

# HOSPITAL ADMISSIONS AND MORTALITY WITH A SOCIAL GRADIENT IN CHILDREN

In New Zealand, many child health outcomes exhibit a social gradient, with hospital admissions and mortality from socioeconomically sensitive conditions being several times higher for Māori and Pacific children, and those living in the most deprived areas [1]. Such disparities have persisted, despite one of the longest periods of economic growth in recent decades, as well as historically low unemployment rates.

In recent months, New Zealand's macroeconomic environment has changed significantly, with unemployment rates rising and the number of children reliant on benefit recipients increasing during the past year. The impact these changes will have on socially sensitive health outcomes remains unclear however, as international evidence suggests that the effects may vary, not only with the magnitude and duration of any economic downturn, but also with the Government's social policy responses, and the extent to which New Zealand can maintain an effective social safety net (e.g. in housing, health, education, income support) for those most affected. Further, the adaptations families make to their economic circumstances (e.g. cutting back on heating and doctor's visits vs. reductions in cigarettes and takeaways), are also important, with the net impact of such positive / negative adaptations on health outcomes for children being difficult to predict (see Introduction).

While the likely impact of the current economic downturn on child wellbeing remains unclear, it would nevertheless seem prudent to prospectively monitor a basket of key child health outcomes, in order to ensure that any deterioration in child health can be identified early, and so that proactive and co-ordinated responses can be put in place, should the need arise. Thus, in order to establish a baseline for future monitoring (it is unlikely that the full impact of the downturn will be evident in this year's data), this indicator uses data from the National Minimum Dataset and the National Mortality collection to explore hospital admissions and mortality from a basket of socially sensitive conditions during 2000-2008.

## Data Source and Methods

### Definition

1. Hospital Admissions for Medical Conditions with a Social Gradient in Children Aged 0-14 Years
2. Injury Admissions with a Social Gradient in Children Aged 0-14 Years
3. Mortality with a Social Gradient in Children Aged 0-14 Years

### Data Source

For details of the methodology used to derive these indicators see **Appendix 9**

### Numerator:

*Hospital Admissions for Medical Conditions with a Social Gradient:* Acute and Arranged Hospital Admissions (Waiting List, ACC Cases and neonates <29 days excluded) in children aged 0-14 years with the following ICD-10 primary diagnoses: A00-A09 or R11 (Gastroenteritis); A15-A19 (Tuberculosis); A33, A34, A35, A36, A37, A80, B05, B06, B16, B26, B18.0, B18.1, P35.0 or M01.4 (Vaccine Preventable Diseases); A39 (Meningococcal Disease); B34 (Viral Infection of Unspecified Site); E40-E64 or D50-D53 (Nutritional Deficiencies / Anaemias); J00-J03 or J06 (Acute Upper Respiratory Infections); J04 (Croup / Laryngitis / Tracheitis / Epiglottitis); J12, J10.0 or J11.0 (Viral Pneumonia); J13-J16 or J18 (Bacterial / Non-Viral Pneumonia); J21 (Acute Bronchiolitis); J45 or J46 (Asthma); J47 (Bronchiectasis); G00 or G01 (Bacterial Meningitis); A87, G02 or G03 (Viral / Other / NOS Meningitis); G40 or G41 (Epilepsy/ Status Epilepticus); H65, H66 or H67 (Otitis Media); I00-I09 (Rheumatic Fever/Heart Disease); K40 (Inguinal Hernia); L00-L08, H00.0, H01.0, J34.0 or L98.0 (Skin Infections); L20-L30 (Dermatitis and Eczema); M86 (Osteomyelitis); N10, N12, N13.6, N30.0, N30.9 or N39.0 (Urinary Tract Infection); R56.0 (Febrile Convulsions).

*Injury Admissions with a Social Gradient:* Hospital admissions (emergency department cases, neonates <29 days excluded) in children 0-14 years, with a primary diagnosis of injury (ICD9 800-995: ICD 10 S00-T79) and an ICD-10 primary external cause code in the following range: V01-V09 (Transport: Pedestrian); V10-V19 (Transport: Cyclist); V40-V79 (Transport: Vehicle Occupant); W00-W19 (Falls); W20-W49 (Mechanical Forces: Inanimate); W50-W64 (Mechanical Forces: Animate); W85-X19 (Electricity / Fire / Burns); X40-X49 (Accidental



Poisoning); In order to ensure comparability over time, all injury cases with an Emergency Department Specialty Code (M05-M08) on discharge were excluded.

*Mortality with a Social Gradient:* All deaths in children 0-14 years, (neonates <29 days excluded) with a main underlying cause of death in the ICD-10 medical and injury categories outlined above. In addition post-neonatal Sudden Unexpected Deaths in Infancy (SUDI) were included, if the child was aged between 29 days and 1 year and their main underlying cause of death was SUDI (ICD-10 R95, W75, R99).

