BAOMS bursary 2023

Title: Re-repair of cleft palates – an evaluation of postoperative outcomes.  
  
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# Abstract

## Objectives

Cleft palate re-repair is an effective treatment for velopharygneal insufficiency (VPI) in patients who have previously undergone a cleft palate repair. In such cases, the purpose of the palate re-repair is to improve velar function; which in turn improves speech outcomes including hypernasality, audible nasal emission, nasal turbulence and intelligibility. The objective of this study was to evaluate the clinical speech outcomes of cleft palate re-repair (CPR-R) performed at a UK cleft centre.

## Materials and Methods

102 patients who underwent a CPR-R by a single surgeon over the 10 year period from 1st January 2011 – 31st December 2021 were identified. Retrospectively, clinical data including preoperative and postoperative speech assessment using the Great Ormond Street Speech Assessment was collected and analysed to determine comparative improvement. Cases that required further re-operation for ongoing VPI were examined in further detail, including the nature of any additional velopharyngeal surgery and subsequent speech outcome.

## Results

Of 102 patients who underwent CPR-R in the 10-year period reviewed, 84.4% of patients did not require further speech surgery. The mean age of patients undergoing CPR-R was 6.5 years. Postoperatively, 60% patients achieved no hypernasality whatsoever and over 83% of our patients were found to have no hypernasality, inconsistent mild hypernasality or consistent mild hypernasality following CPR-R surgery.

## Conclusion

Secondary repair of cleft palate can significantly improve velar function, resulting in velopharyngeal sufficiency and associated improvements in speech. This service evaluation presents the outcomes for patients who underwent CPR-R at a specialist cleft lip and palate unit.

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# Introduction

In primary cleft palate repair surgery, the major aim of treatment is to achieve velopharyngeal sufficiency which results in normal speech and palatal function.1 However, following cleft palate repair, it has been reported that between 20% and 50% patients will go on to develop velopharygneal insufficiency (VPI).2 Cleft palate re-repair (CPR-R) is an effective treatment for VPI in patients who have previously undergone a cleft palate repair. As with primary surgery, the purpose of the palate re-repair is to improve velar function; which in turn improves speech outcomes including hypernasality, audible nasal emission, nasal turbulence and intelligibility.

Many surgical techniques have been described for CPR-R, including pharyngeal flaps, pharyngoplasties, Furlow palatoplasty and intravelar veloplasty.2 The intravelar veloplasty CPR-R technique has gained popularity in more recent years due to high reported success rates, and a lower risk of postoperative complications such as obstructive sleep apnoea when compared with other techniques.2–4

The aim of this service evaluation was to determine the success rates of CPR-R surgery performed at a specialist UK cleft centre. The objectives of the service evaluation were to assess success rates in terms of need for re-operation and speech outcomes, as well as to identify any patient groups who may be more likely to require CPR-R surgery by retrospectively reviewing patient records.

# Method

This was a retrospective evaluation of the cleft service at a single unit. The evaluation had the approval of the unit’s clinical effectiveness unit to access patient records for evaluation, patient information and quality improvement purposes. All patients who underwent CPR-R by a single surgeon over a 10- year period from 1st January 2011 to 31st December 2021 were identified. All patients underwent the same CPR-R technique, intravelar veloplasty, as outlined by the Sommerlad technique (1994).3

Clinical data was collected and analysed, including; demographics, cleft type, speech outcomes, presence or absence of a palatal fistula, whether the patient had a diagnosed syndrome, and the need for further speech surgery, where applicable. Outcomes of further surgery, when carried out, were also evaluated.

Speech outcomes were measured using the Great Ormond Street Speech Assessment (GOS.SP.ASS) tool. Within the patient records, GOS.SP.ASS scores have been recorded over the time period evaluated pre-CPR-R, post-CPR-R and following further speech surgery if required. The GOS.SP.ASS scores were evaluated by specialist speech and language therapists, who graded each parameter by severity. The severity scores for hypernasality, hyponasality, nasal emission and nasal turbulence were recorded for each patient. These parameters were further analysed for comparative improvement.

GOS.SP.ASS scores within some parameters were not available for all patients, but the recorded data available in these cases was still included for analysis. Cases that required further re-operation for ongoing VPI were examined in further detail, including the nature of any additional velopharyngeal surgery and subsequent speech outcome.

Results were analysed using Microsoft Excel and SPSS statistics. Our results were then compared to those of the literature, which informed ideal outcomes in terms of need for further surgery and speech. Where paired data was available, changes in GOS.SP.ASS scores were analysed using the Wilcoxon signed-rank test (two tailed) at a significance level of 0.05.

# Results

Over the 10 year period included in the evaluation, 104 children underwent CPR-R surgery. 2 patients were excluded as they had not yet attended for postoperative GOS.SP.ASS evaluation, and thus a possible need for further surgery could not be determined. Therefore, the records of 102 patients in total were analysed.

Patient postoperative GOS.SP.ASS scores were recorded on average between 17.4 months following surgery, with a standard deviation from the mean of 11.7 months. The minimum postoperative time to review with recorded GOS.SP.ASS score was 3 months, and the maximum was 72 months. It is worth noting that a significant proportion of patients had a delayed GOS.SP.ASS review due to the COVID-19 pandemic. The median time to review was 14 months.

## Demographics

The average age of patients undergoing CPR-R surgery within the cohort was 6.6 years, with a standard deviation from the mean of 3.6 years. The minimum patient age was 1.8 years, and the maximum age 16.5 years. The median age of the cohort was 5.6 years.

## Need for further surgery

Of 102 patients included in the evaluation, 18 required further speech surgery. As such, 82.4% of patients who underwent CPR-R over the 10 year period did not require any further speech surgery.

Figure 1 – Percentage of patients requiring further speech surgery

## Cleft Type

From the records obtained, 97 patients had a clear note of cleft type – broadly broken down into submucous cleft palate (SMCP), cleft palate (CP), unilateral cleft lip and palate (UCLP) and bilateral cleft lip and palate (BCLP). The breakdown of cleft type by percentage is demonstrated in table 1, below.

Of 18 patients who required further speech surgery, 17 had a clear record of cleft type within their medical notes. The breakdown of cleft type by percentage is demonstrated in table 2, below. In addition, a comparison of cleft type in patients not requiring further surgery, as compared to those requiring further surgery is presented in figure 2.

|  |  |
| --- | --- |
| Cleft Type | Percentage |
| SMCP | 7.2 |
| CP | 54.6 |
| UCLP | 27.8 |
| BCLP | 10.3 |

|  |  |
| --- | --- |
| Cleft Type | Percentage |
| SMCP | 5.9 |
| CP | 47 |
| UCLP | 29.4 |
| BCLP | 17.6 |

Table 1 – Comparison of cleft type in all patients, by percentage

Table 2 – Comparison of cleft type in patients requiring further surgery, by percentage

Figure 2 – Breakdown of cleft type, comparing those requiring further surgery with those not requiring further surgery

## Speech outcomes, as recorded by serial GOS.SP.ASS scores

In total, 97 patients had recorded GOS.SP.ASS scores for hypernasality, hyponasality, nasal turbulence and nasal emission. Each parameter is recorded a score of absent, mild, moderate or severe – denoted as 0, 1, 2 and 3 respectively. For hypernasality, an additional category of mild inconsistent (denoted 0-1) is accepted in the literature.5

Preoperative and postoperative values for hypernasality, hyponasality, nasal emission and nasal turbulence were graphically plotted with preoperative scores on x-axis and postoperative scores on y-axis, with each dot representing a patient. The results were “jittered” so that patients with similar scores could be visualised on the graphic representation.

