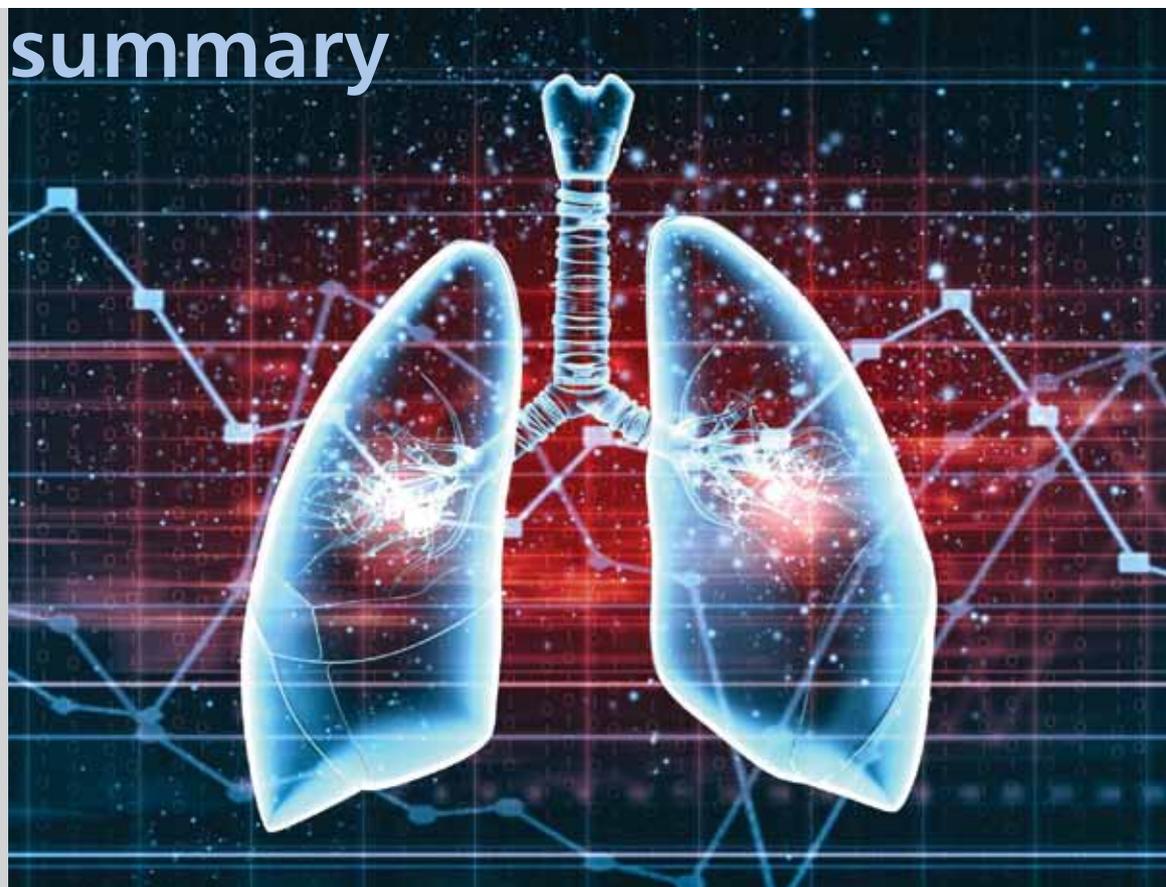


Inspiring Change

A review of the quality of care provided to patients receiving acute non-invasive ventilation

summary



Inspiring Change

A review of the quality of care provided to patients receiving acute non-invasive ventilation

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Principal recommendations

All hospitals should have a clinical lead for their acute non-invasive ventilation (NIV) service. The clinical lead should have time allocated in their job plan with clear objectives, including audit and governance for this service. *(Medical Directors and Nursing Directors)*

Treatment with acute non-invasive ventilation (NIV) must be started within a maximum of one hour of the blood gas measurement that identified the need for it, regardless of the patient's location. A service model whereby the NIV machine is taken to the patient to start treatment prior to transfer for ongoing ventilation will improve access to acute NIV. *(All Clinical Staff Providing Acute Non-Invasive Ventilation and Acute Non-Invasive Ventilation Service Leads)*

All hospitals where acute non-invasive ventilation (NIV) is provided must have an operational policy that includes, but is not limited to:

- Appropriate clinical areas where acute NIV can be provided, and in those areas the minimum safe level of staff competencies;
- Staff to acute NIV patient ratios;
- Escalation of treatment and step down care procedures;
- Standardised documentation; and
- Minimum frequency of clinical review, and seniority of reviewing clinician

Compliance with this policy should be part of the annual audit process. *(Medical Directors, Nursing Directors and Acute Non-Invasive Ventilation Service Leads)*

**See Appendix 1 – British Thoracic Society competency checklist www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrcpics-guideline-for-non-invasive-ventilation/*

All patients treated with acute non-invasive ventilation (NIV) must have a treatment escalation plan in place prior to starting treatment. This should be considered part of the prescription for acute NIV and include plans in relation to:

- Escalation to critical care;
 - Appropriateness of invasive ventilation; and
 - Ceilings of treatment.
- This should take into account:
- The underlying diagnosis;
 - The risk of acute NIV failure; and
 - The overall management plan.

