Outbreaks of vaccine preventable diseases – communicating the science and closing the gaps

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Only clean water and antibiotics have had an impact on childhood death and disease that is equal to that of vaccines

World Health Organization

Diseases vaccination has significantly impacted upon

- Smallpox - eradication 1977
- Diphtheria - control
- Tetanus - (personal protection only)
- Yellow Fever - control
- Pertussis (whooping cough) - control
- Haemophilus influenza type b disease - control
- Poliomyelitis - close to eradication
- Measles - possible eradication
- Mumps - possible eradication
- Rubella - possible eradication

No cases of indigenously acquired poliomyelitis in New Zealand since the OPV mass immunisation campaigns in 1961 and 1962

Hib Laboratory Isolates 1990-1995, New Zealand

- Disease outbreaks and the NZ context: measles, pertussis, meningococcal disease
- Immunisation coverage and equity gaps in NZ
- Challenges around communicating the science
- Occupational health vaccines and other private market vaccines in NZ
Disease outbreaks in NZ

Measles
Meningococcal disease
Pertussis

Measles, confirmed & Probable Cases, all NZ, 1997 to 2011

Total 2011 Hospitalizations = 85

Measles control

- Those born prior to 1969 in NZ: assume to have been exposed to wild measles
- All others: 2 doses for all over 12 months of age
- If unknown vaccination history or in doubt vaccinate
- No concerns about overdosing on MMR

Types of meningococcal disease

- Six capsular groups associated with invasive disease: A, B, C, Y, W-135, X
- Differ by their exterior polysaccharide capsule
- The frequency of different types differs from country to country
- NZ currently major types – B and C
- Is in the community all the time in low numbers
  - Occasional outbreaks

?need for a national campaign
**Meningococcal around the world**

Stephens, Greenwood and Brandtzaeg, Lancet 2007, 369:2196-210

**Nasopharyngeal carriage**

- Can be in the nose/throat for weeks to months
- Usually cleared by your immune system without getting sick
- Occasionally invades the bloodstream and causes disease

- Carriage rate
  - <3% children under 5 years of age
  - 25-35% adolescents 15 – 24 yrs
  - <10% older ages
  - Higher rates in lower socio-economic groups, confined or linked populations eg military recruits, pilgrims, boarding schools, prisoners

Lancet Infec Disease 2010;10:853-861

**Risk factors for meningococcal disease**

- Crowded living conditions, e.g. home or hostel
- Recent respiratory infection
- Exposure to cigarette smoke
- Poor nutrition
- Inherited (genetic) factors

**Meningococcal disease in NZ**

![Graph showing number of cases by year]

**Meningococcal vaccines**

Currently only private market and outbreak use in NZ

- Polysaccharides – A, C, Y, W-135
  - Ineffective in younger children
  - Short duration of immunity
  - Possible hyporesponsiveness with multiple use

- Conjugates – in NZ currently C, soon quadrivalent
  - Effective in younger children
  - Herd immunity effects

- B vaccine.....Phase 3 Trials

**Pertussis**

![Graph showing pertussis notifications and hospitalisations]

31 December – 20 January 2012

ESR Pertussis Report 2012-03
Pertussis

• Unable to eradicate from whole community
• Most severe in younger children
  – Main target of immunisation strategies
• KEY: High coverage and timeliness of delivery
• Other strategies
  – Immunising older children
  – Immunising adults
  – Cocoon strategies
  – Immunising pregnant women

Remember....

• Rotavirus
• Varicella
• Meningococcal
  C Conjugate Meningitec®)
  (different from the polysaccharides: Menomune®, Mencevax®
• HPV vaccine for men
• Adult pertussis protection: Boostrix
• Pneumococcal: PPV23 and PCV13

Private Market Vaccines
-Occupational Health

Private purchase of non-funded vaccines in NZ
Price excludes GST and delivery

Immunisation Coverage in NZ
Figure 2.2 Percentage of children age 12-23 months immunized against the major vaccine-preventable diseases

Ethnic disparities

Socio-economic disparities

Factors that affect coverage/timeliness

National coverage 2007 - 2011

Determinants of immunisation coverage at the general practice level:
Relative contribution to variance in practice childhood immunisation coverage

Factors that affect coverage/timeliness

NZ Environment

Unpublished 2008, University of Auckland
Cameron Grant, Chris Turnhill, St Incorporation,小编一起，Niki Turner, Felicity Goodyear-Smith, Ngaire Kerse, Rhys Jones, Natalie Desmond, Vili Nosa.
Practice
- Early enrolment and good relationships
- Effective Practice Management systems
- Stable practice teams
- Effective and timely recall
- Reducing missed opportunities

Providers
General practitioners/practice nurses
- Knowledge
- Confidence
- Focus on population health for their community
- Lower ratio of nurses to children in the practice
- Perceptions of parental barriers

Parents/caregivers
- Effective antenatal information
- Supported antenatal decision-making
- Early enrolment and engagement with general practice

Environment
- Confidence/trust in the science
- Working well with media
- Communication approaches appropriate to audiences

Why are we improving
- Commitment at all levels – national target
- Feedback loops – DHBs and PHOs
- General Practice engagement and confidence
  - More focus, higher priority
  - Less missed opportunities
- SYSTEMS
  - Early ENROLMENT! – and follow up
  - Precalls/recalls/audits
  - PMU/NIR
  - Providers to OIS: effective interface
- Confident health sector spills over to confident public
  - Less anti-science in the media

Waiting for polio immunisation USA 1962

Proportion Fully Immunised Children by Deprivation and Ethnicity, 2007-2009

Who is missing out?

