Quote

• “These are my principles. If you don’t like them - I have others”.

• Groucho Marx
Analysis of the Auckland 2014 Measles Outbreak Indicates that Adolescents and Young Adults could Benefit from Catch up Vaccination.

• Gary Reynolds, Cassandra Dias, Simon Thornley, Ronald King, Angela Matson, Anne Morrison & Richard Hoskins

• In Press NZ Medical Journal

• Auckland Regional Public Health Service, Private Bag 92605, Symonds Street, Auckland 1150, New Zealand
Measles Outbreak Auckland, NZ 2014

- December 2013 to June 2014
- Epidemiology
- Immunology
- Vaccinology

- Aim: To analyse the Measles 2014 outbreak in Auckland to guide future preventive measures
A contagious disease...

Source: http://www.healthline.com/health/r-nought-reproduction-number#Conditions4
Background

- Measles is highly contagious (Ro = 12-18)
- Burden of disease in developing countries
- Declined markedly in western countries – after mass vaccination campaigns with MMR
- 45 years of MMR vaccine - measles and its complications still persist
- Australia – (But not NZ) is declared by WHO “measles free”
- Notifiable in NZ since 1996
Imported measles common
The MMR

- Highly efficacious and safe vaccine
- Live vaccine so no boost required
- Second dose improves efficacy from 90 to 95%
- NZ schedule 15 months and 4 years
- Under 1 year – interference circulating maternally derived antibodies
- Modeling shows over 95% coverage required to eliminate disease
- Historical unjustified controversy since 1998
Methods

• The setting
  • Auckland (1.4 million)
  • Essentially Indigenous Measles free

• The Method
  • All Measles Notifications go to Public Health Services
  • Each notification is assigned to PH Nurse
  • Collect clinical information, immunisation history and immune status
### Methods: The diagnosis of Measles

<table>
<thead>
<tr>
<th>Confirmed</th>
<th>Probable</th>
<th>Under investigation</th>
<th>Not a case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory results consistent with measles OR Fever ≥ 38°C and a generalised maculopapular rash and: cough or coryza or conjunctivitis or Koplik’s spots and link to confirmed case</td>
<td>Fever ≥ 38°C and a generalised maculopapular rash and: cough or coryza or conjunctivitis or Koplik’s spots</td>
<td>All measles notifications with outstanding diagnostic lab results</td>
<td>No clinically compatible illness OR Laboratory results not consistent with measles infection OR Diagnosed vaccine reaction</td>
</tr>
</tbody>
</table>

Note:
- No link to confirmed case
- Lab work not needed
Methods

• Outbreak coordination
  • Initiated case management
  • Contact tracing (Waiting rooms, schools, sport clubs, flights)
  • Management of households
  • Identified high risk contacts of cases
  • Quarantine, Self isolation, Prophylaxis (Active and Passive Immunisation) as appropriate
Methods

• Laboratory analysis
  • PCR if symptoms in the first 5 days
  • Thereafter serology (anti-measles IgM and IgG detection)
  • Purely qualitative detection of anti measles IgM and IgG
  • Serology was also requested for exposed contacts to establish immune status
  • 1 sample from each linked chain of transmission – genotyped (National Measles Lab)
Statistical Analysis

- Vaccine effectiveness (VE) was calculated using the screening method (Gail)
  - Vaccine effectiveness = \( 1 - \frac{\text{odds(vaccinated | case)}}{\text{odds(vaccinated | non-case)}} \)

- Where:
  - \( \text{odds(vaccinated | case)} \) is the odds of being vaccinated against measles, among cases.
  - \( \text{odds(vaccinated | non-case)} \) is the odds of being vaccinated against measles, in the general population.
Results

• First case visited Sydney
• Later Genotyped and linked to a traveller to same international camp in the Philippines
• Total 113 Cases in the Auckland region
• 13 of which were imported cases
• 9 had travelled to the Philippines
• 16/18 local cases linked to known imported cases
• 82 (73%) were linked to either sporadic or imported cases
The number of measles cases overseas and locally acquired in the 2014 Auckland outbreak showing a local peak in March 2014. There is a temporal seeding of local cases from people travelling to New Zealand from overseas.
Results