*Denominator:* NZ Census

**Indicator Category Proxy B-C**

**Notes on Interpretation (For Further Detail See Appendix 9)**

Note 1: Hospital admissions in neonates (<29 days) were excluded from both indicators, as these admissions are more likely to reflect issues arising prior to / at the time of birth, (e.g. preterm infants may register multiple admissions as they transition from intensive care (NICU), through special care nurseries (SCBU) to the postnatal ward), and respiratory infections / other medical conditions arising in these contexts are likely to differ in their aetiology from those arising in the community.

Note 2: For medical conditions, only acute and arranged admissions have been included, as Waiting List admissions tend to reflect service capacity, rather than actual health need (e.g. inclusion of these admissions would result in a large number of children with otitis media with effusion (OME) and chronic tonsillitis being included (for grommets and tonsillectomies), whose demographic profile is very different from children attending hospital acutely for similar diseases). For injury admissions however, filtering by admission type could not occur, as a number of DHBs admitted injury cases under (now discontinued) ACC admission codes, making it difficult to distinguish between acute and waiting list admissions in this context. As with other injury data in these reports however, all injury cases with an Emergency Department Specialty Code (M05-M08) on discharge were excluded (see **Appendix 4** for rationale).

Note 3: Hospital admissions were considered to have a social gradient if rates for those in the most deprived (NZDep Decile 9-10) areas were  $\geq 1.8$  times higher than for those in the least deprived (NZDep Decile 1-2) areas, or where ethnic differences (Māori, Pacific or Asian vs. European children) met these criteria. In addition, a small number of conditions were included where rates were  $\geq 1.5$  times higher, they demonstrated a consistent social gradient, and the association was biologically plausible.

Note 4: When considering the magnitude of social gradients between medical and injury admissions, it must be remembered that these differences are not strictly comparable, as for technical reasons emergency department cases have been removed from injury admissions (and social differences in attendance at the Emergency Department vs. primary care for minor medical conditions may have accounted for some (but not all) of the social gradients in medical admission seen). No such differential filtering occurred for mortality data however, and thus the magnitude of the social differences seen is more readily comparable.

Note 5: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms significant or not significant have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see Appendix 1 for further discussion of this issue).

## New Zealand Distribution and Trends

### Distribution by Cause

*Hospital Admissions:* In New Zealand during 2004-2008, asthma, bronchiolitis and gastroenteritis made the largest individual contributions to hospitalisations for medical conditions with a social gradient, although infectious and respiratory diseases collectively were responsible for the majority of admissions. Similarly falls, followed by inanimate mechanical forces were the leading causes of injury admissions with a social gradient, although transport accidents as a group also made a significant contribution (**Table 1**).

*Mortality:* In New Zealand during 2002-2006, SUDI made the single largest contribution to mortality with a social gradient in children aged 0-14 years. This occurred despite the fact that, by definition, all of these deaths occurred during the first year of life. Vehicle occupant related deaths made the second largest contribution, followed by pedestrian injuries and drowning, while bacterial / non viral pneumonia was the leading cause of mortality from medical conditions (**Table 2**).



Table 1. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0-14 Years (excluding Neonates) by Cause, New Zealand 2004-2008

Diagnosis	New Zealand			
	Number: Total 2004-2008	Number: Annual Average	Rate per 1,000	% of Total
<b>Medical Conditions</b>				
Asthma	23,471	4694.2	5.41	13.93
Acute Bronchiolitis	22,948	4589.6	5.29	13.62
Gastroenteritis	22,893	4578.6	5.28	13.59
Acute Upper Respiratory Infections	18,813	3762.6	4.34	11.16
Viral Infection of Unspecified Site	17,318	3463.6	3.99	10.28
Bacterial / Non-Viral Pneumonia	14,875	2975.0	3.43	8.83
Skin Infections	14,094	2818.8	3.25	8.36
Urinary Tract Infection	6,044	1208.8	1.39	3.59
Croup / Laryngitis / Tracheitis / Epiglottitis	5,367	1073.4	1.24	3.19
Epilepsy / Status Epilepticus	3,919	783.8	0.90	2.33
Febrile Convulsions	3,677	735.4	0.85	2.18
Otitis Media	3,607	721.4	0.83	2.14
Dermatitis and Eczema	2,759	551.8	0.64	1.64
Inguinal Hernia	1,615	323.0	0.37	0.96
Viral Pneumonia	1,579	315.8	0.36	0.94
Osteomyelitis	1,251	250.2	0.29	0.74
Rheumatic Fever / Heart Disease	845	169.0	0.19	0.50
Viral / Other / NOS Meningitis	817	163.4	0.19	0.48
Bronchiectasis	742	148.4	0.17	0.44
Meningococcal Disease	693	138.6	0.16	0.41
Vaccine Preventable Diseases	525	105.0	0.12	0.31
Nutritional Deficiencies / Anaemias	304	60.8	0.07	0.18
Bacterial Meningitis	273	54.6	0.06	0.16
Tuberculosis	78	15.6	0.02	0.05
<b>Total</b>	<b>168,507</b>	<b>33701.4</b>	<b>38.85</b>	<b>100.00</b>
<b>Injury Admissions</b>				
Falls	23,844	4,768.8	5.50	47.95
Mechanical Forces: Inanimate	14,297	2,859.4	3.30	28.75
Transport: Cyclist	3,296	659.2	0.76	6.63
Accidental Poisoning	2,537	507.4	0.58	5.10
Electricity / Fire / Burns	2,047	409.4	0.47	4.12
Transport: Vehicle Occupant	1,337	267.4	0.31	2.69
Mechanical Forces: Animate	1,102	220.4	0.25	2.22
Transport: Pedestrian	1,074	214.8	0.25	2.16
Drowning / Submersion	197	39.4	0.05	0.40
<b>Total</b>	<b>49,731</b>	<b>9,946.2</b>	<b>11.46</b>	<b>100.00</b>

