# **Structured Abstract**

**Objective**

To determine the impact of the COVID-19 pandemic on acute admissions and inpatient activity at a tertiary referral centre.

**Design**

Retrospective review of coding-based inpatient electronic records.

**Setting**

An otolaryngology and head and neck surgery department at a UK major trauma and tertiary referral centre.

**Participants**

Otolaryngology patients admitted as an emergency over a period of 12 months pre-COVID19 (01/04/2019-31/03/2020) and 10 months post-COVID19 (01/04/2020-23/01/2021).

**Main outcome measures**

Baseline characteristics, admission rates, length of stay (LoS), overall mortality and 30-day mortality.

**Results**

1844 records were reviewed; (1293 pre-COVID19, 551 post-COVID19). Admissions across all age groups were reduced, with an increase in mean age from 40.4 to 47.4 years (p=0.001). LoS remained unchanged (3.74 vs 3.82 days, p=0.251). Epistaxis remained the most common presentation, with an increased LoS compared to the pre-COVID19 cohort. GP referrals reduced from 18.0% to 4.2% (n=233 vs n=23, p<0.001) and ED referrals proportionally increased from 60.9% to 75.3%, n=787 vs n=417, p<0.001). Critical care admissions were higher in the post-COVID19 cohort (OR 1.82 (1.11-2.99) [95% CI], p=0.017).

There was no significant difference in overall mortality between groups (n=74, 5.7% vs. n=33, 6.0%; p=0.844). Thirty-day mortality increased from 0.9% (n=12) pre-COVID19 to 2.3% (n=13) post-COVID19 (p=0.03).

**Conclusions**

This study demonstrates significant changes and a reduction in acute otolaryngology presentations. Our findings suggest that sicker, frailer patients were admitted during the pandemic. This study highlights important considerations for acute otolaryngology care moving forward after the pandemic.

**Keywords:** emergency, coronavirus, COVID-19, admissions, acute

**Key Points**

* Health service provision changed drastically during the COVID-19 pandemic, and admission avoidance was practiced in order to prevent the spread of coronavirus. Additionally, public behaviour and government guidance impacted public usage of the National Health Service.
* An overall reduction in admission numbers was observed during the pandemic to our otolaryngology department. Mean age of admitted patients increased, however there was no significant difference in length of stay or overall mortality.
* Length of stay was higher for patients admitted with epistaxis, compared to a reduced length of stay for infection or foreign body during the pandemic, suggesting there may be scope to ambulate patients and reduce or shorten admissions in otolaryngology practice.
* Overall mortality was unchanged by the pandemic, however survival analysis demonstrated a shorter survival period post-discharge.
* A significant increase in critical care admissions and 30-day mortality post-COVID19 suggests that the cohort of patients presenting to otolaryngology were likely more comorbid, frail and appropriate for inpatient admission.

**Main body (word count – 2231)**

**Introduction**

The coronavirus (COVID-19) pandemic has resulted in a unique challenge to healthcare systems since the SARS-COV2 strain was isolated in Wuhan, Hubei province, China in December 2019. Efforts to curtail the spread of COVID-19 resulted in considerable impact upon health service provision across the United Kingdom (UK), including the cancellation of elective surgical operations, resulting in an elective operating waiting list of 4.7 million people1. Many healthcare consultations were amended to virtual or telephone formats, and non-essential care was postponed. On March 24th 2020, the UK announced a nationwide lockdown, closing schools and non-essential businesses and requiring people to stay at home in order to alleviate the pressures on the National Health Service (NHS).

Sars-CoV2 primarily infects the upper aerodigestive tract, and a higher concentration or viral load is also found within the sino-nasal cavity and middle ear2,3. Additionally, a number of common otolaryngology interventions such as nasopharyngoscopy, tracheostomy and powered drilling of the temporal bone generate aerosol - which further disperses viral particles4. Thus, otolaryngology practice represents a high-risk specialty with notable risk of coronavirus transmission to healthcare staff. As such, clinical activity within ENT had unique challenges and ENT UK guidance during the initial stages of the pandemic advised to avoid admission unless absolutely necessary5. A recent review by the Institute for Fiscal Studies6 found a 21.4% reduction in non-COVID related emergency admissions, with variations between geographical regions and hospital specialties. Although the impact of the pandemic on acute general surgical presentations has been described7,8, to date there has been no similar review within an Otolaryngology setting in the UK. An appreciation of this impact is important in addressing unmet or delayed clinical needs as part of a post-pandemic recovery response.

