APPENDIX 1: SEARCH METHODS FOR POLICY DOCUMENTS AND EVIDENCE-BASED REVIEWS

One of the features of this reporting series is the inclusion of sections which briefly review Government documents, particularly Ministry of Health publications, and international evidence-based reviews that are relevant to the prevention and or management of child and youth health issues. The approach taken in these sections borrows heavily from the principles of the Evidence-Based Medicine (EBM) movement, which has emerged in recent decades as a means of providing busy clinicians with up to date overviews of the evidence in particular areas [409,410]. Evidence-based reviews generally rely on reviewers collating all of the available research evidence (including published and unpublished trials, and observational studies), evaluating it in a rigorous manner, and then publishing the resulting synthesis of the evidence in a format which allows clinicians to quickly evaluate the effectiveness of the intervention(s) reviewed. The evidence base for population level interventions is less developed than that for individual patient therapies because population level interventions tend to be more difficult to evaluate as they often require longer follow up times and have more diffuse outcomes and less readily identifiable "control" groups [410]. Nevertheless, there is a reasonable body of evidence about the effectiveness of specific population level interventions.

The brief overviews presented in this report aim to provide busy DHB staff with a logical starting point from which to consider the types of interventions available to address particular child and youth health issues. The methodology used to prepare these overviews was not exhaustive but it involved searching a number of EBM journals and databases (e.g. the Cochrane Library) as well as Ovid MEDLINE and PubMed for systematic reviews of population level interventions in child and youth health (see Text Box below).

Methodology used in preparing Policy/Evidence-Based Review Sections

New Zealand (health) policy documents

Each review section aims to provide an overview of Ministry of Health (or where appropriate, other Government Agency) policy documents and strategies relevant to the area. The Ministry of Health's website (http://www.moh.govt.nz/moh.nsf) was searched for key documents. All identified documents were then reviewed and the most relevant summarised, focussing on those which provided strategic guidance to DHBs on the prevention/population level management of the issues in question.

Evidence-based and other reviews

The five databases listed below were searched for reviews considering the effectiveness of population level interventions to prevent and/or manage each of the issues in question. While this list is not exhaustive, the databases were selected on the basis of the calibre of the institutions publishing the reviews. The search strategy concentrated on publications which attempted to synthesise all of the available evidence, thereby providing as broad as possible coverage of the relevant literature. In general, only literature from 2005 onwards was searched, although earlier publications were included if there was a paucity of more recent information. While individual trials and protocols were not specifically sought, if there was no other relevant information available, an attempt was made to locate individual research reports or recommendations. While the brief overviews provided in this report are not totally comprehensive, it is nevertheless hoped that they will provide a useful starting point for DHBs wishing to explore strategies to address particular child and youth health issues.

Evidence-Based Medicine Reviews: This database allows seven EBM resources to be searched at once including the Database of Reviews of Effects (DARE), Health Technology Assessments (HTA) and the NHS Economic Evaluation Database (NHSEED) all produced by National Health Services' Centre for Reviews; and Dissemination at the University of York, UK, the Cochrane Database of Systematic Reviews, and the ACP Journal Club.

National Guideline Clearinghouse (http://www.guideline.gov/): This is a searchable database of evidence-based clinical practice guidelines maintained by the Agency for Healthcare Research and Quality in the United States.

Centre for Reviews and Dissemination (CRD): This is a Department of the University of York and is part of the National Centre for Health Research (NCHR) (http://www.york.ac.uk/inst/crd/). While CRD produces the database of Review Effects (DARE), captured in the Evidence-Based Medicine Review Database, searching the CRD site identifies other reviews not captured by DARE. This database is available through most local library services.

National Institute for Health and Clinical Excellence (NICE): This is an independent organisation based in the United Kingdom which provides national guidance on the promotion of good health and the prevention and treatment of ill health (http://www.nice.org.uk/).

Guide to Community Preventive Services: Systematic Reviews and Evidence-Based Recommendations: This guide was developed by the non-federal Task Force on Community Preventive Services whose members are appointed by the Director of the Centre for Disease Control and Prevention (CDC). The Community Guide summarises what is known about the effectiveness, economic efficiency, and feasibility of interventions to promote community health and prevent disease (http://www.thecommunityguide.org/about/).

While undertaking this task it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed. In addition, in many cases, the research provided reasonably strong guidance about what did not work but little guidance on effective interventions. As an example, current evidence suggests additional social support is ineffective in preventing preterm birth in high-risk women, but there is scant evidence indicating effective interventions in this population.

In many cases, therefore, these brief overviews serve to highlight the current paucity of evidence on population level interventions to address child and youth health needs (although the absence of systematic/other reviews does not rule out the existence of individual studies in particular areas). In this context, the search strategy utilised did not aim primarily to identify individual studies or reviews of individual patient therapies. In cases where such studies were identified and where no other systematic reviews were available, they have been included under the heading of “Other Relevant Publications”. In such cases the reader needs to be aware that these studies were identified in a non-systematic manner and that their findings should therefore not be given the same weight as the findings from systematic reviews (e.g. Cochrane reviews) where all of the available evidence has been rigorously evaluated. The evidence-based review tables also include some topical New Zealand research publications.

APPENDIX 2: STATISTICAL SIGNIFICANCE TESTING AND ITS USE IN THIS REPORT

Understanding Statistical Significance Testing

Inferential statistics are used when a researcher wishes to use a sample to draw conclusions about the population as a whole (e.g. weighing a class of 10 year old boys, in order to estimate the average weight of all 10 year old boys in New Zealand). Any measurements based on a sample, however, even if drawn at random, will always differ from that of the population as a whole, simply because of chance. Similarly, when a researcher wishes to determine whether the risk of a particular condition (e.g. lung cancer) is truly different between two groups (smokers and non-smokers), they must also consider the possibility that the differences observed arose from chance variations in the populations sampled.

Over time, statisticians have developed a range of measures to quantify the uncertainty associated with random sampling error (e.g. to quantify the level of confidence we can have that the average weight of boys in our sample reflects the true weight of all 10 year old boys, or that the rates of lung cancer in smokers are really different to those in non-smokers). Of these measures, two of the most frequently used are:

***P* values:** The *p* value from a statistical test tells us the probability that we would have seen a difference at least as large as the one observed, if there were no real differences between the groups studied (e.g. if statistical testing of the difference in lung cancer rates between smokers and non-smokers resulted in a *p* value of 0.01, this tells us that the probability of such a difference occurring if the two groups were identical is 0.01 or 1%. Traditionally, results are considered to be statistically significant (i.e. unlikely to be due to chance) if the probability is <0.05 (i.e. less than 5%) [411].

Confidence Intervals: A 95% Confidence Interval suggests that if you were to repeat the sampling process 100 times, 95 times out of 100 the confidence interval would include the true value. In general terms, if the 95% confidence intervals of two samples overlap, there is no significant difference between them (i.e. the *p* value would be ≥0.05), whereas if they do not overlap, they can be assumed to be statistically different at the 95% confidence level (i.e. the *p* value would be <0.05) [411].

The Use of Statistical Significance Testing in this Report

In the preparation of this report a large range of data sources was used. For the purposes of statistical significance testing, however, these data sources can be considered as belonging of one of two groups: Population Surveys and Routine Administrative Datasets. The relevance of statistical testing to each of these data sources is described separately below:

Population Surveys: A number of indicators in this report utilise data derived from national surveys (e.g. the 2009 New Zealand Tobacco Use Survey), where information from a sample has been used to make inferences about the population as a whole. In this context statistical significance testing is appropriate, and where such information is available in published reports, it has been incorporated into the text accompanying each graph or table. In a small number of cases, however, information on statistical significance was not available in published reports, and in such cases any associations described do not imply statistical significance.

Numbers and Rates Derived from Routine Administrative Data: A large number of the indicators in this report are based on data derived from New Zealand's administrative datasets (e.g. National Minimum Dataset, National Mortality Collection), which capture information on all of the events occurring in a particular category. Such datasets can thus be viewed as providing information on the entire population, rather than a sample and as a

consequence, 95% confidence intervals are not required to quantify the precision of the estimate (e.g. the number of leukaemia deaths in 2003–2007 although small, is not an estimate, but rather reflects the total number of deaths during this period). As a consequence, 95% confidence intervals have not been provided for any of the descriptive data (numbers, proportions, rates) presented in this report, on the basis that the numbers presented are derived from the total population under study.