Source: Numerator National Minimum Dataset (Neonates Removed); Denominator: Census; Medical Conditions: Acute and Arranged Admissions Only; Injury Admissions: Emergency Department Cases Removed



Table 2. Mortality from Conditions with a Social Gradient in Children Aged 0-14 Years (excluding Neonates) by Cause, New Zealand 2002-2006

Diagnosis	Number: Total 2002-2006	Number: Annual Average	Rate per 100,000	Percent of Category
<b>Medical Conditions</b>				
Bacterial/Non-Viral Pneumonia	41	8.2	0.95	30.60
Meningococcal Disease	21	4.2	0.49	15.67
Bacterial Meningitis	12	2.4	0.28	8.96
Epilepsy/ Status	12	2.4	0.28	8.96
Viral Pneumonia	11	2.2	0.26	8.21
Acute Bronchiolitis	6	1.2	0.14	4.48
Asthma	6	1.2	0.14	4.48
Gastroenteritis	6	1.2	0.14	4.48
Other Medical Conditions	19	3.8	0.44	14.18
<b>Total Medical Conditions</b>	<b>134</b>	<b>26.8</b>	<b>3.12</b>	<b>100.00</b>
<b>Injuries</b>				
Transport: Vehicle Occupant	77	15.4	1.79	28.95
Transport: Pedestrian	63	12.6	1.47	23.68
Drowning / Submersion	56	11.2	1.30	21.05
Electricity / Fire / Burns	28	5.6	0.65	10.53
Falls	13	2.6	0.30	4.89
Transport: Cyclist	13	2.6	0.30	4.89
Mechanical Forces: Inanimate	9	1.8	0.21	3.38
Other Injuries	7	1.4	0.16	2.63
<b>Total Injuries</b>	<b>266</b>	<b>53.2</b>	<b>6.19</b>	<b>100.00</b>
<b>Post Neonatal SUDI</b>				
Post Neonatal SUDI	268	53.6	6.24	100.00
<b>Total</b>	<b>668</b>	<b>133.6</b>	<b>15.54</b>	<b>100.00</b>

Source: Numerator National Mortality Collection (Neonates Removed); Denominator: Census: Note SUDI deaths are for infants aged 29-364 days only.

### New Zealand Trends

*Hospital Admissions:* In New Zealand, medical admissions with a social gradient increased during the early 2000s, reached peak in 2002 and then declined, with a small upswing in rates again being evident during 2007-2008. In contrast, injury admissions with a social gradient declined throughout 2000-2008. *Mortality:* In New Zealand, injury mortality with a social gradient declined consistently throughout 2000-2006. Mortality from medical conditions also exhibited a general downward trend, although post-neonatal SUDI declined during 2000-2002, and thereafter remained relatively static (**Figure 1**).

### Trends by Ethnicity

*Hospital Admissions:* In New Zealand during 2000-2008, hospitalisations for medical conditions with a social gradient were consistently higher for Pacific > Māori > European and Asian children. For Pacific children, admissions increased during the early 2000s, reached a peak in 2003 and then declined, with a small upswing in rates again being evident during 2007-2008. For Māori, European and Asian children these changes were less marked. Injury admissions with a social gradient were also higher for Pacific and Māori > European > Asian children, and while in absolute terms the magnitude of these differences appeared to be less marked than for medical conditions, for technical reasons, comparisons between these admission categories is not strictly possible (see Note 4 in Methods section) (**Figure 2**).



