IDReC Symposium

Infectious diseases and poverty: still marching on together in New Zealand

Michael Baker University of Otago, Wellington 24 October 2012



Outline

- Background on infectious diseases (IDs)
- Method for measuring ID burden
- Incidence of ID hospitalisations
- Inequalities in ID hospitalisations
- Causes for increase in IDs
- Interventions
- Conclusions
- Discussion of responses

Articlas	
Articles	
@ [†]	Increasing incidence of serious infectious diseases and
U 4	increasing inclucince of schoos infectious diseases and
	inequalities in New Zealand: a national epidemiological study
	Michael G Baker, LucyTelfar Bernard, Amanda Kvalsvig, Ayesha Verrall, Jane Zhang, Michael Keall, Nick Wilson, Teresa Wall, Philippa Howden-Chapman
	Summary
Lancet 2012; 379: 1112-19	Background Although the burden of infectious diseases seems to be decreasing in developed countries, few national
Published Online	studies have measured the total incidence of these diseases. We aimed to develop and apply a robust systematic
February 20, 2012 DOI:10.1016/S0140-	method for monitoring the epidemiology of serious infectious diseases.
6736(11)61780-7	Mathade We did a national enidemiological study with all hegaital admissions for infectious and non infectious
See Editorial page 1075	diseases in New Zealand from 1989 to 2008, to investigate trends in incidence and distribution by ethnic group and
See Comment page 1080	socioeconomic status. We extended a recoding system based on the ninth revision of international classification of
Department of Public Health,	diseases (ICD-9) to the tenth revision (ICD-10), and applied this to data for hospital admissions from the New Zealand

DALYs per 1,000 population by broad cause group & region, 2004



Omran's health transition theory: in developed countries like NZ, NCDs have overtaken IDs as main threat to population health

Source: World Health Organisation

Meningococcal disease epidemics



Source: ESR surveillance reports



Annual incidence by serious skin infection (SSI) in children by category



O'Sullivan, Baker, Zhang. Epidemiol Infect 2010 Dec 15:1-11



Annual rates of ARF first admissions in 5-14 year olds by ethnicity, 1996-2005



Source: Jaine, Baker, Venugopal. Paed Child Health 2008;44:564-71.

Pandemic influenza A(H1N1) hospitalisation rates: 3.0x higher in Maori 6.7x higher in Pacific peoples



Source: Baker, et al. Euro Surveill. 2009;14:pii=19319

Method for measuring ID burden

- Identify hospitalisations (and deaths) using International Classification of Diseases (ICD) codes for infectious diseases
- Recode to include diagnoses outside ID chapters (ICD-9 001-139 / ICD-10 A00-B99)
- Obtain hospitalisation data for 20 years (1989-2008) from Ministry of Health
- Filter to reduce confounding effects: Public hospitals; Principal diagnosis; Acute + arranged; Overnight; New admissions; First admissions
- Calculate age-standardised rates using Census Pop. data (91, 96, 01, 06)

Results – IDs identified by recoding



Results – IDs identified by recoding Hospitalisations / Hospitalisation rate



Only 16% of ID hospitalisations in ICD Chapter I

Results – IDs identified by recoding Deaths / Mortality rate



Only 7% of ID deaths in ICD Chapter I

Incidence of infectious diseases

 Absolute increase in admission rates from 1242 / 100,000 (1989-2003) to 1880 / 100,000 (2004-08) ie from 1.2% to 1.9% of pop pa

⇒ Extra 26,000 hosp pa

 Relative increase in admissions from 20.5% (1989-2003) to 26.6% (2004-08) of total acute overnight hospitalisations

⇒ Extra 17,000 hosp pa (out of 76,000 ID hosps pa)

Source: Baker et al. Increasing incidence of serious infectious diseases & inequalities in NZ. Lancet 2012; 379, 1112 - 19

Incidence of infectious diseases

ID hospitalisations compared with Non-ID & All-cause, 1989-2008 (age stand. to 2006 Census)



Source: Baker et al. Lancet 2012; 379, 1112 - 19

Incidence of infectious diseases Hospitalisation rates for ID categories



Infectious disease category

Source: Baker et al. Lancet 2012; 379, 1112 - 19

Distribution of infectious diseases ID hospitalisation rates by age group, 1989-2008