(All Clinical Staff Responsible for Starting Acute NIV)

**See Appendix 1 – British Thoracic Society NIV*

prescription chart

www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrcpics-guideline-for-non-invasive-ventilation/

All patients treated with acute non-invasive ventilation (NIV) must be discussed with a specialist competent in the management of acute NIV at the time treatment is started or at the earliest opportunity afterwards. Consultant specialist review to plan ongoing treatment should take place within a maximum of 14 hours. *(Acute Non-Invasive Ventilation Service Leads)*

All patients treated with acute non-invasive ventilation must have their vital signs recorded at least hourly until the respiratory acidosis has resolved. A standardised approach such as the National Early Warning Score is recommended.

(Nurses and Acute Non-Invasive Ventilation Service Leads)

**See Appendix 4 – National Early Warning Score (NEWS)*

www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news

All hospitals should monitor their acute non-invasive ventilation mortality rate and quality of acute NIV care. This should be reported at Board level. *(Chief Executives, Medical Directors, Nurse Directors and Acute Non-Invasive Ventilation Service Leads)*

Please see page 14 for the full list of recommendations.

Introduction

Whilst this is a report looking at the care provided to patients receiving acute non-invasive ventilation (NIV), it must be noted that the most common condition that NIV is used for in hospital is chronic obstructive pulmonary disease (COPD). COPD accounts for around 25% of deaths from lung disease, is the fifth biggest killer disease in the UK and with around 115,000 emergency hospital admissions per year is the second most common reason for hospital admission.

Approximately 20% of patients with COPD present to hospital in acidotic ventilatory failure (elevated carbon dioxide, CO₂). Once CO₂ levels have started to rise, a small further reduction in breathing will lead to a larger rise in CO₂ levels and worsening of acidosis. This leads to a downward spiral and eventually, coma and death. Rapid access to treatment as soon as possible after respiratory acidosis develops is therefore important. NIV can provide this support by using a mask or similar device to attach a ventilator to the patient.

A key study in 2000 demonstrated the effectiveness of NIV delivered by nursing staff on respiratory wards in the UK.¹ NIV reduced mortality from 20% to 10% when compared to standard care. Although NIV was shown to be safe and effective when delivered in a ward environment by nurses, this was in a clinical trial and the survival advantage was limited to patients with less severe acidosis (pH 7.25-7.35).

It is recommended that all patients admitted to hospital with COPD with acidotic ventilatory failure should receive NIV delivered by appropriately trained staff in a dedicated setting.² NIV therefore needs to be widely available in clinical practice to achieve this standard. However, the availability

of NIV means that patients with non-COPD diagnoses are increasingly being treated with it. These patients often require a more complex approach to ventilation. Mortality rates are also higher in patients with diagnoses such as cardiogenic pulmonary oedema and pneumonia treated with NIV.³

There is wide variation in how hospital NIV services are organised. In some hospitals it is delivered in intensive care or specialist respiratory high dependency units and in others, on the medical wards. Acute non-invasive ventilation is a specialist procedure. Introduction on general wards means that it can be initiated by non-specialists and often junior staff working out of hours.

The British Thoracic Society (BTS) has conducted an annual audit of NIV since 2010.³⁻⁵ This has included patients with any diagnosis leading to treatment with acute NIV in hospitals in the UK. In the last three audit periods the dataset has shown an increase in mortality rates rather than an improvement. The audit data raises a number of important questions about both the organisation of services and the care delivered to patients receiving NIV. These include whether the correct patients are being treated with NIV, whether treatment is being delayed inappropriately and whether better escalation of treatment to critical care is needed. It also raises questions about whether services for NIV are organised in a way that ensures it is commenced by appropriately trained staff and delivers the most effective results.

The study presented in this report was proposed to answer these questions about the care received by patients treated with acute NIV in hospital in the United Kingdom.

Method and Data Returns

Method

Study Advisory Group

The Study Advisory Group (SAG) comprised a multidisciplinary group of clinicians in: respiratory medicine, acute medicine, critical care, anaesthesia, emergency medicine, specialist respiratory physiotherapy, respiratory specialist nursing, a patient treated with NIV and a lay person.

Study aim

To identify and explore avoidable and remediable factors in the process of care for patients treated acutely with non-invasive ventilation (NIV).

Objectives

The Study Advisory Group identified a number of objectives that would address the primary aim of the study:

- Prompt recognition of ventilatory failure and rapid initiation of NIV
- Appropriate documentation and management of ventilator settings to correct respiratory failure
- Escalation of treatment decisions and planning including admission to critical care
- Assessing multidisciplinary team approach
- Assessing the adequacy of communications with families and carers
- Examining the management of the 'acute' end of life pathway and ceilings of treatment including appropriateness of NIV as an intervention
- Organisational aspects of care delivery for NIV on acute, general or respiratory wards to include aspects of staff training

Hospital participation

National Health Service hospitals in England, Scotland, Wales and Northern Ireland were expected to participate as well as public hospitals in the Isle of Man, Guernsey and Jersey.

