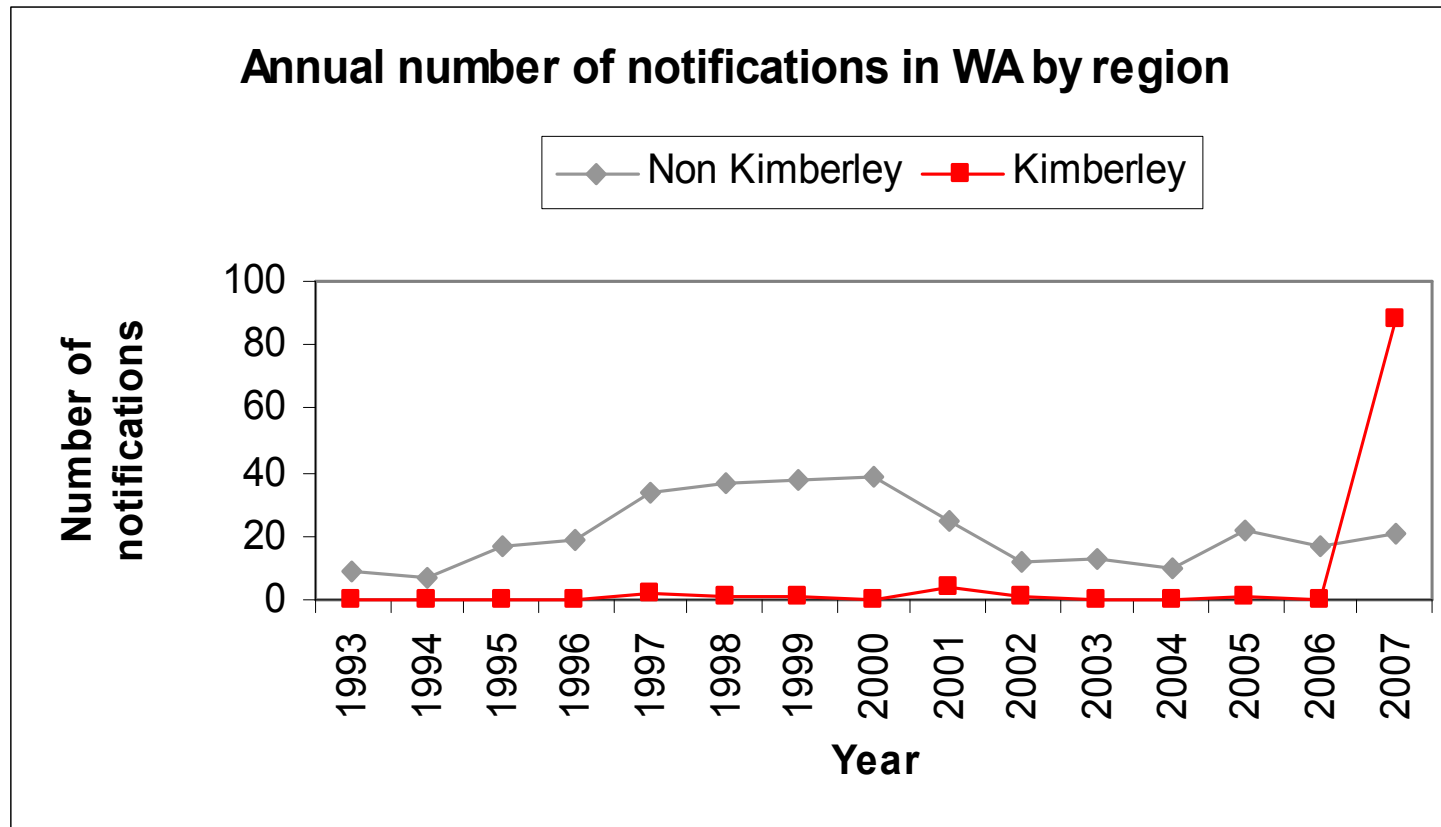
Table 1: Key dates in mumps vaccine scheduling in Western Australia

Year	Type of vaccine	Number of doses	Scheduled age
1981	mumps	1	12 months
1983	measles-mumps	1	12 months
1989	measles-mumps-rubella	1	12 months
1994	measles-mumps-rubella	2	12 months, 12 years
1998	measles-mumps-rubella	2	12 months, 4-5 years

Historical mumps data, WA, by Aboriginality.



Historical mumps data, WA, by region.





The journey begins...

- Cluster of cases of mumps in a boarding school in Darwin, June 2007
- 12 boarders return to Beagle Bay in the Kimberley for the school holidays in July 2007
- The index case of mumps in the Kimberley was one of these boarders
- Within 3 weeks, one fellow boarder developed the disease, as well as a household contact of the index case



...and marches across the Kimberley

- No other notifications from boarders from NT school
- The disease spreads East to Warmun and South to Broome: asymptomatic boarders?
- Notifications continue to rise with a peak in November 2007

Who was affected?