We hypothesised that the UK national lockdown, announced on March 24th 2020 was a key factor in changing the general public attitude towards utilising the NHS during the COVID-19 pandemic.

*Objectives:* This study aims to examine the effect of the COVID-19 pandemic on acute otolaryngology admissions at a tertiary referral centre in the UK.

**Methods**

We defined the ‘start’ of the COVID-19 pandemic for the purposes of data analysis to be April 2020. Hospital electronic patient records coded with an acute admission to otolaryngology between a 12-month period from 01/04/2019 to 31/03/2020 (defined as the ‘pre-COVID19’ group) and 10-month period from 1/4/2020 to 23/01/2021 (defined as the ‘post-COVID19’ group) were retrospectively reviewed. No age criteria were applied.

### *Exclusion criteria*

Outpatient otolaryngology consultations and same-day emergency clinic consultations without an associated unplanned admission to an inpatient ward were excluded. Patients admitted for elective procedures were also excluded.

All patients who were coded as having been admitted as an ‘emergency’ during the aforementioned dates were retrieved and pooled into a dataset provided by business analyst services at our centre. Key information from each admission episode, including diagnosis, admission, and discharge dates, and whether an admission also included a critical care stay were also retrieved from electronic patient records. Diagnosis data was imported from the coded diagnosis on hospital discharge summary letters written by clinicians at the end of a patient’s hospital admission. Coded mortality data, including overall mortality (defined as death occurring due to any cause, at any point post-discharge from ENT) and 30-day mortality (defined as death occurring due to any cause, within 30 days of discharge from ENT) for the patients included in this dataset was also obtained.

*Main outcome measures*

Baseline characteristics, admission rates, reason for admission, length of stay (LoS), overall mortality and 30-day mortality were examined. Diagnoses were multiple (being in excess of 250 individual diseases or presenting symptoms, reflecting the breadth of acute presentations to otolaryngology) and therefore were subsequently grouped into broad categories by the authors (Table 1).

### *Statistical analyses*

Categorical data were cross-tabulated and assessed using Chi-squared test. For continuous data, an independent *t* test or Mann-Whitney test was used, depending on normality of distribution. Kruskall-Wallis tests were used to determine the presence of significant differences between multiple strata. Comparisons between cohorts were made using proportions rather than absolute numbers, in order to account for the difference in time periods between the pre-COVID group (12 months) vs post-COVID group (10 months).

Binary logistic regression models were performed for LoS (<4 days, >4 days). Overall and 30-day mortality was analysed using Cox regression. Survival analysis was plotted using Kaplan Meier charts with log-rank analysis. All statistical analysis was performed using SPSS for Macintosh (IBM Corp. Armonk, NY, USA, Version 27).

*Ethical considerations*

Ethical approval and patient consent was not required for this review. All data was handled according to Good Clinical Practice (GCP) guidelines.

**Results**

### *Overall numbers and admission trend*

A total of 1844 patient records were coded with an emergency admission to ENT during the designated dates. Of these, 1293 (male=643[49.73%]) were pre-COVID19 and 551 (male=280[50.82%]) were post-COVID-19. A sharp decline in acute admission numbers was noted from February 2020, to April 2020 before a subsequent increase thereafter (Figure 1). However, admissions (expressed as numbers per month) did not return to pre-pandemic levels at any point during the studied dates.

### *Baseline characteristics*

Age and gender between the pre-COVID19 and post-COVID19 cohorts were compared (supplementary material). A reduction in admissions across all age groups (Figure 2) was found. Mean age was 40.4 years and 47.4 years for the pre-COVID19 and post-COVID19 groups respectively; with an overall increase in mean age of admitted patients (*p* = 0.001). Male to female ratio was 1:1 and there was no significant difference in gender between cohorts.