• Cases peaked in March 2014
• Temporal seeding of local cases from overseas
• Majority of cases occurred in adolescents and young adults
• 41/113 (36.3%) in 15-19 year age group
• 27/113 (23.4%) in 10-14 year age group
The numbers of confirmed and probable measles cases overseas and locally acquired by age, showing peaks in the under 1 and adolescent age groups.
Results

• Among cases 44/113 (38.9%) occurred in the unimmunised
• 36/113 (31.8%) unknown immune status
• 16/113 (14%) occurred in infants too young to vaccinate
• 17/113 (15%) had received one or two doses of vaccine
2014 Surveillance Year Measles Cases by Immunisation Status
Confirmed and Probable Cases only

Source: NDCMS Index Case records
Extract Date: 1/07/2014
Incidence by age & ethnic group

Incidence rate (per 100,000)

Age category (years)

European or Other ethnicity
Maori
Pacific peoples
Asian
Results

• Of the total cases 26/113 (23%) required hospital treatment
• Secondary cases linked by contact at 1 school (n=37)
• Household contact (n=29)
• Social contacts (n=8)
• Primary care (n=3)
• Hospital (n=5)
Results-Contacts

- 3113 Contacts were traced by ARPHS
- Immune status established by -
  - Documented 2x MMR vaccination history
  - Or proven Serology
  - n= 2,594
  - Highest non immune gp was under 1 year olds 68/75 ; 90.7%
  - Non immune 20-29 year olds (60/ 325; 18.5%)
  - Non immune 15-19 year olds (28/186; 15.1%)
  - Non immune 10-14 year olds (22 /149; 14.8%)
Results – Contacts

• Contacts underwent serological (IgG) testing
  • N= 737
  • Tested negative median age 27.4
  • Tested equivocal median age 26.6
  • Tested positive median age 34.0

• Serological immunity lower in people aged 10-24 years
Proportion of tested exposed contacts who were either serologically immune or equivocal, by age ($n=737$; 597 positive, 57 equivocal and 83 negative).
Serological testing of contacts

Proportion immune or equivocal

Age group (years)
The contacts

Proportion of exposed contacts who were assessed as immune

Exposed contacts with assessed immune status showing 95% Confidence Intervals and total number in each group

Source: NDCMS

Extract Date: 1/07/2014

Source: NDCMS Exposed Contacts records
Vaccine Effectiveness Calculation

- 60/113 (53%) Unimmunised
- 16 were less than 15 months (too young)
- 44 known unimmunised
- 36 unknown vaccine status
- Prevalance of vaccination 90%
- VE if 36 unknown vaccinated = 89%
- VE if 36 unknown unvaccinated = 98%
- VE Range = 89-98%
Discussion

- Adolescents are susceptible
- So are the under 1 year olds
- MOH figures 400,000 in NZ from a population of 4 million (10%)
- The MMR vaccine is safe and effective 89-98%
- Reasons previous poor uptake due to safety concerns and structural issues with delivery
- Effective cold chain did not start until 2004 in NZ
- Waning immunity low immunity without natural boosting
Limitations of this Analysis

• It is only one part of an outbreak
  • Countrywide 280 cases
• Relative small numbers affecting power
• Lack of Quantitative Serology Analysis
Conclusion

• Rapid expansion of Outbreak likely due to
  • Unimmunised European adolescents and young adults in a close contact environment - school
  • Measles is highly contagious nature of disease

• Outbreaks will likely continue until coverage is improved in at risk groups (up to 30 years)

• Most secondary cases occurred at school and were bought home
Recommendations

• Early prompt reporting
• Check all adolescence have 2x recorded MMR
• Use of Dose 0 for under 1 year olds
• A targeted Catch up campaign
Acknowledgements

- Richard Hoskins
- Simon Thornley
- Cassandra Dias
- Angela Matson
- Anne Morrison
- Ronald King
- Staff at ARPHS