Rate ratios Derived from Routine Administrative Data: In considering whether statistical significance testing is ever required when using total population data Rothman [412] notes that if one wishes only to consider descriptive information (e.g. rates) relating to the population in question (e.g. New Zealand), then statistical significance testing is probably not required (as per the argument above). If, however, one wishes to use total population data to explore biological phenomena more generally, then the same population can also be considered to be a sample of a larger super-population, for which statistical significance testing may be required (e.g. the fact that SUDI in New Zealand is 5 times higher in the most deprived areas (NZDep deciles 9–10) might be used to make inferences about the impact of the socioeconomic environment on SUDI more generally (i.e. outside of New Zealand, or the 5 year period concerned)). Similarly, in the local context the strength of observed associations is likely to vary with the time period under study (e.g. in updating 5-year asthma admission data from 2004–2008 to 2006–2010, rate ratios for Pacific children are likely to change due to random fluctuations in annual rates, even though the data utilised includes all admissions recorded for that particular 5-year period). Thus in this report, whenever measures of association (i.e. rate ratios) are presented, 95% confidence intervals have been provided on the assumption that the reader may wish to use such measures to infer wider relationships between the variables under study [412].

The Signalling of Statistical Significance in this Report

In order to assist the reader to identify whether tests of statistical significance have been applied in a particular section, the statistical significance of the associations presented has been signalled in the text with the words *significant*, or *not significant* in italics. Where the words *significant* or *not significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.

APPENDIX 3: THE NATIONAL MINIMUM DATASET

Introduction

The National Minimum Dataset (NMDS) is New Zealand's national hospital discharge data collection and is maintained by the Ministry of Health (the Ministry). The information contained in the dataset has been submitted by public hospitals in a pre-agreed electronic format since 1993. Private hospital discharges for publicly funded events (e.g. births, geriatric care) have been submitted electronically since 1997. The NMDS was implemented in 1993, and contains public hospital information from 1988 [413]. Information in the NMDS includes principal and additional diagnoses, procedures, external causes of injury, length of stay and sub-specialty codes; and demographic information such as age, ethnicity and usual area of residence.

The NMDS is useful for monitoring children's hospital admissions, predicting future health service demand, and planning new services and interventions. However, there are a number of issues to take into account when interpreting information from the NMDS. Many of these issues arise from regional differences in the way data are reported to, or coded in, the NMDS. These include:

1. Differences in the way DHBs report their Emergency Department (ED) cases to the NMDS and how this has changed over time.
2. The changeover from the ICD-9 to ICD-10 coding system and irregularities in the way in which diagnoses and procedures are allocated ICD codes.
3. Changes in the way ethnicity information has been recorded over time.

This Appendix considers the first two issues, while the third is considered in **Appendix 6**, which reviews the way ethnicity information is collected and coded in the health sector.

1. Differences in the Reporting of ED Cases to the NMDS

Historically there have been differences in the way DHBs have reported their ED events to the NMDS, which pose challenges for the interpretation of hospital admission data. This section provides a brief overview of how DHBs have been reporting their ED cases to the NMDS, as well as the different settings DHBs use to assess children presenting acutely with medical conditions. The rationale for the NZ Child and Youth Epidemiology Service's (NZCYES) approach to the analysis of hospital admissions is then presented before the potential impacts of inconsistent reporting of ED cases to the NMDS on trends in hospital admissions for children are considered.

Defining Hospital Admissions

In New Zealand, a hospital admission is defined as a hospital event with a treatment time of more than three hours (this is referred to as the three hour rule). Treatment time is counted from when the patient first sees the doctor (or other health professional) rather than when they first arrive in ED [413].

Admissions that meet the three hour rule are sometimes subdivided into: day cases (or day patients) where the patient is admitted and discharged (routinely/alive) on the same day, and inpatient events where the patient spends at least one (mid)night in hospital [414]. Other DHBs, however, include all cases meeting the three hour rule in their definition of an inpatient event (personal communication Ministry staff).

Note: Throughout this report, the term hospital admission has been used in preference to hospital discharge in the description of child hospitalisation.

Regional Differences in the Reporting of ED Cases

Regional variations in the way DHBs report their ED day cases to the NMDS include the following:

1. During the mid-1990's, the Starship Children's Hospital (which provided inpatient services to the Auckland and Waitemata DHBs) started reporting ED events if the total time in the ED (including waiting time) exceeded 3 hours rather than reporting only ED events where treatment time exceeded 3 hours [414]. Following advice from the Ministry this practice ceased in January 2005. However, it took several years for the hospital to begin reporting its ED cases consistently again as changes in recording practice (i.e. recording the time of first treatment by a doctor rather than time of first triage) took time to implement. This resulted in large variations in rates in the Auckland and Waitemata DHBs during the mid-1990s to early 2000s.
2. In a number of DHBs, ED cases have been assigned the health specialty code of the consulting doctor on discharge, even though the patient was discharged directly from ED (e.g. a child with a fracture seen by an orthopaedic registrar in ED receiving an orthopaedic specialty code instead of an ED one). This practice has varied both over time and by region and makes the identification of ED cases using the health specialty code on discharge difficult. A separate ED identifier code was introduced in 2007, but adoption by DHBs has been variable (personal communication Ministry staff).
3. The way DHBs manage the assessment of paediatric medical cases also varies around the country. In the large Auckland DHBs, the majority of children can access acute paediatric care via specialist paediatric EDs, which are staffed by specialist paediatric staff. In other parts of the country, children are either assessed in paediatric assessment units (PAUs, often attached to the paediatric ward), or sent to the general paediatric ward for review. During 2008–2012, the proportion of admissions for medical conditions with a social gradient receiving an ED specialty code varied markedly by DHB. It was highest in the large Auckland DHBs (range 25%–50%) which see the majority of their children in specialist paediatric EDs, and lowest in those DHBs that assess most children on the paediatric ward (e.g. 0%–7% in some smaller DHBs).
4. Analysis of medical day cases (where the child is admitted and discharged the same day) also suggest that many non-Auckland DHBs were assessing these cases in a non-ED setting and assigning them a paediatric medical specialty code on discharge, rather than simply failing to report their ED cases to the NMDS. In an analysis of 2008–2012 data, over 85% of day case admissions for medical conditions with a social gradient in the South Island had a non-ED specialty code on discharge, as compared to only 10% in the Auckland DHB.
5. While the three hour rule has remained unchanged, to address inconsistency, the Ministry implemented a new directive in July 2009 that made it mandatory for DHBs to report ED cases meeting the three hour rule. While most DHBs (including all of the Auckland DHBs and many medium sized and smaller DHBs) were reporting their ED cases consistently prior to this time or do not appear to have changed their practice during the past decade, in a small number of DHBs there was an abrupt increase in the reporting of ED cases from 2009. In most cases, the number of additional cases reported was relatively modest, however the staggered increase in reporting from 2009 resulted in a gradual increase in the number of admissions in subsequent years.

The Ministry's Approach to Inconsistent ED Reporting

To minimise the impact of the inconsistent reporting of ED cases, the Ministry utilises a set of filters that aim to create comparability between regions, and over time, when analysing trends in hospital admission data. While these filters vary with the work being undertaken, the majority exclude short stay ED events. For example:

1. In its Hospital Throughput Reports [415], the Ministry excluded all cases where: the admission and discharge date were the same (length of stay = 0), AND the patient was discharged alive, AND the health specialty code on discharge was Emergency Medicine (M05, M06, M07, and M08).
2. In a review of hospitalisations for intentional self-harm [416], the Ministry excluded all hospital admissions with a health specialty code on discharge of Emergency Medicine (M05, M06, M07, and M08) AND a length of stay of less than two days.
3. When monitoring ambulatory sensitive hospital admissions, the Ministry has traditionally excluded all ED short stay cases from its analysis (personal communication Ministry staff).

Limitations of the Ministry's ED Filters in the Paediatric Context

For children's medical admissions however, excluding all ED day cases from the analysis is problematic as:

1. The desire to manage children in a developmentally appropriate healthcare environment that is separate from sick adults [417] has led to a plurality of acute assessment practices around the country. As previously discussed, this includes the use of specialist paediatric emergency departments in larger centres, PAUs attached to children's wards in many regional centres, and the fast tracking of children to the general paediatric ward in some smaller DHBs. Applying the Ministry's ED day case filters in this context excludes a high proportion of the workload of the three Auckland DHBs that assess much of their acute caseload in the specialist ED setting. However, the same filters include the workload of those DHBs that undertake similar acute assessments in a ward based setting. When ED cases are excluded, paediatric admissions for medical conditions with a social gradient in the Waitemata and Auckland DHBs fall well below those of New Zealand's other DHBs.
2. The majority of medical admissions in children are for acute onset infectious and respiratory diseases of relatively short duration. Exclusion of those with a length of stay of 0 days (as per some Ministry filters) means that those children who begin their treatment late at night and are discharged in the early hours of the following morning are included as hospital admissions, whereas those who begin their treatment in the morning and are discharged in the evening are excluded, even though they may have a similar or longer length of stay. (Note: Some Ministry filters exclude admission with a length of stay of 0 or 1 day in an attempt to address this issue).
3. Historically, concerns have been expressed about the high costs of after-hours primary care [418], with some families potentially bypassing after hours services in favour of the ED, which is free. Analysis of children's ED presentations for minor medical conditions may be one way of monitoring improvements/emergent barriers in family's access to primary care (particularly in those DHBs which have been reporting their ED cases to the NMDS consistently over time). The exclusion of ED cases from time series analysis however, precludes the identification of emerging concerns in this area.