Within each hospital, a named contact, referred to as the NCEPOD Local Reporter, acted as a link between NCEPOD and the hospital staff, facilitating case identification, dissemination of questionnaires and data collation.

Study population and case ascertainment

Patients aged 16 years or older who were admitted as an emergency between 1st February 2015 and 31st March 2015 inclusive, and who received NIV acutely.

Exclusions

Patients already on active treatment with long-term NIV at home.

Case identification using the OPCS code for NIV

The standard procedure code (OPCS code) for NIV is E85.2. This code includes continuous positive airways pressure (CPAP), intermittent positive pressure ventilation (IPPV) and negative pressure ventilation (NPV).

Non-invasive ventilation is a treatment which is used to improve CO₂ elimination. CPAP is a form of respiratory support which is used either to improve oxygenation or to act as a splint to maintain patency of the upper airway. It does not improve CO₂ elimination and was not therefore included in this study. Since the introduction of IPPV, NPV is rarely used. The machines currently used to deliver NIV and CPAP often look similar.

For the purposes of this study the term NIV applies to IPPV within this OPCS code. It was clear from entries in the case notes submitted for this study that there is a poor clinical understanding of the difference between NIV and CPAP.

The use of the term NIV as a code that includes a form of respiratory support that is not ventilation is unhelpful. This adds to the poor understanding of the difference between ventilation and CPAP that is seen clinically. There are important differences between the indications for ventilation and CPAP. Confusion can have adverse effects on patient care. Avoiding this confusion is therefore of great importance. The effect of the mixed use of the code was demonstrated clearly in the cases identified, and the high number of cases that had to be excluded in this study (Figure 1.1).

Questionnaires and case notes

Two questionnaires were used to collect data for this study; a clinician questionnaire for each patient and an organisational questionnaire for each hospital participating in the study.

Clinician questionnaire

This questionnaire was sent to the consultant responsible for the patient at the time of their discharge or death. If that consultant was not the most suitable person to complete the questionnaire they were asked to identify a more appropriate consultant. Information was requested on the patient's presenting features/comorbid conditions, initial management, investigations, NIV treatment, complications, escalation in care, follow-up and outcome.

Organisational questionnaire

The data requested in this questionnaire included information on the staff that manage patients on NIV, locations where NIV patients were managed, guidelines and standard operating procedures relevant to the management of patients on NIV.

Case notes

Copies of case note extracts were requested for each case that was to be peer reviewed:

Final inpatient admission

- All inpatient annotations/medical notes for the patient's final admission
- Nursing notes
- Critical care notes
- Operation/procedure notes

- Anaesthetic charts
- Observation charts
- Haematology/biochemistry results
- Fluid balance charts
- Blood transfusion records
- Drug charts
- Nutrition/dietitian notes
- Consent forms
- Discharge letter/summary
- Autopsy report if applicable

Peer review of the case notes and data

A multidisciplinary group of case reviewers was recruited to peer review the case notes and associated clinician questionnaires. The group of case reviewers comprised consultants, trainees and clinical nurse specialists, from the following specialties: respiratory medicine, anaesthesia, intensive care medicine, high dependency medicine, acute medicine, physiotherapy and respiratory nursing.

Questionnaires and case notes were anonymised by the non-clinical staff at NCEPOD. All patient identifiers were removed. Neither the Clinical Co-ordinators at NCEPOD, nor the case reviewers, had access to patient identifiable information.

After being anonymised, each case was reviewed by at least one reviewer within a multidisciplinary group. At regular intervals throughout the meeting the Chair allowed a period of discussion for each reviewer to summarise their cases and ask for opinions from other specialties or raise aspects of the case for discussion.

Case reviewers answered a number of specific questions using a semi structured electronic questionnaire and were encouraged to enter free text commentary at various points.

The grading system below was used by the case reviewers to grade the overall care each patient received:

Good practice: A standard that you would accept from yourself, your trainees and your institution.

Room for improvement: Aspects of **clinical** care that could have been better.

Room for improvement: Aspects of **organisational** care that could have been better.

Room for improvement: Aspects of both **clinical and organisational** care that could have been better.

Less than satisfactory: Several aspects of clinical and/or organisational care that were well below that you would accept from yourself, your trainees and your institution.

Insufficient data: Insufficient information submitted to NCEPOD to assess the quality of care.

Information governance

All data received and handled by NCEPOD complies with all relevant national requirements, including the Data Protection Act (DPA) 1998 (Z5442652), the NHS Act 2006 (PIAG 4-08(b)/2003, App No 007) and the NHS Code of Practice.

Quality and confidentiality

Each case was given a unique NCEPOD number. The data from all questionnaires received were electronically scanned into a preset database. Prior to any analysis taking place, the data were cleaned to ensure that there were no duplicate records and that erroneous data had not been entered during scanning. Any fields that contained data that could not be validated were removed.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries were produced.

