

# Day-case tonsillectomy for children in Glasgow: the impact of changing indications and deprivation

W A CLEMENT

*Department of Otolaryngology – Head and Neck Surgery, Royal Hospital for Sick Children, Glasgow, Scotland, UK*

## Abstract

**Objective:** To determine the number of children undergoing tonsillectomy that could have this performed as a day surgery procedure.

**Methods:** This paper reports a prospective cohort study, which entailed a comparison of children's eligibility for day-case surgery between 2001 and 2011 and an assessment of the Scottish Index of Multiple Deprivation scores.

**Results:** In total, 148 children were enrolled. In 2011, 60 children (42 per cent) were eligible for surgery with same day discharge compared with 27 per cent in 2001. The percentage of children undergoing tonsillectomy for sleep-related breathing disorders or obstructive sleep apnoea hypopnoea syndrome increased from 26 per cent to 55 per cent.

**Conclusion:** Eligibility for tonsillectomy with same day discharge has increased. This appears to be related to an increase in the number of children who are able to fulfil the social criteria for same day discharge. The results indicate an association between deprivation and tonsillectomy, particularly surgery carried out for the symptoms of sleep-related breathing disorders or obstructive sleep apnoea hypopnoea syndrome. There has been a significant increase in the percentage of children undergoing tonsillectomy for the indication of sleep-related breathing disorders or obstructive sleep apnoea hypopnoea syndrome.

**Key words:** Adenoidectomy; Ambulatory Surgical Procedures; Audit; Deprivation; Socioeconomic Factors; Tonsillectomy

## Introduction

Paediatric day-case tonsillectomy is a well-established and safe procedure for appropriately selected children.<sup>1,2</sup> There is, however, a large degree of variability, both nationally and internationally, regarding the percentage of children that are appropriate for ambulatory day-case surgery. Many factors will affect eligibility, including medical, social and geographical factors.

This study was undertaken to assess changes in trends in terms of patient eligibility for this procedure in the local population, and to examine what factors might have influenced this. Individuals at the author's institution were particularly interested in the role of deprivation as this has been associated with higher tonsillectomy rates and also has a strong impact on patient selection and appropriateness for tonsillectomy day-case surgery.<sup>3,4</sup> In addition, we wanted to assess changes in the indications for surgery, particularly regarding the number of procedures being undertaken for sleep-related breathing disorders and obstructive sleep apnoea hypopnoea syndrome (OSAHS), to see if this reflected current international trends<sup>5–7</sup> and

also examine what impact, if any, this had on eligibility rates for day-case surgery.

## Materials and methods

The study was undertaken prospectively, using 150 children who were enrolled sequentially. All parents of children undergoing tonsillectomy with or without adenoidectomy, grommet insertion or other minor procedure, who were attending the Royal Hospital for Sick Children, Glasgow, were questioned as part of a routine pre-assessment undertaken by the pre-assessment nursing team at the author's institution. Social and geographical eligibility for day-case surgery was identified using a questionnaire. This was adapted from the 'Guidelines for Day Case Surgery' issued by The Royal College of Surgeons of England<sup>8</sup> and the 'Tonsillectomy and Adenoidectomy Inpatient Guidelines' published by the American Academy of Otolaryngology Head and Neck Surgery (AAO-HNS).<sup>9</sup>

The inclusion criteria are defined in Table I. Patient notes were reviewed to determine the following exclusion criteria: any additional procedure(s) that the

TABLE I  
INCLUSION CRITERIA FOR SAME DAY DISCHARGE

Inclusion criteria
Social
– Access to a telephone
– Access to a car
– Two adults at home
Geographical
– Living <30 min drive from the hospital
Medical
– Non-syndromal children
– Syndromal children who have been screened for OSAHS & have normal sleep studies
– ASA ≤2
– Pulse oximetry or polysomnography <10.0 dips/hour from baseline
– No bleeding diatheses
– No other procedure being performed under same anaesthetic requiring overnight stay
– Age ≥4 y
Min = minutes; OSAHS = obstructive sleep apnoea hypopnoea syndrome; ASA = American Society of Anesthesiologists score; y = years

children may have been scheduled for that required an overnight stay; American Society of Anesthesiologists scores of more than 2; children aged 3 years or younger; and pulse oximetry or polysomnography results showing 10.0 or more dips per hour of more than 4 per cent from baseline. A comparison of the results of studies carried out in 2001<sup>10</sup> and 2011 by individuals at the author's institution was then performed.