Mueller S, Easter D, Turner N unpublished data, University of Auckland, 2010
Association with independent risk factors

- Ethnicity is the most significant association
- Bigger households, single parents, income from benefit, derivation status, household income.
- No association with education variables
- Rural: increased odds of being immunised, except for highly rural/remote.
- A trend towards improving coverage for the children of highly mobile families since 2005

Myths and Fears

"The Cow Pock – or – the Wonderful Effects of the New Inoculation!"
J. Gillray, 1802

International Examples leading to reduction in coverage

- Polio vaccine and contraceptives – Nigeria 2004
- Multiple sclerosis and HepB vaccine – France
- Pertussis vaccine and brain damage internationally 1980s
- MMR and autism – UK, 1998.....
The Wakefield “Study”

• Theory: The MMR vaccine induces a series of events that includes bowel problems and subsequent development of autism.

• Study design: 12 children (8 with autism) in the United Kingdom who recently received the MMR vaccine.
  – 5/8 of those children clients of personal injury lawyer
  – That lawyer paid Wakefield, not disclosed.

Andrew Wakefield found ‘irresponsible’ by UK General Medical Council over MMR vaccine scare March 2010

Last week, the GMC ruled that Dr Wakefield had shown a “callous disregard” for children and acted “dishonestly” while he carried out his research. It will decide later whether to strike him off the medical register.
BBC News 2/3/10

Sir Peter Medawar - Nobel Prize in Physiology or Medicine 1969

“I cannot give any scientist of any age better advice than that the intensity of the conviction that a hypothesis is true has no bearing on whether it is true of not”. 1973

The legacy of Wakefield’s study

Recent outbreaks of measles in the United Kingdom. Three children in Ireland died of measles.

In the United States some parents still refuse the MMR vaccine for their children or ask that the vaccine be separated into its component parts.

Measles in the UK

Health Protection Agency

Power of the media

“Our job is to be interesting. If the story also happens to be true — great.”

Junior producer, NBC’s Dateline
Two young adults with brain damage post receiving the whole cell pertussis vaccination who have been given ACC payouts.

- ACC is no fault compensation
- Whole cell vaccine changed to acellular in 2000
- History of whole cell pertussis vaccine:
  - Links to encephalopathy in 1980s
  - More recent large studies showing no link
- If the pertussis vaccine increases the risk of brain damage it has to be so rare an event that despite the huge studies over the years that have been performed that have included millions of people comparing vaccinated with unvaccinated children, no difference between the groups can be found.

The third story presented of a case of a young woman who died 6 months after receiving HPV vaccine,
- From the publically known data there does not appear to have any biologically plausible link to the vaccine at all

**US Vaccine Safety Datalink Group**

Ray et al PIDJ 2006


“In this study of more than 2 million children, DTP and MMR vaccines were not associated with an increased risk of encephalopathy after vaccination.”
Absence of disease is not a great marketing line

Overcoming ‘Out-of-sight-out-of-mind’

Estimated Incidence of severe measles reactions in the absence of an immunisation programme for NZ 1990 - 2000

- 600,000 cases
- 200 - 600 deaths
- 600 cases encephalitis
- 300 permanent brain damage

Diseases reappear when coverage drops

Coincidence vs. Causality

“Regardless of what the research tells us, I know what I saw.”

Dr. Kathy Pratt, April 25th, 2001, during a hearing by the Office of Government Reform to investigate MMR and autism

The importance of knowing background rates of disease in assessment of vaccine safety

If a cohort of 10 million individuals was vaccinated with a hypothetical vaccine, the medical events that would be expected to occur within 6 weeks post hypothetical vaccine dose:

- 21.5 cases of Guillain-Barré Syndrome
- 5.75 cases of sudden death

In a cohort of 1 million vaccinated pregnant women, within 1 day of hypothetical vaccination:

- 397 would be predicted to have a spontaneous abortion

Misunderstanding of safety surveillance

- passive versus active surveillance
- CARM (Centre for Adverse Reaction Monitoring), University of Otago, Dunedin – Looking for warning signals – No denominator data
Long term follow up of vaccines