The qualitative data collected from the case reviewers' opinions and free text answers in the clinician questionnaires were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD Clinical Co-ordinators, a Clinical Researcher and two Researchers to identify the nature and frequency of recurring themes.

Case studies have been used throughout this report to illustrate particular themes.

All data were analysed using Microsoft Access™ and Excel™ by the research staff at NCEPOD.

The findings of the report were reviewed by the Study Advisory Group, Reviewers, NCEPOD Steering Group including Clinical Co-ordinators, Trustees and Lay representatives prior to publication.

Data returns

In total 9,299 patients were identified as meeting the study inclusion criteria (Figure 1.1 overleaf). When the sampling criteria, of up to five cases per hospital was applied and 1152 cases were selected for inclusion in the main data collection. A large number of cases (474) were subsequently excluded (both originally sampled cases and reselections). In the large majority of cases (291) this was because the patient received CPAP rather than NIV. A total of 432/678 (64%) completed clinician questionnaires and 353 sets of case notes were returned to NCEPOD.

METHOD AND DATA RETURNS

Within this study the denominator will change for each chapter and occasionally within each chapter. This is because data have been taken from different sources depending on the analysis required. For example, in some cases the data presented will be a total from a question taken from the clinician questionnaire only, whereas some analysis may have required the clinician questionnaire and

the case reviewer's view taken from the case notes. The term 'clinician' is used to refer to data obtained from the clinician responsible for that patient's discharge and care and the term 'reviewer' used to refer to data obtained from the multidisciplinary group who undertook the peer review of case notes.

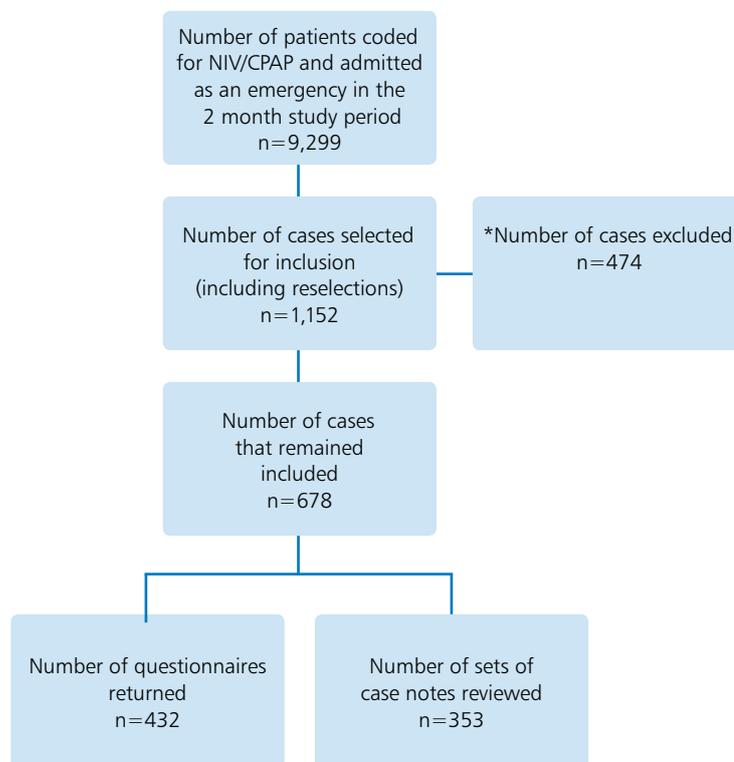


Figure 1.1 Data returns

Key Findings

Organisational data

- 39/165 hospitals routinely collected data on the number of NIV episodes in their hospital
- In 23.4% (37/158) of hospitals, NIV services were covered out of hours by a respiratory consultant all of the time
- In 75.3% (119/158) of hospitals respiratory consultants provided cover for 50% or less of the out of hours time period and in 15 hospitals there was no out of hours cover provided by a respiratory consultant
- Continuous oxygen saturation monitoring was only available on 98/121 respiratory wards, 26/35 general medical wards, where NIV was used, and on 61/66 respiratory high care wards
- Continuous ECG monitoring was available in just under 68/96 acute medical units and 44/66 respiratory high care areas
- Just under half of hospitals (79/162; 48.8%) had a defined ratio of nurses to NIV patients as recommended by this BTS
- 144/166 (86.7%) hospitals had a named medical clinical lead for their NIV service. This was usually a respiratory consultant (138/140). In 110 hospitals, the lead consultant had no specific time allocated in their job plan to lead the service
- 160/165 (97.0%) hospitals had a local guideline or protocol for the provision of NIV
- Over 90% of local guidelines listed indications, contraindications and a recommendation to make an escalation plan when initiating NIV treatment
- 114/166 (68.7%) hospitals had a prescription form for NIV
- 136/163 (83.4%) hospitals used an observation chart specifically for use with NIV
- 70/154 (45.4%) hospitals had staff without a defined competency who supervised patients receiving NIV.