Social deprivation scores were identified using the 'Scottish Index of Multiple Deprivation' (2009).<sup>11</sup> This index contains 37 indicators of deprivation covering 7 domains, including: current income; employment; health; education, skills and training; geographic access to services; housing; and crime. The index is presented at data zone level, thereby enabling small pockets of deprivation to be identified. The data zones, which have a median population size of 769, are ranked from most deprived (1) to least deprived (6505) on the overall index and on each of the individual domains. Overall deprivation scores are available for each postal code and are divided into vigintiles for the identification of 5 per cent groupings of deprivation, and quintiles for the identification of 20 per cent groupings of deprivation. Postal codes were used to calculate the percentage of children in each deprivation quintile, with 1 representing the lowest 20 per cent (most deprived) and 5 representing the highest 20 per cent (most affluent). These were then compared to eligibility for day-case surgery. The statistics for the categorical data were calculated using Fisher's exact test.<sup>12</sup> Unpaired data were analysed using the Mann–Whitney U test.<sup>13</sup>

## Results

In total, 148 children were enrolled. Two were excluded as they did not require tonsillectomy. Of the 146

children, 67 (46 per cent) underwent tonsillectomy for symptoms of sleep-related breathing disorders or OSAHS, 64 (44 per cent) underwent tonsillectomy for recurrent tonsillitis, 14 (10 per cent) underwent tonsillectomy for recurrent tonsillitis and sleep-related breathing disorders or OSAHS, and 1 (less than 1 per cent) underwent tonsillectomy for tonsillar asymmetry.

The results for deprivation related to indications for surgery are shown in Figure 1. Thirty-eight children underwent tonsillectomy with or without other procedures, and 108 children underwent adenotonsillectomy with or without other procedures. Other procedures included grommet insertion (10 cases), microlaryngobronchoscopy (8 cases including 1 supraglottoplasty) and other minor procedures (3 cases). There were 98 boys and 67 girls. The average age of all children undergoing tonsillectomy was 5.0 years (median = 5.0 years, range 1–13 years). The respective mean and median ages were 6.8 years and 6.5 years (range 1–13 years) for the recurrent tonsillitis group, 3.5 years and 3.0 years (range 1–9 years) for the sleep-related breathing disorders or OSAHS group, and 3.7 years and 3.0 years (range 2–11 years) for those children listed as having both indications. Age distribution for the indications is shown in Figure 2. The average age of all children undergoing tonsillectomy in the 2001 cohort was 7.4 years.

Sixty children (42 per cent) were eligible to have their procedure(s) performed with same day discharge. A comparison of the 2001 and 2011 results is shown in Table II. Forty-one children (28 per cent) were ineligible for social reasons, including distance. This was less than in 2001 but the difference did not reach statistical significance. A breakdown of eligibility due to social criteria is provided in Table III. Sixty-six children (45 per cent) were ineligible for medical reasons, including

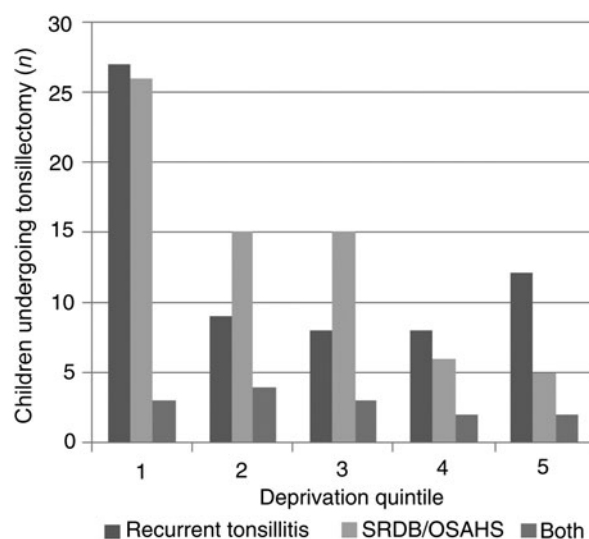


FIG. 1

Number of children undergoing tonsillectomy in each deprivation quintile per indication in 2011. SRDB = sleep related disordered breathing; OSAHS = obstructive sleep apnoea hypopnoea syndrome