NZCYES' Approach to the Analysis of Hospital Admission Data

Given the plurality of approaches (specialist ED, PAU, general paediatric ward) to the assessment of children requiring acute paediatric care, the NZCYES has from the outset chosen to include all ED day cases in its analysis of hospital admissions for medical conditions. The NZCYES believes that this provides the best comparison of the workload of DHBs of differing sizes around the country. However, in light of its concerns about inconsistencies in the reporting of ED cases to the NMDS, the NZCYES has always included an appendix in its reports to alert readers to these issues so that trend data can be interpreted with these concerns in mind.

For injuries, the NZCYES has adopted the Ministry's practice of filtering out ED cases based on the hypothesis that the processes for injury assessments is relatively consistent around the country (e.g. children presenting to ED with a fracture may be more likely to be assessed by ED staff, or by an orthopaedic registrar in ED, than to be sent to the ward for paediatric review). On this basis, filtering out ED cases is less likely to disproportionately discount the workload of the Auckland DHBs.

Further research is required to confirm this hypothesis. However, analysis of hospital admission data for 2008–2012 found that excluding ED cases resulted in paediatric medical admission rates in the Auckland and Waitemata DHBs being much lower than those of other DHBs. Including these cases resulted in rates that were somewhat higher. In contrast, for injuries, exclusion of ED cases resulted in admission rates that were a little lower than the NZ rate, whereas the inclusion of ED cases resulted in rates that were much higher. One possible interpretation of these differences is that the exclusion of ED cases in the context of injury admissions may not disproportionately discount the work of the large Auckland DHBs to the same extent as it does for medical admissions.

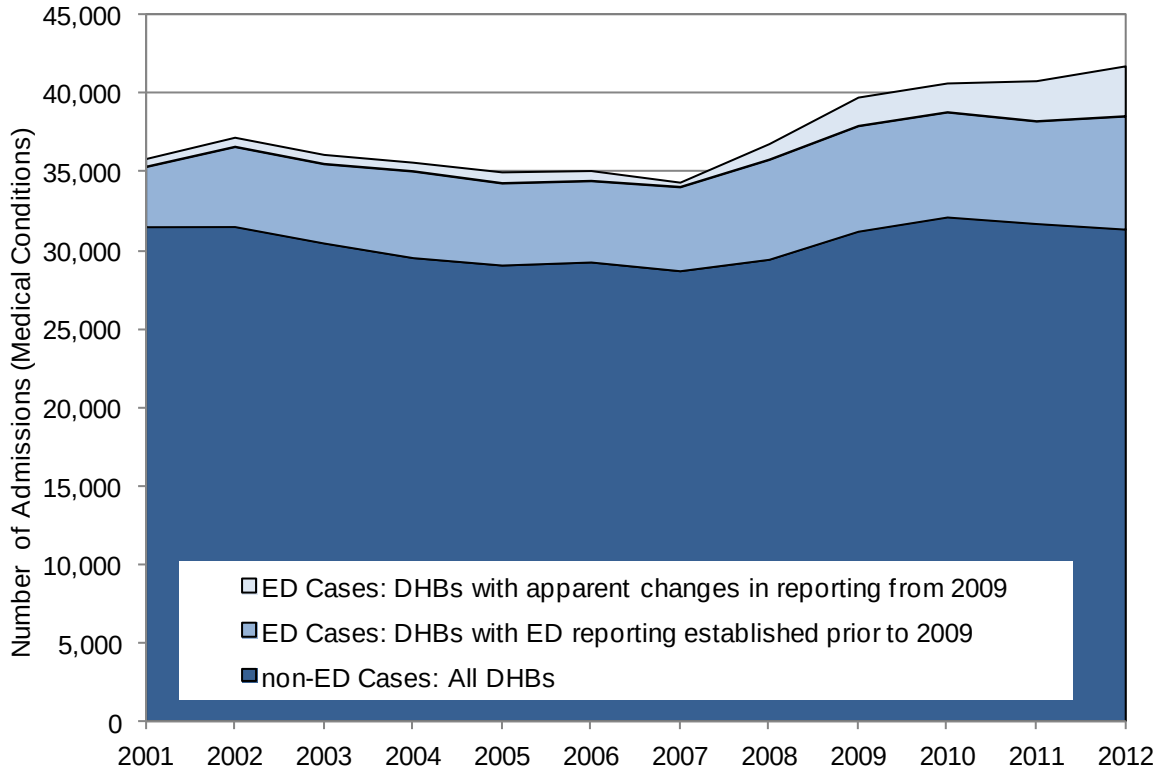
Implications for Interpretation

While the inclusion of ED cases is thought to provide the most meaningful comparison across DHBs, it has a number of implications for time series analysis. **Figure 1** shows trends in children's hospital admissions for medical conditions with a social gradient during 2001–2012. In this figure, admissions have been broken into three groups: 1) non-ED cases (e.g. those discharged with a paediatric medical/surgical specialty code); 2) ED cases in DHBs that consistently reported their ED cases prior to 2009 or where reporting did not change in or after 2009; 3) ED cases in DHBs where an abrupt increase in reporting was evident in or after 2009. Analysis suggests that:

- In the early 2000s, the correction of the historical under-reporting of ED cases by a number of Auckland and Upper North Island DHBs may have contributed to the increase in hospital admissions for medical conditions between 2000 and 2002.
- During 2002–2007, the declines seen in medical admissions may have been greater, had not a number of small to medium sized DHBs begun to report their ED cases more comprehensively.
- Since 2009, the correction of the under-reporting occurring in the remaining DHBs may have contributed to some of the rise seen in ED admissions. This in turn may have steepened the rate of increase in overall admissions seen during 2009–2012.
- Between 2007 and 2012, non-ED admissions and ED admissions in DHBs already reporting their ED cases consistently, rose from 34,054 to 38,608 (an increase of 4,554) while ED admissions in DHBs who appeared to change their reporting practices from 2009 rose from 271* to 3,206 (an increase of 2,935) (*2007 was an unusually low year due to a reporting anomaly in one DHB, with admissions averaging around 500–600 per year in the years immediately prior to 2007).

- It is difficult to determine how much of the increase in ED admissions in DHBs who changed their ED reporting practices in or after 2009, was due to the change in reporting practice and how much was due to a real rise in ED presentations. However, if the rate of increase in ED admissions during 2007–2012 for DHBs who did not change practice was applied to the DHBs that did, an additional 490 admissions might have been expected during this period. This is much lower than the 2,935 additional admissions seen (a net excess of 2,445 admissions).

Figure 1. Hospital admissions for medical conditions with a social gradient in children aged 0–14 years by health specialty on discharge and DHB reporting practice, New Zealand 2001–2012



Source: National Minimum Dataset; Note: Acute and arranged admissions only; ED cases are those with a health speciality code on discharge of M05–M08.

Other potential limitations to take into account when interpreting NMDS data include:

1. The inclusion of ED medical cases may lead to apparently higher admission rates for DHBs that have been reporting all of their ED cases consistently over time or that have been including triage or waiting time in the calculation of the three hour rule, when compared to DHBs that have been under-reporting their ED caseload. However, the extent to which these ED cases have been undercounted is difficult to quantify with many DHBs managing their acute assessments via PAUs or the paediatric ward. As a result, many acute assessments are assigned a M55 Paediatric Medicine specialty code on discharge (as there is no specific code for PAU) making them indistinguishable from other paediatric ward admissions.
2. Conversely, filtering out injury ED cases may have led to apparently lower injury admission rates in those DHBs who manage a higher proportion of their caseload in ED. Further, the resultant injury data are no longer representative of all types of injury presentation in children as they reflect only the more serious end of the spectrum. Finally, the filtered data are unable to provide any insights into changes in families' service access patterns (e.g. primary care vs. ED) for less serious injuries in children, thereby losing its capacity to provide an early warning of a shift in families health seeking behaviour for minor injuries.

2. Data Quality and Coding Changes over Time (ICD-9 and ICD-10)

Change Over from ICD-9 to ICD-10 Coding

From 1988 until June 1999, clinical information in the NMDS was coded using versions of the ICD-9 classification system (ICD-9 CM until June 1995, then ICD-9-CM-A until June 1999). From July 1999 onwards, the ICD-10-AM classification system has been used, although for time series analysis, back and forward mapping between the two systems is possible using pre-defined algorithms [419].

