Orbital infection in New Zealand: increased incidence due to socioeconomic deprivation and ethnicity

Nicholas R Johnston, Gordon Sanderson

Abstract

Aim This study aimed to identify the relationship between the incidence of orbital infection, ethnicity and socioeconomic deprivation in New Zealand.

Method Cases admitted to all public hospitals in New Zealand with the ICD-10 diagnosis of acute inflammation of the orbit for a 9-year period were retrieved from the National Minimum Data Set. Incidence rates of acute infection of the orbit were correlated with socioeconomic deprivation (measured by New Zealand Deprivation Index) and ethnicity.

Results There were 530 cases admitted with acute orbital inflammation over a 9-year period from 1 July 2000 to 30 June 2009. This study identified a significant association between orbital infection incidence and socioeconomic deprivation and ethnicity.

Cases in the moderate deprivation group had 1.5 times the rate of the least deprived group and the most deprived group had 2.9 times the rate of orbital infection of the least deprived group. Māori had 1.9 times the rate of the European group, and Pacific people had 3.6 times the rate of European group.

Conclusion Greater socioeconomic deprivation, and ethnicity was associated with an increased incidence of orbital infection in New Zealand. The reasons why these associations exist are currently not clear.

Orbital infections are a group of potentially vision and life threatening infections. Orbital infections can range from inflammatory oedema to orbital abscess with cavernous sinus thrombosis. They are more common in younger children, and are often associated with sinusitis. All cases presenting with proptosis, red eye, reduced or painful eye movements and decreased vision are assumed to be an orbital infection until proven otherwise.

Māori and Pacific people have been shown to have higher rates of many diseases, often with poorer prognosis. Deprivation is associated with late presentation of ocular and other diseases. In New Zealand both socioeconomic deprivation and being Māori or Pacific people have been associated with poorer health outcomes.

No published study to our knowledge has looked at the effect of ethnicity or socioeconomic deprivation on the rate of orbital infection. We report the first study looking at socioeconomic deprivation and ethnicity role in orbital infection in New Zealand.
Methods

The New Zealand National Minimum Dataset (NMDS) is a national collection of public and private hospital discharge information, including clinical information, for inpatients and day cases. It uses ICD-10 codes to record primary and secondary admission diagnoses. There is no ICD-10 code for orbital infection so ICD-10 code H050: acute orbital inflammation was used, which includes abscess, cellulitis, osteomyelitis, periostitis, and tendonitis.

All cases with the diagnosis of acute inflammation of the orbit (ICD-10 H050) for a 9-year period from 1 July 2000 to 30 June 2009 were retrieved from the NMDS.

Socioeconomic deprivation was measured by the New Zealand Deprivation index 2001 (NZDep01). This tool uses a meshblock (a geographically defined) measure of deprivation extracted from New Zealand census data. It is based on income, employment, communication, transport, support, qualifications, home ownership and living space.

The NZDep01 divides New Zealand into geographically defined deciles giving a score from 1 to 10, with 10 being the most deprived. For the purposes of this study we grouped NZDep01 into 3 groups 1-3, 4-7 and 8-10, giving low, medium and high levels of deprivation.

In the NMDS ethnicity is self-identified at the time of hospital admission. Up to three ethnic group codes are reported and the Statistics New Zealand prioritisation algorithm is used to generate a prioritised ethnicity that was employed in this study. The cases were grouped into European, Māori, Pacific peoples and other.

Secondary diagnoses, procedures, admitting specialties, and length of hospital stays were also collected. Adjusted incidences to the New Zealand European population where calculated using New Zealand Census data, using Stata/IC 11.0 for Mac.

Results

Over a 9-year period, 530 cases were identified, an incidence of 1.31 per 100,000/year of which 54.5% were male. The median age of admission was 13 years with range from 0 to 91 years. The median length of admission was 3 days with a range of 0-33 days.

The prioritised ethnicity of the cases were 47.9% European, 23.2% Māori, 21.1% Pacific people, and 7.7% were another ethnic group. Cases were admitted under several specialties: ophthalmology (36.2%), paediatrics (32.6%), otolaryngology (9.7%), medicine (11.4%), or other surgical specialties (10.1%).

Fifty-four percent of cases came from the three most deprived socioeconomic groups, with 22.2% of cases being from the most socioeconomically deprived group. There was an increasing proportion of cases admitted with orbital infection as socioeconomic deprivation increased (See Figure 1).