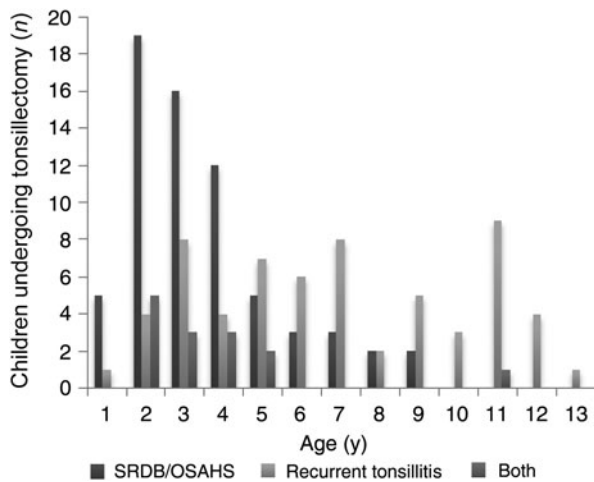


FIG. 2

Age distribution of all children undergoing tonsillectomy for each indication. Y = years; SRDB = sleep related disordered breathing; OSAHS = obstructive sleep apnoea hypopnoea syndrome

9 that were due to have other operations performed under the same anaesthetic which were not suitable for same day discharge, 12 children were ineligible because their American Society of Anesthesiologists score was more than 2, and 61 were ineligible as they were 3 years or younger. Of the 81 children undergoing tonsillectomy with symptoms of sleep-related breathing disorders or OSAHS, 35 (43 per cent) underwent pre-operative sleep examination (33 using home pulse oximetry and 2 using polysomnography). The findings for 5 of these children (14 per cent) demonstrated more than 10 dips per hour of greater than 4 per cent, which is consistent with moderate to severe OSAHS.

Deprivation was associated with tonsillectomy, with 39 per cent of children falling into the most deprived quintile and 13 per cent in the least deprived quintile. There was a trend for an association between eligibility for day-case surgery and deprivation when tonsillectomy overall was examined, with 39 per cent of children

TABLE II  
ELIGIBILITY FOR SAME DAY DISCHARGE IN 2001 AND 2011

Eligibility	2001* (n (%))	2011 (n (%))	p-value
Eligible for same day discharge	27/100 (27)	60/146 (42)	0.030
Excluded for social reasons incl geographical	39/100 (39)	41/146 (28)	0.096
Excluded for social reasons alone	33/94 (35)	33/138 (24)	0.076
Excluded for all medical reasons incl age	40/100 (40)	66/146 (45)	0.435
Excluded for medical reasons (excl age)	40/100 (40)	12/146 (8)	0.0001
Excluded because <3 y	13/100 (13)	34/146 (23)	0.049

\*Data values as reported in the 2001 study.<sup>10</sup> Incl = including; excl = excluding; y = years

TABLE III  
INELIGIBILITY FOR SAME DAY DISCHARGE IN 2001 AND 2011\*

Reason for ineligibility	2001† (n (%))	2011 (n (%))	p-value
No telephone	6/100 (6)	1/146 (1)	0.02
Travel (>30 min drive)	6/100 (6)	11/146 (8)	0.80
Only one adult at home	11/100 (11)	19/146 (13)	0.70
No car	29/100 (29)	20/146 (14)	0.005

\*A comparison of social and geographical reasons. †Data values as reported in the 2001 study.<sup>10</sup> Min = minutes

in the lowest quintile being eligible for same day discharge compared with 52 per cent of those in the highest quintile, but this did not reach statistical significance ( $p = 0.366$ ). There was, however, a strong association between eligibility for day-case surgery and deprivation when children with sleep-related breathing disorders or OSAHS were examined as a subgroup, with only 10 per cent of children in the lowest quintile being eligible for same day discharge compared with 57 per cent of those in the highest quintile ( $p = 0.012$ ; Figure 3). For tonsillectomies overall, an examination of eligibility for same day discharge due to social reasons and deprivation demonstrated a weak trend, which again did not reach statistical significance: 69 per cent of children in the lowest quintile were eligible for same day discharge compared with 88 per cent of those in the highest quintile in this group ( $p = 0.067$ ). However, there was a strong association when examining this eligibility criterion for the sleep-related breathing disorders or OSAHS subgroup: 54 per cent of children in the lowest quintile were