The introduction of ICD-10-AM represented the most significant change in the International Classification of Diseases (ICD) in over 50 years and uses an alphanumeric coding system for diseases in which the first character of the code is always a letter followed by several numbers. This has allowed for the expansion of the number of codes to provide for recently recognised conditions and to provide greater specificity about common diseases (there are about 8,000 categories in ICD-10-AM as compared to 5,000 in ICD-9). While for most conditions there is a reasonable 1:1 correspondence between ICD-9 and ICD-10 codes, for some this may lead to some irregularities in time series analysis [420]. Where possible such irregularities will be highlighted in the text, although care should still be taken when interpreting time series analysis across the 1999–2000 period as some conditions may not be directly comparable between the two coding systems.

Accuracy of ICD Coding

The Ministry has undertaken a number of reviews of the quality of ICD coding in the NMDS. In one audit 2,708 events were audited over 10 sites during a 3 month period during 2001/2002. Overall the audit found that 22% of events required a change in coding, although this also included changes at the fourth and fifth character level. The average ICD code change was 16%, with changes to the principal diagnosis being 11%, to additional diagnoses being 23% and to procedure coding being 11%. There were 1625 external causes of injury codes, of which 15% were re-coded differently [421]. These findings were similar to an audit undertaken a year previously.

While the potential for such coding errors must be taken into consideration when interpreting the findings of this report, it may be that the 16% error rate is an overestimate, as in the majority of the analyses undertaken in this report, only the principal diagnosis (with an error rate of 11%) is used to describe the reason for admission. In addition, for most admissions the diagnostic category (e.g. lower respiratory tract infections) is assigned using information at the 3 digit level (with the 16% error rate also including issues with coding at the 4th or 5th digit level).

3. Ethnicity Information in the NMDS

The reader is referred to **Appendix 6** for a discussion of this issue.

Conclusion

The inconsistencies outlined above tend to make time series analyses based on the NMDS less reliable than those based on Mortality or Birth Registration data (where legislation dictates inclusion criteria and the type of information collected). While using hospital discharge data still remains a valuable and reasonably reliable proxy for measuring the health outcomes of children and young people in this country, the reader is cautioned to take into consideration the issues discussed above, when interpreting the findings outlined in this report.

APPENDIX 4: THE BIRTH REGISTRATION DATASET

Mode of Data Collection

Since 1995 all NZ hospitals and delivering midwives have been required to notify Internal Affairs (within 5 working days of delivery), of the birth of a live or stillborn baby 20+ weeks' gestation or weighing >400g. Prior to 1995, only stillborn babies reaching 28+ weeks of gestation required birth notification. Information on the hospital's notification form includes maternal age, ethnicity, multiple birth status, and baby's sex, birth weight and gestational age. In addition, parents must complete a Birth Registration Form within two years of delivery, duplicating the above information with the exception of birth weight and gestational age, which are supplied only on hospital notification forms. Once both forms are received by Internal Affairs, the information is merged into a single entry. This two-stage process it is thought to capture 99.9% of births occurring in New Zealand and cross-checking at the receipting stage allows for the verification of birth detail [54].

Interpretation of Information Derived from the Birth Registration Dataset

Because of the two-stage birth registration process, the majority of variables contained within the birth registration dataset are >98% complete, and cross-checking at the receipting stage (with the exception of birth weight and gestational age) allows for the verification of birth details. In addition, the way in which ethnicity is collected in this dataset confers a number of advantages, with maternal ethnicity being derived from the information supplied by parents on their baby's birth registration form. This has the advantage of avoiding some of the ambiguities associated with hospital and mortality data, which at times have been reported by third parties. Changes in the way ethnicity was defined in 1995 however make information collected prior to this date incomparable with that collected afterwards. For births prior to 1995, maternal ethnicity was defined by ancestry, with those having half or more Māori or Pacific blood meeting ethnic group criteria, resulting in three ethnic groups, Māori, Pacific and non-Māori non-Pacific. For births after 1995 maternal ethnicity was self-identified, with an expanded number of ethnic categories being available and parents being asked to tick as many options as required to show which ethnic group(s) they belonged to. For those reporting multiple ethnic affiliations a priority rating system was introduced, as discussed **Appendix 6** of this report.

Because this dataset captures 99.9% of births occurring in NZ, is >98% complete for most variables, collects self-reported ethnicity in a standard manner and is collated and coded by a single agency, information derived from this dataset is likely to be of higher quality than that derived from many of NZ's other data sources. Limitations however include the relatively restricted number of variables contained within the dataset (e.g. it lacks information on maternal smoking, Body Mass Index or obstetric interventions) and the lack of cross-checking for birth weight and gestational age (which is supplied only on the hospital notification form). The changeover in ethnicity definition during 1995 also prohibits time series analysis by ethnicity over the medium to long term. Finally, since the last report, the Ministry of Health has stopped providing stillbirth data in the Birth Registration Dataset, and thus all analyses based on this set are restricted to live births only. Each of these factors must thus be taken into account when interpreting information in this report that has been derived from the Birth Registration Dataset.

APPENDIX 5: THE NATIONAL MORTALITY COLLECTION

Mode of Data Collection

The National Mortality Collection is a dataset managed by the Ministry of Health which contains information on the underlying cause(s) of death as well as basic demographic data for all deaths registered in New Zealand since 1988. Data pertaining to fetal and infant deaths are a subset of the Mortality Collection, with cases in this subset having additional information on factors such as birth weight and gestational age [419].

Each month the Births, Deaths and Marriages service of the Department of Internal Affairs sends the Ministry of Health electronic death registration information, Medical Certificates of Cause of Death, and Coroner's reports. Additional information on the cause of death is obtained from the National Minimum Dataset (NMDS), private hospital discharge returns, the NZ Cancer Registry (NZCR), the Department of Courts, the Police, the Land Transport Authority (LTSA), Water Safety NZ, Media Search and from writing letters to certifying doctors, coroners and medical records officers in public hospitals. Using information from these data sources, an underlying cause of death (ICD-10-AM) is assigned by Ministry of Health staff using the World Health Organization's rules and guidelines for mortality coding [419].

Data Quality Issues Relating to the National Mortality Collection

Unlike the NMDS, where information on the principal diagnosis is coded at the hospital level and then forwarded electronically to the Ministry of Health, in the National Mortality Collection each of the approximately 28,000 deaths occurring in New Zealand each year is coded manually by Ministry of Health staff. For most deaths the Medical Certificate of Cause of Death provides the information required, although coders also have access to the information contained in the NMDS, NZ Cancer Registry, LSTA, Police, Water Safety NZ and ESR [420]. As a consequence, while coding is still reliant on the accuracy of the death certificate and other supporting information, there remains the capacity for a uniform approach to the coding which is not possible for hospital admissions data.

While there are few published accounts of the quality of coding information contained in the National Mortality Collection, the dataset lacks some of the inconsistencies associated with the NMDS, as the process of death registration is mandated by law and there are few ambiguities as to the inclusion of cases over time. As a consequence, time series analyses derived from this dataset are likely to be more reliable than that provided by the NMDS. One issue that may affect the quality of information derived from this dataset, however, is the collection of ethnicity data, which is discussed in more detail in **Appendix 6** of this report.

APPENDIX 6: THE MEASUREMENT OF ETHNICITY

The majority of rates calculated in this report rely on the division of numerators (e.g. hospital admissions, mortality data) by Statistics NZ Estimated Resident Population denominators. Calculation of accurate ethnic-specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and the denominator, and that a single child will be identified similarly in each dataset. In New Zealand this has not always been the case, and in addition the manner of collecting information on ethnicity has varied significantly over time. Since 1996, however, there has been a move to ensure that ethnicity information is collected in a similar manner across all administrative datasets in New Zealand (Census, Hospital Admissions, Mortality, Births). The following section briefly reviews how information on ethnicity has been collected in national data collections since the early 1980s and the implications of this for the information contained in this report.

1981 Census and Health Sector Definitions

Earlier definitions of ethnicity in official statistics relied on the concept of fractions of descent, with the 1981 census asking people to decide whether they were fully of one ethnic origin (e.g. Full Pacific, Full Māori) or if of more than one origin, what fraction of that ethnic group they identified with (e.g. 7/8 Pacific + 1/8 Māori). When prioritisation was required, those with more than 50% of Pacific or Māori blood were deemed to meet the ethnic group criteria of the time [422]. A similar approach was used to record ethnicity in health sector statistics, with birth and death registration forms asking the degree of Pacific or Māori blood of the parents of a newborn baby/the deceased individual. For hospital admissions, ancestry-based definitions were also used during the early 1980s, with admission officers often assuming ethnicity, or leaving the question blank [423].

1986 Census and Health Sector Definitions

Following a review expressing concern at the relevance of basing ethnicity on fractions of descent, a recommendation was made to move towards self-identified cultural affiliation. Thus the 1986 Census asked the question “What is your ethnic origin?” and people were asked to tick the box or boxes that applied to them. Birth and death registration forms however, continued to use the “fractions of blood” question until 1995, making comparable numerator and denominator data difficult to obtain [422]. For hospital admissions, the move from an ancestry-based to a self-identified definition of ethnicity began in the mid-80s, although non-standard forms were used and typically allowed a single ethnicity only [423].

1991 Census and Health Sector Definitions

A review suggested that the 1986 ethnicity question was unclear as to whether it was measuring ancestry or cultural affiliation, so the 1991 Census asked two questions:

1. Which ethnic group do you belong to? (tick the box or boxes which apply to you)
2. Have you any NZ Māori ancestry? (if yes, what iwi do you belong to?)

As indicated above, however, birth and death registrations continued with ancestry-based definitions of ethnicity during this period, while a number of hospitals were beginning to use self-identified definitions in a non-standard manner [423].

1996 Census and Health Sector Definitions

While the concepts and definitions remained the same as for the 1991 census, the ethnicity question in the 1996 Census differed in that:

- The NZ Māori category was moved to the top of the ethnic categories
- The 1996 question made it more explicit that people could tick more than one box
- There was a new "Other European" category with 6 subgroups

As a result of these changes, there was a large increase in the number of multiple responses, as well as an increase in the Māori ethnic group in the 1996 Census [422]. Within the health sector, however, there were much larger changes in the way in which ethnicity information was collected. From late 1995, birth and death registration forms incorporated a new ethnicity question identical to that in the 1996 Census, allowing for an expansion of the number of ethnic groups counted (previously only Māori and Pacific) and resulting in a large increase in the proportion of Pacific and Māori births and deaths. From July 1996 onwards, all hospitals were also required to inquire about ethnicity in a standardised way, with a question that was compatible with the 1996 Census and that allowed multiple ethnic affiliations [423]. A random audit of hospital admission forms conducted by Statistics NZ in 1999, however, indicated that the standard ethnicity question had not yet been implemented by many hospitals. In addition, an assessment of hospital admissions by ethnicity over time showed no large increases in the proportions of Māori and Pacific admissions after the 1996 "change-over", as had occurred for birth and death statistics, potentially suggesting that the change to a standard form allowing for multiple ethnic affiliations in fact did not occur. Similarities in the number of people reporting a "sole" ethnic group pre- and post-1996 also suggest that the way in which information on multiple ethnic affiliations was collected did not change either. Thus while the quality of information available since 1996 has been much better than previous, there remains some concern that hospitals continue to undercount multiple ethnic identifications and as a result, may continue to undercount Pacific and Māori peoples [423].

2001 Census and Health Sector Definitions

The 2001 Census reverted back to the wording used in the 1991 Census after a review showed that this question provided a better measure of ethnicity based on the current statistical standard [422]. The health sector also continued to use self-identified definitions of ethnicity during this period, with the *Ethnicity Data Protocols for the Health and Disability Sector* providing guidelines which ensured that the information collected across the sector was consistent with the wording of the 2001 Census (i.e. *Which ethnic groups do you belong to (Mark the space or spaces that apply to you)?*)

2006 Census and Health Sector Definitions

In 2004, the Ministry of Health released the *Ethnicity Data Protocols for the Health and Disability Sector* [424] with these protocols being seen as a significant step forward in terms of standardising the collection and reporting of ethnicity data in the health sector [425]. The protocols stipulated that the standard ethnicity question for the health sector was the 2001 Census ethnicity question, with respondents being required to identify their own ethnicity, and with data collectors being unable to assign this on respondent's behalf, or to transfer this information from another form. The protocols also stipulated that ethnicity data needed to be recorded to a minimum specificity of Level 2 (see below) with systems needing to be able to store, at minimum, three ethnicities, and to utilise standardised prioritisation algorithms, if more than three ethnic groups were reported. In terms of outputs, either sole/combination, total response, or prioritised ethnicity needed to be reported, with the methods used being clearly described in any report [424].

The following year, Statistics New Zealand's Review of the Measurement of Ethnicity (RME), culminated in the release of the *Statistical Standard for Ethnicity 2005* [426], which recommended that:

1. The 2006 Census ethnicity question use identical wording to the 2001 Census
2. Within the "Other" ethnic group, that a new category be created for those identifying as "New Zealander" or "Kiwi". In previous years these responses had been assigned to the European ethnic group
3. All collections of official statistics measuring ethnicity have the capacity to record and report six ethnicity responses per individual, or at a minimum, three responses when six could not be implemented immediately
4. The practice of prioritising ethnicity to one ethnic group should be discontinued.

At the 2006 Census, however, a total of 429,429 individuals (11.1% of the NZ population) identified themselves as a New Zealander, with further analysis suggesting that 90% of the increase in those identifying as New Zealanders in 2006, had arisen from those identifying as New Zealand European at the 2001 Census [427]. In 2009 Statistics NZ amended the Standard to reflect these issues [428] with the current recommendation being that future Censuses retain the current ethnicity question (i.e. that New Zealander tick boxes not be introduced) but that alongside the current standard outputs where New Zealander responses are assigned to the Other Ethnicity category, an alternative classification be introduced which combines the European and New Zealander ethnic groups into a single European and Other Ethnicity category for use in time series analysis (with those identifying as both European and New Zealanders being counted only once in this combined ethnic group [428].

The Current Recording of Ethnicity in New Zealand's National Datasets

In New Zealand's national health collections (e.g. National Minimum Dataset, Mortality Collection and NZ Cancer Registry), up to three ethnic groups per person are stored electronically for each event, with data being coded to Level 2 of Statistics New Zealand's 4-Level Hierarchical Ethnicity Classification System [413]. In this Classification System increasing detail is provided at each level. For example [424]:

- Level 1 (least detailed level) e.g. code 1 is European
- Level 2 e.g. code 12 is Other European
- Level 3 e.g. code 121 is British and Irish
- Level 4 (most detailed level) e.g. code 12111 is Celtic

Māori, however, are identified similarly at each level (e.g. Level 1: code 2 is Māori vs. Level 4: code 21111 is Māori).

For those reporting multiple ethnic affiliations, information may also be prioritised according to Statistics New Zealand's protocols, with Māori ethnicity taking precedence over Pacific > Asian/Indian > Other > European ethnic groups [424]. This ensures that each individual is counted only once and that the sum of the ethnic group sub-populations equals the total NZ population [423]. The implications of prioritisation for Pacific groups however are that the outcomes of those identifying as both Māori and Pacific are only recorded under the Māori ethnic group.

For those reporting more than 3 ethnic affiliations, the ethnic groups recorded are again prioritised (at Level 2), with Māori ethnicity taking precedence over Pacific > Asian/Indian > Other > European ethnic groups (for further details on the prioritisation algorithms used see [424]. In reality, however, less than 0.5% of responses in the National Health Index database have three ethnicities recorded, and thus it is likely that this prioritisation process has limited impact on ethnic-specific analyses [424].

Undercounting of Māori and Pacific Peoples in National Collections

Despite significant improvements in the quality of ethnicity data in New Zealand's national health collections since 1996, care must still be taken when interpreting the ethnic-specific rates presented in this report, as the potential still remains for Māori and Pacific children and young people to be undercounted in our national data collections. In a review that linked hospital admission data to other datasets with more reliable ethnicity information (e.g. death registrations and Housing NZ Corporation Tenant data), the authors of Hauora IV [429] found that on average, hospital admission data during 2000–2004 undercounted Māori children (0–14 years) by around 6%, and Māori young people by around 5–6%. For cancer registrations, the undercount was in the order of 1–2% for the same age groups. While the authors of Hauora IV developed a set of adjusters which could be used to minimise the bias such undercounting introduced when calculating population rates and rate ratios, these (or similar) adjusters were not utilised in this report for the following reasons:

1. Previous research has shown that ethnicity misclassification can change over time, and thus adjusters developed for one period may not be applicable to other periods [430].
2. Research also suggests that ethnic misclassification may vary significantly by DHB [430], and thus that adjusters developed using national level data (as in Hauora IV) may not be applicable to DHB level analyses, with separate adjusters needing to be developed for each DHB.

Further, as the development of adjusters requires the linkage of the dataset under review with another dataset for which more reliable ethnicity information is available, and as this process is resource-intensive and not without error (particularly if the methodology requires probabilistic linkage of de-identified data), the development of a customised set of period and age specific adjusters was seen as being beyond the scope of the current project. The reader is thus urged to bear in mind that the data presented in this report may undercount Māori and Pacific children to a variable extent (depending on the dataset used) and that in the case of the hospital admission dataset for Māori, this undercount may be as high as 5–6%.

Ethnicity Classifications Utilised in this Report and Implications for Interpretation of Results

Because of inconsistencies in the manner in which ethnicity information was collected prior to 1996, all ethnic-specific analyses presented in this report are for the 1996 year onwards. The information thus reflects self-identified concepts of ethnicity. In order to ensure that each health event is only counted once, prioritised ethnic group has been used unless otherwise specified.

APPENDIX 7: THE NZ DEPRIVATION INDEX

The NZ Deprivation Index (NZDep) is a small area index of deprivation, which has been used as a proxy for socioeconomic status in this report. The main concept underpinning small area indices of deprivation is that the socioeconomic environment in which a person lives can confer risks/benefits which may be independent of their own social position within a community [431]. They are thus aggregate measures, providing information about the wider socioeconomic environment in which a person lives, rather than about their individual socioeconomic status.

The NZDep was first created using information from the 1991 census, but has since been updated following each census. The NZDep2006 combines 9 variables from the 2006 census which reflect 8 dimensions of deprivation (**Table 1**). Each variable represents a standardised proportion of people living in an area who lack a defined material or social resource (e.g. access to a car, income below a particular threshold), with all 9 variables being combined to give a score representing the average degree of deprivation experienced by people in that area. While the NZDep provides deprivation scores at meshblock level (Statistics NZ areas containing approximately 90 people), for the purposes of mapping to national datasets, these are aggregated to Census Area Unit level (≈1,000–2,000 people). Individual area scores are then ranked and placed on an ordinal scale from 1 to 10, with decile 1 reflecting the least deprived 10% of small areas and decile 10 reflecting the most deprived 10% of small areas [432].

Table 1. Variables used in the NZDep2006 Index of Deprivation

No	Factor	Variables in Order of Decreasing Weight in the Index
1	Income	People aged 18–64 receiving means tested benefit
2	Employment	People aged 18–64 unemployed
3	Income	People living in households with income below an income threshold
4	Communication	People with no access to a telephone
5	Transport	People with no access to a car
6	Support	People aged <65 living in a single parent family
7	Qualifications	People aged 18–64 without any qualifications
8	Owned Home	People not living in own home
9	Living Space	People living in households below a bedroom occupancy threshold

The advantage of NZDep is its ability to assign measures of socioeconomic status to the elderly, the unemployed and to children (to whom income and occupational measures often don't apply), as well as to provide proxy measures of socioeconomic status for large datasets when other demographic information is lacking. Small area indices have limitations, however, as not all individuals in a particular area are accurately represented by their area's aggregate score. While this may be less of a problem for very affluent or very deprived neighbourhoods, in average areas, aggregate measures may be much less predictive of individual socioeconomic status [431]. Despite these limitations, the NZDep has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

APPENDIX 8: POLICE AREA BOUNDARIES

Most boundaries for the Police Areas in New Zealand map closely to District Health Board boundaries. **Figure 2** shows the District Health Boards as colour/shaded blocks, while Police Area boundaries are drawn as blue lines. Where there is a significant mismatch, the overlap is shown as being striped. **Table 2** provides an overview of the Police Areas that overlap the District Health Boards.

Figure 2. Police Area boundaries compared with District Health Board boundaries

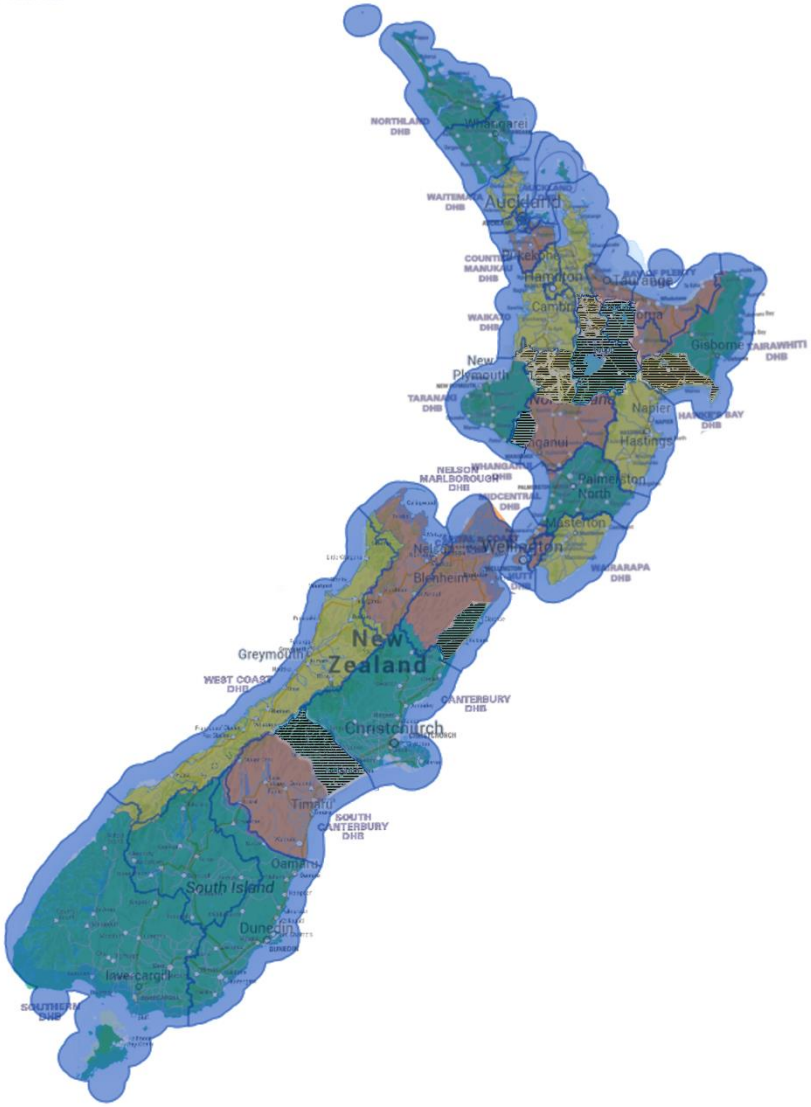


Image sources: Police Areas (as at 14/08/2014): https://koordinates.com/layer/3825-nz-police-area-boundaries/; District Health Boards (as at 2/10/2014): http://www.health.govt.nz/system/files/documents/pages/north-island.pdf and http://www.health.govt.nz/system/files/documents/pages/south-island.pdf

Table 2. Overlap between District Health Boards and Police Areas

District Health Board	Police region	Police Area	District Health Board	Police region	Police Area
Northland	Northland	Far North Area	Tairawhiti	Eastern	Tairawhiti Area
Northland	Northland	Whangarei Area	Taranaki	Central	Taranaki Area
Waitemata	Waitemata	Auckland Motorways Area	Taranaki	Central	Taranaki Area
Waitemata	Waitemata	North Shore Area	Taranaki	Central	Whanganui Area
Waitemata	Waitemata	Rodney Area	Hawke's Bay	Eastern	Hawke’s Bay Area
Waitemata	Waitemata	Waitakere Area	Hawke's Bay	Eastern	Tairawhiti Area
Auckland	Auckland City	Auckland Central Area	MidCentral	Central	Manawatu Area
Auckland	Auckland City	Auckland East Area	Whanganui	Central	Whanganui Area
Auckland	Auckland City	Auckland West Area	Hutt Valley	Wellington	Hutt Valley Area
Counties Manukau	Counties/Manukau	Counties Manukau Central Area	Capital & Coast	Wellington	Kapiti-Mana Area
Counties Manukau	Counties/Manukau	Counties Manukau East Area	Capital & Coast	Wellington	Wellington Area
Counties Manukau	Counties/Manukau	Counties Manukau South Area	Wairarapa	Wellington	Wairarapa Area
Counties Manukau	Counties/Manukau	Counties Manukau West Area	Nelson Marlborough	Tasman	Marlborough Area
Waikato	Waikato	Hamilton City Area	Nelson Marlborough	Tasman	Nelson Bays Area
Waikato	Waikato	Waikato East Area	South Canterbury	Canterbury	Mid / South Canterbury Area
Waikato	Waikato	Waikato West Area	Canterbury	Tasman	Nelson Bays Area
Waikato	Bay of Plenty	Taupo Area	Canterbury	Canterbury	Central Canterbury Area
Waikato	Central	Whanganui Area	Canterbury	Canterbury	Mid / South Canterbury Area
Waikato	Central	Taranaki Area	Canterbury	Canterbury	Northern Canterbury Area
Bay of Plenty	Bay of Plenty	Eastern Bay of Plenty Area	Canterbury	Canterbury	Southern Canterbury Area
Bay of Plenty	Bay of Plenty	Rotorua Area	West Coast	Tasman	West Coast Area
Bay of Plenty	Bay of Plenty	Western Bay of Plenty Area	Southern	Southern	Dunedin Area
Lakes	Bay of Plenty	Rotorua Area	Southern	Southern	Otago Rural Area
Lakes	Bay of Plenty	Taupo Area	Southern	Southern	Southland Area

APPENDIX 9: METHODS USED TO DEVELOP THE CHILD POVERTY MONITOR

This appendix provides an overview of the methodology used to develop the Child Poverty Monitor that was used originally for the New Zealand Children's Social Health Monitor.