Figure 3 – “Jittered” preoperative (x-axis) and postoperative (y-axis) scores for hypernasality, hyponasality, nasal emission and nasal turbulence.

## Hypernasality

Figure 4 demonstrates hypernasality GOS.SP.ASS scores, using the “traffic light” system to allow comparison of preoperative and postoperative scores. Where further surgery was undertaken, further postoperative scores were also included. On Wilcoxon signed-ranked test evaluation, improvements in hypernasality were statistically significant (p < .00001). There was a strong correlation between preoperative severity of hypernasality and postoperative severity of hypernasality. It is evident from the colour distribution in figure 3 that, in general, hypernasality scores improved following CPR-R surgery.

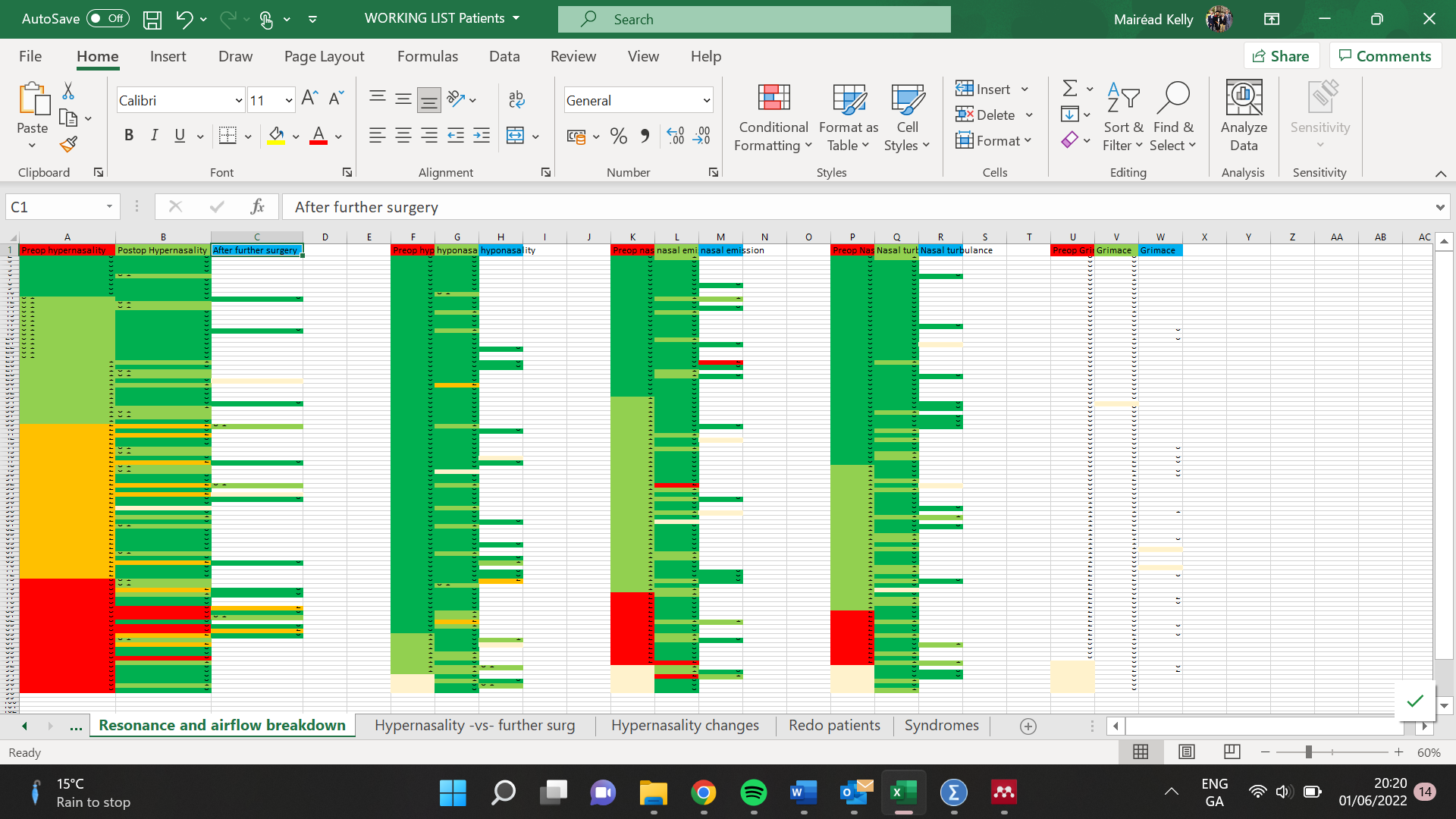
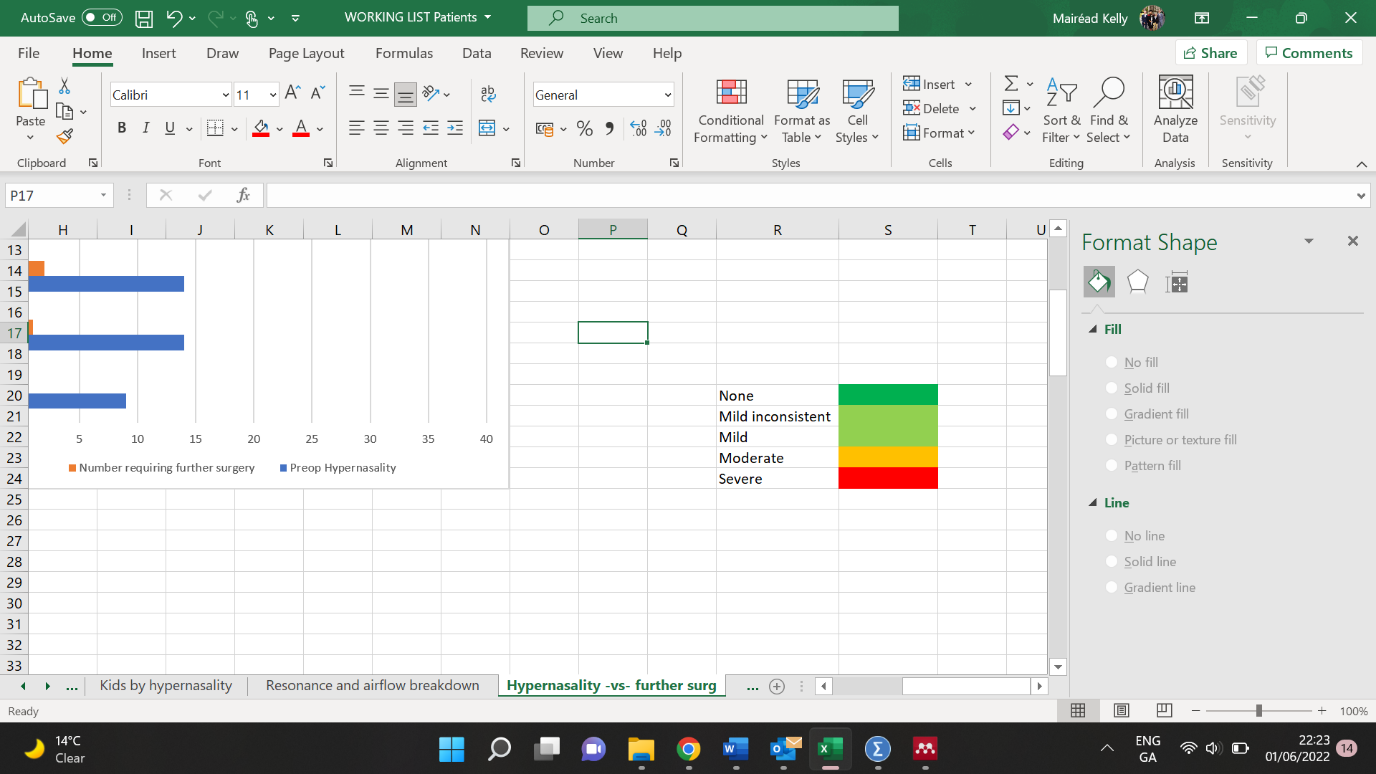