- Difficult to follow up large cohort of millions long term. (very large numbers required for rare risks)
- Instead use a mixture of methods
  - Hypothesis generate e.g. do vaccines cause cot death
  - No one study answers all your questions
  - Beware of poorly designed studies creating bias
  - Several studies, range of methods such as
    - Case-control studies
    - Cohort studies
    - Prospective
    - Retrospective
    - Cross-sectional
  - For example - all these have been used to explore and reject the hypothesis that MMR causes Autism

Examples of safety evaluation

- Vaccine safety datalinks
  - E.g. encephalopathy MMR, wPertussis
  - US CDC and HMOs collaboration
  - autism/MMR, rotavirus/intussusception, HepB/MS, thiomersal
- Matching hospital records to immunisation records
  - UK MMR/autism
- Prevalence studies
  - MMR autism, Denmark, whole birth cohort
- Case control
  - neurological damage and pertussis vaccine (UK)
- Independent reviews e.g. IOM reviews
  - Thiomersal, multiple antigens, influenza vaccine / neurological disorders...

Poor understanding of the scientific method

- Systematic Reviews and Meta-analyses
  - Randomized Controlled Double Blind Studies
  - Cohort Studies
  - Case Control Studies
  - Case Series
  - Case Reports
  - Ideas, Editorials, Opinions
  - Animal research
  - In vitro ('test tube') research

Lack of understanding of immunology

- Baby’s system is too young
- Overloaded immune systems
- Skewering of the immune system
- Too many antigens in each vaccine

Do multiple vaccines overload the infant immune system?

- More T and B cells per cc of blood than adults
- $10^{15}$ possibilities!
- Huge Capacity

- Genital tract flora – 18 species
- Faecal flora – 400 species
- Breast milk – 8 species
- $= > 10^6$ different foreign proteins

'Ve're concerned about overwhelming Johnny so he's getting his car seat and vaccines in staged installments.
### Multiple vaccines

<table>
<thead>
<tr>
<th>Year</th>
<th>Antigens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>~200 (Smallpox vaccine)</td>
</tr>
<tr>
<td>1960</td>
<td>~3217 (included smallpox vaccine and wPertussis)</td>
</tr>
<tr>
<td>1980</td>
<td>~3041 (Included whole cell pertussis vaccine)</td>
</tr>
<tr>
<td>2000</td>
<td>~50</td>
</tr>
</tbody>
</table>

- Currently infants receiving NZ scheduled vaccines receive around 50 different antigens at one time.

### Skewers towards autoimmunity

*The diseases were going away anyway
- natural is best*

*Nasty products in the vaccines – aluminium, mercury…*  
*Corrupt pharmaceutical companies*

### Vaccine safety concerns and zero tolerance

*“A one in a million risk”*

*But what if that one in a million was my child?*

### Assessing Risk

*A deep-rooted fear of needles!*

*Different needs for different people*
Typologies

- **Nuturers** – children at low risk of disease
- **Fearfuls** – experience emotionally distressing
- **Vulnerables** – barriers to access
- **Unwell** - child poor health
- **Rejectors** - opposed

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**Communicating ......**

"I do not believe in vaccines"

1st: open approach....... e.g.
- Have you got any specific concerns around vaccines you wish to discuss?
- Would you like to talk further or receive further information

2nd if appropriate raise a bit of dissonance
- Do you have any concerns about any of these diseases
- Are you aware XXX will need to show an immunisation certificate when they start preschool/school
- 3rd if hitting a brick wall stop digging

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**2011 NZ Immunisation Schedule**

<table>
<thead>
<tr>
<th>Age (weeks)</th>
<th>DTaP-IPV-HepB/Hib</th>
<th>PCV</th>
<th>DTaP-IPV</th>
<th>dTap</th>
<th>HPV</th>
<th>Td</th>
<th>Influenza</th>
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<td>15 years</td>
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**Targeted programmes**

- **BCG for high risk infants**
  - List of high-incidence countries:
    - www.moh.govt.nz/immunisation
    - www.bcgatlas.org/index.php

- **Neonatal hepatitis B and HBIG for infants of hepatitis B carrier mothers**
  - P 133 Handbook

- **Influenza for those at high risk**
  - http://www.influenza.org.nz/?t=887
  - P 263 handbook

- **Pneumococcal programme for high risk children**
  - P 321 handbook

- **Splenectomised older children/ adults**
15 February
The Biofilm Hypothesis of Chronic Infection
Speaker: Dr. Phillip Stewart, Center for Biofilm Engineering, University of Montana

01 March 12
Developing a Sustainable and Effective Approach to Hygiene and Infection Prevention in Home and Everyday Life Settings
Speaker: Dr. Sally Bloomfield, International Scientific Forum on Home Hygiene

07 March 12
(NEW, WHO Teleclass - Europe) Achievements in Improving Injection Safety Worldwide
Speaker: Prof. Chuck Gerba, University of Arizona
Sponsor: World Health Organization First Global Patient Safety Challenge

29 March 12
Water and Infection Control
Speaker: Andrew Streifel, University of Minnesota

Look for additional teleclass lectures broadcast live from South Pacific conferences. www.webbertraining.com