- 183 cases in total
- 153 identified as linked to the Kimberley
- 141 of the outbreak cases were Aboriginal (92%)
- Even split of males to females
- Peak age 15-19 years

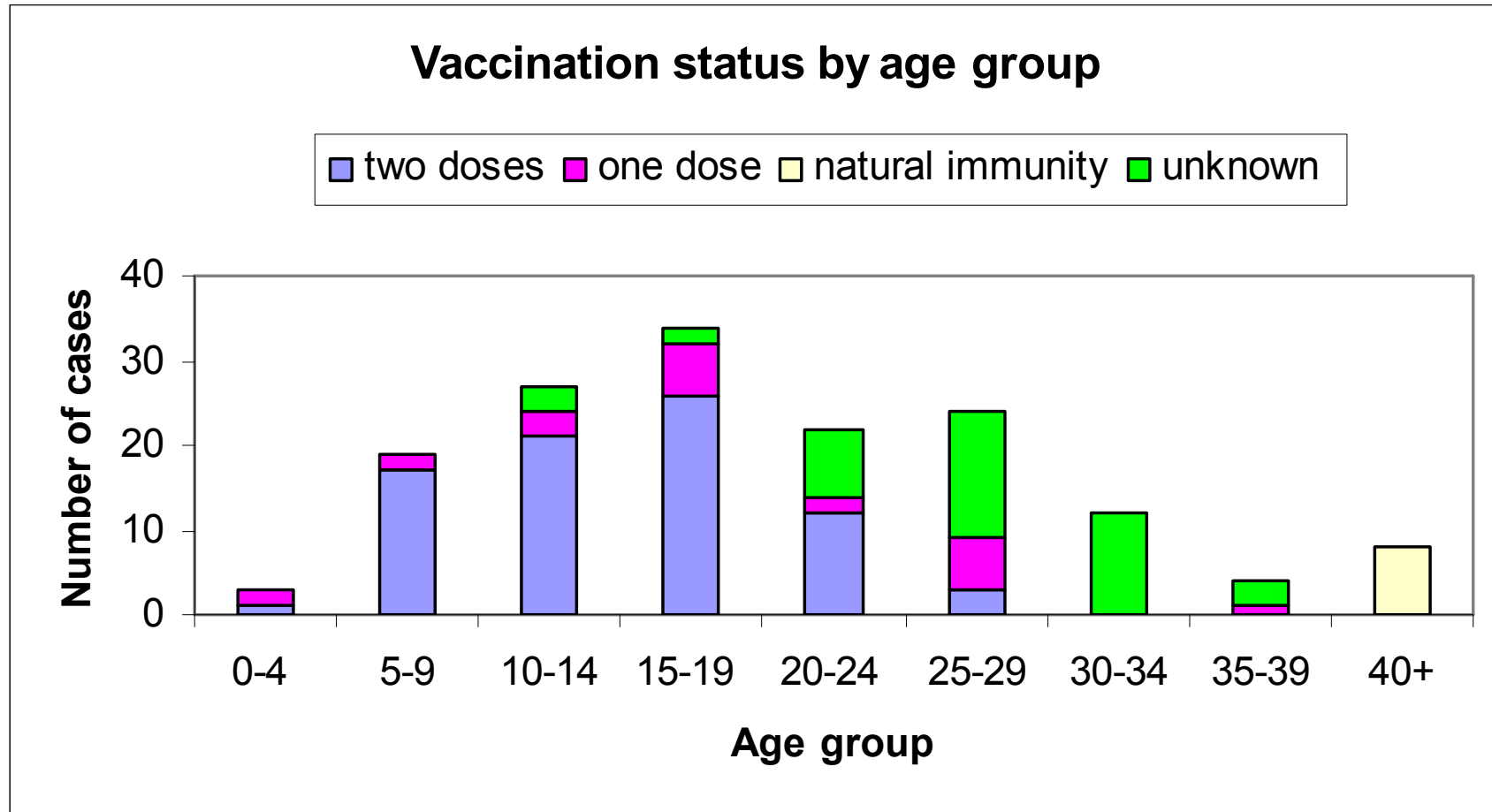
Age distribution of mumps cases

Table 2: Age distribution of outbreak cases and age-specific notification rates for Kimberley mumps outbreak

Age group (years)	All outbreak cases	Aboriginal outbreak cases	
	n (%)	n (%)	Rate per 100,000 [†]
0-4	3 (1)	3 (2)	97
5-9	19 (13)	19 (13)	920
10-14	27 (18)	24 (17)	1,256
15-19	34 (22)	34 (24)	1,816
20-24	22 (14)	19 (14)	1,191
25-29	24 (16)	21 (15)	1,521
30-34	12 (8)	11 (8)	894
35-39	4 (3)	2 (1)	172
40+	8 (5)	8 (6)	203
Total	153 (100)	141 (100)	822

[†]Aboriginal population of Kimberley used as denominator

Vaccination status of the Kimberley cases



Laboratory testing

Table 4: Laboratory testing results of outbreak cases			
Diagnostic test	Tested n (%)	Test result*	
		Positive n (%)	Negative n (%)
Culture	37 (24)	23 (62)	14 (38)
PCR	142 (93)	131 (92)	11 (8)
Serology: IgG	73 (48)	73 (100)	0
IgG+/IgM+	-	23 (32)	-
IgG+/IgM-	-	-	50 (68)

*some cases had more than one test performed

Laboratory results



- 50 cases were IgM negative; 94% of these were PCR positive
- Overall, 94% were laboratory confirmed
- 6 cases had no lab tests

Genotyping



- 20 samples were genotyped
- 20 of these were genotype J
- How does this compare with genotypes found previously in Australia?