Sixty percent of cases had had a procedure performed. The most common surgical procedures were nasal or sinus surgery (21.7%) and orbital surgery (18.1%). Cases’ secondary diagnoses consistent with orbital infection were sinusitis (37.4%), bacterial infection (29.2%), other ocular inflammation/infection (17%), and cellulitis of the face (8.7%).
Age group infection rates adjusted for deprivation were calculated for each ethnicity (see Figure 2). Pacific people had, for most age groups, a higher rate than both Māori and European people, except for in the over 70 years of age groups where Māori had the highest rates (2 cases in a population of 888).
The low socioeconomic deprivation group had an incidence rate (adjusted for age and ethnicity) of 6.3/100,000, the medium socioeconomic deprivation group had 9.2/100,000 and 18.4/100,000 in the high socioeconomic deprivation group. A statistically significant association was found between NZDep01 score, and age and ethnicity-standardised incidence ratios of orbital infection (see Table 1).

Table 1. Orbital infection rates and standardised incidence ratios (SIR) adjusted for age and ethnicity by socioeconomic deprivation

<table>
<thead>
<tr>
<th>Deprivation group</th>
<th>Cases observed</th>
<th>Adjusted rate/100,000</th>
<th>SIR</th>
<th>SIR confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low deprivation</td>
<td>75</td>
<td>6.3</td>
<td>1</td>
<td>0.79–1.25</td>
</tr>
<tr>
<td>Medium deprivation</td>
<td>164</td>
<td>9.2</td>
<td>1.5</td>
<td>1.25–1.71*</td>
</tr>
<tr>
<td>High deprivation</td>
<td>287</td>
<td>18.4</td>
<td>2.9</td>
<td>2.60–3.29*</td>
</tr>
</tbody>
</table>

*Statistically significant difference (p <0.05).

The European group had an incidence (adjusted for deprivation and age) of 9.7/100,000, the Māori group had 18.3/100,000 and Pacific 31.12/100,000. A statistically significant association was found between ethnicity and age-standardised incidence ratios of orbital infection (see Table 2).

Table 2. Orbital infection rates and standardised incidence ratios (SIR) adjusted for age and deprivation ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Cases observed</th>
<th>Adjusted rate/100,000</th>
<th>SIR</th>
<th>SIR confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>254</td>
<td>9.7</td>
<td>1</td>
<td>0.88–1.13</td>
</tr>
<tr>
<td>Māori</td>
<td>121</td>
<td>18.3</td>
<td>1.9</td>
<td>1.56–2.24*</td>
</tr>
<tr>
<td>Other</td>
<td>40</td>
<td>4.2</td>
<td>0.4</td>
<td>0.31–0.59*</td>
</tr>
<tr>
<td>Pacific</td>
<td>111</td>
<td>34.7</td>
<td>3.7</td>
<td>2.93–4.30*</td>
</tr>
</tbody>
</table>

*Statistically significant difference (p <0.05).

Compared to Europeans in the low deprivation group there was a higher incidence of orbital infection as deprivation increased in the European group (see Table 3). There was also an increased rate of orbital infection as deprivation increased in the Māori group. In the Pacific people group there was no statistically significant difference between the two least deprived groups and the least deprived European group, but the most deprived group had a statistically significant increased rate of orbital infection.
Table 3. Orbital infection rates and standardised incidence ratios (SIR) by ethnicity and socioeconomic deprivation

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Deprivation</th>
<th>Cases observed</th>
<th>Adjusted rate/100,000</th>
<th>SIR</th>
<th>SIR confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>Low deprivation</td>
<td>64</td>
<td>7.7</td>
<td>1</td>
<td>0.77–1.28</td>
</tr>
<tr>
<td></td>
<td>Medium deprivation</td>
<td>113</td>
<td>10.2</td>
<td>1.3</td>
<td>1.08–1.58*</td>
</tr>
<tr>
<td></td>
<td>High deprivation</td>
<td>77</td>
<td>11.3</td>
<td>1.5</td>
<td>1.15–1.82*</td>
</tr>
<tr>
<td>Māori</td>
<td>Low deprivation</td>
<td>2</td>
<td>2.8</td>
<td>0.37</td>
<td>0.04–1.33</td>
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<tr>
<td></td>
<td>Medium deprivation</td>
<td>25</td>
<td>12.9</td>
<td>1.7</td>
<td>1.08–2.47*</td>
</tr>
<tr>
<td></td>
<td>High deprivation</td>
<td>94</td>
<td>27.9</td>
<td>3.6</td>
<td>2.91–4.42*</td>
</tr>
<tr>
<td>Other</td>
<td>Low deprivation</td>
<td>5</td>
<td>1.9</td>
<td>0.25</td>
<td>0.08–0.58*</td>
</tr>
<tr>
<td></td>
<td>Medium deprivation</td>
<td>17</td>
<td>4.6</td>
<td>0.60</td>
<td>0.35–0.96*</td>
</tr>
<tr>
<td></td>
<td>High deprivation</td>
<td>18</td>
<td>6.3</td>
<td>0.82</td>
<td>0.49–1.30</td>
</tr>
<tr>
<td>Pacific</td>
<td>Low deprivation</td>
<td>4</td>
<td>20.4</td>
<td>2.6</td>
<td>0.72–6.78</td>
</tr>
<tr>
<td></td>
<td>Medium deprivation</td>
<td>9</td>
<td>13.7</td>
<td>1.8</td>
<td>0.81–3.38</td>
</tr>
<tr>
<td></td>
<td>High deprivation</td>
<td>98</td>
<td>48.3</td>
<td>6.3</td>
<td>5.09–7.63*</td>
</tr>
</tbody>
</table>

