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Access and ASH in New Zealand

Improving primary health care access did not reduce ambulatory sensitive hospitalizations in New Zealand.

ABSTRACT

Ambulatory sensitive hospitalizations (ASH) are those thought to be preventable by timely and effective primary health care. Better access to primary health care has been associated with lower ASH rates. Funding increases to primary health care in New Zealand beginning in 2001 led to an improvement in access. Analysis of hospitalizations to all New Zealand public hospitals revealed that, for most age groups, ASH rates did not show long-term reductions from 2001-2009, while socio-economic differences in ASH rates widened across this period. We conclude that increasing funding and access to primary health care will not, by itself, reduce ASH rates.

Keywords: Avoidable admissions, Access to care, Deprivation, Ethnicity
INTRODUCTION

Hospitalizations for certain conditions (e.g., asthma, hypertension, gastroenteritis) are thought to be preventable by timely and effective primary health care (Ansari et al., 2006). Such ‘ambulatory sensitive hospitalizations’ (ASH) affect some groups more than others, e.g., lower socio-economic groups (Rickets et al., 2001; Agha et al., 2007; Agabiti et al., 2009), and some ethnic groups (Dharmalingam et al., 2004; Biello et al., 2010). There is evidence that better access to primary health care is associated with lower rates of ASH (Ansari et al., 2006; Bindman et al., 1995; Basu et al., 2002; Laditka et al., 2005; Rizza et al., 2007; Finegan et al., 2010), and it has also been suggested that the socio-economic and ethnic inequalities in ASH are due to inequalities in access to primary health care (Agabiti et al., 2009). It follows that increasing access to primary health care should reduce rates of ASH, and that reducing inequalities in access to primary health care should reduce inequalities in ASH rates.

New Zealand experienced a substantial funding increase in its primary health care sector from 2001, when all children aged 0-5 received an increase in their fee for service payments. The Primary Healthcare Strategy (King, 2001) then increased funding further on a capitation basis, i.e., based on the size and demographic structure of enrolled populations. Higher needs areas (i.e., areas with >50% of the population was either deprived or in an ethnic minority) received the first batch of increased funding (July 2002), and funding to other areas was staggered by patient age: 6-17 years (October 2003), 65 years and over (July 2004), 18-24 years (July 2005), 45-64 years (July 2006), 25-44 years (July 2007), and additional funding for 6-17 year olds (October 2007) and 0-5 year olds (January 2008) (Cumming, 2008).

Access to primary health care improved as a result, with a general reduction in patient fees for all patients from 2001 to 2007, a population-wide increase in the number of consultations per patient
Access and ASH in New Zealand from 2001 to 2007, and levels of unmet need halving from 12% in 2002 to 6% in 2007 (Cumming and Mays, 2009; Cumming et al., 2008; New Zealand Ministry of Health, 2004; 2008). There is also evidence that equity of access has improved since 2001: fees dropped more for those attending practices with high numbers of New Zealand Māori (the indigenous people), Pacific patients, and patients from the most deprived areas (Cumming and Mays, 2009). Also, while the proportions of Māori men and women visiting their GP in 2001 were below the national average by 8 and 3 percentage points, respectively, the proportions were in line with the national average in 2006 (New Zealand Ministry of Health, 2008).

The recent history of primary health care reform in New Zealand makes it an ideal test case for the impact of increasing primary health care access on ASH rates. All other things being equal, if access to and use of primary health care services are strong determinants of ASH rates then ASH rates should have dropped in New Zealand since 2001. Similarly, if access and use differentials between ethnic and socioeconomic groups are strong determinants of ASH differentials between these groups, then ethnic and socioeconomic differentials in ASH rates should have reduced in New Zealand since 2001. In this paper we will describe trends in ASH rates in New Zealand between 2001 and 2009, and assess the impact of ethnicity and socioeconomic status on ASH rates across these years.

METHODS

We screened for ASH events among all admissions to New Zealand public hospitals by 0-74 year-olds from 2001-2009 (n=6,092,824 admissions). Data were obtained from the New Zealand Ministry of Health (MOH)’s National Minimum Dataset, which records routine information about all admissions to public hospitals in New Zealand. Data were filtered to remove non-treated cases, error diagnostic-related group (DRG) codes, overseas patients, and inconsistent stays (e.g., where
date of discharge was recorded as prior to data of admission). We screened admissions only for those aged 74 or less as the New Zealand MOH’s definition of ASH only applies to patients in this age range – older patients are excluded because of the likelihood of comorbidities. We did include day-stay events.