Figure 4 – Preoperative, postoperative and post-further surgery hypernasality scores, as demonstrated by the “traffic light” system

|  |  |  |
| --- | --- | --- |
| Score | Preop | Postop |
| 0 | 10 | 57 |
| 0-1 | 14 | 16 |
| 1 | 14 | 7 |
| 2 | 25 | 9 |
| 3 | 33 | 6 |

The number of patients who had no hypernasality, inconsistent hypernasality, mild hypernasality, moderate hypernasality and severe hypernasality are illustrated in table 4 and figure 5, whilst the comparative percentages are demonstrated visually in figure 6. These figures demonstrate that the preoperative hypernasality scores show a greater degree of severity than those recorded postoperatively. In addition, almost 60% patients had no recorded hypernasality postoperatively. In total, 83.34% of patients had a hypernasality score of 1 or less following CPR-R surgery.

Table 4 - Preoperative and postoperative hypernasality scores, by number of patients

Figure 5 – Preoperative and postoperative hypernasality scores, by number of patients

Figure 6 – The percentage change of preoperative hypernasality when compared with postoperative hypernasality

Finally, the preoperative hypernasality score was compared to the number of patients requiring further surgery in each score category. It is unsurprising that a greater proportion of patients who required further surgery had preoperative scores of 2 or 3 for hypernasality, than those who scored 1 or less. This is demonstrated in figure 7, which demonstrates that the higher the score for hypernasality, the greater the number of patients who later required further surgical intervention.

Figure 7 – The breakdown of severity of hypernasality versus the need for further surgery

## Hyponasality

Hyponasality parameters were graded on the GOS.SP.ASS score as absent, mild, moderate or severe in a similar manner to those of hypernasality (scoring 0, 1, 2 or 3). On evaluation of hyponasality data using a Wilcoxon signed-rank test, the changes were not statistically significant (p = 0.0703). It is interesting to note that in some cases, CPR-R resulted in a higher postoperative hyponasality score than preoperatively. Of 93 patients where hyponasality scores were available, 15 patients (16.1%) appeared to have a worse hyponasality score postoperatively. However, it is worth noting that of these, 12 patients had moderate or severe preoperative hypernasality scores. These 12 patients all saw improvement in their hypernasality scores following CPR-R.

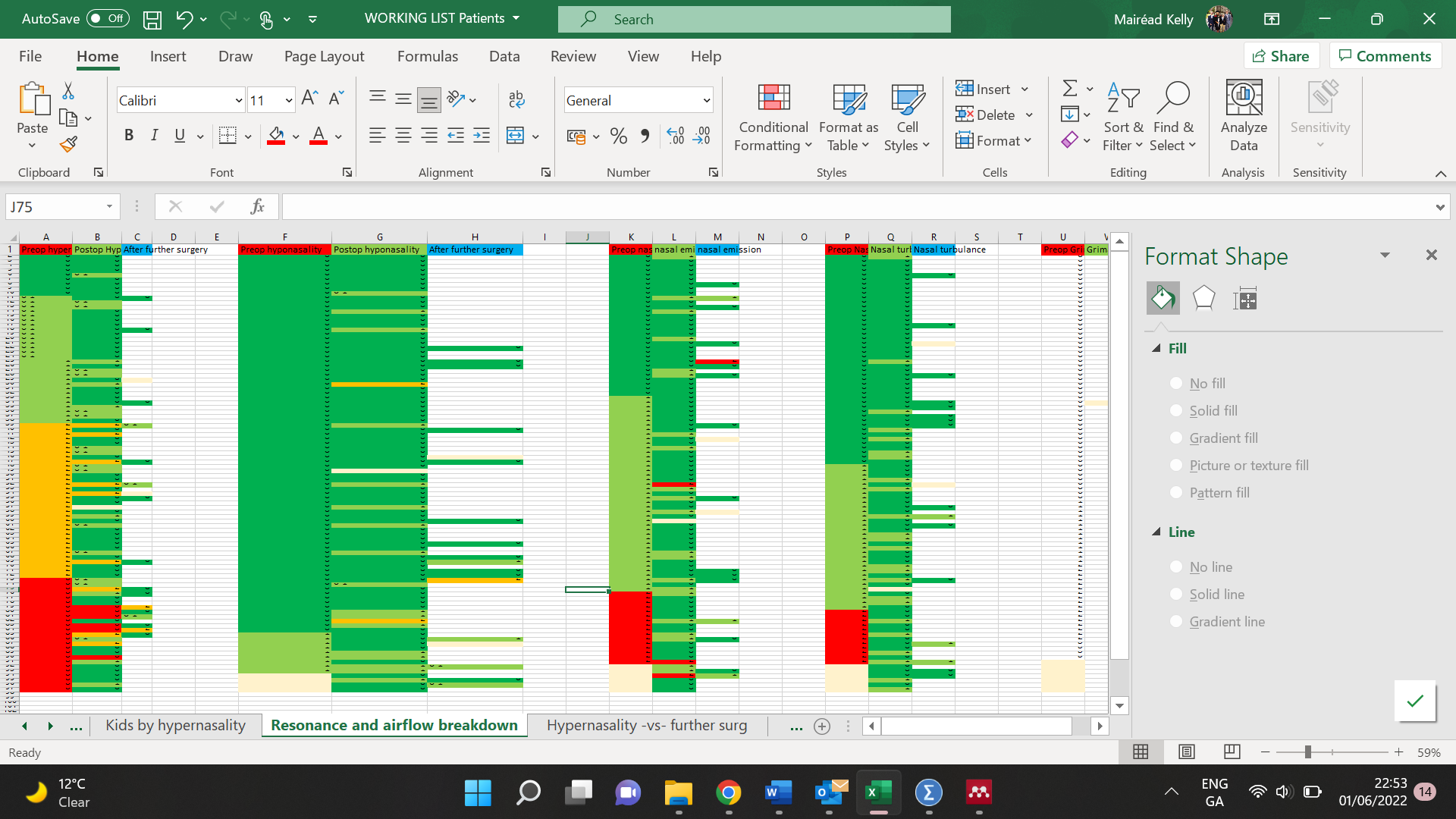


Figure 8 - Preoperative, postoperative and post-further surgery hyponasality scores, as demonstrated by the “traffic light” system (cream = not recorded)

## Nasal emission

As with hypernasality and hyponasality, nasal emission parameters were graded on the GOS.SP.ASS score as absent, mild, moderate or severe (scoring 0, 1, 2 or 3). As a general trend, patients experienced an improvement in nasal emission following CPR-R surgery, demonstrated in figure 9 below. On Wilcoxon signed-rank test statistical evaluation, changes in nasal emission scores preoperatively and postoperatively were statistically significant (p < 0.00001). Postoperatively, 95.8% patients had a score of 1 or less for nasal emission. The percentage of patients with each score for nasal emission is demonstrated in figure 10.

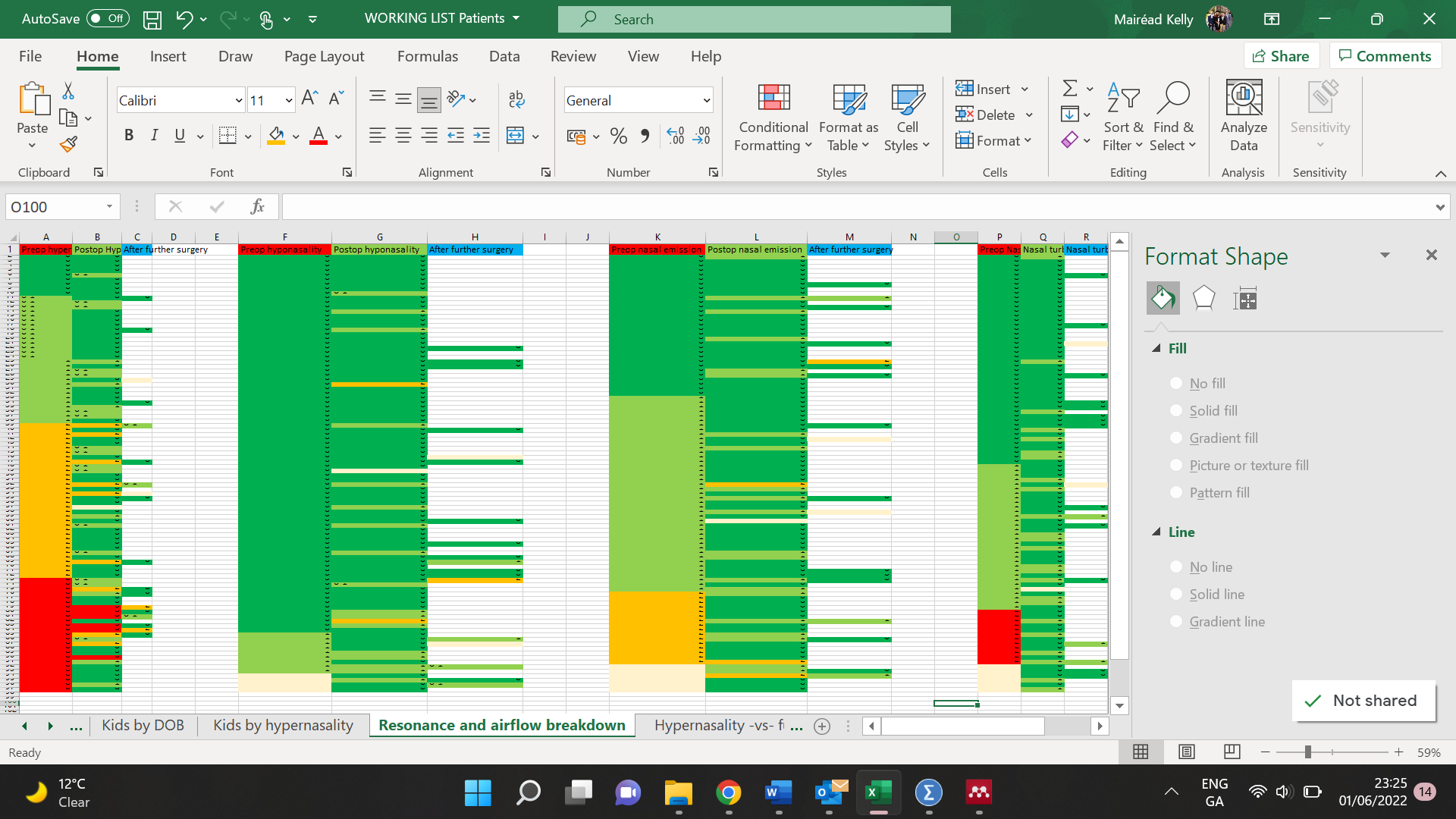


Figure 9 - Preoperative, postoperative and post-further surgery nasal emission scores, as demonstrated by the “traffic light” system (cream = not recorded)

Figure 10 – The percentage change of preoperative nasal emission when compared with postoperative nasal emission

## Nasal turbulence

As with the other parameters above, nasal emission was also graded on the GOS.SP.ASS score as absent, mild, moderate or severe (scoring 0, 1, 2 or 3). Figure 11 below demonstrates that postoperatively, 100% of patients had a score of 1 or less for nasal turbulence. This is compared with the preoperative value, 78/90 (86.7%), where 6 patients did not have a preoperative score for nasal turbulence recorded. On Wilcoxon signed-rank test evaluation of preoperative and postoperative scores, the changes were statistically significant (p = 0.0001).

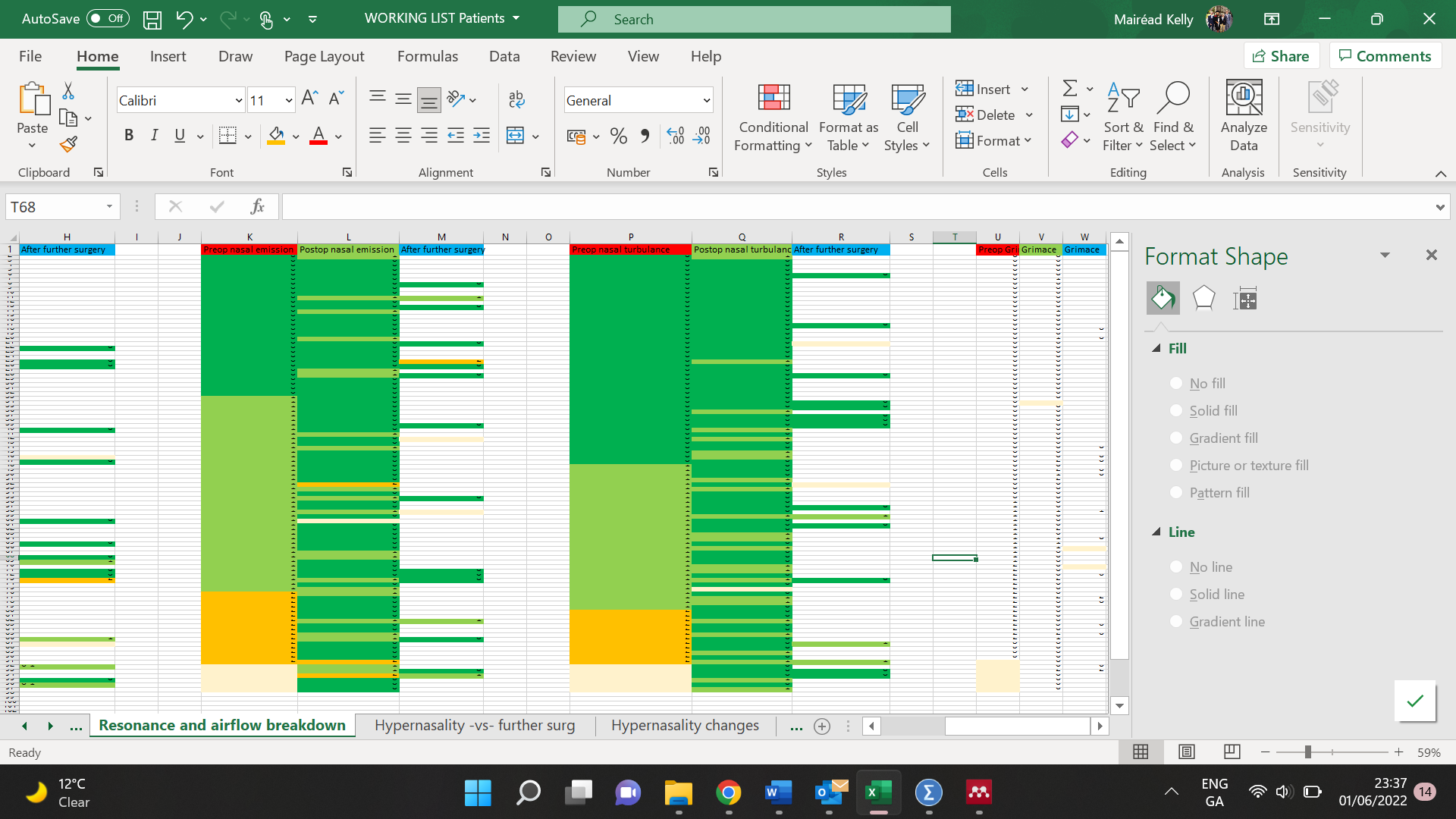


Figure 11 - Preoperative, postoperative and post-further surgery nasal turbulence scores, as demonstrated by the “traffic light” system (cream = not recorded)

## Presence or absence of a palatal fistula

Of 102 patients, 14 were found to have a palatal fistula at the time of CPR-R surgery. Unfortunately, this outcome was not routinely measured postoperatively, thus comparison between preoperative and postoperative fistula presence could not be determined. Of those patients who did not have further surgery, 77.37% did not have a palatal fistula detected perioperatively as demonstrated in figure 12 below. Similarly, figure 13 shows that patients who did go on to have further surgery would appear to be more likely to have a palatal fistula noted at the time of CPR-R.

Figure 12 – Presence of a fistula in those patients who did not undergo further surgery following CPR-R, by percentage

Figure 13 – Presence of a fistula in those patients who underwent further surgery following CPR-R, by percentage

## Syndromic-vs-non-syndromic

Of 102 patients included in the study, 6 did not have presence/absence of a syndrome or Pierre Robin Sequence (PRS) recorded within their medical record. Of the remaining 96 patients, 15 (15.6%) had a recorded diagnosis of a syndrome, and 5 (5.2%) had a recorded diagnosis of PRS without the presence of another syndrome. 3 patients were recorded as having a syndrome and PRS, whilst it was recorded on the operative notes that 76 patients did not have a syndrome or PRS.

In terms of further surgery, none of the 5 patients with PRS only went on to have further surgery. Of those with a recorded syndrome, 5 of the 15 patients required further speech surgery within the timeframe reviewed. Although the number of syndromic patients is too small to draw a meaningful conclusion, it would appear that a greater proportion of syndromic patients require surgery. In fact, they comprise 27.7% of all patients who required further surgery. Of 87 non-syndromic patients, 13 underwent further surgery, comprising a re-operation rate of 14.9%.

With regards to hypernasality, there was a clear improvement in hypernasality scores preoperatively as compared with postoperative scores. This is demonstrated in figure 14, below. Of syndromic patients who underwent further surgery, all saw improvement in their GOS.SP.ASS scores in the following 12 months.

Figure 14 – Preoperative and postoperative hypernasality scores, by number of patients

## Re-operation

18 patients out of 102 underwent further speech surgery following CPR-R. The mean age of patients undergoing further surgery was 5.8 years, with a standard deviation of 2.5 years. The minimum and maximum ages of the patients were 2.7 years and 11.1 years respectively. The median age of patients having further surgery was 5.45 years.

With regards to the interval between surgeries, the mean time between CPR-R and subsequent operations was 37.4 months, with a median of 21.2 months. The minimum time between operations was 7.8 months, and the maximum was 100.2 months. The decision to undertake further surgery was generally informed by severity of GOS.SP.ASS scores, with scores for hypernasality predominating as the deciding factor. All patients also underwent video fluoroscopy prior to further surgery in order to determine if they were likely to benefit from operative intervention. However, the video fluoroscopy findings were outside the scope of this review.

In terms of hypernasality, as mentioned above, patients who underwent further surgery generally had worse preoperative hypernasality scores than those who did not. Figure 15 below demonstrates the sequential improvement in hypernasality scores from preoperative, postoperative and further postoperative GOS.SP.ASS scores.

The proportion of patients with hypernasality scores 0, 0-1, 1, 2 and 3 are demonstrated sequentially in figure 16. This demonstrates again that a larger proportion had hypernasality within normal limits following further surgery. Following re-operation, 50% had normal hypernasality and 77.8% had hypernasality recorded as mild or better.

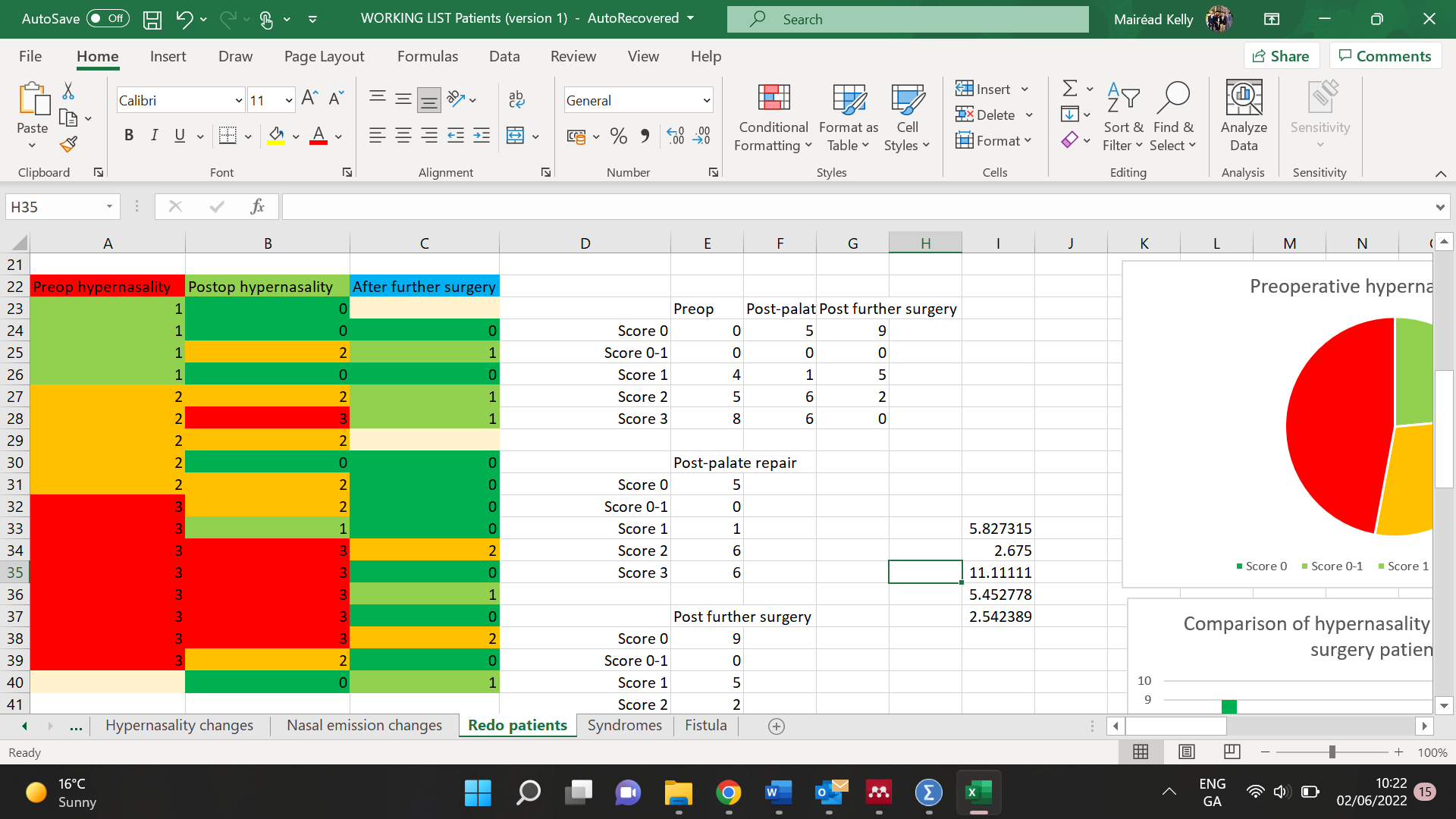


Figure 15 - Preoperative, postoperative and post-further surgery hypernasality scores, as demonstrated by the “traffic light” system (cream = not recorded)

Figure 16 - The change in preoperative hypernasality when compared with postoperative hypernasality, and hypernasality following further surgery (left to right respectively)

Finally, those patients who underwent further surgery were more likely to have a palatal fistula than those who did not. This is demonstrated in figure 17, which compares patients who underwent further surgery to those who did not, by whether or not a palatal fistula was present. In both instances, it was less common to have a palatal fistula, but this was more frequent in the further surgery cohort.

Figure 17 – Comparison of fistula presence in those who went on to have further surgery versus those who did not (in percentage)

Of those patients who underwent further surgery, half had an orticochea pharyngoplasty procedure, and the remaining half had palatal lengthening with bilateral buccal flaps. Those who underwent pharyngoplasty were typically carried out at a point in time prior to those who underwent buccal flaps, with the exception of one patient who had both. Both groups had comparable scores for hypernasality postoperatively, as demonstrated in figure 18 below.