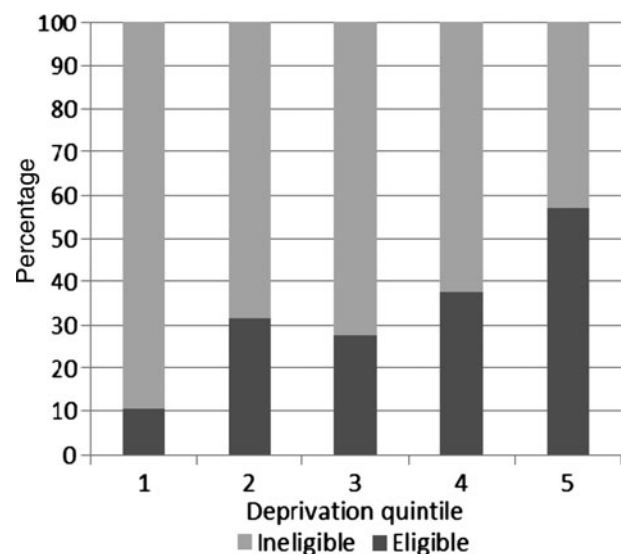


FIG. 3

Same day discharge eligibility rates of all children undergoing tonsillectomy for sleep-related breathing disorders or obstructive sleep apnoea hypopnoea syndrome in each deprivation quintile.

eligible for same day discharge compared with 100 per cent of those in the highest quintile ( $p = 0.013$ ).

## Discussion

Tonsillectomy is one of the most commonly performed paediatric surgical procedures in the UK, with 27 319 procedures performed on children aged 14 years or younger in England within the last year.<sup>14</sup> Paediatric day-case tonsillectomy has been established as a safe procedure for appropriately selected children and is frequently undertaken in North America, Australasia and Europe.<sup>1,2,15,16</sup> There is a growing drive to increase the number of ambulatory same day discharge tonsillectomies in the UK. However, same day discharge in the UK remains uncommon; between 2003 and 2004, only 12.4 per cent of all patients – adults and children included – underwent tonsillectomy as a planned same day discharge procedure in England and Northern Ireland.<sup>17</sup>

This study was undertaken to determine changes in patient eligibility for day-case tonsillectomy in the local population, and to ascertain what factors may have influenced such changes. An initial study was undertaken in 2001 to assess the possibility of establishing a same day discharge service.<sup>10</sup> This demonstrated such a low eligibility rate that it was felt the service was not viable at that time. At the author's institution, eligibility for day surgery has subsequently increased from 27 per cent to 42 per cent over the 10-year period. This appears to mainly be due to a change in the social factors associated with eligibility, with only 28 per cent now being excluded on these criteria compared with 39 per cent in 2001. The percentage of children ineligible for medical reasons has remained constant at around 40–45 per cent.

Compared with other studies, eligibility rates at the author's institution are in the mid-range. These other studies show considerable regional variations in eligibility, within the UK and also internationally. In the UK, reported day-case surgery eligibility rates have ranged between 16 and 92 per cent.<sup>18–23</sup> Internationally, individual unit studies from the US, France and New Zealand have reported patient eligibility rates of 80 per cent, 86 per cent and 93 per cent respectively.<sup>24–26</sup>

When examining how many children are eligible for day-case tonsillectomy, it is important to determine the grounds on which they might fail to be eligible. Overall ineligibility on social grounds appears to be more common in the UK, with rates ranging between 24 and 82 per cent, compared with ineligibility on medical grounds, which ranges between 8 and 40 per cent.<sup>18–21</sup> Interestingly, this was not the case in this study, in which the main reason for ineligibility was medical reasons. It is suspected that this decrease in exclusion on social grounds most likely represents an overall improvement in social conditions over time. However, no other studies seem to have examined

this factor and so it is not possible to provide any comparisons.