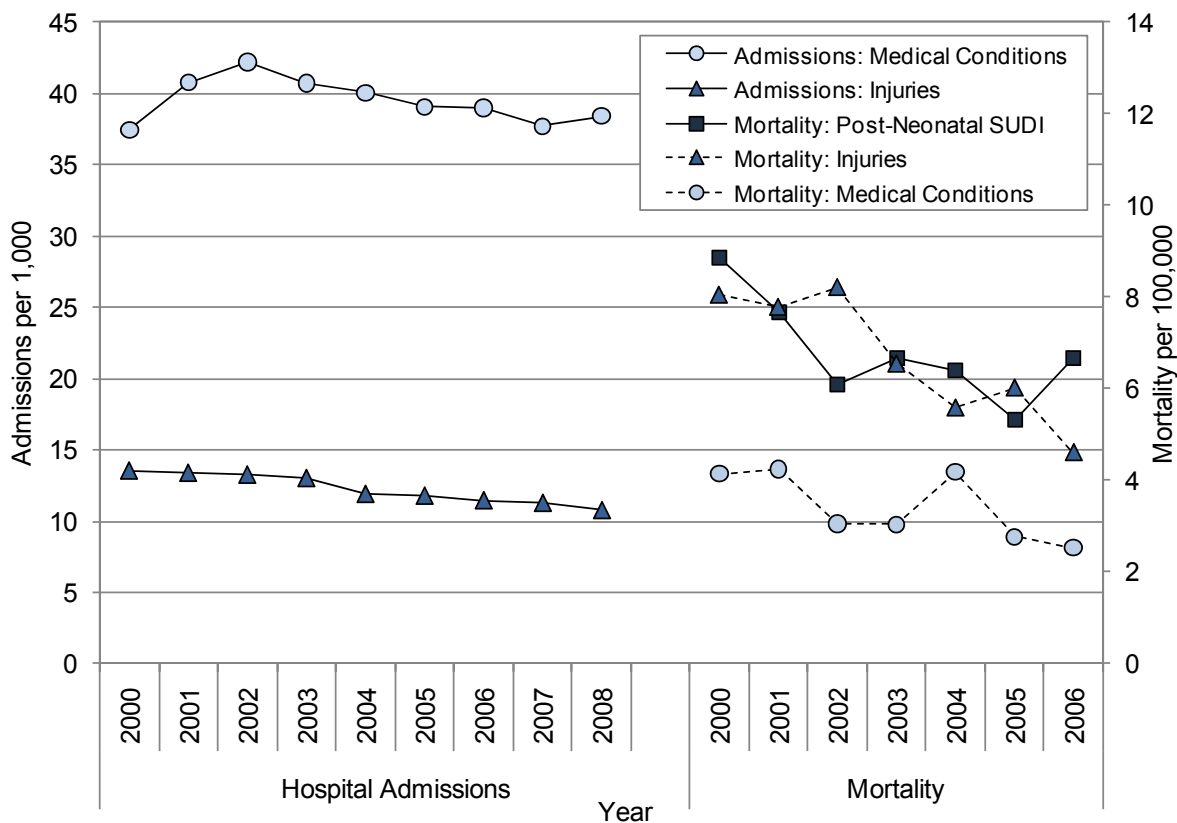
**Mortality:** In New Zealand during 1990-2006, SUDI mortality was consistently higher for Māori > Pacific > European and Asian infants, while mortality from medical conditions with a social gradient was generally higher for Māori and Pacific > European and Asian children. While mortality from injuries with a social gradient was also consistently higher for Māori than for European and Asian children, rates for Pacific children were more variable (**Figure 3**).

**Trends by NZ Deprivation Index Decile**

**Hospital Admissions:** In New Zealand during 2000-2008, medical admissions with a social gradient were consistently higher for those living in Decile 9-10 > Decile 7-8 > Decile 5-6 > Decile 3-4 > Decile 1-2 areas. Injury admissions with a social gradient also demonstrated a consistent socioeconomic gradient over time, and while in absolute terms these differences were less marked than for medical conditions, for technical reasons comparisons between these admission categories is not strictly possible (see Note 4 in Methods section) (**Figure 4**).

**Mortality:** In New Zealand during 2000-2006, medical conditions and injuries with a social gradient, and post neonatal SUDI were all consistently higher for those in the most deprived (Decile 9-10) areas, than for those in the least deprived (Decile 1-2) areas, with the greatest absolute differences being seen for post neonatal SUDI (**Figure 5**).