### *Referral source*

Prior to the pandemic, the most common referral sources were primary care and the emergency department (ED) (*n*= 233/1293; 18% and *n*=787/1293; 60.9% respectively) (Figure 3). However, primary care referrals were dramatically reduced from 18.0% to 4.2% (*n*=233 vs *n*=23, *p*<0.001) and referrals resulting in admission from ED proportionally increased from 60.9% to 75.3% (*p*<0.001). Emergency admissions from outpatient clinics and transfers from regional/ district general hospitals were a smaller subset of admissions and were largely unaffected.

### *LoS*

Mean LoS was 3.74 days in the pre-COVID19 cohort, and 3.82 days in the post-COVID19 cohort, demonstrating no significant change (*p*=0.251). However, LoS in epistaxis patients was significantly longer in the post-COVID19 cohort (hazard ratio 1.40(95% CI 1.12-1.75), *p*=0.003). In contrast to this, LoS for infection (hazard ratio 0.62 (95% CI 0.39-0.98), *p*<0.001) and foreign body (hazard ratio 1.14 (95% CI 0.80-1.62), *p*=0.039) was significantly shorter.

### *Diagnosis*

A total of 276 independent diagnoses were listed in the dataset, which were grouped into broader descriptive categories encompassing common presenting complaints and conditions seen in otolaryngology (figure 4). A reduction in all conditions post-COVID19 occurred, with epistaxis and infection (including tonsillitis, quinsy, supraglottitis and deep neck space infections) remaining the most common diagnoses resulting in admission.

### *Critical Care Admissions*

Logistic regression was performed to evaluate likelihood of critical care admission (defined as any stay in an intensive care setting (general, neurological, cardiac or paediatric). 38/1293 patients (2.94%) in the pre-COVID19 cohort required a critical care bed during their admission, compared to 28/551(0.05%) in the post-COVID19 cohort, demonstrating an increased odds ratio of 1.82 (1.11-2.99 [95% CI], *p*=0.017).

### *Mortality*

In terms of all-cause overall mortality, no significant difference in incidence of death between cohorts was detected; 5.7% (n=74/1293) pre-COVID-19 and 6.0% post-COVID19 (n = 33/554). Kaplan-Meier survival analysis was performed on patients who died (figure 5), indicating that time to event i.e., days from discharge to death was significantly less (p <0.001) in the post-COVID19 cohort.

An increase in 30-day all-cause mortality was observed, from 0.9% (n=12) in the pre-COVID-19 cohort to 2.3% (n=13) in the post-COVID-19 cohort which was statistically significant (*p*=0.03). Cox-multivariate regression analysis demonstrated an increased association between ICU admission and 30-day mortality (hazard ratio 4.61, 95% CI 1.42-14.91, *p*=0.011) in the pre-COVID19 cohort.

**Discussion**

Our data shows a clear and substantial reduction in emergency admissions to a busy otolaryngology department, in keeping with national political and public health measures during the COVID-19 pandemic (figure 1). Of note, the decrease in admission numbers was observed from late February 2020 onwards - perhaps reflecting the growing concerns from the public and their subsequent reluctance to attend healthcare environments.

This overall reduction in patients admitted, regardless of age or diagnosis, is in keeping with larger reports on inpatient hospital activity6,9. National guidance from ENT UK5 and pathways developed in part by local consultant expertise, were implemented and aimed to reduce unnecessary admissions for management of common conditions. This, alongside public behaviour, could account for reduced admissions observed. Patients who were managed on such pathways are not easily identifiable, as these pathways are not distinctly coded or recorded uniformly on the electronic patient records and reflect discretion of the individual admitting clinician. Therefore, linking with outcomes such as LoS and readmission rates was not possible. Stansfield et al. used similarly modified pathways which demonstrated a reduction in emergency admissions10, adding to the evidence that admission avoidance in conditions such as epistaxis can be a lesson applied to ENT practice after the pandemic11,12.

Many otolaryngology conditions, such as otitis externa and tonsillitis for example, often present to primary care in the first instance, before being referred on to ENT if required. In early March 2020, general practice surgeries were instructed by NHS England to reduce face-to-face services and operate on telephone triage systems as much as possible13. Additionally, due to concerns about risk of transmission, examination of the oropharynx was advised against14 unless unavoidable - adding to the diagnostic and referral dilemma for primary care clinicians. Unsurprisingly, our data shows that our centre received far fewer referrals from primary care compared to the preceding year, and the majority of patients that were admitted were via the emergency department.