There are a multitude of factors that may have contributed to the large variations in eligibility for same day surgery across different populations. These include: variations within populations in terms of medical, geographical, economic factors and so on; the available facilities (e.g. high dependency unit, paediatric intensive care unit and paediatric anaesthetic services); and also the interpretation and compliance with, or variations in, local or national clinical guidelines.<sup>27–29</sup>

There are several clinical guidelines, including those for paediatric tonsillectomy relating to indications, appropriateness for day surgery, the recommended level of post-operative care, and guidelines for when investigation is required.<sup>8–9,30–35</sup> The clinical guidelines for recurrent tonsillitis are the most robust, but there remains a great deal of flexibility in the guidelines for tonsillectomy as a treatment for sleep-related breathing disorders or OSAHS, which is mainly due to the limited evidence on which they are based.

The Royal College of Surgeons of England have issued 'Guidelines for Day Case Surgery' in the UK,<sup>8</sup> as have the AAO-HNS in North America,<sup>9</sup> although there remains significant debate concerning the latter.<sup>1</sup> At the author's institution, we have based our same day discharge criteria on these two documents, but no longer adhere to the absolute contraindication of sleep-related breathing disorders or OSAHS when considering a child for same day discharge. We based this decision on the work of Brigger and Brietzke.<sup>1</sup> They compiled an evidence-based review of outpatient tonsillectomy in children, which incorporated 17 articles and included 7500 children. The authors identified a higher rate of complications in those children with sleep-related breathing disorders or OSAHS but noted that 'the increased complication rate among those with OSAHS as a possible diagnosis may be secondary to age effects and not indicative of OSAHS as an independent modifier of operative risk'. The majority of children with sleep-related breathing disorders or OSAHS had been, as they were in the current series, diagnosed on clinical grounds alone. Individuals at the author's institution are extremely cautious regarding this issue and have used overnight pulse oximetry in selected children to try to identify those whose surgery might be more appropriately undertaken on an in-patient basis. We recognise that polysomnography remains the gold standard for the investigation and diagnosis of OSAHS, and that the sensitivity and specificity of pulse oximeters and their effectiveness in diagnosing OSAHS is still a matter of debate.<sup>36–38</sup> However, as we have reasonable accessibility to pulse oximetry and waiting times for full polysomnography are lengthy, we continue to use pulse oximeters as a screening tool to identify those children who may require overnight admission, and we are not alone in taking this approach.<sup>28,39,40</sup> Sleep

studies (predominantly pulse oximetry) would have altered the management in 6 per cent of children (5 out of 81) who underwent tonsillectomy for sleep-related dissociative disorders and OSAHS in this study.

With regards to the risk factors for post-operative complications and unplanned re-admissions, two large studies have identified an increased risk for children aged less than four years. In their meta-analysis, Brigger and Brietzke<sup>1</sup> demonstrated that being under the age of four years was associated with a higher rate of early complications (12.3 per cent vs 7.9 per cent) and unplanned admissions (13.7 per cent vs 8.5 per cent) in children undergoing tonsillectomy, compared with older children. This is supported by the work of Bhattacharyya<sup>2</sup> who reviewed tonsillectomies as part of the US National Survey of Ambulatory Surgery in 2006. The review, which incorporated around half a million children, revealed that those under the age of 4 years had a return to hospital rate of 2.5 per cent, with an unplanned admission rate of 9.28 per cent. These rates were significantly higher than those of older children. The author's institution therefore included being aged four years or older as one of the inclusion criteria, which is a year older than in the original study. A large number of children (42 per cent) in the current series were not eligible for day-case surgery on these grounds. There are two presumed reasons why so many of the children in this series are aged three years or younger. Firstly, sleep-related breathing disorders or OSAHS are more prevalent in this age group. Secondly, there may be a possible referral bias as a result of The Royal College of Anaesthetists document 'Guidance on the provision of paediatric anaesthesia services',<sup>41</sup> several district general hospitals that are geographically close to our hospital now routinely refer younger children to our department for surgery.