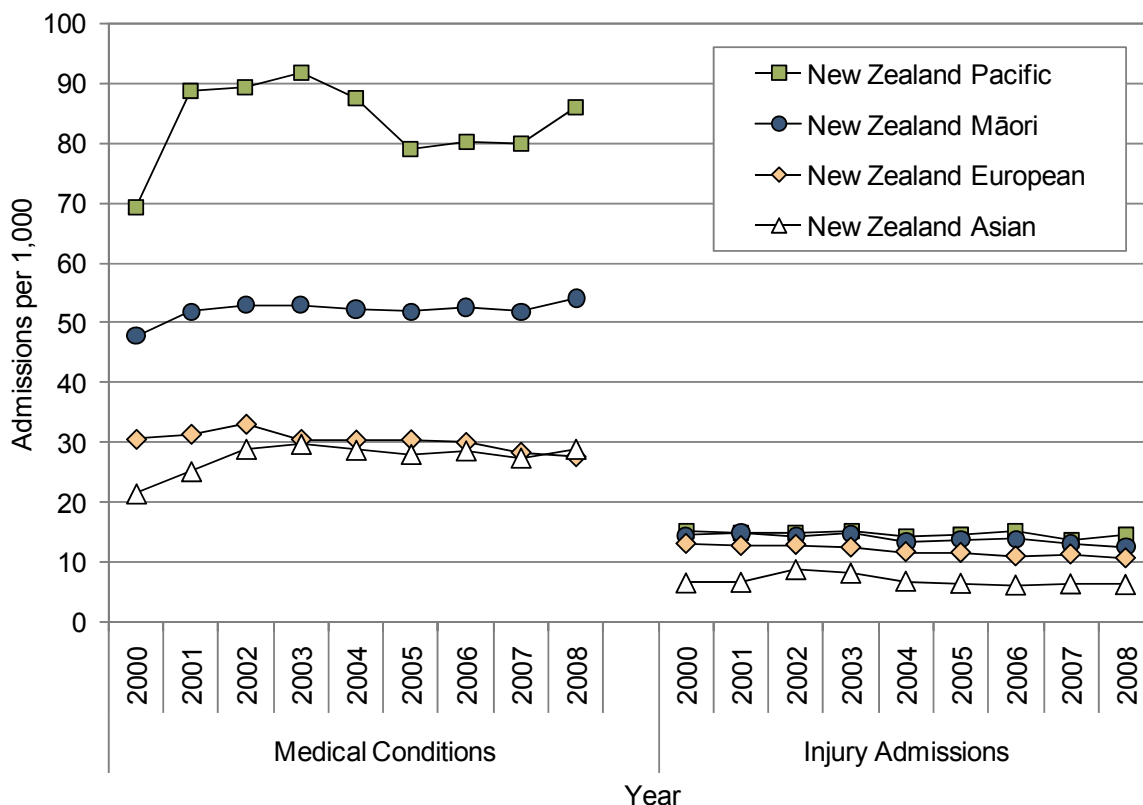
Figure 1. Hospital Admissions (2000-2008) and Mortality (2000-2006) from Conditions with a Social Gradient in New Zealand Children Aged 0-14 Years (excluding Neonates)



Source: Admissions: Numerator National Minimum Dataset (Neonates Removed); Denominator: Census; Medical Conditions: Acute and Arranged Admissions Only; Injury Admissions: Emergency Department Cases Removed; Mortality: Numerator National Mortality Collection (Neonates Removed); Denominator: Census