So why did the outbreak occur?

- Inadequate herd immunity?

67% had received at least one dose of vaccine
(Need 88-92% coverage for non-outbreak settings;
much higher in high-risk settings for exposure)

- Primary vaccine failure?

- Cold chain breach?
- Failure to seroconvert? – all 73 tested had +ve IgG
- Genotype mismatch? – outbreak J vs vaccine A



Other reasons

- Secondary vaccine failure? (failure to maintain adequate immunity after initial response)
 - Duration of immunity
 - Boosting of immunity by wild type virus
 - Antibody titres
 - Virus genotype



Some further questions

- Is the immune response to the mumps vaccine different in Aboriginal vs non Aboriginal people?
- Is the duration of immunity different in these two groups?



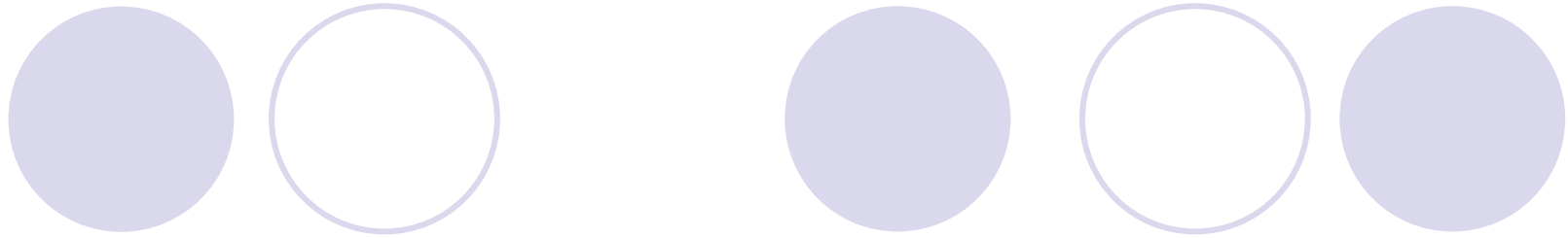
Conclusion

- Vaccine: the mono-specific genotype A-derived vaccine may not provide adequate protection against heterologous strains
- Individual immunity: wanes over time especially with reduced exposure to wild type virus
- Herd immunity: may not be sufficient to prevent an outbreak



Public Health Implications

- Mumps infection is re-emerging
- Two-dose vaccination is important to prevent infection in children
- Infection control measures of hand-washing and isolation remain crucial to the prevention of transmission



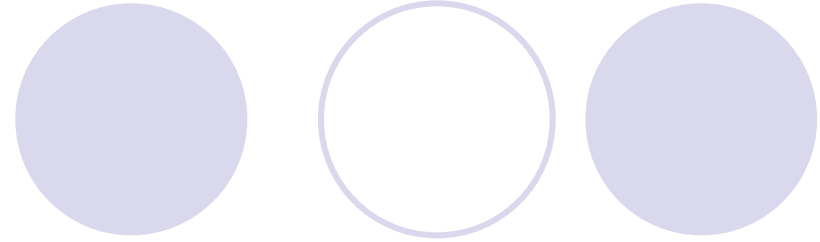
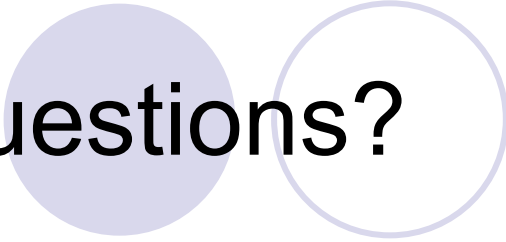
- Vaccine effectiveness: genotyping and neutralisation studies may help to determine the effectiveness of the current mumps vaccine
- Booster dose of mumps vaccine should be considered in the outbreak setting

Acknowledgements



- Dr Gary Dowse
- Carolien Giele
- Dr Paul van Buynder
- Dr Shelley Deeks
- Mary Whitty, and the staff at KPHU
- Dr Meredith Hodge
- Megan Scully

Questions?



A decorative graphic consisting of six circles arranged in two groups of three. The first group on the left has a solid light purple circle on the left and an outlined light purple circle on the right. The second group on the right has a solid light purple circle on the left, an outlined light purple circle in the middle, and a solid light purple circle on the right.

Thank you.

Dr Reyle Bangor-Jones

Communicable Disease Control Directorate

Perth WA.