*Statistically significant difference (p <0.05).

Discussion

This is the first reported population-based study of orbital infection by ethnicity and deprivation index in the world. Both deprivation and ethnicity were independently associated with differences in orbital infection rates. The strength of this study lay in its population-base, and that almost all cases with orbital infection would be admitted to hospital, however the data was anonymised so cases transferred between hospitals may have appeared more than once.

One of the weaknesses of the study was that NZDep is not a perfect measure of each case’s socioeconomic deprivation, “Not all ‘deprived people’ live in deprived small areas”. NZDep is not a measure of individual socioeconomic deprivation but of the neighbourhood’s deprivation, but this is the best measure available to us at a population level.

We were unable to measure only orbital infection, but used the closest ICD10 code H050, which includes a number of other related diagnoses. There was the possibility for incorrect coding, but clinical coders receive training and audit to ensure accuracy.

It was likely that we did have a significant number of orbital inflections; approximately 40% had a sinusitis and 8% had a facial cellulitis diagnosed, and about 20% had sinus and/or orbital surgery. The low rate of surgery was not surprising as purely medical management in younger cases with intravenous antibiotics, covering upper respiratory tract pathogens is often effective.

In the European and Māori groups there were increased rates of orbital infection as socioeconomic deprivation increased. This was not shown in the Pacific group. This was likely to be due to the large confidence intervals caused by the small number of Pacific people in the two least deprived groups in the New Zealand population.

The very high rate of orbital infection in Māori over 70 years of age may due to the small size of the census population in this group, as this would give a very high incidence rate with a large confidence interval, when a small number of cases of orbital infection were identified.
Links between socioeconomic deprivation and ethnicity, and other diseases have been observed in New Zealand. Higher levels of socioeconomic deprivation are associated with higher rates of total mortality, admission to hospital, second hand smoke exposure, diabetes, rheumatic fever, ischaemic heart disease, obesity, cervical cancer, breast cancer, hypertension, chronic obstructive pulmonary disease, dental disease, psychological distress and complications of pregnancy.

Māori and Pacific people have higher rates of hospital admission, skin infections, mortality, secondhand smoke exposure, obesity, hypertension, ischaemic heart disease, diabetes, chronic obstructive pulmonary disease, dental disease, and psychological distress.

More than half the Māori population and Pacific peoples live in NZdep01 deciles 8-10, but socioeconomic deprivation does not completely explain the health differences between European and Māori or Pacific people.

Higher orbital infection rates may be due to delayed presentation to primary health care, lack of education, transport or finances. Māori and socioeconomically deprived people have been shown to be less likely to be able to see a primary healthcare provider within 24 hours and not have seen a GP due to cost.

Māori and Pacific people are more likely to report that they feel they are not treated with respect or dignity or listened to carefully, by their healthcare provider.

There have been education campaigns addressed at healthcare providers not to give antibiotics for sinusitis as it is often viral. If the socioeconomically deprived, Māori or Pacific people were prescribed antibiotics they may not take it as people in the most deprived neighbourhoods, and Māori and Pacific people are significantly more likely to have an uncollected prescription due to cost.

There may be some other environmental factors, such as overcrowding at home that ethnicity and socioeconomic deprivation are markers of, rather than the cause of increased orbital infection rates. Māori and Pacific people may have different sinus or orbital anatomy or physiology that puts them at a higher risk of orbital infection.

The association between the orbital infection and ethnicity were different from the association with deprivation, which indicated that ethnicity is not just a marker of socioeconomic deprivation. There may be modifiable factors for Māori, Pacific people and those with socioeconomic deprivation that could potentially decrease their risk of orbital infection.

Identification of these factors may lead to a reduction in the incidence of orbital infection in New Zealand. This suggests a need for targeted health interventions to Māori and Pacific people as well as the socioeconomically disadvantaged.

In summary, this study reports a significant association between New Zealand orbital infection incidence and ethnicity and socioeconomic deprivation (as measured by the NZDep01 deprivation index). The reasons why these associations exist are currently not clear.
Competing interests: None known.

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References:


