

# **A 20-year observational study of paediatric tonsillitis and tonsillectomy**

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## **Introduction**

Tonsillectomy is now only indicated in the UK when specific criteria are met, as outlined by the Scottish Intercollegiate Guidelines Network (SIGN) and NICE. As a result, fewer numbers of tonsillectomy are being performed. Tonsillectomy is the primary treatment for recurrent tonsillitis therefore we hypothesise that acute admissions to hospital with tonsillitis and infective complications will have risen since criteria were introduced. Our aim was to assess the rates of acute hospital admissions with tonsillitis in children and the factors associated with this.

## **Methods**

Data was provided by Information Service Division (ISD) for all under 16s in Scotland between 1996/7 and 2016/17. Socio-economic background was determined from the Scottish Index of Multiple Deprivation (SIMD) score. Poisson regression analysis was used to model predictors of surgery and correlation analysis to study the relationship between tonsillitis and other factors.

## **Results**

60,456 tonsillectomies were performed. The number of tonsillectomies dropped significantly following the introduction of SIGN guidelines and the rates of tonsillitis increased however admissions with tonsillitis were already on an upward trajectory. Children from the most deprived areas were 72.0% more likely to receive tonsillectomy and 72.2% more likely to be admitted with tonsillitis than the least deprived areas.

## **Conclusion**

Tonsillectomy and tonsillitis rates are highest in the most deprived; postulated reasons include antibiotic stewardship and difficulty accessing primary care. Current guidelines on tonsillectomy may be disproportionately harmful in children from deprived households.

*Key Words: tonsillitis, tonsillectomy, paediatric, infectious disease, deprivation*

## **Introduction**

Recurrent tonsillitis results in morbidity, negatively impacts quality of life, and in children, absence from school and extra-curricular activities.<sup>1</sup> Recurrent tonsillitis can be prevented by tonsillectomy which is rationed according to the Scottish Intercollegiate Guideline Network (SIGN) guidelines introduced in 1999.<sup>2</sup> The Department of Health has since identified tonsillectomy as a procedure of 'low clinical value' which further restricted commissioning of this procedure. A study of tonsillectomy data from 2001/2 and 2011/2 in England demonstrated that children from the most deprived areas were around twice as likely to receive tonsillectomy than the most affluent. This became more pronounced in the latter study period especially in children aged <4 years.<sup>3</sup>

In a 20-year nationwide cohort study investigating the trends in adult tonsillectomy rates in Scotland, there was a 48% decrease between 1993/94 and 2015/16. There was a corresponding increase in acute admissions to hospital with severe tonsillitis, quinsy and deep neck space infection (DNSI).<sup>4,5</sup> A study of Scottish paediatric emergency departments in 2000-2013 demonstrated that tonsillitis was among the top 10 most common presenting diagnoses, accounting for 2.5% of admissions in children, with the odds of admission with tonsillitis increasing over the 3-year period.<sup>6</sup> There has been a linear increase in paediatric acute tonsillitis admissions over the decade 1999-2010 which is not purely explained by reduced tonsillectomy rates. Postulated reasons include changes in the definition of admission including greater use of short-stay

observation wards and possible increased virulence of causative bacteria such as group A streptococcus.<sup>7</sup>

Our primary aim was to assess the rates of acute hospital admissions with tonsillitis in Scottish children within the context of changing guidance for tonsillectomy and the effect of deprivation. We then performed a review of the literature to describe the observed trends.

## **Materials and Methods**

In this retrospective cohort study, data relating to tonsillectomy, tonsillitis, quinsy and deep neck space infection in patients under 16 years old were available for all non-obstetric and non-psychiatric hospitals from the Information Services Division (ISD) Scotland. Financial year, sex of the patients, age group and deprivation were included over a 20-year period. Deprivation was ranked according to Scottish Index of Multiple Deprivation (SIMD), a government tool used to identify the level of deprivation in small geographical areas based on postcode.<sup>8</sup> For this study, the rank was divided into 5 groups -1 being the most deprived and 5 being the least deprived - except for the quinsy and DNSI data which was only available in deciles.

Statistical analysis was carried out using RStudio 1.1.463 (RStudio Team, 2016) and the AER (Kleiber and Zeileis, 2008) package. A Poisson regression model was fitted for tonsillectomy using the model parameters; financial year, sex, age group and SIMD quintile. The data was tested for over-dispersion. Dispersion was found to be significantly greater than 1 therefore a Quasi-Poisson regression model was fitted. A standard 5% significance level was used. The baseline year for the Quasi-Poisson regression model was set as 1999/00. Correlation analysis was used to look at the relationship between tonsillectomy and related infections - tonsillitis, quinsy and DNSI. NHS Research and Ethics Committee approval was not required for this study.

## Results

A total of 60,456 tonsillectomies were carried out in under 16s in Scotland between 1996/97-2016/17. In the financial years prior to the introduction of SIGN guidelines (1999/00), there is a significantly higher tonsillectomy rate; in 1996/97 the overall rate of paediatric tonsillectomy is 48% higher than in 1999/00. In recent years, very young children (age 0-4) constitute a greater proportion of those undergoing tonsillectomy [Figure 1]. As demonstrated by previous studies a falling rate of tonsillectomy was accompanied by a steady increase in observed tonsillitis admissions [Figure 2]. Analysing data from 2000/01 onwards - following the implementation of SIGN guidelines - the Pearson  $r = 0.78$  shows significant positive correlation ( $P < 0.001$ ) between tonsillectomy rate and admission with tonsillitis.

Tonsillectomy rates were highest in the most deprived quintile and then followed in order of deprivation to the lowest rates in the least deprived quintile. The rates in SIMD quintiles 1, 2, 3 and 4 were all significantly higher than SIMD quintile 5 ( $P < 0.001$ ), as demonstrated in Figure 3. The model estimates that the children from the most deprived areas were 72.0% more likely to receive tonsillectomy than the least deprived areas. Children from the most deprived areas were also 72.2% more likely to be admitted to hospital with tonsillitis.

There were 569 episodes of hospital admission for quinsy over the 20-year period 1997-2007 with an average annual rate of 2.85 per 100,000. There was no significant correlation between the rates of quinsy and tonsillectomy over the period ( $r = -0.13$ ,  $P = 0.56$ ) although children from SIMD 1 were 59% more likely to be admitted with quinsy than children from SIMD 5. There were 121 episodes of deep neck space infection in Scotland over the study period with an average annual rate of 0.62 per 100,000. When post-SIGN data was analysed, a

moderate, inverse correlation between DNSI and tonsillectomy was observed, but remained non-significant ( $r = 0.45$ ,  $P\text{-value} = 0.071$ ).

## **Discussion**

We have found a strong inverse correlation between tonsillectomy rate and tonsillitis in our paediatric population. However, the rate of hospital admissions with tonsillitis appears to have been on the rise prior to the introduction of the SIGN criteria and since then it has not consistently mirrored tonsillectomy rates. This suggests that there may be factors driving the increasing incidence of tonsillitis in the UK aside from restrictions on tonsillectomy. We identified that socioeconomic deprivation is significantly associated with tonsillitis despite this group still being more likely to have tonsillectomy. To our knowledge, this is the first time this association has been described in the UK population. It has long been established that deprived children are more likely to suffer with infections of the upper respiratory tract and middle ear.<sup>9</sup> The reasons for this are complex, but may include poor nutrition, including lower rates of breast-feeding<sup>10</sup> and higher rates of vitamin D deficiency<sup>11</sup>; poor living conditions, especially damp and mould<sup>12</sup> and parental smoking.<sup>13,14</sup>

Another factor which may lead to increased tonsillitis admission rates are public health interventions which have sought to deter antibiotic-seeking behaviour by parents. NHS messaging around the management of acute sore throat stresses the 'minor viral illness' aetiology, the futility of antibiotics and mainstay of treatment being analgesia and antipyretics.<sup>15</sup> NICE guidance and patient advice website NHS Inform state that, even in the case of bacterial infection, antibiotics are unlikely to reduce the duration of symptoms, and are associated with unpleasant side effects.<sup>16</sup> This may have particularly exacerbated hospital admissions for tonsillitis in socioeconomically deprived communities, where there may already be lower rates of antibiotic prescribing.<sup>17</sup> In a study of UK general

practice prescribing patterns for respiratory tract infection, rates of peritonsillar abscess were significantly higher in practices that prescribed fewer antibiotics. However the effect size is small; the authors calculate that even a 10% reduction in antibiotic prescribing would lead to around 1 additional case of quinsy over 10 years.<sup>18</sup> The effect size of preventing severe tonsillitis was not measured.

Surveys by the group HealthWatch have repeatedly demonstrated that patients have difficulty booking appointments at their GP, especially out of hours.<sup>19</sup> Lack of availability of GP appointments is a key determinant in the decision-making of parents to utilise unscheduled paediatric care.<sup>20</sup> A recent study of GP referrals in England from 2004-2011 demonstrated that a higher number of full-time equivalent GPs leads to lower emergency admission rate, specifically in the most deprived areas.<sup>21</sup> Unfortunately an analysis of general practice workforce distribution in England has shown that there are significantly fewer full-time equivalent GPs in practices in deprived catchment areas and this inequality widened from 2015-2020.<sup>22</sup> This is likely to lead to increased reliance on secondary care for children whose tonsillitis symptoms are worsening with initial conservative management.

National guidelines recommend prescription of antibiotics in the case of sore throat secondary to streptococcal infection.<sup>21</sup> Despite this, SIGN guidelines advise against routine use of throat swabs and rapid tests for Group A Streptococcal (GAS) infections are not recommended as they are “unlikely to be a cost-effective use of NHS resources”.<sup>23</sup> A positive result may not be clinically significant given that the point prevalence of GAS carriage amongst school-aged children is around 16% and the majority of positive throat cultures in this group are not symptomatic.<sup>24</sup> Increased use of throat swabs may facilitate early identification and management of GAS infections, as well supporting clinician decision-making where antibiotic prescription is not indicated. There is some evidence that in countries where throat swabbing is common practice such as

the US, clinicians are more likely to refrain from prescribing antibiotics when a throat swab yielded no growth, thereby supporting antibiotic guardianship.<sup>25</sup> Furthermore, a practice of throat swabbing would provide population-level data regarding evolving trends in microbial pathogenesis and anti-microbial resistance which is currently difficult to establish in the UK.

Our data is concordant with other studies which show the rate of tonsillectomy in children under 4 has been increasing, particularly over the last 10 years.<sup>26</sup> As a consequence of the implementation of SIGN guidelines, the indication for tonsillectomy has shifted away from recurrent tonsillitis. There is increased awareness and subsequent diagnosis of obstructive sleep apnoea (OSA) amongst general practitioners and otolaryngologists. Childhood obesity is an independent risk-factor for sleep-disordered breathing and OSA<sup>27</sup> and is more prevalent in socioeconomically deprived groups which significantly contributes to the association between sleep-disordered breathing and socioeconomic deprivation.<sup>3,28</sup> The emergence of OSA as an indicator for tonsillectomy in children clouds the relationship between tonsillitis and surgery. It may also be partially alleviating the morbidity of recurrent tonsillitis in deprived children and subsequently reducing their chance of acute admissions to hospital.

Due to our study period ending in 2016/7 we cannot comment of the effect of the coronavirus pandemic. A recent UK study demonstrated a dramatic fall in presentations with tonsillar infection because of lockdowns, social distancing and public pressure to avoid coming to hospital during this time.<sup>29</sup> Although this may be true, the disruption to routine operating in the NHS has been significant and the waiting-list for tonsillectomy in many institutions is now at unprecedented levels. Fox et al. described the morbidity of paediatric patients waiting more than 12 months for tonsillectomy.<sup>30</sup> Of the 264 survey responders, 58% of the children were absent from school for greater than 1 week due to sore throats and teachers were concerned about the school progress of 92 children (35%).