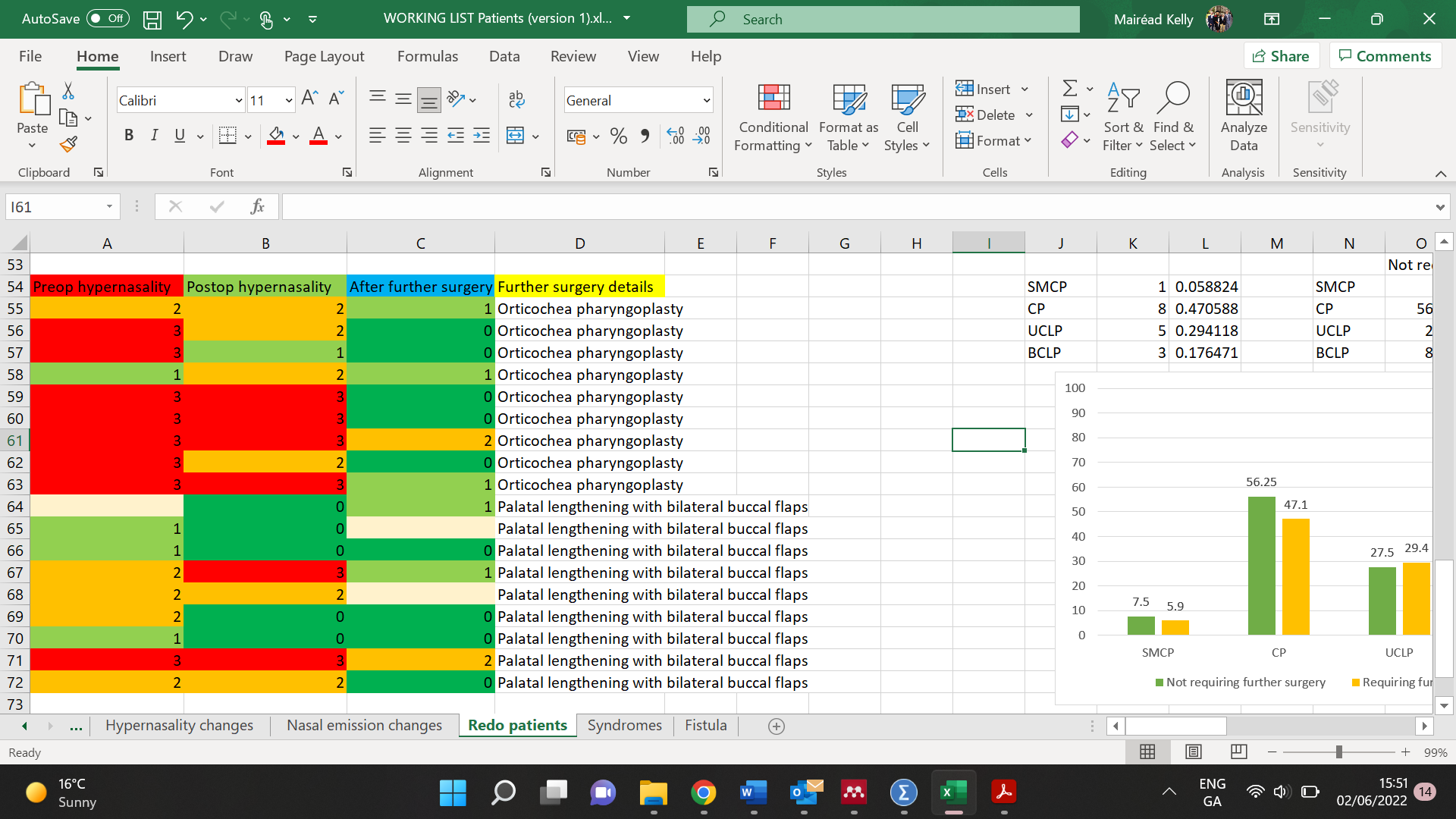


Figure 18 - Preoperative, postoperative and post-further surgery hypernasality scores, organised by procedure, as demonstrated by the “traffic light” system (cream = not recorded)

# Discussion

Over a 10 year period, 104 patients underwent CPR-R surgery at a single unit. Two were excluded as postoperative clinical records could not be obtained, and as such, the records of 102 patients were evaluated in the present study. For speech outcome measures, GOS.SP.ASS scores were utilised, per the UK National Standard for Audit.6 Throughout much of the literature, speech outcomes are reported as either GOS.SP.ASS scores, or as Cleft Audit Protocol for Speech – Augmented (CAPS-A) score. GOS.SP.ASS scores and CAPS-A scores have been found to be directly comparable, thus enabling a comparison with the literature, where CAPS-A scores are more frequently used by international authors.5,6

Within our cohort, where possible, the GOS.SP.ASS score was taken 12 months postoperatively, or at subsequent assessments. Where assessment was only carried out at a time earlier than 12 months, this score was then taken, resulting in a large standard deviation from the mean. However, as our patients attend from a large geographical area, later reviews often take place at local speech and language services. As such, although longer term data for these patients was not always available, patients who were unlikely to require further surgical intervention were generally followed up at another unit. Furthermore, it is worth noting that children under 3 years are not usually amenable to GOS.SP.ASS evaluation, and the decision to treat these children is often informed by video fluoroscopy findings. Video fluoroscopy findings were not considered within the scope of this evaluation.

## Demographics

Within our patient cohort, the mean age of patients (6.5 years) was comparable to that found in the literature, which varies from 5.7 years and 6.8 years in more recent papers, to 10.8 years in a slightly older study.4,7,8 Similarly, the literature suggests that patients undergoing CPR-R have a wide variation in age, likely owing to the fact that the decision to undertake further surgery is tailored to each individual patient and their progress with regards to speech.4,7,8

## Need for further surgery

Ultimately, CPR-R surgery can, in most cases, be considered a success when no further surgical intervention is required. In our unit, 82.4% of patients did not require any further surgery to improve their speech outcomes or function. Within the literature, the rate of re-operation varied greatly. In a 2002 paper by Sommerlad where, as in our cohort, all patients underwent intravelar veloplasty the re-operation rate was reported to be 11.8%. Where further surgery was required, pharyngoplasty was the operative technique of choice.4 In another study where z-plasty of the palate was performed for palate re-repair, 12% required subsequent pharyngoplasty or pharyngeal flap surgery.7 A systematic review carried out in 2018 reported re-operation rates of between 6.1% and 18.6%, dependent on technique used.9 A further systematic review in 2020 reported re-operation rates to be 21% following CPR-R surgery.2

It is worth noting that a significant proportion of studies excluded patients with syndromes from their dataset. As aforementioned, 5 of our re-operation patients were noted to have a diagnosed syndrome. As such, when syndrome patients are excluded, our re-operation rate was 14.9%. Our overall re-operation rate of 15.6% would therefore appear to be largely in keeping with the literature.

## Cleft type

As outlined above, our patients were broadly categorised by cleft type into SMCP, CP, UCLP and BCLP groups. Our findings of 7.2%, 54.6% 27.8% and 10.3% for SMCP, CP, UCLP and BCLP patients respectively mirror those of the Sommerlad, where CP again accounted for 53% patients, and SMCP accounted for 5%.4 UCLP was present in 14-30% patients, and BCLP was present in 11-12% patients across the literature in studies where cleft type was broken down in a comparable manner to those of this evaluation.4,8

The CP subgroup of cleft patients were the most numerous in terms of requiring further surgery. However, it is likely that this is owing to the fact that this is also the most frequent cleft subtype within our cohort. This finding is echoed by a recent study, which also found the CP subdivision to most frequently require re-operation.8

## Speech outcomes

GOS.SP.ASS scores were analysed for the patients in our cohort, with a focus on hypernasality, hyponasality, nasal emission and nasal turbulence in order to enable comparison with the findings of the literature. Additionally, as alluded to above, GOS.SP.ASS and CAPS-A scores are directly comparable and allow comparison with the findings of papers published outside of the UK, where GOS.SP.ASS is considered the acceptable standard for speech outcome measurement.6 Our GOS.SP.ASS scores were recorded by specialist speech and language therapists, with considerable experience in providing care to cleft patients. GOS.SP.ASS and CAPS-A scores have been found to show high consistency between examiners, with minimal inter-examiner variability.5 Therefore, although our patients were not all evaluated by the same speech and language therapist, if variability is low, a meaningful comparison between patients can still be made. Results were found to be statistically significant for hypernasality (p < 0.00001), nasal emission (p < 0.00001) and nasal turbulence (p = 0.0001). Hyponasality results were not statistically significant (p = 0.0703). Statistical significance for hypernasality, nasal emission and nasal turbulence, was found in Sommerlad’s 2002 study - which was similarly evaluated using the Wilcoxon signed-ranked test.4 Statistical significance was not found for hyponasality in this evaluation, nor in the comparable literature.4