We classified each admission as an ASH admission based on the ICD-10AM-coded primary diagnosis field (the 1st edition version of ICD-10AM was used across all years), according to MOH criteria (see web appendix; Ministry of Health, 2013). Because not all instances of some ASH conditions are able to be prevented by timely and effective primary health care, the New Zealand MOH criteria treat the following three conditions as ‘half’ ASH events: Myocardial infarction, Other ischaemic heart disease, and Stroke. The treatment of these ‘half’ conditions in analyses is described in the Statistical Analyses section below.

To analyse ASH admissions at a population-level we identified, for each calendar year from 2001-2009, the number of ASH admissions for each individual patient. We then merged these patient records with a dataset obtained from the New Zealand MOH containing data for all residents aged 0-74 for the years 2001-2009 (n=34,562,952 across nine years; data for individual years ranged from 3,666,807 in 2001 to 3,968,627 in 2009).

The data merge was undertaken using the following by-groups:

(i) Year, 2001-2009;
(ii) District Health Board (DHB), 21 regional health districts;
(iii) Sex, male/female;
(iv) Age, 15 five-year blocks from 0-4 to 70-74;
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(v) *Ethnicity*, New Zealand Māori (16%), Pacific People (6%, e.g., Samoan, Tongan), and “non-Māori, non-Pacific” (78%). The MOH population dataset only classified these three ethnic groups, but it is likely that most (~69%/78%) of those classified as “non-Māori, non-Pacific” identify as New Zealanders of European descent, while the remainder identify as either Asian (~8%, e.g., Indian, Chinese), or some other ethnic group (~1%) (Statistics New Zealand, 2013); and

(vi) *Deprivation*, coded according to the New Zealand Deprivation Index (NZDep), which classifies individuals into deciles of deprivation based on census information regarding the socioeconomic characteristics of their area of residence (Salmond et al., 2007). For analysis purposes we formed five quintile groups by combining adjacent deciles: i.e., deciles 1-2, deciles 3-4, deciles 5-6, deciles 7-8, and deciles 9-10 formed quintiles 1 (least deprived), 2, 3, 4 and 5 (most deprived), respectively.

Cases in the merged file with no data for ‘number of ASH admissions’ were assumed to have had zero ASH admissions and were coded as such. For example, if there were 50 individuals in the population dataset with a particular set of characteristics, and 10 individuals in the hospitalization dataset with ASH events with those same characteristics, then merging these datasets together would produce 50 cases, 10 of whom have data for ‘number of ASH admissions’ and 40 of whom do not. It is these 40 that we assume to have zero ASH admissions. This is a relatively safe assumption given that the hospital dataset contained data for all public hospital admissions for New Zealand residents, and there are very few ASH admissions to private hospitals in NZ.

**Statistical analyses**

Creating a merged dataset in this way allowed us to conduct cross-sectional regression analyses using a whole population. We conducted negative-binomial regression analyses using the *GENMOD* procedure in SAS (SAS Institute Incorporated, 2010), with the number of ASH admissions as the outcome, and the following entered as fixed factors: calendar year, ethnicity,
deprivation, sex, age, and DHB. We used negative binomial regression analyses as the count outcome (number of ASH admissions) was overdispersed (mean = 0.052 admissions, variance = 0.154 admissions).

To control for the impact of changes in the admission and discharge practices of hospitals from 2001-2009 on ASH admissions and so control for changes in secondary health care that cannot be attributed to changes in primary health care, we used the hospital admission dataset to calculate (i) the unplanned readmission rate for each DHB for each of the years 2001-2009, calculated as the proportion of acute admissions occurring within 30 days of a previous admission; and (ii) the mean length of stay for each DHB for each of the years 2001-2009. These two measures were also entered as fixed-factors in analyses. Thus, analyses allowed us to assess whether the number of ASH events has increased over time, controlling for ethnicity, deprivation, sex, age, DHB, and DHB-level readmission rate and mean length-of-stay; and whether the number of ASH events is influenced by deprivation and ethnicity, controlling for calendar year, sex, age, DHB, and DHB-level readmission rate and mean length-of-stay.

Because some ASH events were counted as half (as described above), the count of ‘number of ASH events’ included non-whole numbers (e.g., an individual who experienced two full ASH events and one half event in a particular year would be assigned 2.5 ASH events for that year). As negative binomial regression analyses usually require whole numbers, we doubled each individual’s score to produce whole numbers before undertaking analyses. Estimates of effect, e.g., incident rate ratios, have been estimated correctly using these ‘doubled’ counts. However, estimates of group means, e.g., incidence measures derived using the _LSMEANS_ option in SAS, have been estimated as double their true value, so halves of these measures are reported.
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For comparison purposes, we also estimated the prevalence of ASH admissions in the population. Logistic regression analyses using the SAS GLIMMIX procedure with the LSMEANS option were used to estimate prevalence, with ASH (yes/no) as the outcome and ethnicity, deprivation, sex, age, DHB, and DHB-level readmission rate and mean length-of-stay entered as fixed factors. To estimate prevalence accurately given some ASH events counted as half, we estimated (i) the prevalence of having at least one ‘full’ or two ‘half’ ASH event separately from (ii) the prevalence of having a ‘half’ ASH event only, and then added (i) to 0.5 x (ii).

RESULTS

Admissions for ASH rose from 78,878 in 2001 to 98,880 in 2009 (see Table 1). Expressing these as a proportion of all hospitalizations revealed a very slight increase from 12.4% in 2001 to 13% in 2009. The number of admissions for specific ASH conditions is presented in the web appendix.

Population incidence (the number of admissions per 1000 population) and prevalence (the number of people admitted per 1000 population) of ASH is shown in Figure 1. Results are adjusted for DHB, sex, age, ethnicity, deprivation, and DHB-level readmission rate and mean length of stay. After these adjustments, there were small reductions in incidence from 2001-2004 (from 25.3/1000 to 23.3/1000) which then increased slightly from 2004 to 2009 (to 24.4/1000). Prevalence showed a similar trend and indeed tracked incidence across the period, indicating that multiple admissions in a year for ASH events became neither more nor less likely from 2001-2009. The incidence:prevalence ratio was 1.30-1.32 across the period, indicating that each person admitted for an ASH event was admitted approximately 1.3 times each year.

As the role out of primary health care funding increases was staggered by age, we also investigated whether the ASH trend from 2001-2009 varied by age. This is shown in Figure 2, with ASH
incidence shown as percent change since 2001, and age groups chosen to match as best as possible those allocated funding at different times (note our population dataset categorizes age into five-year blocks). Three trends are apparent. First, the oldest (>65 years) and youngest (0-4 years) age groups had ASH rates that declined from 2001-2004 and remained 10-15% lower than 2001 rates through to 2009. Second, the next youngest three age groups (5-14 years, 15-24 years and 25-44 years) had ASH rates that declined by 6-10% from 2001-2004 but returned to baseline levels thereafter. Third, those aged 45-64 showed little change in ASH rates from 2001-2008 but then increased by 10% in 2009.

The effect of deprivation and ethnicity on ASH admissions is shown in Table 2. There was a clear and strong deprivation gradient, with incidence of having an ASH event increasing across deprivation quintiles. Those in deprivation group 5 (the most deprived group) had 2.3 times the number of ASH admissions as those in deprivation group 1 (the least deprived group). Among ethnic groups, the incidence of ASH per 1000 was higher among Pacific (29.6) and Māori (26.1) than among “non-Māori, non-Pacific” (18.4).

Figure 3 shows deprivation and ethnic inequalities over time for ASH events. Panel A of Figure 3 shows that incidence of ASH events decreased sharply for those in deprivation quintile 1 from 2001-2004 before increasing again to 2009. ASH events were stable over time for those in deprivation quintiles 2 and 3, but rose for those in quintiles 4 and 5. This resulted in a widening of ASH incidence between deprivation groups from 2001-2009. Thus, while in 2001 the incidence rate ratio of ASH admissions was 1.5 for those in the worst performing deprivation quintile (5) versus those in the best performing deprivation quintile (1), it was 2.4 in 2009.
Panel B of Figure 3 shows clear ethnic differences in ASH incidence were maintained from 2001-2009, with Pacific having the highest incidence, “non-Māori, non-Pacific” the lowest, and Māori in between. Ethnic differences were greatest in 2001-2 and 2008-9, and least in 2004-5.