Sample population

- The majority of patients were admitted via the emergency department (343/421; 81.5%)
- 69.1% (288/417) of patients were admitted with COPD
- 14.4% (60/417) of patients were admitted with cardiogenic pulmonary oedema
- 50 patients (12%) were admitted where the primary indication for NIV was pneumonia
- 60/300 (20%) of patients had been ventilated previously for the same indication
- The majority of patients were moderately (32.9%) or severely (18.8%) frail
- Over three quarters (216/283; 76.3%) of the patients for which it was assessed, had a MMRC dyspnoea score of 3 or 4 which reflects breathlessness on exertion on mobilising 100 meters or less.

Initial management

- First consultant review was documented in 410 cases. In 98 (23.9%) patients this review was by a respiratory consultant. In 97 (23.7%) it was by a consultant in acute medicine
- Early warning scores were not used in 159/338 (47%) cases
- In patients where an early warning score was used, the majority (101/179; 56.4%) of patients had a score of 6 or more indicating the need for urgent clinical assessment
- There were 84/312 (26.9%) peer reviewed cases where the case reviewers found that oxygen toxicity contributed to the hypercapnia
- Only 81/283 (28.6%) patients had an oxygen saturation level within the recommended target range of 88-92%
- Of the 158 patients with an oxygen delivery device recorded, a venturi mask was used in only 27 (17.1%)
- In total 50/347 (14.4%) patients either had no clear initial management plan or an inappropriate one.

Medical management and treatment prior to NIV being started

- In nearly a fifth of cases treatment with NIV was not an appropriate intervention (66/351; 18.8%). In this group, 42 out of the 66 patients died
- In 80/352 (22.7%) cases, non-ventilator management prior to NIV was not appropriate and clinicians who reviewed the case notes in their own hospital found 72/422 (17.1%) cases where there was room for improved non-ventilator management. The areas for improvement that were identified included use of controlled oxygen therapy and better use of bronchodilators
- There were 58/348 (16.7%) cases where appropriate specialist review was not documented
- 297/395 (75.2%) patients were reviewed by a respiratory consultant during the admission
- In 151/284 (53.2%) patients treatment changes were initiated as a result of a senior review
- In the cases where treatment was changed, ventilator settings were altered in approximately a half (72/142; 50.7%) and in non-ventilator treatments in almost three quarters (105/143; 73.4%) of cases
- 59/382 (15.5%) of cases reviewed, the decision to start NIV was made by a junior member of medical staff.

Non-invasive ventilation episode

- There was a delay in starting NIV in 96/350 (27.4%) patients in the view of the reviewers and in 63/420 (15.0%) in the view of the clinicians
- For 88/156 (56.4%) patients who started NIV in the emergency department, their pH was below 7.26 and there was a sub-group (28/88) who were suffering from oxygen toxicity
- 66/150 (44.0%) patients were treated on acute medical units, respiratory or general wards with a starting pH <7.26 and in 56/150 (37.3%) patients treatment was continued in a general ward area despite a high risk of treatment failure and guidelines that recommend a higher level of care
- In 180/350 (51.4%) of the cases reviewed, ventilator settings were not adequately documented
- Despite the severity of illness, the frequency of documentation of vital signs was not appropriate in over a third (104/311; 33.4%) of patients
- Blood gas sampling was too infrequent in almost a third of cases (107/331; 32.3%)
- The ongoing ventilator management after initial set up was not appropriate in 100/288 (34.7%) cases
- There were signs of deterioration on NIV in 145/345 (42.0%) patients. The most common feature was worsening acidosis which occurred in 70 of the patients
- In the majority of cases (100/145; 69%) clinical deterioration resulted in clinical review of the patient
- There did not appear to be a difference in the pH response to ventilation during the first four hours of treatment between the patients who survived and those who died
- In those patients who survived the average pH at initiation of NIV was 7.247, rising to an average of 7.402 which reflected success of ventilation in correcting the acidosis
- In patients who died, the average starting pH was 7.261. In this group, the pH failed to correct and the final pH on stopping NIV remained below normal at 7.317
- The average time to correct the acidosis was just under 22 hours for 148 patients where pH values were available for both time points
- In survivors, the average respiratory rate improved in treatment from 25 to 21 (114 patients)
- In patients who died, the average respiratory rate was 29 at the beginning of the NIV episode and 26 when NIV was discontinued (43 patients)
- 28/184 (15.2%) patients had an initial heart rate of more than 120 beats per minute at the start of the episode. Current guidelines recommend continuous ECG monitoring for this group
- In 90/322 (28%) patients, the reviewers felt that ventilation was not discontinued at an appropriate time
- NIV was successful in 221/347 (63.7%) patients. In the group of 126/347 (36.3%) where NIV failed, 18 patients proceeded to intubation and invasive ventilation. In almost a quarter of all cases (86/347; 24.8%) treatment was withdrawn
- Overall 112/264 (42.4%) patients had some aspect of ventilator management which was found not to be appropriate
- There was room for improvement in decision making about ventilator management in 174/288 (60.4%) cases reviewed.

Escalation and critical care

- 156/328 (47.6%) patients were referred to critical care
- In 77 cases where reviewers felt that NIV treatment failure was predictable, 26 patients had no treatment escalation plan in place
- In 36 patients the reviewers considered that the initial acidosis was so severe that intubation would have been appropriate. Of these, 14/36 were not referred to critical care
- 68/144 (47.2%) patients referred to critical care had a frailty score of 6 (moderately frail) or higher. In the patients not referred to critical care, 117/165 (70.9%) had a frailty score in this range
- Of the patients admitted to critical care, 91 received NIV and 18 were intubated. This gave an overall intubation rate of 5.1% (18/353) in the peer reviewed cases
- Of the patients admitted to critical care, 26/92 died in the critical care unit, 3 patients were discharged directly home on NIV, 63 patients were discharged back to a ward and of these, 10 were discharged on NIV.

Discharge, follow-up and advance care planning

- 31/432 (7.2%) patients were discharged on NIV
- In patients who survived, the discharge summary did not include arrangements for follow-up in 44/176 (25.0%) cases
- Follow-up arrangements were made in two thirds of cases (171/266; 64.3%)
- Where documented, the follow-up that was arranged did not take place in over a third of cases (50/145; 35.7%)
- Almost one in six patients (49/270; 18.1%) were readmitted within 30 days of discharge
- In 199/217 of the reviewed cases (91.7%), no documented decision was made about future use of NIV
- In only a small number (24/217, 11.1%) of cases was an advance care plan documented prior to discharge.

Mortality

- National NIV audits over the last three cycles have shown worsening mortality rates, rising most recently to 34%
- Data from the peer review of cases in this study showed a mortality rate of 34.6% (117/338) and from the overall cohort of patients 35.3% (150/425)
- The largest diagnosis group was COPD and mortality in this group was 25.1% (50/199)
- The outcome for patients with a pH in the 7.26-7.35 range in this study was a mortality rate of 25.8% (39/151) for all cases and 18.7% (20/107) in the COPD group
- When NIV was initiated in the first 24 hours of admission, mortality was 25.1% (57/227). If it was used at a later stage of the admission, the mortality in this group was 55.4% (56/101)
- Initiation of NIV in the emergency department or the acute medical unit was associated with a mortality rate of 25% (42/168) and 31.5% (23/73) respectively. In other areas, the mortality rate was 40% or higher.

Pneumonia

- In the peer reviewed cases there was evidence of pneumonia in just over half (177/351; 50.4%) of the cases
- Overall 57/166 (34.3%) patients with pneumonia were admitted to critical care. This compares with 45/160 (28.1%) of the cases without pneumonia
- 76/171 (44.4%) patients with pneumonia died compared with 41/165 (24.8%) without pneumonia
- In 130/175 (74.3%) patients who had pneumonia, reviews considered the NIV was an appropriate treatment.

Governance arrangements for NIV services

- Of the 150 patients who died, only 30 had their care discussed at a morbidity and mortality meeting
- Most (135/160; 84.4%) hospitals contributed to the latest British Thoracic Society audit of NIV in 2013
- Fewer than half (74/162; 45.7%) of hospitals audited their own NIV service annually
- 65/165 (39.4%) hospitals reported in the previous 12 months that they had had times when they had more patients requiring NIV than machines available
- 44/154 (28.6%) hospitals investigated serious incidents or safety events related to NIV in 2015.

Recommendations

The overarching purpose of these recommendations is to improve the quality of care provided to patients receiving acute non-invasive ventilation (NIV). Issues in relation to the timeliness, appropriateness, location, level of care and competency of staff treating patients with acute NIV have been highlighted. Those who should be primarily responsible for leading on the recommendations are listed in parentheses after each recommendation. These are NCEPOD's suggestions and can be extended to others as appropriate.