## Hypernasality and hyponasality

The most frequently evaluated speech outcome throughout the literature was hypernasality, due its bearing on intelligibility of speech. In 2002, Sommerlad reported that 82.4% patients had either normal or mild and inconsistent hypernasality, nasal emission or turbulence, following his description of the CPR-R technique in 1994.3,4 More recently, de Blacam *et al*., described that 70.7% of their patients had normal nasality postoperatively.9 In a systematic review and meta-analysis, the achieving of no consistent hypernasality following CPR-R surgery was 61%.2 However, the same review also reported that achieving no hypernasality whatsoever postoperatively was even lower, at 53%.2

Our results in terms of hypernasality compare favourably to those of the literature. Within our group, 60% patients achieved no hypernasality whatsoever postoperatively. Furthermore, in excess of 83% of our patients were found to have no hypernasality, inconsistent mild hypernasality or consistent mild hypernasality following CPR-R surgery. It is perhaps unsurprising that those with more severe hypernasality preoperatively were more likely to require further surgery following CPR-R.

Hyponasality was more frequently reported as a negative postoperative outcome in the literature than other speech parameters. 10.2% of patients were reported to have developed hyponasality postoperatively in a systematic review of the literature.9 Within our group, 16.1% developed hyponasal speech or experienced a worsening of hyponasality postoperatively. As described above, all except 3 of these patients had either moderate or severe hypernasality preoperatively and had considerable improvement in hypernasality following CPR-R.

## Nasal emission and nasal turbulence

Nasal emission is another parameter which is very frequently described in the literature as a measure of speech outcome following CPR-R.2 Across 18 studies reviewed in meta-analysis, the postoperative incidence of no consistent nasal emission was found to be 78%.2 Another study published following this meta-analysis reported that nasal emission following CPR-R (by any technique) improved in 85% of cases, and resolved entirely in 50% cases.8 They additionally reported that 65% patients had no consistent nasal emission postoperatively.8 Although Sommerlad reported outcomes for only one technique (the same technique used in our cohort), there was no specific breakdown with regards to nasal emission or turbulence. Rather, this study described that 82.4% patients showed normal or inconsistent mild hypernasality, nasal emission or nasal turbulence postoperatively, as aforementioned.4

Our reported results compare very favourably with the findings as described in the literature. In terms of nasal emission, approximately 74% patients had no reported nasal emission following CPR-R. Almost 96% patients had nasal emission scores classed as mild or better. Regarding nasal turbulence, 100% patients had either mild or no turbulence reported after CPR-R.

## Palatal fistula presence

The incidence of a palatal fistula following primary cleft palate repair has been reported to be 8.6% in a systematic review of the literature.10 Carvajal Álvarez *et al.,* in 2021 reported a higher incidence of 12%.8 Our finding of 13.7% would seem, therefore, to be more consistent with the value reported in the 2021 study.

Within our cohort, it would appear that a higher proportion of patients with a palatal fistula recorded at the time of CPR-R required further surgery subsequently. However, as these patients were only 14 in number, it is not possible to draw a meaningful conclusion with regards to wither the presence of a fistula is a true predictive factor for further surgery. Furthermore, this variable has not been evaluated in the literature to determine if a palatal fistula prior to CPR-R is predictive of future need for more speech surgery.

## Syndromic patients

Within the literature, syndromic patients are often excluded from study design, as these patients may present with more complex oropharyngeal manifestations of their conditions, and this may impact the outcome of results. Of studies that did include syndromic patients, these were usually classified as non-syndromic, non-syndromic with PRS and syndromic (including syndromic with PRS). In terms of outcomes for syndromic patients, one study reported a success rate of 79% in nonsyndromic PRS patients and 58% in syndromic patients, where success was defined as “velopharyngeal competence” on speech and language assessment – that is to say, where no nasality or emission was detected.7 A meta-analysis of the literature reported a range of improved resonance from 18-100%, with 54.5% patients reported to have normal postoperative resonance.9 However, it is worth noting that this paper did not specify the inclusion or exclusion of PRS patients in these values, likely due to heterogeneity in the studies included.

Our re-operation rate for patients with syndromes was 27.7%, as compared to 14.9% in nonsyndromic patients. However, as with the data on palatal fistula presence, the number of patients in the syndromic group was too small (n=15) to allow meaningful analysis or comparison of results. 9/20 (45%) PRS and syndromic patients had no hypernasality following CPR-R, and 14/20 (70%) had hypernasality recorded as mild or better. Of syndromic patients who underwent further surgery, all had a recorded improvement in hypernasality postoperatively.

## Re-operation

In patients requiring re-operation, outcomes were not reported in any of the literature. In our cohort, the mean time between CPR-R and re-operation if required was 37.4 months, with a wide range of 7.8 - 100.2 months. The decision to undertake further surgery was informed by both speech outcomes and results of videofluoroscopy investigations.

Where re-operation was carried out, patients either underwent orticochea pharyngplasty or palatal lengthening with bilateral buccal flaps. It is worth noting that palatal lengthening with bilateral buccal flaps was the treatment of choice for those who underwent re-operation more recently. One patient required further subsequent speech surgery following palatal lengthening with bilateral buccal flaps, and orticochea pharyngoplasty was the further treatment of choice in this case. 50% of patients (9/18) who underwent re-operation had normal nasality on GOS.SP.ASS postoperatively, and 77.8% had either mild or normal hypernasality scores. No patient had severe hypernasality following re-operation.

# Conclusions

Within our unit, the records of 102 patients who underwent CPR-R over a 10-year period were evaluated retrospectively to determine success of surgery and speech outcomes. Within our cohort, CPR-R was generally a very successful operation, with 84.4% not requiring further speech surgery after postoperative review.

Speech outcomes within our unit also compared favourably to the literature, with a large majority of patients showing an improvement in speech outcome measures following CPR-R. When re-operation outcomes were taken into consideration, all patients had improved speech outcomes on follow up and GOS.SP.ASS assessment.

The type of cleft, presence of a palatal fistula and a diagnosed syndrome may be influencing factors in the success of CPR-R. However further and longer-term studies are required in order to more comprehensively evaluate the impact these variables may have on the outcomes of surgery.

The findings of the service evaluation presented can be used for comparison in future audit of CPR-R, as well as to inform patients and their parents prior to CPR-R surgery.

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