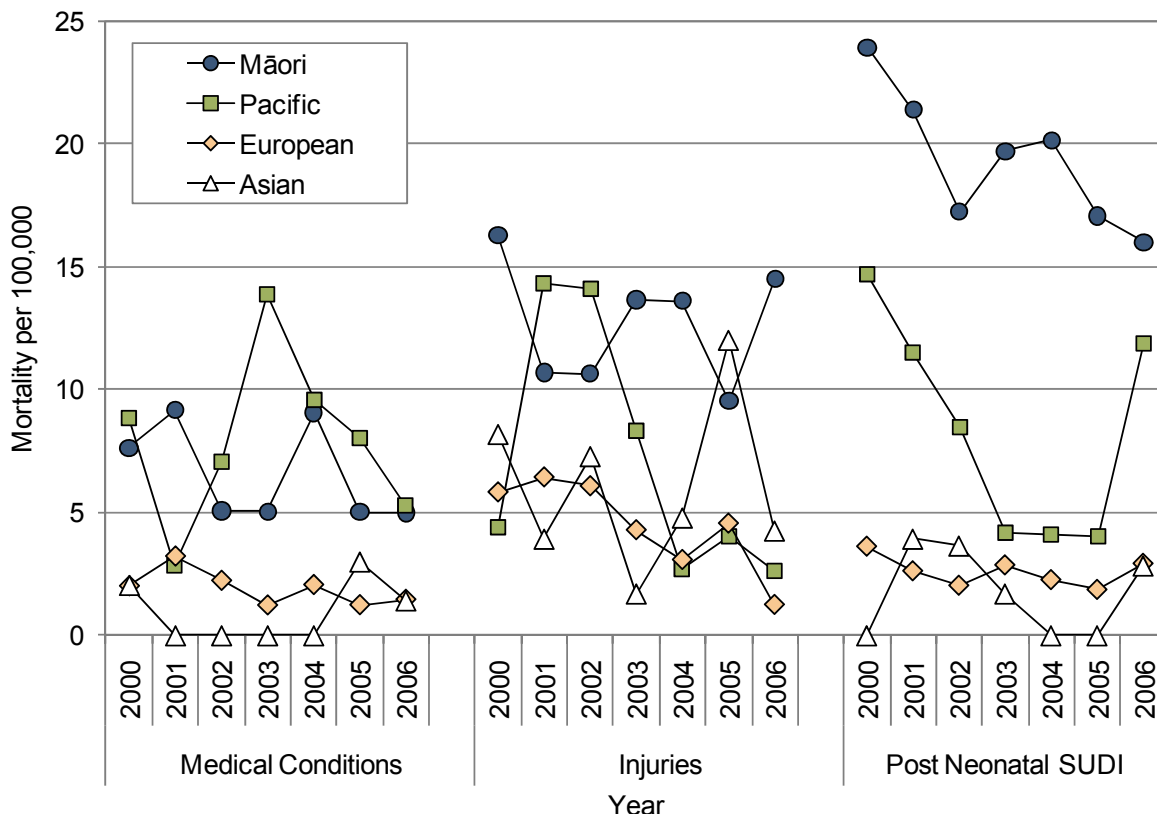


Figure 2. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0-14 Years by Ethnicity, New Zealand 2000-2008



Source: Numerator National Minimum Dataset (Neonates Removed); Denominator: Census; Medical Conditions: Acute and Arranged Only; Injury Admissions: Emergency Department Cases Removed; Ethnicity is Level 1 Prioritised

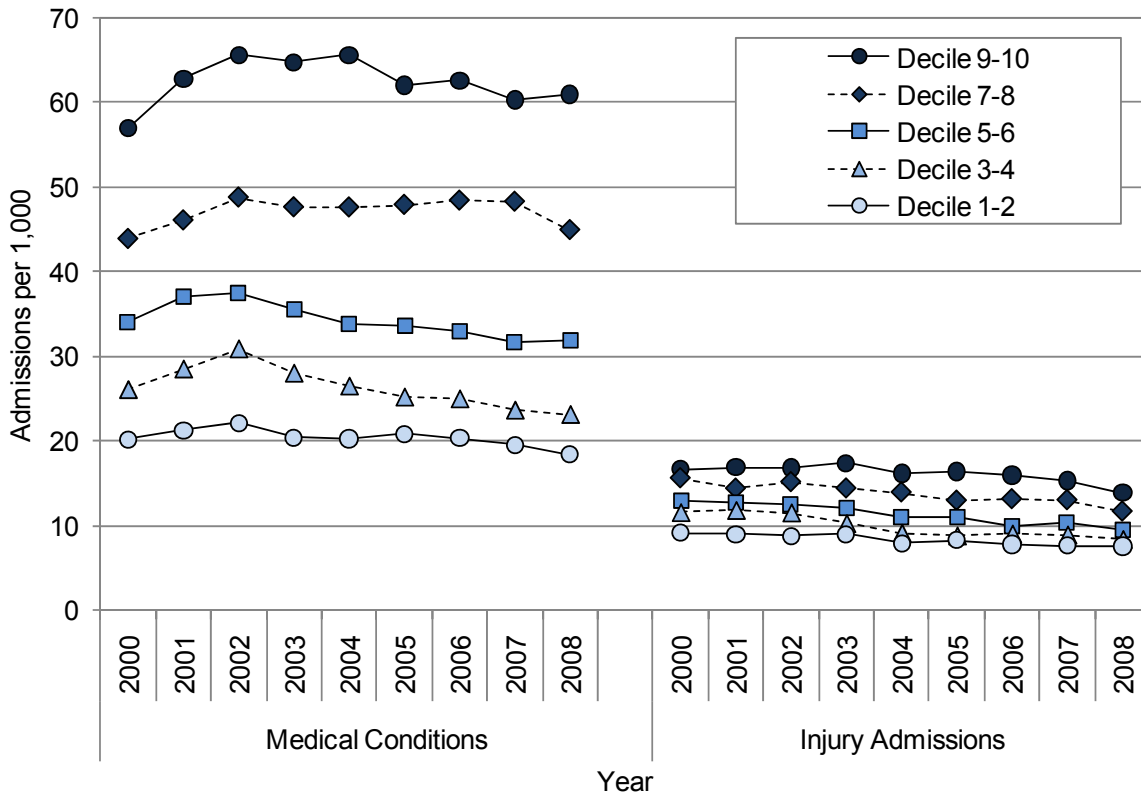
Figure 3. Mortality from Conditions with a Social Gradient in Children Aged 0-14 Years (excluding Neonates) by Ethnicity, New Zealand 2000-2006



Source: Numerator: National Mortality Collection (Neonates Removed); Denominator: Census; Ethnicity is Level 1 Prioritised; Note SUDI deaths are for infants aged 29-364 days only.