UK statistics show that pupils eligible for free school meals (a surrogate marker for deprivation) consistently have higher rates of school absence.<sup>31</sup> Tonsillitis disproportionately affects the same children, contributing to and augmenting this disruption to education. There is also a significant burden on caregivers of children with recurrent tonsillitis. 79% of children required attention over-night at least once a week due to problems with the tonsils and 49% of parents needed to take time off work to care for their children due to tonsillitis. This compounds the negative effect of tonsillitis on socioeconomically deprived families.

Scotland has a single, cohesive national health service and therefore a strength of this study is the availability of high quality, long-term data with national coverage both from ISD - a branch of NHS Scotland - and SIMD, which is collected and updated by the Scottish Government. The SIMD is effective at evaluating the relative deprivation of areas, however it is worth highlighting that not all deprived people live in a deprived area. Also, it is noted that private hospital data is not included in this study which may have increased the surgery rate observed in the most affluent areas.

## **Conclusion**

In conclusion, the decline in tonsillectomies being performed is clearly associated with acute hospital admissions for tonsillitis. There is a significant correlation between deprivation and both tonsillectomy and tonsillitis and the reasons for this are multifactorial. The morbidity associated with rationing tonsillectomy disproportionately affects lower socioeconomic groups. We suggest a revision of the triage criteria for tonsillectomy for recurrent tonsillitis is required to reflect the burden of the disease on factors such as school absence and missed workdays for caregivers. These factors should be carefully considered when re-establishing surgical services following lifting of the pandemic restrictions. We cannot fully explain the increase in tonsillitis admissions in deprived children by

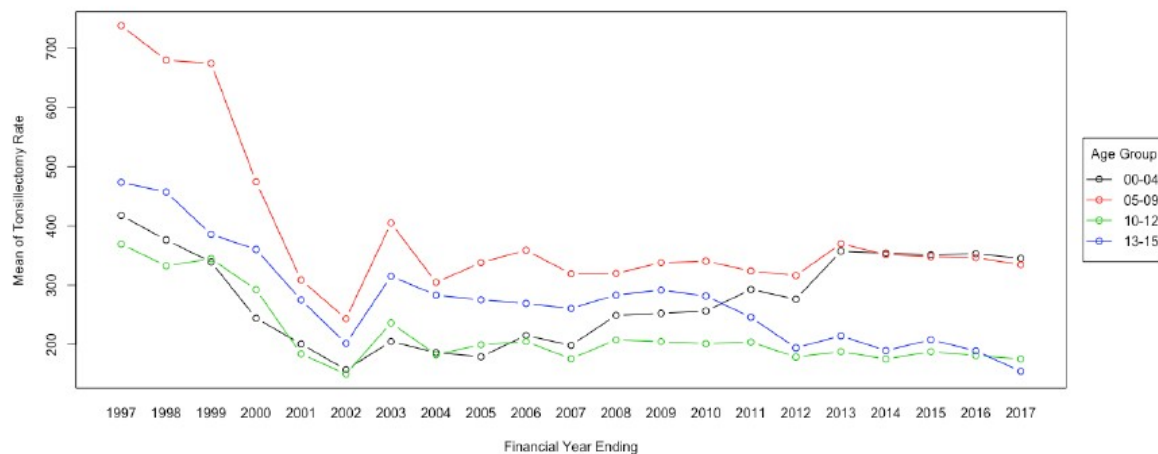
reduced tonsillectomy rate and further assessment should be made of other contributory factors including difficulty accessing primary care.

*What is already known on this topic:*

- The introduction of the SIGN/NICE guidelines on tonsillectomy resulted in reduced numbers of these procedures in adults.
- Since 2000 tonsillectomy rates have remained constant in children although more are happening at a young age for obstructive sleep apnoea.

*What this study adds:*

- Children from deprived areas in Scotland are significantly more likely to require tonsillectomy than the least deprived.
- Children from deprived areas are significantly more likely to be admitted with acute tonsillitis and quinsy than children from the least deprived



areas.