Figure 4 explores whether increasing deprivation disparities from 2001-2009 were apparent for each of the three ethnic groups investigated. Three findings are of note. First, deprivation disparities increased for each of the three ethnic groups. Second, deprivation disparities widened most for Māori: the incidence rate ratio of the worst performing versus the best performing deprivation quintile was 1.5 in 2001 and rose to 2.7 in 2009. The equivalent incidence rate ratios for “non-Māori, non-Pacific” increased from 1.7 to 2.4 from 2001-2009, while those for Pacific rose from 1.7 to 2.1. Third, among Pacific, the rank ordering of deprivation quintiles changed markedly over time. For example, those in the least deprived deprivation quintile (1) had the highest incidence of ASH admissions in 2001-2, but among the lowest from 2004-2009.

DISCUSSION

The three main findings of this paper were that (i) reductions in ASH rates were inconsistent in New Zealand from 2001 to 2009, and were dependent on age; (ii) there were clear effects of deprivation and ethnicity on ASH rates; and (iii) deprivation disparities increased over time. Moreover, widening gaps between deprivation quintiles were evident for each of the ethnic groups investigated.

Improvements in ASH rates for sub-populations did not closely match funding increases for those sub-populations. For example, while 0-5 year olds received the earliest increases and 0-4 year olds (the closest age group we could assess) showed sustained ASH reductions from 2001-2009, >65 year olds also showed sustained ASH reductions beginning in 2001 but did not receive funding
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increases in 2004. Similar, 18-24 year olds and 45-64 year olds were not targeted for funding increases until 2005 and 2007, respectively, yet ASH reductions for these groups appeared to occur from 2001-2004 only.

Indeed, most age groups experienced the greatest ASH reductions from 2001-2004, regardless of when funding increases began, and reductions for Māori and Pacific populations were also noticeable from 2001-2004 and diminished thereafter. Timing of funding aside, there is no reason to expect differences between the two periods 2001-2004 and 2005-2009. The same criteria for defining ASH was used throughout, using the same version of ICD (ICD-10AM, version 1). Also while hospitalisations for all conditions increased at a greater rate across 2005-2009 than across 2001-2004, ASH admissions more than kept pace with these (12.4%-12.5% of 2001-2004 admissions were for ASH vs. 12.7%-13.0% of 2005-2009 admissions, see Table 1).

We are left with the conclusion then that while some population sub-groups showed ASH reductions from 2001-2009, these were not strongly aligned with the timing of primary health care funding increases, and were often short-lived. This is despite the fact that these funding increases did bring about improvements to access in the form of reduced fees, greater consultation rates and lower levels of unmet need (Cumming et al., 2008; Cumming & Mays, 2009; Ministry of Health, 2004; 2008).

These findings should be considered alongside other interventions that have improved primary health care access and use but have failed to reduce ASH rates. For example, Saha et al. reported that the Oregon Health Plan, which increased access to health care by extending Medicaid cover to all adults in Oregon whose incomes fell below the federal poverty line, actually produced a slight increase in ASH rates after Medicaid coverage increased (Saha et al., 2007). This suggests that
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bringing about improvements in access and use will not necessarily bring about reductions in ASH rates and that, despite the well-established cross-sectional associations, access may not be the key determinant of ambulatory sensitive hospitalizations.

Our finding of a strong association between deprivation and high rates of ASH, and between ethnicity and rates of ASH is in line with previous work. For example, higher rates of ASH have been reported among those with lower incomes (Rickets et al., 2001; Agha et al., 2007; Agabiti et al., 2009), those from deprived backgrounds (Dharmalingam et al., 2004; Barnett & Malcolm, 2010), Māori and Pacific in New Zealand (Dharmalingam et al., 2004), African Americans in the U.S.A. (Biello et al., 2010; O’Neill et al., 2010), and Indians and Malays in Singapore (Niti and Ng, 2003). Most disturbingly from our work, socio-economic disparities are getting wider. This worrying pattern of increasing inequalities in health outcomes in New Zealand has been reported by others. Baker et al. (2012) report an increase in both socioeconomic and ethnic inequalities in hospital admissions for infectious diseases across 1989-2008.