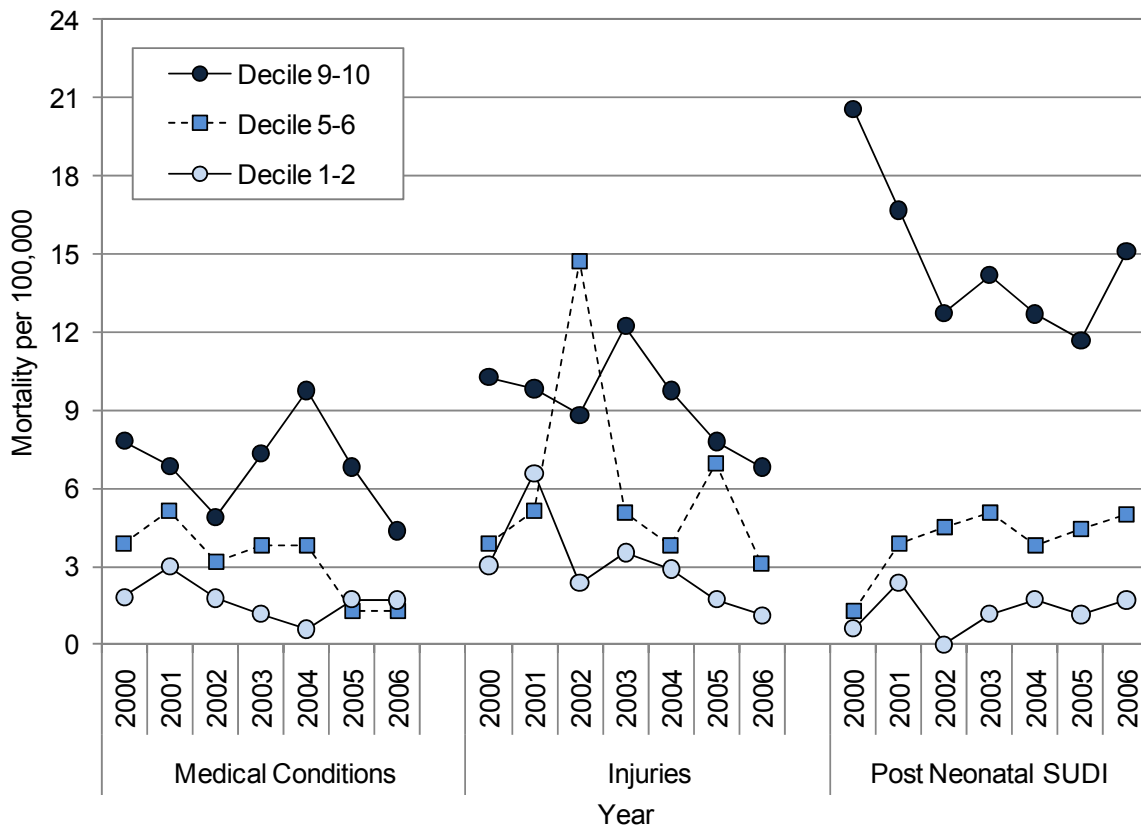


Figure 4. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0-14 Years by NZ Deprivation Index Decile, New Zealand 2000-2008



Source: Numerator: National Minimum Dataset (Neonates Removed); Denominator: Census; Medical Conditions: Acute and Arranged Only; Injury Admissions: Emergency Department Cases Removed

Figure 5. Mortality from Conditions with a Social Gradient in Children Aged 0-14 Years (excluding Neonates) by NZ Deprivation Index Decile, New Zealand 2000-2006



Source: Numerator: National Mortality Collection (Neonates Removed); Denominator: Census; Note SUDI deaths are for infants aged 29-364 days only.



### Distribution by Ethnicity, Gender and NZDep Deprivation

*Hospital Admissions:* In New Zealand during 2004-2008, hospital admissions for medical conditions with a social gradient were *significantly* higher for Pacific > Māori > European > Asian children, males and those in the more deprived areas. Similarly, injury admissions with a social gradient were *significantly* higher for Pacific > Māori > European > Asian children, males and those in the more deprived areas. While the magnitude of the social differences appeared smaller for injury admissions, it must be remembered that that for technical reasons (See Note 4 in Methods Section) these categories are not strictly comparable (**Table 3**).

Table 3. Risk Factors for Hospital Admissions with a Social Gradient in Children Aged 0-14 Years, New Zealand 2004-2008