Age group

Ratio of Māori & Pacific ID hospitalisation rates to European/Other, 1989-2008



Source: Baker et al. Lancet 2012; 379, 1112 - 19

Children < 5 years, Ratio of Māori & Pacific ID rates to European/Other, 1989-2008



Source: Baker et al. Lancet 2012; 379, 1112 - 19

ID hospitalisation rates by NZDep quintile, ratio to least deprived (NZDep1-2), 1989-2008



Source: Baker et al. Lancet 2012; 379, 1112 - 19

IDs as cause of acute overnight hospitalisations 2004-08

	<u>Total</u>	Children<5
 European 	23.6%	55.1%
• Maori	29.1%	64.4%
 Pacific 	<u>32.9%</u>	68.5%
 Total 	26.6%	60.3%

Average ID hospitalisation rates for 2004–08 period for Māori, Pacific, and European/Other by deprivation level



Source: Baker et al. Lancet 2012; 379, 1112 - 19



Source: Tobias et al. Aust NZ J Pub Health 2008; 32: 431-6

ID hospitalisation rates for Māori and Pacific peoples by deprivation level, 1989-2008



Source: Baker et al. Lancet 2012; 379, 1112 - 19

Ratio of Māori hospitalisation rates to European/Other rates for 2004–08 period by deprivation level for IDs & non-IDs



Causes for the increase in IDs

Increase in ID hospitalisations largely occurred from 1991 to 2001

Slight decrease from 2001 to 2005



Source: Baker et al. Lancet 2012; 379, 1112 - 19

Year

Causes for increase in IDs

Income inequality increased markedly 1988 to 2000 period as measured by Gini coefficient & other indicators used by MSD & internationally



Source: Ministry of Social Development (Perry). Household incomes in NZ, 2011. Low Gini coefficient \Rightarrow low income inequality

Causes for increase in IDs

Housing affordability = proportion of households spending > 30% of income on housing costs From 1988 to 1997 prop increased 11% to 25%



Source: Ministry of Social Development. The Social Report 2010.

Canadian National Occupancy Standard (CNOS), household crowded if dwelling requires extra bedrooms to allow:

- no more than 2 people per bedroom (parents or couples share a bedroom)
- children <5 years may share a bedroom
- children 5-17 years, of the same sex, may share a bedroom
- children 5-17 years should not share a bedroom with one of the opposite sex
- single adults 18+ years require a separate bedroom.

Crowded = 1 + bedroom short

Severely crowded = 2+ bedrooms short

CNOS used by Statistics NZ, Housing NZ, Australian Bureau of Statistics









IDs and household crowding

Meningococcal disease cases in Auckland, 1998-2002, and CAU crowding level at 2001 Census

Source: Baker M, Goodyear R, Howden-Chapmen P. Household crowding and health. In: *What is the extent of crowding in NZ?* Wellington, Statistics New Zealand, 2003



IDs and household crowding Meningococcal disease in NZ

- Case-control study of meningococcal disease in Auckland children < 8 years during 1997-99
- 202 cases and 313 controls
- Overcrowding, measured by the number of adults aged ≥10 years, was the most important risk factor for disease

Source: Baker M, et al. *Household crowding a major risk factor for meningococcal disease in Auckland children*. Paed Infect Dis J 2000; 19: 983-90



IDs and household crowding Meningococcal disease in NZ

Average family living in 6 room house Median of 2.6 adults in household



Additional adults Risk of meningococcal dis.



IDs and Household Crowding Multiple studies on Meningococcal disease



Meta analysis of 11 studies \Rightarrow Risk of meningococcal disease approx. doubles in crowded households

IDs and household crowding Multivariate analysis, Tuberculosis, NZ-born <40 years, 2000-04

Explanatory variable	IRR	<u>95%CI</u>
 Prop crowded NZ<40 (%) 	1.08	1.04-1.12
 Prop Migrants (%) 	1.02	0.99-1.04
 Median income <40 (\$1000) 	0.95	0.93-0.98
• Prop <40 (%)	0.89	0.87-0.91
 TB Migrants last 5 yrs (no.) 	0.99	0.91-1.07
TB NZ last 5 vrs (no.)	1.10	0.93-1.31

Source: Baker, Das, Venugopal, Howden-Chapman. JECH 2008; 62; 715-21

IDs and household crowding

Average annual rates of ARF first admissions by variable quintiles, 1996-2005



Source: Jaine, Baker, Venugopal. Paed Infect Dis J 2011; 30: 315-9

ARF and household crowding

Multivariate analysis

- Risk of ARF hospitalisation in relation to CAU characteristics
- Zero inflated negative binomial regression
- Restricted to Māori and Pacific 5-14 year old, 1996-2005