The strengths of this study include the ability to analyse data for a whole country across nine years, and use of a standardized measure of ASH. Our findings should also be interpreted in the context of the following limitations. First, there are limitations of using administrative data, including potential misclassifications and omissions and the narrow scope of data collected (Grosse et al., 2010). However, the providers of the administrative data – the New Zealand Ministry of Health – have elaborate procedures to ensure the quality of their data, including formal processes for checking the quality of data on ASH (Pidd, 2010). Second, the stability of ASH admissions to New Zealand hospitals over time might be consistent with improved primary care performance if a lower proportion of ASH conditions resulted in hospitalization while simultaneously the prevalence of ASH conditions in the population rose (e.g., due to changes in population health in New Zealand.
access across the period). It may also be the case that access and use improved but primary health care services approach to treatment and referral, or patient adherence to treatment regimes, did not, resulting in a continuing pattern of admissions to hospital for ASH. Third, while we used administrative data from a whole country, we excluded data from a number of private or smaller hospitals and hospitals that did not admit emergency patients. Fourth, we did not undertake analyses of individual ASH conditions (e.g., congestive heart failure, cellulitis), so it is possible that different conditions had different time trends and different associations with ethnicity and deprivation.

Finally, our analyses involved marrying together data from two sources that may not perfectly reconcile. ASH admission data (e.g., age, area deprivation), on the one hand, were recorded at the time of hospital admission (for individuals with multiple admissions we used values from the first admission in each year). Population data, on the other hand, were based on population numbers for each DHB as at June 30 of each of the calendar years 2001-2009, derived from population projections from Census information collected in 2001 and 2006. Inconsistencies between the two sources may occur for a number of reasons (e.g., age changes, residential changes, deaths between hospitalization and when population estimates were compiled). A small number of inconsistencies were found in the data analysed, in that for some strata with small population numbers (e.g., minority ethnicities in older age groups in small DHBs) the number recorded as having been admitted for an ASH event sometimes exceeded the population number in those strata. This affected 567 of 85,050 strata (0.67%), and just 643 individuals (0.002% of the combined New Zealand population aged 0-74 across 2001-2009). We conducted analyses with these strata removed and found that this did not affect results.
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With these limitations in mind, implications of our findings can be noted. First, our results suggest that increasing funding and access to primary health care may not, in and of itself, reduce ASH rates, nor will it reduce inequalities in ASH rates. There are clearly factors other than access that impact rates of ASH and inequalities in rates of ASH. For example, some aspects of primary health care, such as heavy practitioner workload and low continuity of care, have been shown to increase ASH rates (Rizza et al., 2007). Others, such as physician experience and adherence to clinical guidelines, have been shown to decrease ASH (Loeb et al., 2006). The availability and quality of secondary care has also been shown to be important (Rickets et al., 2001; Saha et al., 2007).

Second, it is worrying that inequalities in ASH are on the rise in New Zealand. This may indicate that certain patients are being treated later than they should be, and that their health and quality of life deteriorates to a point where hospitalization becomes necessary (Billings et al., 1993). It is also likely that treatment for these patients is more expensive than if their condition had been treated earlier in primary health care. One New Zealand estimate has suggested that NZ$96 million was spent annually on avoidable hospitalizations in one hospital alone, and most of these hospitalizations were sensitive to primary health care treatment (Sheerin et al., 2006).

Third, modifying factors that have been identified in observational studies as being associated with ASH will not necessarily affect ASH rates. Intervention data, where available, should be used to determine how to modify ASH, and intervention studies, where feasible, should be undertaken to determine the factors that have an impact.

In conclusion, we found that an intervention to improve access did not have long-term effects on ASH rates and actually increased ASH inequalities. This suggests that increasing access to primary health care will not, in and of itself, reduce ASH rates, nor will it reduce ASH inequalities.
REFERENCES


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Figure legends

**Figure 1.** Population incidence and prevalence (per 1000) of ambulatory sensitive hospitalizations (ASH), 2001-2009.

**Figure 2.** Incidence of ambulatory sensitive hospitalizations (ASH) 2001-2009, by age. Lines denote percent change since 2001.

**Figure 3.** Effect of (A) deprivation and (B) ethnicity on ASH events 2001-2009. Plots show incidence rates (per 1000 population), adjusted for sex, age, DHB, DHB-level unplanned readmission rate and mean length of stay, and ethnicity (for deprivation effects in A), and deprivation (for ethnicity effects in B).

**Figure 4.** Effect of deprivation on ASH events 2001-2009 among different ethnic groups. Plots show incidence rates (per 1000 population), adjusted for sex, age, DHB, and DHB-level unplanned readmission rate and mean length of stay for (A) non-Māori, non-Pacific, (B) Māori, and (C) Pacific.
Table 1. Admissions to New Zealand hospitals 2001-2009 for Ambulatory Sensitive Hospitalizations (ASH) for those aged 0-74.