1. All hospitals should have a clinical lead for their acute non-invasive ventilation (NIV) service. The clinical lead should have time allocated in their job plan with clear objectives, including audit and governance for this service. *(Medical Directors and Nursing Directors)*
2. Continuous positive airways pressure (CPAP) and non-invasive ventilation (NIV) should be coded separately. They are two distinct treatments given for different conditions and separate coding will reduce clinical confusion and improve reporting of outcomes. *(NHS Digital and the Association of Clinical Coders)*
3. Acute non-invasive ventilation treatment should only be provided in clinical areas equipped with:
 - a. Continuous pulse oximetry;
 - b. Continuous ECG monitoring; and
 - c. Rapid access to the results of blood gas analysis.*(Medical Directors and Nursing Directors)*
4. In line with current British Thoracic Society guidelines, patients with known chronic obstructive pulmonary disease, or other known risk factors for hypercapnic respiratory failure, should have an oxygen saturation of 88-92% maintained, both prior to admission and on admission to hospital. The device used for oxygen delivery, the concentration of oxygen administered and the target saturation should be documented in the relevant patient record. *(Ambulance Trusts and Emergency Medicine Physicians)*
5. Treatment with acute non-invasive ventilation (NIV) must be started within a maximum of one hour of the blood gas measurement that identified the need for it, regardless of the patient's location. A service model whereby the NIV machine is taken to the patient to start treatment prior to transfer for ongoing ventilation will improve access to acute NIV. *(All Clinical Staff Providing Acute Non-Invasive Ventilation and Acute Non-Invasive Ventilation Service Leads)*
6. In all areas providing acute non-invasive ventilation (NIV), a minimum staffing ratio of one nurse to two acute NIV patients must be in place, as recommended in the British Thoracic Society guideline. The duration for which this should continue will be determined by each individual patient's response to ventilation. *(Nursing Directors and Medical Directors)*
7. All hospitals where acute non-invasive ventilation (NIV) is provided must have an operational policy that includes, but is not limited to:
 - a. Appropriate clinical areas where acute NIV can be provided, and in those areas the minimum safe level of staff competencies;
 - b. Staff to acute NIV patient ratios;
 - c. Escalation of treatment and step down care procedures;
 - d. Standardised documentation; and
 - e. Minimum frequency of clinical review, and seniority of reviewing clinicianCompliance with this policy should be part of the annual audit process. *(Medical Directors, Nursing Directors and Acute Non-Invasive Ventilation Service Leads)*
**See Appendix 1 – British Thoracic Society competency checklist www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrcpics-guideline-for-non-invasive-ventilation/*

RECOMMENDATIONS

8. All staff who prescribe/make changes to acute non-invasive ventilation treatment must have the required level of competency as stated in their hospital operational policy. A list of competent staff should be maintained. *(Medical Directors and Nursing Directors)*
**See Appendix 1 – British Thoracic Society competency checklist and NIV prescription chart*
www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrpic-guideline-for-non-invasive-ventilation/
9. All patients treated with acute non-invasive ventilation (NIV) must have a treatment escalation plan in place prior to starting treatment. This should be considered part of the prescription for acute NIV and include plans in relation to:
 - a. Escalation to critical care;
 - b. Appropriateness of invasive ventilation; and
 - c. Ceilings of treatment.This should take into account:
 - d. The underlying diagnosis;
 - e. The risk of acute NIV failure; and
 - f. The overall management plan.*(All Clinical Staff Responsible for Starting Acute NIV)*
**See Appendix 1 – British Thoracic Society NIV prescription chart*
www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrpic-guideline-for-non-invasive-ventilation/
10. All patients treated with acute non-invasive ventilation (NIV) must be discussed with a specialist competent in the management of acute NIV at the time treatment is started or at the earliest opportunity afterwards. Consultant specialist review to plan ongoing treatment should take place within a maximum of 14 hours.
(Acute Non-Invasive Ventilation Service Leads)
11. All patients receiving acute non-invasive ventilation (NIV) should receive, as a minimum, daily consultant review while they remain on ventilation. This consultant must be competent in acute NIV management.
(Clinical Directors and Consultants Responsible for Acute NIV)
12. All patients treated with acute non-invasive ventilation must have their vital signs recorded at least hourly until the respiratory acidosis has resolved. A standardised approach such as the National Early Warning Score is recommended. *(Nurses and Acute Non-Invasive Ventilation Service Leads)*
**See Appendix 3 – National Early Warning Score (NEWS)*
www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news
13. Documentation of all changes to ventilator settings is essential and the use of a standardised proforma is recommended. *(Acute Non-Invasive Ventilation Service Leads)*
**See Appendix 1 – British Thoracic Society NIV prescription and settings chart*
www.brit-thoracic.org.uk/standards-of-care/guidelines/btsrpic-guideline-for-non-invasive-ventilation/
14. The use of acute non-invasive ventilation could act as a flag to consider referral to palliative care services, as this may be valuable for both active symptom control and end of life care. *(Clinical Staff)*
15. Following an acute non-invasive ventilation episode, a structured plan for future treatment should be discussed with the patient and/or carer either at the point of discharge from hospital or at subsequent follow-up. This must be documented and a copy of the plan given to the patient and to the patient's general practitioner.
(Clinical Staff)
16. In the absence of a recognised indication for acute non-invasive ventilation (e.g. chronic obstructive pulmonary disease) patients with acute ventilatory failure and evidence of pneumonia have a high risk of death and acute NIV should not be considered standard treatment. Escalation of treatment should be actively considered. There should be close liaison between senior members of the medical and critical care teams to agree the most appropriate approach to management. *(Consultants)*

RECOMMENDATIONS

17. Governance arrangements for acute non-invasive ventilation (NIV) services should be in place in all organisations that provide acute NIV treatment. These should include all disciplines and specialities involved in the delivery of NIV. Depending on the local service model, those involved in the governance of acute NIV services are likely to include medical, nursing and physiotherapy staff from Emergency Medicine, Acute Medicine, Respiratory Medicine and Critical Care. *(Medical Directors, Nursing Directors and Acute Non-Invasive Ventilation Service Leads)*
 18. All acute non-invasive ventilation services should have a record kept of the number of patients treated, to aid service planning. *(Acute Non-Invasive Ventilation Service Leads)*
 19. All acute non-invasive ventilation services should be audited annually. The audit results should be reported to the Hospital Board. *(Acute Non-Invasive Ventilation Service Leads and Medical Directors)*
 20. All hospitals should monitor their acute non-invasive ventilation mortality rate and quality of acute NIV care. This should be reported at Board level. *(Chief Executives, Medical Directors, Nurse Directors and Acute Non-Invasive Ventilation Service Leads)*
 21. A quality standard for acute non-invasive ventilation is required to facilitate quality improvement in acute non-invasive ventilation services. *(British Thoracic Society and Local Quality Improvement Leads)*
- NCEPOD strongly encourages the establishment of quality improvement work both locally and nationally to target the issues identified by this study. A gap analysis table to start this is available at www.ncepod.org.uk/niv
- Effective quality improvement initiatives and their results should be shared locally and nationally wherever possible. NCEPOD would support dissemination of this work at future NCEPOD report launches and in NCEPOD newsletters.

Overall quality of care and summary

Overall quality of care

The reviewers were asked to assign a grade to the overall care received by each patient in the study.

Overall care was rated as good in 67/347 (19.3%) cases. The reviewers judged that there was room for improvement in clinical and/or organisational care in a high proportion of patients, 254/347 (73.2%). There were 26 patients where the overall care was felt to be less than satisfactory (Table 12.1 and Figure 12.1)

Table 12.1 Overall quality of care – reviewers' opinion

	Number of patients	%
Good Practice	67	19.3
Room for improvement clinical	119	34.3
Room for improvement organisational	43	12.4
Room for improvement clinical and organisational	92	26.5
Less than satisfactory	26	7.5
Subtotal	347	
Insufficient data	6	
Total	353	

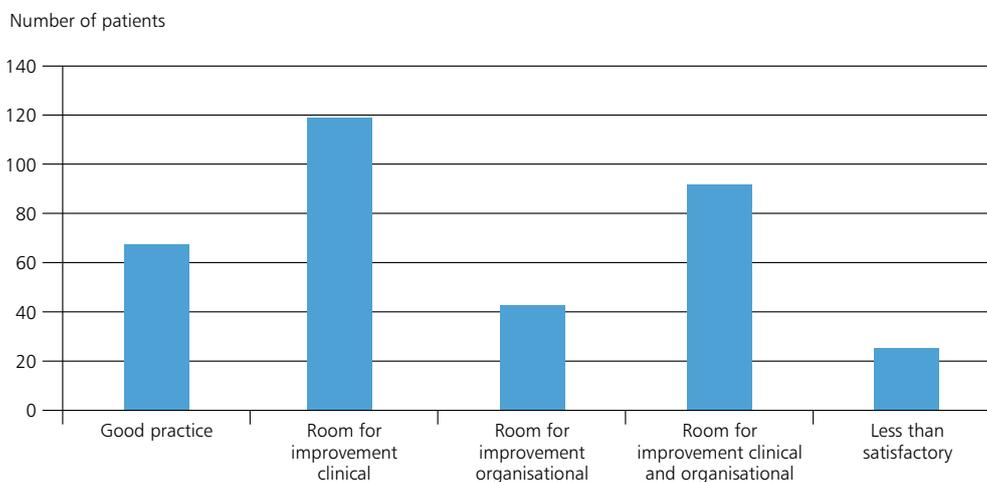


Figure 12.1 Overall quality of care – reviewers' opinion

Summary

The provision of effective care to patients with acute non-invasive ventilation is more complex than it first seems.

This study has shown that major improvements are required. The care of these patients was rated as less than good four out of five cases. The mortality rate was high; more than one in three patients died.

Despite guidelines that recommend staffing levels and arrangements for monitoring patients treated with NIV, there was wide variation in how services were organised. Supervision of care and patient monitoring were commonly inadequate.

Case selection for NIV was often inappropriate, and treatment was frequently delayed due to a combination of service organisation and a failure to recognise that NIV was needed. The quality of medical care provided was often poor. This poor care included both non-ventilator treatments and ventilator management which were frequently inappropriate.

This study has also revealed the complexity involved in assessing an individual patient's response to NIV. This involves detailed vital signs monitoring, and blood gas analysis alongside an understanding of the effect of changes in ventilator settings and the overall goals of treatment. All aspects of this assessment were frequently poorly done or omitted entirely.

Both the reviewers who assessed the cases and the clinicians who looked after the patients in their own hospitals identified the same areas for improvement in care. Organisations regularly reported clinical incidents related to patients receiving NIV. Despite this they frequently did not audit their own practice.

In order to improve the outcome from NIV, organisations must act to ensure services are well designed, local leadership is in place and competent staff are available to deliver care. For clinicians, the importance of case selection, regular patient assessment, specialist involvement and the clinical factors that influence outcome needs to be emphasised.

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