Explanatory variable	Incidence rate ratio	95% conf. interval	p-value
Household crowding	1.022	1.010-1.034	0.000
Household income	1.006	0.998-1.024	0.523
Prop. 5-14 year olds	1.038	1.005-1.071	0.022

Source: Jaine, Baker, Venugopal. Paed Infect Dis, 2011; 30: 315-9

IDs and household crowding Multiple IDs

Systematic review of household crowding and IDs found positive association for

- Bacterial respiratory diseases:
 - Meningococcal disease, Hib, Pneumococcal disease
 - Respiratory viral infections (RSV)
- Enteric infections:
 - Helicobacter pylori infection
 - Hepatitis A
- Blood borne viral infections:
 - Hepatitis B
- RR typically 1.5-2.5 ie a 50% to 150% increase for those exposed to household crowding relative to those not exposed

Source: Baker et al. Systematic review of household crowding and IDs 2012.

Consider disease pathways and risk factors

Influenza exposure: Seasonal virus load Household crowding Children in house School & Work exposure Urban domicile Weather Indoor air Influenza susceptibility: Influenza vaccination Age Obesity Immune competence Smoking

Influenza progression cofactors:

Age, Sex, Ethnicity Chronic illness, Pregnancy Immune deficits Obesity, Smoking Pneumococcal immunisation Primary care access Antiviral treatment Quality of hospital care

Influenza infection

Influenza illness Serious influenza Influenza death

Consider which risk factors are modifiable

Risk factors for influenza infection and/or poor outcome	Evidence
Exposure factors	
Household crowding	*
Poor indoor air quality in household	*
Susceptibility factors	
Lack of influenza vaccination	* * *
Active & Passive smoke exposure	* *
Immune deficiencies	* *
Progression factors	
Micronutrient deficiencies eg vitamin D deficiency	*
Obesity	*
Chronic illness, eg COPD, asthma, diabetes	* *
Poor access to primary healthcare	*
Lack of antiviral treatments	* *
Lack of pneumococcal vaccination	*
Broad determinants	
Poverty	**

Interventions Consider intervention frameworks

Ottawa Charter for Health Promotion

- Healthy Public Policy, eg introducing minimum standards for NZ rental housing
- Reorientating Health Services, eg new vaccines & increased vaccine coverage
- Supportive Environments, eg reduced tobacco displays and plain packs
- **Community Action**, eg help for groups supporting those with chronic respiratory diseases
- Personal Skills, eg health literacy regarding cough etiquette and home isolation

Interventions Consider intervention frameworks

Need multiple strategies to prevent IDs

- Disease-specific, eg New vaccines (pneumococcal, HPV), Primary prevention of acute rheumatic fever
- Mode of transmission focused, eg Behavioural focus on cough etiquette, ASPIRE 2025
- Determinant focused, eg Reduced household crowding, Improved access to primary health care
- Research & surveillance, eg Surveillance of key diseases, risk factors, determinants

Disease specific eg Hib vaccination



Source: ESR notification data

Transmission focussed eg Improving food safety



Source: Sears A et al. Emerg Infect Dis, 2011; 209: 1007-15

Determinant focused eg HNZC Healthy Housing Programme (HHP) HHP tenants (7,477) compared with Non-HHP tenants (27,903)in Auckland and Northland 2004-08

Children < 20 years participating in HHP:

- 27% (95%CI -43% to -6%) decline in acute and arranged hospitalisations
- Crowding reduction associated with:
 - 61% (95%CI -79% to –26%) reduction in acute and arranged hospitalisations
 - 69% (95%CI-91% to +1%) reduction in IDs

Source: Baker et al. Health Impacts of the HHP on HNZC Tenants: 2004-2008

Strategic surveillance eg determinants



Source: Baker, Easther, Wilson. A surveillance sector review. BMC Public Health, 2010