<table>
<thead>
<tr>
<th></th>
<th>Total Admissions</th>
<th>ASH Admissions(^1) (% of total admissions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>635,820</td>
<td>78,878 (12.4)</td>
</tr>
<tr>
<td>2002</td>
<td>636,597</td>
<td>79,424 (12.5)</td>
</tr>
<tr>
<td>2003</td>
<td>640,397</td>
<td>79,569 (12.4)</td>
</tr>
<tr>
<td>2004</td>
<td>648,458</td>
<td>80,620 (12.4)</td>
</tr>
<tr>
<td>2005</td>
<td>664,161</td>
<td>84,643 (12.7)</td>
</tr>
<tr>
<td>2006</td>
<td>685,405</td>
<td>88,815 (13.0)</td>
</tr>
<tr>
<td>2007</td>
<td>695,521</td>
<td>88,791 (12.8)</td>
</tr>
<tr>
<td>2008</td>
<td>723,132</td>
<td>92,819 (12.8)</td>
</tr>
<tr>
<td>2009</td>
<td>763,333</td>
<td>98,880 (13.0)</td>
</tr>
</tbody>
</table>

\(^1\)These include conditions considered as ‘half’ ASH events which count 0.5 towards the total. Numbers are rounded to the nearest whole number.
**Figure 1.** Population incidence and prevalence (per 1000) of ambulatory sensitive hospitalizations (ASH), 2001-2009.
Figure 2. Incidence of ambulatory sensitive hospitalizations (ASH) 2001-2009, by age. Lines denote percent change since 2001.
Table 2. Associations between deprivation, ethnicity and ambulatory sensitive hospitalizations (ASH). Panels show the incidence (per 1000 population) of ASH admissions, and adjusted incident rate ratios (IRR) and 95% confidence intervals of ASH admissions compared to the reference category for each factor. Incident rate ratios are derived from a negative binomial regression adjusted for the other factor (i.e., deprivation is adjusted for ethnicity and ethnicity for deprivation), as well as for district health board (DHB), admission year, sex, age, and DHB-level unplanned readmission rate and mean length of stay. The scaled deviance ($d=3.5\times10^7$, df=$2.8\times10^6$, p>$0.99$) for the model suggested a good fit. Numbers shown are totalled across the nine years: 2001-2009. All associations are significant.

<table>
<thead>
<tr>
<th>deprivation quintile</th>
<th>incidence per 1000</th>
<th>IRR (95% CI)</th>
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<tbody>
<tr>
<td>1 (least deprived)</td>
<td>16.6</td>
<td>--</td>
</tr>
<tr>
<td>(N=6,877,125)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>18.7</td>
<td>1.12 (1.11 - 1.13)</td>
</tr>
<tr>
<td>(N=6,931,338)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>23.3</td>
<td>1.41 (1.39 - 1.42)</td>
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<tr>
<td>(N=6,939,276)</td>
<td></td>
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<tr>
<td>4</td>
<td>30.0</td>
<td>1.81 (1.79 - 1.82)</td>
</tr>
<tr>
<td>(N=6,857,825)</td>
<td></td>
<td></td>
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<tr>
<td>5 (most deprived)</td>
<td>38.4</td>
<td>2.31 (2.30 - 2.33)</td>
</tr>
<tr>
<td>(N=6,957,388)</td>
<td></td>
<td></td>
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<tr>
<td>non-Maori, non-Pacific</td>
<td>18.4</td>
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<tr>
<td>(N=26,866,062)</td>
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<tr>
<td>Maori</td>
<td>26.1</td>
<td>1.42 (1.40 - 1.43)</td>
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<tr>
<td>(N=5,514,880)</td>
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<tr>
<td>Pacific</td>
<td>29.6</td>
<td>1.60 (1.59 - 1.62)</td>
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<td>(N=2,182,010)</td>
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</table>
**Figure 3.** Effect of (A) deprivation and (B) ethnicity on ASH events 2001-2009. Plots show incidence rates (per 1000 population), adjusted for sex, age, DHB, DHB-level unplanned readmission rate and mean length of stay, and ethnicity (for deprivation effects in A), and deprivation (for ethnicity effects in B).
Figure 4. Effect of deprivation on ASH events 2001-2009 among different ethnic groups. Plots show incidence rates (per 1000 population), adjusted for sex, age, DHB, and DHB-level unplanned readmission rate and mean length of stay for (A) non-Māori, non-Pacific, (B) Māori, and (C) Pacific.