Bisset and Russell<sup>3</sup> were the first to note an association between deprivation and tonsillectomy in the UK. Internationally, both Croxford *et al.*<sup>42</sup> and Brouillette *et al.*<sup>43</sup> noted a similar association in Canada. However, deprivation appears to be inversely related to tonsillectomy in the US. Boss *et al.*<sup>44</sup> reported that, in the US, children with private medical insurance were more likely to undergo adenotonsillectomy. In addition, these authors identified that children of racial and/or ethnic minority and low socioeconomic status appeared to have a higher prevalence and greater risk for sleep-related breathing disorders or OSAHS. Drake-Lee and Harris<sup>4</sup> have previously commented on the impact of social deprivation on the eligibility of paediatric patients for day-case tonsil surgery. They noted that children deemed socially suitable for day-case tonsillectomy dropped from 95 per cent in the least deprived quintile to 55 per cent in the most deprived quintile. A similar but weaker association was noted in the current study (88 per cent in the most affluent quintile compared with 69 per cent in the most deprived quintile). In our study, the association

was strongest in the sleep-related breathing disorders or OSAHS subgroup when looking at both social reasons alone as well as all reasons for ineligibility for same day discharge.

- **Day-case tonsillectomy appears safe in appropriately selected children, but remains uncommon in the UK**
- **Tonsillectomy is associated with deprivation**
- **Eligibility rates for day-case tonsillectomy appear to be rising due to improved social conditions**
- **Internationally, tonsillectomies undertaken for sleep-related breathing disorders or obstructive sleep apnoea hypopnoea syndrome are increasing**
- **Changes in case mix reflect international trends; this has not previously been documented in the UK**

This study identified a significant change over time in terms of the indications for tonsillectomy. In particular, there was an increase in the number of procedures being undertaken for sleep-related breathing disorders and OSAHS. This change reflects current international trends, which show a decrease in the number of children undergoing tonsillectomy for infective causes and an increase in those having the surgery for sleep-related breathing disorders or OSAHS.<sup>5-7</sup> There has been no study of trends for these indications in the UK, but the 2003–2004 national audit of tonsillectomies carried out in England, Wales and Northern Ireland did identify that sleep-related breathing disorders or OSAHS were the indications for tonsillectomy in 33 per cent of children under 5 years and in 9 per cent of 6–16 year olds.<sup>17</sup> The reason that this indication is as high as 55 per cent in the current study is because all children with symptoms of sleep-related breathing disorders or OSAHS were included in this group. Even if those children with symptoms of both sleep-related breathing disorders or OSAHS and recurrent tonsillitis are excluded, sleep-related breathing disorders or OSAHS alone still results in 46 per cent of the total. The frequency of sleep-related breathing disorders or OSAHS as indications for surgery in this series is similar to the findings of two recent North American studies. Parker and Walner (2011)<sup>5</sup> identified that obstruction was the primary indication for tonsillectomy in 91.8 per cent of patients in a 0–3 year age group. This rate fell to 73.2 per cent in a group of 4–10 year olds and to 43.0 per cent in a group of 11–18 year olds. Erickson *et al.*<sup>7</sup> identified a significant increase in the incidence of children having their tonsils out for the indication of upper airway obstruction, increasing from 12 per cent in 1970 to 77 per cent in 2005. We suspect that the high incidence in

this study is likely to be a reflection of these trends and the result of a referral bias as previously discussed.

There are several acknowledged weaknesses of this study. These include the small sample size. There is also the possibility that the deprivation associated with the tonsillectomy group may simply reflect the general population distribution for the catchment area, as the author's institution provides a service to some of the areas of greatest deprivation in Scotland.<sup>3</sup> However, a much larger national population-based study, that included our catchment area, has already demonstrated the association between tonsillectomy and deprivation.<sup>3</sup> It is also recognised that the evidence behind the age inclusion criteria and the use of pulse oximetry for screening is not as robust as one would like them to be and that these factors have a significant impact on eligibility. It is possible that some children in the 2–4 year old group might be appropriate candidates for ambulatory day-case surgery. In addition, the study arbitrarily used 10 dips per hour of greater than 4 per cent from baseline saturations on overnight pulse oximetry for the eligibility criteria, although the research supporting this threshold was derived using polysomnography.<sup>34</sup>

In conclusion, the eligibility rates for day-case tonsillectomy appear to have increased over time due to improved social conditions. Tonsillectomy remains associated with deprivation, and sleep-related breathing disorders or OSAHS appear to have a stronger association with deprivation than recurrent tonsillitis.

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Address for correspondence:  
Mr W A Clement,  
Department of Otolaryngology – Head and Neck Surgery,  
Royal Hospital for Sick Children,  
Glasgow G3 8SJ,  
Scotland, UK

Fax: 0141 2010865  
E-mail: [wcclement@nhs.net](mailto:wcclement@nhs.net)

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