Analysis of the National Reporting and Learning System Database to identify Patient Safety trends in Respiratory Medicine: Results from a Pilot Study

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Introduction

As part of its remit within the British Thoracic Society (BTS), the Quality Improvement Committee (QIC) included as part of its 2023-2025 strategy a plan to focus on key themes prioritized by Committee members. These themes included 1) enhancing the use of data (minimising the burden of data collection by mining external sources of data); 2) broadening the range of tools used to deliver improvement for respiratory patients; and 3) working in partnership with other organisations. In addition, within the organisational structure of BTS, responsibility for patient safety sits with the QIC.

The National Reporting and Learning System (NRLS) is a confidential database that contains all patient safety incidents reported by healthcare organisations or individuals in England. A number of organisations have established data sharing arrangements with NHS England and have undertaken thematic analysis of these incidents, to identify areas for improvement in patient care.

These organisations include the Faculty of Intensive Care Medicine (FICM) that produces a regular bulletin: Safety incidents in critical care, and the Royal College of Emergency Medicine (RCEM) that began producing significant incident reports in emergency medicine in 2016. The UK Kidney Association and the Safe Anaesthesia Liaison Group (SALG) have also reviewed NRLS reports.

The above specialties are organised to deliver care in defined clinical areas (Critical care, Emergency departments, Renal units and operating theatres). Safety incidents relevant to these specialties can therefore be identified by the NRLS categorical recording of specialty and/or location. Patients with respiratory diagnoses are cared for under many specialties, often on non-specialist wards. Reports relevant to respiratory practice therefore cannot currently be identified systematically. The introduction of respiratory support units might provide an opportunity to examine patient safety incidents in these areas in the future. This will depend on the categorical fields included in the new Learn From Patient Safety Events Service which is planned to replace NRLS.

The objective of this work was to test whether, by choosing respiratory specific free text search terms for NRLS data, it was a) viable and b) a useful way to identify important issues / areas for improvement in the quality of respiratory care. If this was possible, the plan would be to identify other areas of respiratory practice where this approach could be used by BTS in the future.

Method/Approach Taken

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Two topics were chosen for investigation. These were incidents that related to respiratory support (focused on non-invasive ventilation) and pneumonia. Arrangements were made with the NHS England Patient Safety Team for data sharing agreements with BTS so that patient safety incidents in these areas could be analysed. The search criteria used for this pilot were deliberately broad. A three-month period (based on the date incidents occurred) was chosen. This was to ensure that there were enough incidents in the dataset to identify any themes and messages from the analysis. As a result of this strategy, it was accepted that there would be a significant number of incidents where the incident was not directly relevant to the search term (e.g. co-incidental, commonly reported issues such as patient falls or sacral pressure ulcers).

The same three-month period was chosen as that used to select cases for the NCEPOD review of community acquired pneumonia which was in progress at the time of the analysis. Searches were undertaken for reports that included any of the terms listed. The terms used for the NRLS searches were:

Respiratory support / Non-invasive ventilation: *NIV, HFNC, CPAP, high flow, V40, airvo, nasal high flow, HFNO, V60, nippy, opti flow, non invasive ventilation*

Pneumonia: *pneumonia, LRTI, low respiratory tract infection*

Data were held securely at BTS, complying with all information governance arrangements. Each dataset was analysed on one day, in a face-to-face meeting of three members of the QIC at BTS Head Office. The group discussed the cases they had reviewed to help identify themes from the review. Brief summaries of the cases reviewed and themes were kept by the reviewing team for analysis. No data that could identify an individual case was taken outside the BTS head office.

The reviewing team met to agree the design of this report and the themes identified. Initial findings were presented at the BTS winter meeting in 2023. Case synopses have been adapted from the source data and used in this report to illustrate the type of problems identified.

Results

Pneumonia

The search criteria for events related to pneumonia returned 2,078 reports, of which 495 (the most severe) were reviewed. Of the total, 50 (2.4%) were reported as death, 19 (0.9%) were reported as severe, 126 (6.1%) moderate, 779 (37.5%) low, and 1,104 (53.1%) were reported as no harm (**Figure 1**). In the 495 available to review, 316 (64%) occurred in hospital inpatients, 48 (10%) in Emergency Department and 131 (26%) in other locations.

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Vol 15, Issue 4, 2024

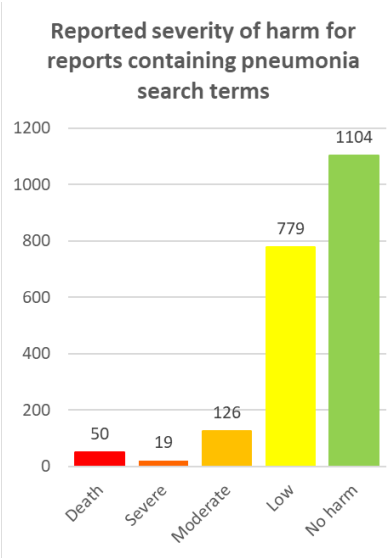

Figure 1: Reported severity of harm for reports containing pneumonia search terms.

Of the reports reviewed, the most common theme centred around aspiration (n=33). Other recurring themes included healthcare-acquired Covid-19, medication-related incidents, issues relating to communication or handover, delays to senior review and complications with discharging patients (**Figure 2**).

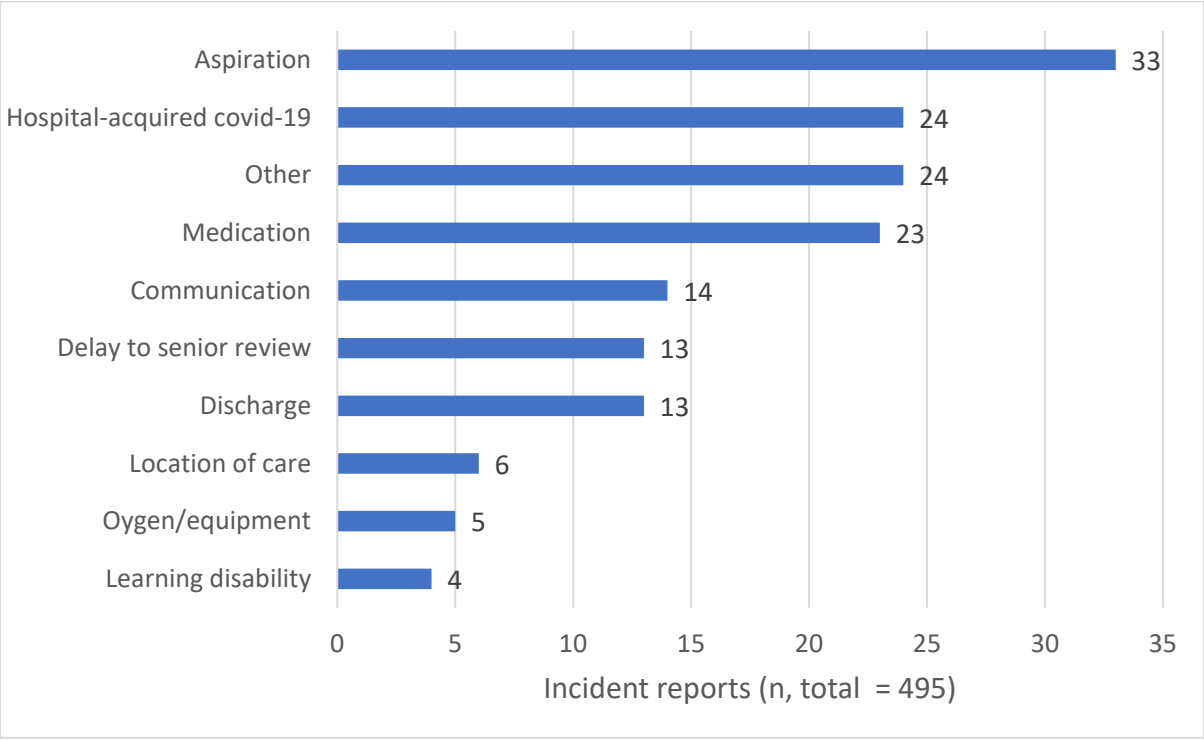

Figure 2: Thematic analysis of reports containing Pneumonia search terms

Thematic analysis revealed a number of trends which warrant further discussion.

British Thoracic Society Reports,
ISSN 2040-2023:
Vol 15, Issue 4, 2024

1. Aspiration

Case synopsis 1:
A patient was admitted following a stroke. No initial swallow assessment was performed. When swallowing impairment was eventually noted, there was significant delay in speech and language review due to lack of staff availability. During this time, the patient continued to eat and drink, and subsequently developed aspiration pneumonia.

Aspiration-associated events were the most common reason for reported incidents relating to pneumonia. These included delays in assessments being performed in high-risk patients, issues with nasogastric feeding tubes and aspiration events in patients with learning disabilities.

Best practice and key areas for improvement

The British Thoracic Society Clinical Statement on aspiration pneumonia[1] provides best-practice guidance for the prevention and management of aspiration pneumonia. NICE guidelines on Stroke and transient ischaemic attack[2] (Section 1.6 1.6 Nutrition and hydration) and BTS Clinical Statement on the prevention and management of community-acquired pneumonia in people with learning disability[3] may also be relevant.
Our review did not identify any unexpected areas requiring improvement beyond those risk areas addressed in these guidelines.

RECOMMENDATION: All hospitals should have a process to identify and learn from events relating to aspiration to give assurance that clinical practice achieves established standards (including BTS and NICE guidelines).

2. Discharging patients with pneumonia

Case synopsis 2:
A patient admitted overnight with community-acquired pneumonia was considered stable for discharge on oral antibiotics the following day. However, antibiotics were not supplied. The patient deteriorated in the community and was re-admitted.

There were 13 of the 495 incident reports containing the Pneumonia search terms that were due to complications arising following discharge of patients with pneumonia. These included discharging patients without antibiotics and patients deteriorating following discharge requiring re-admission.

Best practice and key areas for improvement

Management of pneumonia in the community is a valid approach within the parameters recommended by NICE clinical guidelines (CG191: Pneumonia in adults: diagnosis and management[4]). These guidelines advise not routinely discharging people with community-acquired pneumonia if in the past 24 hours they have had 2 or more of: temperature > 37.5°C; respiratory rate ≥ 24 breaths per minute; heart rate > 100; systolic blood pressure ≤ 90 mmHg; oxygen saturation < 90% on room air; abnormal mental status, or inability to eat without assistance, and to consider delaying discharge when temperature is higher than 37.5°C.

British Thoracic Society Reports,
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Vol 15, Issue 4, 2024

Within the data available from the NRLS reports, we did not identify a specific area where care differed from accepted standards; rather the events identified primarily represented issues with implementation of recognised guidelines (such as oral antibiotics not being provided).

RECOMMENDATION: Hospitals should have a process to review re-admissions of patients discharged with community acquired pneumonia. This will help to determine whether a) the initial discharges were appropriate, and b) whether any action could have been undertaken to reduce risk of subsequent readmission.

Specialist Pneumonia Intervention Nurses have been found in some centres to improve outcomes[7] and trusts may consider a provision of this service to improve care of patients with pneumonia.

Non-invasive ventilation and high-flow nasal oxygen

The search criteria for NIV-related events returned 4,705 reports, of which 523 (the most severe) were reviewed. Of the total, 26 (0.6%) reported as death, 15 (0.3%) were graded severe harm, 182 (3.9%) were graded moderate harm, 1574 (33.5%) were graded low harm and 2908 (61.8%) were graded no harm (**Figure 3**). 396 (76%) occurred on inpatient wards, 44 (8%) in Emergency departments and 83 (16%) were in other locations.

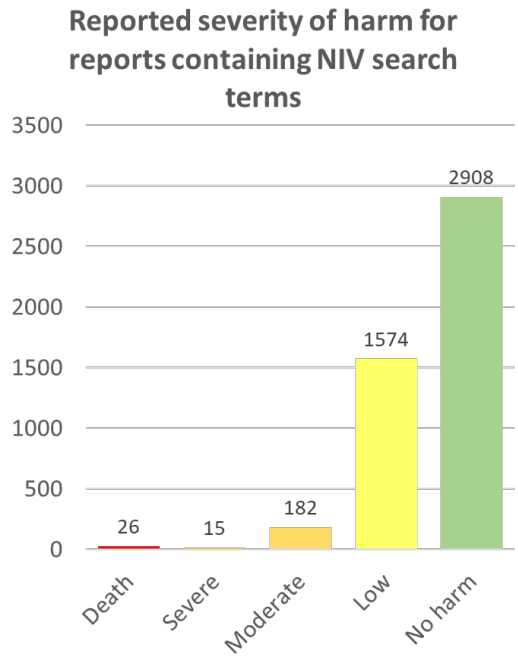

Figure 3: Reported severity of harm for reports containing non-invasive ventilation search terms.

Of those reviewed, the most common reason for incident reports to be completed relating to NIV was for mask related pressure sores (64 of 523 cases reviewed). Other common reasons for incident reports included competence of staff to manage NIV (27 cases) or NIV being administered in inappropriate clinical areas (19 cases), issues with monitoring patients once NIV was commenced (27 cases), delays to starting NIV (26 cases), and issues occurring during intra-hospital transfers of patients started on NIV (12 cases) (**Figure 4**).

British Thoracic Society Reports,
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Vol 15, Issue 4, 2024

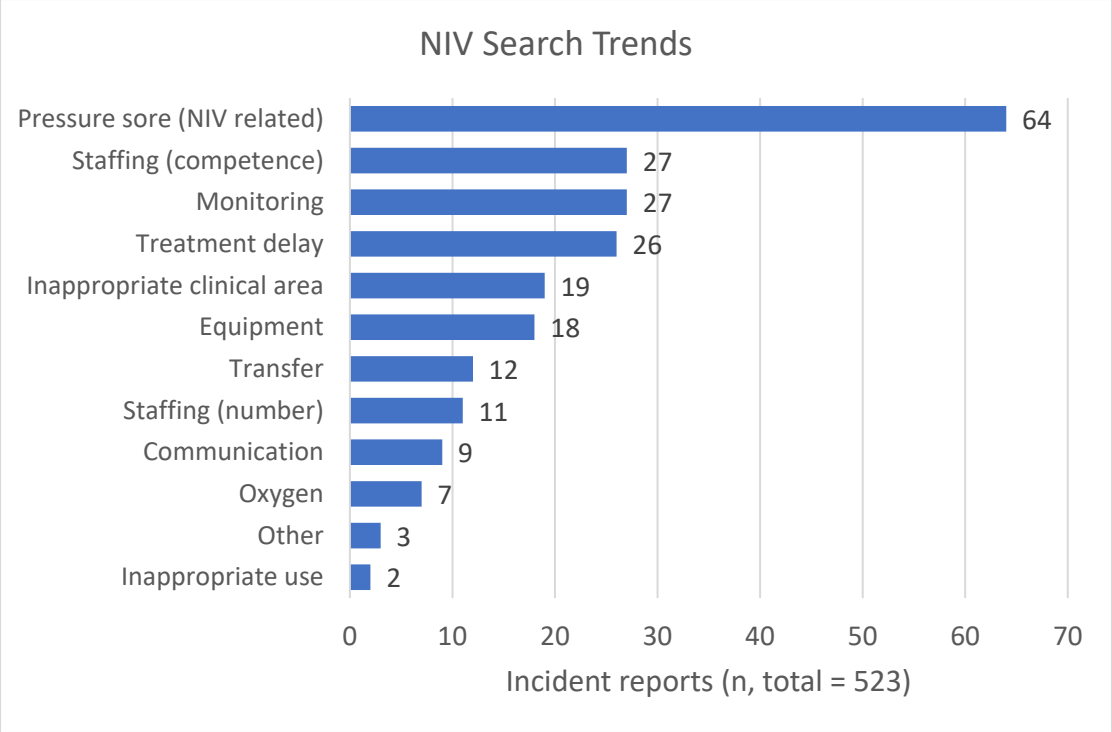

Figure 4: Thematic analysis of reports containing NIV search trends

Thematic analysis revealed a number of trends which warrant further discussion:

1. Pressure sores from facemasks

Case synopsis 3:
A patient was commenced on NIV after being admitted with Acute Hypoxemic Respiratory Failure (AHRF) due to acute exacerbations of COPD. He remained on NIV for several days via an oro-nasal facemask and developed a pressure area on the nasal bridge. Barrier dressings were applied.

The most common reason for incident reports to be completed relating to NIV was for pressure sores from NIV facemasks. This corresponds to previous findings that this is the most common complication from acute NIV[5].

Best practice and key areas for improvement:
The BTS Guideline for the ventilatory management of acute hypercapnic respiratory failure in adults[6] acknowledge the potential for this complication and give the following advice:

- Patients should be frequently assessed to identify potential complications of NIV, including facial pressure sores
- Avoid over-tightening – NIV masks are designed to mould to the face when pressurised which over-tightening impairs
- Should signs of skin trauma become apparent, a barrier dressing should be applied and a strategy of regular breaks and alternating between different interface types should be used.
- A mask the covers the face can reduce nasal bridge ulceration
- In severe cases, topical steroids and/or antibiotics may be indicated

British Thoracic Society Reports,
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Vol 15, Issue 4, 2024

RECOMMENDATION: All services that provide acute NIV should establish a process to learn from and reduce the rate of pressure damage caused by NIV masks.

Local sleep and ventilation services (who have extensive experience of management of patients on long-term respiratory support) as well as tissue viability teams, are key stakeholders to involve in this process.

2. Domiciliary NIV in the hospital environment

Case synopsis 4:
A patient with neuromuscular disease on home NIV was admitted. Their usual NIV was not given during the first few days of admission and instead they were given supplementary oxygen. When they developed respiratory deterioration and an arterial blood gas confirmed ventilatory failure, this was initially interpreted as due to oxygen/hypoxic respiratory drive rather than omission of NIV, leading to further delay in (re)starting their usual NIV.

We identified a number of cases where incidents occurred relating to the provision of long-term NIV in patients admitted acutely, including cases where nocturnal ventilation was not administered following hospital admission.

Best practice and key areas for improvement:

Home CPAP (continuous positive airway pressure) and NIV should be continued following hospital admission to avoid risk of respiratory deterioration. BTS Guidelines[6] advise that a modest increase in the domiciliary ventilator settings should be made in the case of home mechanical ventilation patients being admitted with AHRF.
Patients on home NIV are often admitted via acute medical or medical admission units where staff may have less experience of NIV than those on specialist respiratory wards.

RECOMMENDATION: Hospitals that admit patients on long term respiratory support should have clear care pathways that ensure the ongoing provision of respiratory support.

These may include prioritising such patients for transfer to level 2/Acute Respiratory units, or alternatively, where the patient is independent with their own NIV, allowing them to self-administer this on a ward where NIV is not usually provided.

Another reason domiciliary NIV may be omitted following acute admission, is that the admitting team were unaware the patient was receiving this treatment.

RECOMMENDATION: Safety alerts should be used in local IT systems to highlight patients receiving domiciliary NIV when they are admitted.

3. Transfer of unstable patients requiring NIV/HFNO between clinical areas

Case synopsis 5:
A patient presenting with acute exacerbations of COPD with ventilatory failure was commenced on NIV in ED resus. When transferred to the ward, they were transferred without NIV or monitoring, accompanied only by a porter. Breathing worsened during transfer/time off NIV. On arrival at the ward, no bed was initially available, so there was further delay in (re)starting NIV.

British Thoracic Society Reports,
ISSN 2040-2023:
Vol 15, Issue 4, 2024

Best practice and key areas for improvement:
BTS Guidelines describe the appropriate care environments for delivery of NIV. Although no specific guidelines regarding the transfer of patients on NIV are given, the existing recommendations that oxygen saturation should be continuously monitored and that ECG monitoring is advised if the patient has a tachyarrythmia should be followed. The Intensive Care Society Guidelines on the transfer of critically ill patients[8] (although primarily applicable to transfers between hospitals) advise that "Minimum standards of monitoring must be applied in every case. Monitoring should be continuous throughout the transfer. All monitors, including ventilator displays and syringe drivers should be visible to accompanying staff".

RECOMMENDATION: When patients receiving acute NIV (or HFNO) are transferred between clinical areas in the hospital, safety measures should include, as a minimum, continuous monitoring and transfer accompanied by a nurse with experience of NIV. Local policies and protocols should reflect this standard.

Summary and conclusions

This pilot project was undertaken both to investigate potential trends in patient safety in Pneumonia and NIV, but also to explore the feasibility and usefulness of this approach.

Advantages and limitations of analysing the NRLS dataset to identify patient safety issues related to respiratory medicine

This analysis of the NRLS patient safety reports allowed review of a large, diverse dataset. We were able to review reports from trusts across England. Given the volume of data involved, this approach was also significantly less labour-intensive than a conventional audit of a comparable subject; as described in the methods the two reviews were undertaken by three members of the QIC across two days.

Another advantage of this approach was the ability to analyse both quantitative data to determine broad themes and individual cases for specific learning points. This allowed the reviewers to identify rare but significant problems that might not be visible if only national audit data was looked at (as in a traditional audit). Finally, the methodology offers the possibility for replicating the same search criteria at different timepoints. This has potential as a simple method to monitor evolving themes.

However, limitations with this approach need to be acknowledged. Unlike (for example) Emergency Medicine, where relevant incidents can be directly identified by the "specialty or location" filter, topics of interest in respiratory medicine span areas in the hospital. This means identifying reports relating to an index condition requires review of free-text fields. A significant issue encountered was the high numbers of reports returned by the free-text search criteria of no direct relevance to the area of interest. For example, any neonate treated with CPAP was included in the "NIV" search terms, and a number of *Klebsiella pneumonia* bacteraemias were included in the "Pneumonia" search. Analysis of each index condition therefore required review of individual reports, and quantitative data with numerators and denominators could not be given.

Secondly, there was variation in how severity was reported. There were a few instances of very similar events given different grades of harm, and even some events resulting in death reported as "low harm". Limiting analysis by level of harm was therefore unreliable, meaning cases needed to be looked through individually.

British Thoracic Society Reports,
ISSN 2040-2023:
Vol 15, Issue 4, 2024

Thirdly, we are only able to review and present the data on NIV and pneumonia from incident reports completed. Unlike a traditional audit, it is therefore not possible to say whether these rates are representative of the frequency such adverse effects occur in clinical practice. A final limitation is that the anonymous nature of these reports means that we cannot seek further information from the trusts involved, nor can we feedback learning points.

Learning points for future analysis of NRLS data

This pilot review has shown that analysing patient safety incident data for respiratory medicine is both feasible and useful. BTS would like to encourage the respiratory community to consider further areas where this approach could be useful, accepting the limitations described above. Using the experience of the NRLS team at NHS England to define appropriate free text search terms is likely to improve the process. Setting the criteria too narrow will lead to cases being missed, but too broad and the needle of relevant cases will be lost amidst the haystack of noise in the system.

Given the uncertainty about the extent to which adverse event reporting quantifies the scale of problems in clinical practice, this approach may be most effective when used alongside traditional audits. For example, it could be used to identify previously unrecognised safety signals that can be quantified more accurately by a national audit.

In conclusion, the findings from this pilot analysis demonstrate that interrogation of the NRLS patient safety incident database can be used to effectively and meaningfully to identify patient safety issues in respiratory medicine. Such an approach offers a further valuable tool for the BTS to support ongoing improvements in patient care.

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