Figure 1: Interaction plot for tonsillectomy rate by age group

**Tonsillectomy and tonsillitis rates per 100,000**

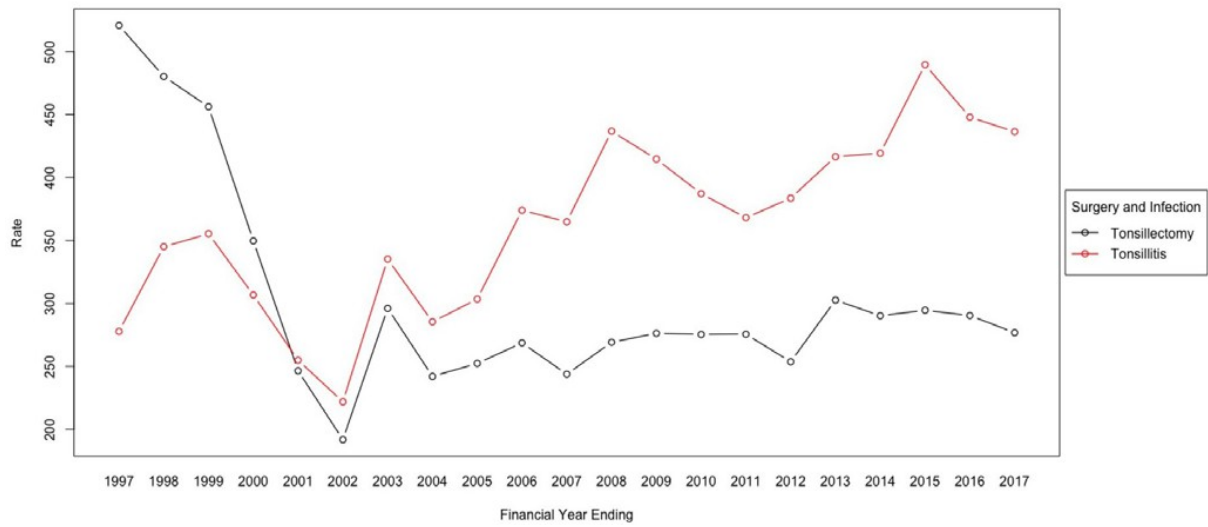


Figure 2. Interaction plot of tonsillectomy and hospital admissions with tonsillitis

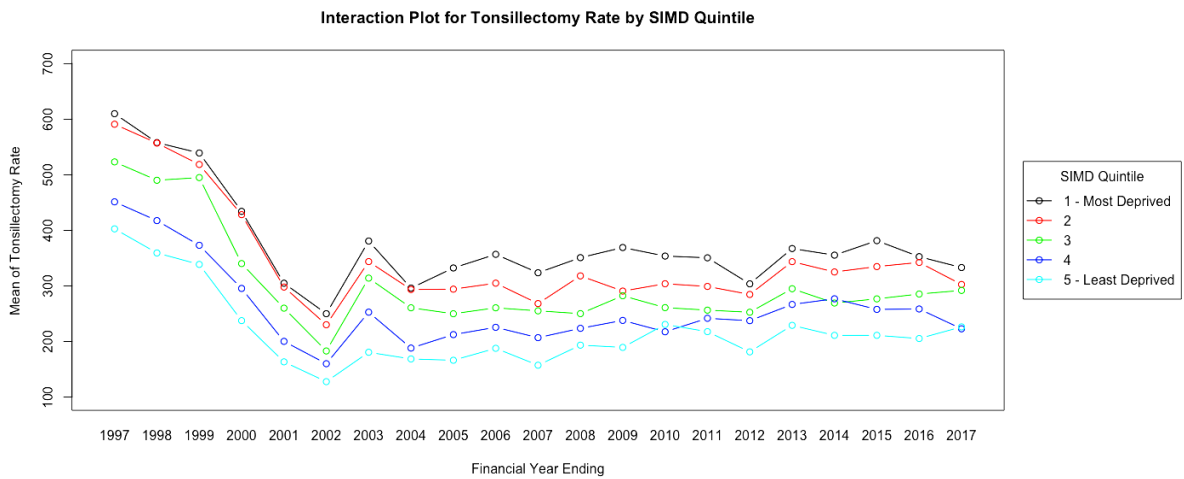


Figure 3: Interaction plot of Tonsillectomy Rate by SIMD Quintile. The yellow vertical line indicates the introduction of SIGN guidelines.

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