Medical Conditions							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	20.1	1.00		Decile 1-2	19.9	1.00	
Decile 2	19.7	0.98	0.95 - 1.01	Decile 3-4	24.7	1.24	1.22 - 1.27
Decile 3	22.3	1.11	1.08 - 1.14	Decile 5-6	32.8	1.65	1.62 - 1.68
Decile 4	27.1	1.35	1.32 - 1.39	Decile 7-8	47.4	2.38	2.34 - 2.42
Decile 5	28.5	1.42	1.38 - 1.46	Decile 9-10	62.3	3.13	3.08 - 3.18
Decile 6	37.2	1.85	1.81 - 1.90	Ethnicity			
Decile 7	40.6	2.02	1.97 - 2.07	Asian	28.5	0.97	0.95 - 0.99
Decile 8	53.9	2.68	2.62 - 2.75	European	29.5	1.00	
Decile 9	58.8	2.93	2.86 - 3.00	Māori	52.5	1.78	1.76 - 1.80
Decile 10	65.1	3.24	3.17 - 3.32	Pacific	82.5	2.80	2.76 - 2.84
Gender							
Female	35.1	1.00		Male	42.5	1.21	1.20 - 1.22
Injuries							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	8.1	1.00		Decile 1-2	7.9	1.00	
Decile 2	7.6	0.94	0.90 - 0.98	Decile 3-4	8.9	1.13	1.09 - 1.17
Decile 3	8.3	1.02	0.97 - 1.07	Decile 5-6	10.4	1.31	1.27 - 1.36
Decile 4	9.6	1.18	1.12 - 1.23	Decile 7-8	13.0	1.64	1.59 - 1.69
Decile 5	9.4	1.15	1.10 - 1.20	Decile 9-10	15.6	1.97	1.92 - 2.03
Decile 6	11.4	1.40	1.34 - 1.46	Ethnicity			
Decile 7	11.8	1.45	1.38 - 1.51	Asian	6.5	0.58	0.55 - 0.60
Decile 8	14.1	1.73	1.66 - 1.80	European	11.3	1.00	
Decile 9	15.8	1.94	1.87 - 2.02	Māori	13.4	1.19	1.16 - 1.21
Decile 10	15.4	1.89	1.82 - 1.96	Pacific	14.6	1.29	1.25 - 1.33
Gender							
Female	9.2	1.00		Male	13.6	1.48	1.46 - 1.51

Source: Numerator: National Minimum Dataset (Neonates Removed); Denominator: Census; Medical Conditions Acute and Arranged Admissions Only; Injury Admissions Emergency Department Cases Removed; Rates are per 1,000, Rate Ratios are Unadjusted, Ethnicity is Level 1 Prioritised.

*Mortality:* In New Zealand during 2002-2006, mortality from medical conditions with a social gradient was *significantly* higher for Pacific and Māori > European and Asian children, and those in more deprived (Decile 7-10) areas. Similarly mortality from injuries with a social gradient was *significantly* higher for Māori and Pacific > Asian and European



children, males and those in average-more deprived (Decile 3-10) areas (**Table 4**). Differences in SUDI mortality are considered in the Infant Mortality section.

Table 4. Risk Factors for Mortality with a Social Gradient in Children Aged 0-14 Years, New Zealand 2002-2006

Medical Conditions							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Quintile				Ethnicity			
Decile 1-2	1.39	1.00		Asian	0.96	0.58	0.18 - 1.88
Decile 3-4	0.86	0.61	0.24 - 1.56	European	1.65	1.00	
Decile 5-6	2.67	1.91	0.94 - 3.89	Māori	5.84	3.55	2.37 - 5.31
Decile 7-8	3.10	2.22	1.12 - 4.42	Pacific	8.75	5.32	3.34 - 8.46
Decile 9-10	6.64	4.76	2.58 - 8.80	Gender			
				Female	2.91	1.00	
				Male	3.32	1.14	0.81 - 1.60
Injuries							
NZ Deprivation Index Quintile				Ethnicity			
Decile 1-2	2.32	1.00		Asian	6.06	1.57	0.96 - 2.57
Decile 3-4	4.29	1.84	1.06 - 3.19	European	3.87	1.00	
Decile 5-6	6.73	2.89	1.73 - 4.84	Māori	12.39	3.20	2.45 - 4.19
Decile 7-8	7.18	3.09	1.86 - 5.14	Pacific	6.29	1.63	1.03 - 2.57
Decile 9-10	9.09	3.91	2.41 - 6.34	Gender			
				Female	5.10	1.00	
				Male	7.22	1.42	1.11 - 1.81
SUDI: See Infant Mortality Section							

Source: Numerator: National Mortality Collection; Denominator Census; Rates are per 100,000; Rate Ratios are Unadjusted; Ethnicity is Level 1 Prioritised.

## Summary

In New Zealand during 2004-2008, infectious and respiratory diseases were responsible for the majority of hospitalisations for medical conditions with a social gradient, while falls, followed by inanimate mechanical forces were the leading causes of injury admissions. In contrast, during 2002-2006 SUDI made the single largest contribution to mortality with a social gradient. Vehicle occupant deaths were the second leading cause, followed by pedestrian injuries and drowning, while bacterial / non viral pneumonia was the leading cause of death from medical conditions. During 2004-2008, hospital admissions with a social gradient were higher for males, Pacific > Māori > European and Asian children and those in more deprived areas. Similarly, during 2002-2006, mortality with a social gradient was higher for Pacific and Māori > European and Asian children and those in more deprived areas. While the effects of the current economic downturn are unlikely to be fully visible in this year's data, such figures provide a baseline for monitoring in future years.

## References

1. Craig, E., et al., *Monitoring the Health of New Zealand Children and Young People: Indicator Handbook*. 2007, Paediatric Society of New Zealand & New Zealand Child and Youth Epidemiology Service: Auckland.