New research on respiratory diseases eg SHIVERS





Systematic reporting of child health status

Hospital Admissions for Medical Conditions with a Social Gradient in Children 0-14 Years, New Zealand 2006-2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total	
Medical Conditions					
Gastroenteritis	26,610	5,322.0	5.96	14.9	
Acute Bronchiolitis	26,228	5,245.6	5.88	14.7	
Asthma	24,030	4,806.0	5.38	13.5	
Acute Upper Respiratory Infections Excl Croup	18,890	3,778.0	4.23	10.6	
Viral Infection of Unspecified Site	17,635	3,527.0	3.95	9.89	
Skin Infections	15,198	3,039.6	3.40	8.52	
Bacterial/Non-Viral Pneumonia	14,900	2,980.0	3.34	8.35	
Urinary Tract Infection	6,647	1,329.4	1.49	3.73	
Croup/Laryngitis/Tracheitis/Epiglottitis	5,752	1,150.4	1.29	3.23	
Epilepsy/Status Epilepticus	3,982	796.4	0.89	2.23	
Febrile Convulsions	3,555	711.0	0.80	1.99	
Otitis Media	3,483	696.6	0.78	1.95	
Dermatitis and Eczema	3,136	627.2	0.70	1.76	
Viral Pneumonia	1,925	385.0	0.43	1.08	
Inguinal Hernia	1,427	285.4	0.32	0.80	
Osteomyelitis	1,169	233.8	0.26	0.66	
Rheumatic Fever/Heart Disease	914	182.8	0.20	0.51	
Viral/Other/NOS Meningitis	722	144.4	0.16	0.40	
Bronchiectasis	702	140.4	0.16	0.39	
Meningococcal Disease	449	89.8	0.10	0.25	
Vaccine Preventable Diseases	410	82.0	0.09	0.23	
Nutritional Deficiencies/Anaemias	299	59.8	0.07	0.17	
Bacterial Meningitis	221	44.2	0.05	0.12	
Tuberculosis	59	11.8	0.01	0.03	
New Zealand Total	178,343	35,668.6	40.0	100.0	

Source: Numerator-National Minimum Dataset (Acute and Arranged Only, Neonates Removed); Denominator-Statistics NZ Estimated Resident Population





Source: Craig et al Child health monitor, 2011

Source: Numerator-National Minimum Dataset (Neopates Removed): Denominator-Statistics NZ Estimated Resident Population: Medica Conditions: Acute and Arranged only; Injury Admissions: Emergency Department Cases removed

Monitoring the Health of New Zealand Children and Young People

Indicator Handbook

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Source: Mueller S, Exeter D, Turner N unpublished data, University of Auckland, 2010



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



Source: Mueller S, Exeter D, Turner N unpublished data, University of Auckland, 2010

Systematic errors in surveillance eg salmonellosis notification vs. hospitalisation (1997-2008)



Source: Lal et al Epi & Infect 2011 Epub Nov 30: 1-10

Interventions Diphtheria, 1910-2010



Conclusions

Problem of increasing IDs

- Marked increase in burden of serious IDs in NZ over 20-year period 1989-2008 as measured by acute overnight hospitalisations
 - Absolute increase (~50%)
 - Relative increase (>> than NCDs)
- Largest contribution from respiratory IDs
- Rising ethnic & socioeconomic inequalities
- Increase in ID rates in 1990s coincided with rise in income inequalities
- Multiple mechanisms linking poverty to increased ID risk eg household crowding, reduced access to primary health care



Responding to increased IDs

- Preventing IDs may be a particularly effective strategy for reducing ethnic health inequalities
- Need high coverage of disease specific interventions like vaccination
- Important role of health care services, particularly in early treatment
- Increasing evidence for effectiveness of housing interventions (notably crowding reduction) for preventing IDs
- Surveillance of key diseases, risk factors, determinants & interventions is essential
- Ultimately we need to reduce income inequalities or at least the proportion of population living below an adequate income level

Conclusions

A "toxic combination" of poverty and social injustice is "killing people on a grand scale"



Health equity through action on the social determinants of health

Commission on the Social Determinants of Health, 2008, commissioned by WHO, chaired by Sir Michael Marmot



Conclusions

"Preventing suffering and ensuring the wellbeing of our youngest citizens during their formative years in an ethical issue for our nation, an issue of what we value as a society, and the best investment for a highly productive, innovative and resilient nation in the future."

THE NEW ZEALAND MEDICAL JOURNAL



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Every child to thrive, belong and achieve? Time to reflect and act in New Zealand

Amanda J D'Souza, Nikki Turner, Don Simmers, Elizabeth Craig, Tony Dowell

Abstract

New Zealand continues to grapple with poor and inequitable child health and

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