Rationale for the Child Poverty Monitor Indicators

The precursor to the Child Poverty Monitor was the Children's Social Health Monitor which arose from the work of a group of health professionals responding to the deteriorating economic conditions in New Zealand and Australia in the late 2000s. Coming from a range of organisations[1] with an interest in child health this Working Group was concerned about the impact of the recession on child wellbeing. The Group formed in early 2009 and discussed a set of indicators with which to monitor this impact: the types of indicators that might be included and the criteria by which individual indicators should be selected. As a result of these discussions, the Children's Social Health Monitor was developed, comprising two sets of indicators:

1. *To monitor prevailing economic conditions:* Ideally, indicators would capture different facets of economic wellbeing (e.g. in a recession several quarters of negative growth (*GDP*) may precede upswings in unemployment rates, which in turn will influence the number of children reliant on benefit recipients.
2. *To monitor children's wellbeing:* Ideally indicators would respond relatively quickly (e.g. months to small number of years) to family's adaptations to deteriorating economic conditions (e.g. hospitalisations for poverty-related conditions) and would provide an overview of family wellbeing from a variety of different perspectives.

The Expert Advisory Group: solutions to child poverty

In 2012, the Children's Commissioner established the Expert Advisory Group on Solutions to Child Poverty (EAG).He gave the EAG the task of providing him with realistic, pragmatic and effective solutions to address child poverty in the short term and in the longer term. In their report *Child Poverty in New Zealand: Evidence for Action* [3], the EAG recommended that governments adopt a strategic framework for addressing child poverty issues and ensuring accountability for outcomes. They stated that the framework should include the enactment of legislation requiring the measurement of child poverty, the setting of short and long term poverty reduction targets, and the establishment, monitoring and reporting of various child poverty related indicators [3].

Indicator Selection Criteria

The working group decided to gather good quality routinely collected data able to provide complete population coverage. This was to ensure the indicator set was methodologically robust and could be consistently monitored over time. A set of selection criteria were established against which candidate indicators were scored. The selection criteria included:

[1]The Paediatric Society of New Zealand, the Population Child Health Special Interest Group of the Royal Australasian College of Physicians, the New Zealand Child and Youth Epidemiology Service, TAHA (the Well Pacific Mother and Infant Service), the Māori SIDS Programme, the Kia Mataara Well Child Consortium, the New Zealand Council of Christian Social Services, and academics from the Universities of Auckland and Otago

Conceptual Criteria

Criteria for Indicators to Monitor Prevailing Macroeconomic Conditions

1. Internationally recognised and reported measure of economic performance/wellbeing
2. Should impact on at least one facet of children's wellbeing (i.e. the pathway(s) via which it impacts on children's wellbeing should be relatively well understood, or an association between the indicator and wellbeing documented in the literature)
3. Likely to change in response to a recession (i.e. months to small number of years)

Criteria for Indicators to Monitor Children's Health and Wellbeing

1. The condition is likely to be influenced by family's physical adaptations to worsening economic conditions (e.g. saving on heating to pay for food, moving in with family to save on rent)
2. The condition is likely to be influenced by family's psychological adaptations to worsening economic conditions (e.g. increased family conflict in response to financial stress)
3. The condition exhibits a socioeconomic gradient (e.g. rates are higher in more deprived areas)
4. The condition is likely to respond to changing economic conditions in the short to medium term (e.g. months to 1–2 years)

Data Quality Criteria

Data Quality Criteria (for either of the above indicator categories)

1. Needs to be routinely collected
2. Available at the national level (i.e. complete coverage of target population)
3. Updated at least annually (although quarterly preferable)
4. Availability of consistent time series data going back several years (i.e. standard and stable method of data collection)
5. Distribution can be broken down by e.g. ethnicity, socioeconomic status, region

Selection of the Baseline Indicator Set

In mid-2009 a long list of candidate indicators (selected by means of a scan of the available literature, email consultation with child health networks, and the suggestions of Working Group members) were then scored against each of these criteria by Working Group members and other health professionals (n=20). Those scoring the indicators were also asked to select a Top Five Economic and Top Five Health and Wellbeing Indicators for inclusion in the Children's Social Health Monitor. The resulting Top Five Economic and Wellbeing indicators (as determined both by criteria scoring and priority ranking) were:

Economic Indicators:

Gross Domestic Product
Income Inequality
Child Poverty
Unemployment Rates
The Number of Children Reliant on Benefit Recipients

Child Health and Wellbeing Indicators:

Hospital Admissions with a Social Gradient
Mortality with a Social Gradient
Infant Mortality
Hospital Admissions and Mortality from Non-Accidental Injury

Methodology for Developing the Hospital Admissions and Mortality with a Social Gradient Indicator

While the top five economic indicators and a number of the child health and wellbeing indicators already had established methodologies, the hospital admissions and mortality with a social gradient indicator had to be developed specifically for the Children's Social Health Monitor. The methodology used to develop this indicator is outlined below:

Hospital Admissions

In considering which conditions should be included in the analysis of hospital admissions with a social gradient, the 40 most frequent causes of hospital admission in children aged 0–14 years (excluding neonates) were reviewed, and those exhibiting a social gradient (a rate ratio of ≥1.8 for NZDep deciles 9–10 vs. deciles 1–2; or for Māori, Pacific or Asian vs. European children) were selected. A small number of conditions with rate ratios in the 1.5–1.8 range were also included, if they demonstrated a consistent social gradient (i.e. rates increased in a stepwise manner with increasing NZDep deprivation) and the association was biologically plausible (the plausibility of the association was debated by Working Group members).

Inclusion and Exclusion Criteria

Neonatal hospital admissions (<28 days) were excluded on the basis that 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) → special care nurseries (SCBU) → 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.

For medical conditions, only acute and arranged hospital admissions were included, as Waiting List admissions are likely to reflect service capacity, rather than the burden of health need (e.g. the inclusion of Waiting List admissions would result in a large number of children with otitis media and chronic tonsillitis (who were being admitted for grommets and tonsillectomies) being included, and the demographic profile of these children may be very different from children attending hospital acutely for the same conditions).

For injury admissions, filtering by admission type was not possible, 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. In accordance with other reports produced by the NZ Child and Youth Epidemiology Service (NZCYES), all injury cases with an Emergency Department Specialty Code (M05–M08) on discharge were excluded as a result of inconsistent uploading of Emergency Department cases across DHBs (see **Appendix 3** for further detail). This differential filtering however means that it is not possible to accurately compare the magnitude of the social gradients between the medical condition and injury categories, as they were derived using different methodologies (and social differences in Emergency Department vs. primary care attendances for minor medical conditions may have accounted for some of the social gradients seen). No such differential filtering occurred for mortality data, however (see below), and thus the magnitude of the social differences seen in this context is more readily comparable.

Mortality

In the case of mortality, because in many instances, the number of deaths from a particular condition was insufficient to calculate reliable rate ratios by NZDep and ethnicity, the rate ratios derived from the analysis of hospital admission data were used to denote category membership. The most frequent causes of mortality in those 0–14 years (excluding neonates) were reviewed however, in order to ensure that no additional conditions making a large contribution to mortality had been missed by the analysis of hospital admission data. This identified two further conditions (which by analysis of mortality of data met rate ratio criteria); deaths from drowning and Sudden Unexpected Death in Infancy, which were then included in the coding algorithms (for both hospital admissions and mortality data). A number of deaths were also identified, which were attributed to issues arising in the perinatal period (e.g. extreme prematurity, congenital anomalies), but in order to preserve consistency with previous exclusion criteria (i.e. the exclusion of conditions arising in the perinatal period) these were not included in coding algorithms.

APPENDIX 10: DIAGNOSTIC SHIFTS IN CODING

In New Zealand, the Ministry of Health regularly updates the ICD-10-AM coding system it uses to assign diagnostic codes, in order to ensure New Zealand remains congruent with international best practice. As a consequence, since 2000 New Zealand's national health collections have sequentially used the ICD-10-AM 1st, 2nd, 3rd, and 6th Editions, with the 6th Edition being in use since 1 July 2008 [413].

While the Technical Report's coding algorithms take such Edition changes into account, what is often harder to identify is changes in the way the codes themselves are assigned, either as a result of new directives to clinical coders on how to document specific conditions, or due to changes in the way clinicians diagnose clinically overlapping, ambiguous, or emerging conditions. In this Technical Report, two changes have been made to the coding algorithms previously used by the CSHM to define medical conditions with a social gradient, as a result of these issues. Specifically these changes relate to:

The Broadening of Asthma to Asthma and Wheeze

In recent years there has been a move away from diagnosing asthma in pre-school age children, with the majority of a European Respiratory Society Taskforce in 2008 "*agreeing not to use the term asthma to describe preschool wheezing illness, since there is insufficient evidence to show that the pathophysiology of preschool wheezing illness is similar to that of asthma in older children [433]".*

Figure 3 shows the large increases in hospital admissions with a primary diagnosis of wheeze (R062) that have occurred in New Zealand since this time, with almost all of these increases being in preschool aged children (0–4 years). A corresponding fall in the number of children admitted with asthma (J45–J46) has also occurred during 2010–2012, with the largest changes again being seen in pre-school age children.

As a consequence, in this year's Technical Report, Asthma (J45–J46) has been replaced with a new category, Asthma and Wheeze (J45–J46, R062), in order to minimise the impacts of this probable diagnostic shift on time series analysis.

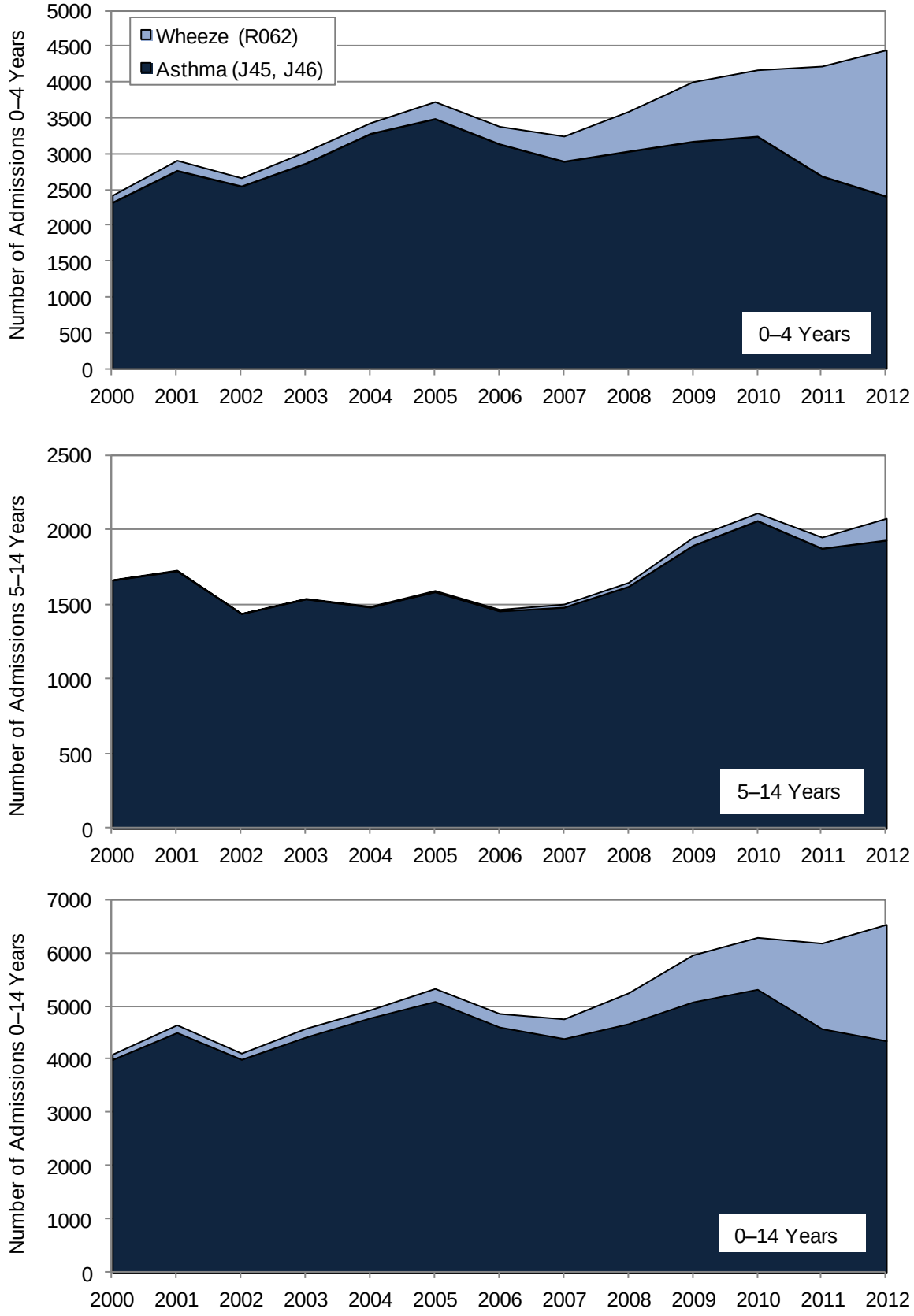
The Addition of J22 (Unspecified Lower Respiratory Infections)

J22 was not initially included in the CSHM's coding algorithms, as it was not present in ICD-9, and thus could not be used in time series analyses prior to 2000. However, there are considerable clinical similarities between J22 (Unspecified Lower Respiratory Tract Infection) and J18.9 (Unspecified Pneumonia), a code which accounts for the majority of admissions in the Monitor's current Bacterial/Non-Viral/Unspecified Pneumonia category.

Whether this diagnostic overlap has resulted in any actual diagnostic transfer between these categories remains unclear, although the number of admissions with a primary diagnosis of J22 has increased since 2007, while the number with Bacterial/Non-Viral/Unspecified Pneumonia has declined since 2009 (**Figure 4**).

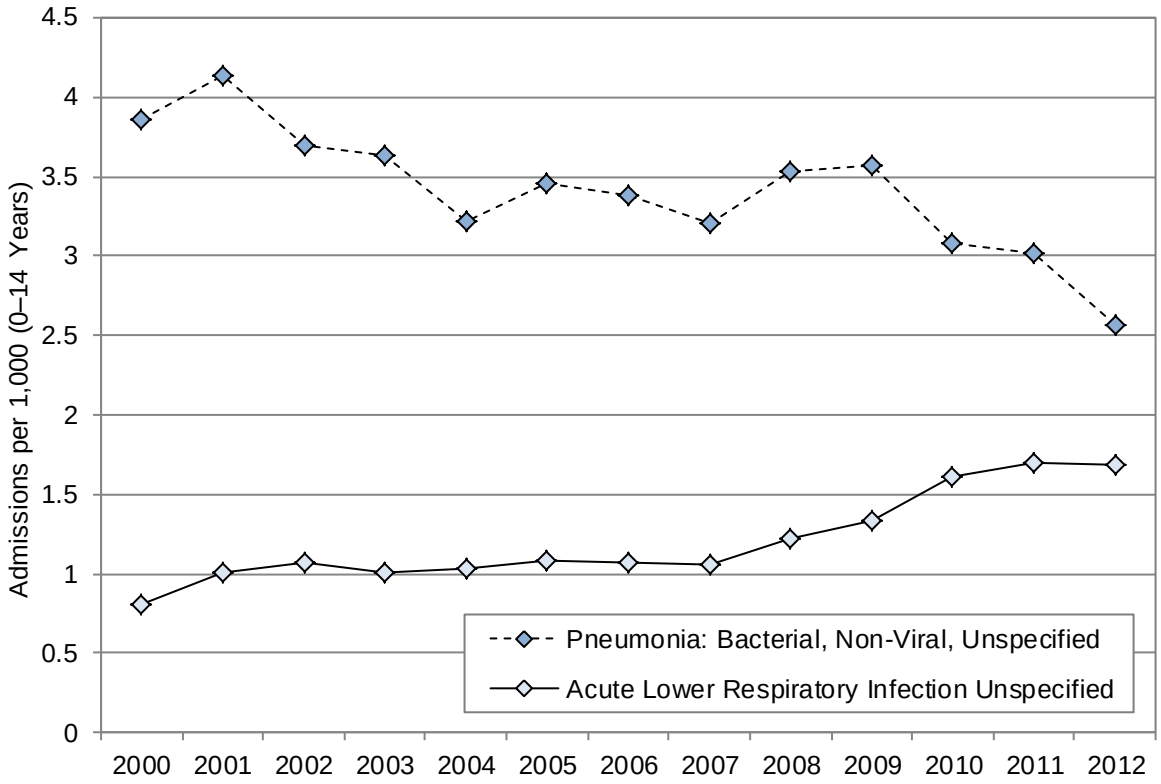
Given this uncertainty, the code J22 has been added to the Technical Report's coding algorithms. As a result, the rates presented in this report are not directly comparable to those previously presented in the CSHM.

Figure 3. Diagnostic shifts in the coding of asthma and wheeze by age group for children aged 0–14 years, New Zealand 2000–2012



Source: National Minimum Dataset

Figure 4. Hospital admissions for bacterial/non-viral/unspecified pneumonia and acute unspecified lower respiratory infections in children aged 0–14 years, New Zealand 2000–2012



Source: Numerator: National Minimum Dataset (neonates removed); Denominator: Statistics NZ Estimated Resident Population (projected from 2007); acute and arranged admissions onlys