LoS in our centre for acute admissions was approximately 4 days on average and was unchanged by the pandemic. Of note, this was shorter than the average general inpatient stay in UK hospitals of 5.9 days15, perhaps reflecting the large turnover of patients in otolaryngology and pathophysiology of acute conditions. There was an increased LoS in post-COVID19 patients admitted with epistaxis, and this finding may highlight an inclination to only admit those with an increased need for medical intervention, increased frailty, higher risk of rebleeding and those unsuitable for discharge with nasal packing. We postulate that mean LoS for epistaxis increased, as patients who likely would have been discharged in a shorter timeframe were ambulated to avoid unnecessary admissions. In contrast, LoS for patients admitted with infection and foreign body were shorter, underlining the pressure to avoid admission if at all possible. Learning from the acute adaptations to emergency ENT practice, and the effect on LoS, will serve as a useful lesson post-pandemic in shortening admissions and ambulating more patients where appropriate. This may provide bed capacity for other services.

Another finding, supporting the more co-morbid nature of the post-COVID19 cohort is the significantly increased likelihood of admission to critical care during the pandemic. The post-COVID19 cohort were 80% more likely to be admitted to a critical care bed during their acute ENT admission, a likely reflection on the increasingly morbid nature of patients admitted to our department. ITU admission was associated with an increase in 30-day mortality in the pre-COVID19 cohort, however neither increased LoS or ITU admission was associated with all-cause 30-day mortality in the post-COVID19. Our study was likely underpowered to detect an association between these comparators.

Previous studies have shown all-cause mortality for epistaxis, which forms the majority of emergency otolaryngological admissions, to be as high as 9.8%16,17. Although all-cause overall mortality was unchanged between our cohorts (5.7% pre-COVID19 vs. 6.0% post-COVID19), the survival period was significantly shorter in the post-COVID19 group, possibly indicating that cause of death was more likely to have been related to their hospital admission; and the post-COVID19 cohort were likely more morbid overall. The increase in 30-day all-cause mortality further supports this. These findings are perhaps unsurprising, considering there is overwhelming evidence of all-cause excess deaths during the pandemic18.

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### *Limitations*

Information has been extracted via coded data from local electronic systems, beginning at the translation of clinical information into administrative code and back once again into clinical information for the purposes of this study. This can introduce coding-related subjectivity, variability and error. Additionally, it is possible a small subset of patients were missed during coding retrieval due to inaccuracies on discharge summaries or other coding outcomes.

# **Conclusion**

Our findings demonstrate a significant reduction in acute admissions to otolaryngology during the COVID-19 pandemic, across all age groups, with an increase in mean age of patients admitted. This likely reflects both our drive to adhere to national COVID19 admission guidance, and also public reticence in presenting to healthcare services. Mean LoS for emergency admissions to ENT was unchanged by the pandemic, however analysis of LoS in individual common conditions such as infection and foreign body demonstrated a reduction in LoS, whereas epistaxis was associated with an increased mean LoS. Thirty-day mortality was significantly worse in the post-COVID19 cohort, however this was not associated with an increased LoS or ITU admission.

We postulate that these findings likely reflect the more morbid nature of patients admitted during the pandemic, and the strong selection pressure to discharge or ambulate patients where possible. Understanding the effect that the COVID-19 pandemic has had on acute presentations serves not only in planning a post-pandemic recovery response, but also in planning more robust, evidence-based emergency services moving forward in otolaryngology practice.

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**Legends**

**Figure 1**: A timeline of the COVID-19 pandemic and emergency admissions to ENT at our centre.

**Figure 2**: Age and gender characteristics of patients admitted to ENT as an emergency, pre-COVID-19 and post-COVID-19.

**Figure 3**: Referral source of patients admitted as an emergency, pre-COVID-19 and post-COVID19.

**Figure 4**: Categories encompassing the most common diagnoses and presenting complaints to ENT, pre- COVID19 and post-COVID-19.

**Figure 5**: Kaplan-Meier survival analysis on cohort of patients who died post-discharge from ENT, demonstrating a significantly shorter survival period in the post-COVID-19 cohort (p<0.001).

**Table 1**: Coded diagnoses were grouped into the above broad categories encompassing the most common emergency presentations to ENT.