



HEALTHCARE SAFETY
INVESTIGATION BRANCH

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Summary

Treating COVID-19 patients using Continuous Positive Airway Pressure (CPAP) outside of a critical care unit

Independent report by the
Healthcare Safety Investigation Branch NI-003087

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About HSIB

We conduct independent investigations of patient safety concerns in NHS-funded care across England. Most harm in healthcare results from problems within the systems and processes that determine how care is delivered. Our investigations identify the contributory factors that have led to harm or the potential for harm to patients. The safety recommendations we make aim to improve healthcare systems and processes, to reduce risk and improve safety.

We work closely with patients, families and healthcare staff affected by patient safety incidents, and we never attribute blame or liability.

Considerations in light of coronavirus (COVID-19)

A number of HSIB national investigation reports were in progress when the COVID-19 pandemic significantly affected the UK in 2020. Much of the work associated with developing the reports necessarily ceased as HSIB's response was redirected.

For this national report, the investigation continued as the pandemic progressed due to its association with COVID-19.

A note of acknowledgement

HSIB thanks Terry's family, who shared the events documented in this report. They gave generously of their time and were involved and supportive throughout the investigation. In accordance with their wishes, Terry is referred to by name throughout this report.

HSIB also thanks the healthcare staff for their engagement with the investigation, and for their openness and willingness to support improvements in this area of care.

About Terry

Terry was married to Pat. Together they had six children. Terry is described as a “real family man” who loved his grandchildren and “loved helping people”. He previously worked as a butcher and enjoyed building things in his spare time. Terry loved Christmas and decorated his home with amazing Christmas lights. This was a yearly commitment through which he raised money for charity, dressing up as Father Christmas and showering the street and its excited children and their parents in pretend snow. Terry had decorated his house prior to his admission to hospital in December with the help of his son. In the year Terry died, he had raised £4,000 for charity.

About the report

This report is intended for healthcare organisations, policy makers and the public to help improve patient safety in relation to the management of patients with COVID-19 being treated with non-invasive respiratory support, for example continuous positive airway pressure (CPAP), in non-critical care environments. For readers less familiar with this area of healthcare, medical terms are explained within the report.

Disclaimer

Non-invasive ventilation, high-flow nasal oxygen and continuous positive airway pressure (CPAP) are used as forms of non-invasive respiratory support for those with respiratory failure, which has not responded to conventional oxygen therapy. This investigation report is primarily focussed on the use of CPAP as a form of non-invasive respiratory support outside of the critical care unit. Some of the principles of care for patients receiving CPAP in this report will also be applicable to patients receiving non-invasive ventilation and high-flow nasal oxygen; however, the specifics of monitoring and staffing requirements may be different.

Our investigations

Our investigators and analysts have diverse experience of healthcare and other safety-critical industries and are trained in human factors and safety science. We consult widely in England and internationally to ensure that our work is informed by appropriate clinical and other relevant expertise.

We undertake patient safety investigations through two programmes:

National investigations

Concerns about patient safety in any area of NHS-funded healthcare in England can be referred to us by any person, group or organisation. We review these concerns against our investigation criteria to decide whether to conduct a national investigation. National investigation reports are published on our website and include safety recommendations for specific organisations. These organisations are requested to respond to our safety recommendations within 90 days, and we publish their responses on our **website**.

Maternity investigations

We investigate incidents in NHS maternity services that meet criteria set out within one of the following national maternity healthcare programmes:

- Royal College of Obstetricians and Gynaecologists' 'Each Baby Counts' report
- MBRRACE-UK 'Saving Lives, Improving Mothers' Care' report.

Incidents are referred to us by the NHS trust where the incident took place, and, where an incident meets the criteria, our investigation replaces the trust's own local investigation. Our investigation report is shared with the family and trust, and the trust is responsible for carrying out any safety recommendations made in the report.

In addition, we identify and examine recurring themes that arise from trust-level investigations in order to make safety recommendations to local and national organisations for system-level improvements in maternity services.

For full information on our national and maternity investigations please **visit our website**.

Executive Summary

Background

This investigation explores the issues associated with caring for patients attending hospital with COVID-19 who need help with their breathing. Often this help takes the form of oxygen therapy, where oxygen is given through a face mask or through little tubes that sit in the nose. Even with oxygen therapy, however, some patients still cannot take in enough oxygen to breathe. When this happens, a patient is described as being in respiratory failure. These patients' oxygen levels may be improved by using a special device that delivers a flow of oxygen-enriched air at a constant pressure through tubing and a mask, or hood, worn by the patient. This is known as continuous positive airway pressure (CPAP). CPAP is a form of non-invasive (that is, used outside the body) respiratory support that is used when the patient is awake and able to breathe on their own.

CPAP is often used to support a patient's breathing in critical care or high-dependency units, where there are high numbers of staff to patients. Staff in these units are trained and familiar with the use of non-invasive respiratory support. During the first and second waves of the COVID-19 pandemic, however, many more patients needed CPAP than there were beds in critical care and high-dependency units. Thus, hospitals had to create alternative areas and arrangements for delivering and caring for patients who needed CPAP.

This investigation explores the use of CPAP outside of critical care and high-dependency units during the COVID-19 pandemic. Specifically, the investigation explores the risks of caring for acutely unwell patients requiring CPAP in the side rooms of general wards.

As an example, which is referred to as 'the reference event', the investigation considered the death of Terry, who was admitted to hospital with symptoms of COVID-19 and required support with his breathing using CPAP. Terry was cared for in the side room of a medical ward. On the second day after his admission to hospital, Terry was found on the floor next to his bed, having called for assistance. Terry's CPAP tubing had become disconnected from his mask, meaning that Terry's breathing was not supported. Staff attempted to resuscitate Terry. They were not successful and Terry died.

The investigation's findings aim to improve the safety of patients being treated in side rooms and other clinical areas outside of a critical care unit, and so improve care for patients across the NHS. The findings and conclusions of this investigation may be applicable to other conditions that require patients to be cared for in a side room.

The reference event - December 2020

Terry's family telephoned for an ambulance after Terry had become increasingly unwell at home with symptoms of COVID-19. He was admitted to the emergency department of his local hospital and was initially given oxygen therapy via a facemask to support his breathing. Other recommended medications for treating COVID-19 were started after Terry tested positive for the infection.

Despite oxygen therapy, Terry's oxygen kept dropping below acceptable levels. The decision was made to start non-invasive respiratory support using CPAP. Because CPAP is an aerosol-generating procedure, meaning small airborne particles (aerosols) can be released from the respiratory tract when it is used, Terry required nursing in a side room to reduce the risk of COVID-19 cross-infection to other patients and staff. Terry was therefore transferred to a side room on a medical ward to receive CPAP. Terry found the CPAP mask uncomfortable, and it caused him anxiety at times.

Terry's condition, including his changing oxygen requirements, was monitored. In addition to care given by medical and nursing staff on the ward, Terry was regularly seen by nurses from the critical care outreach team. He was also seen by a doctor from the critical care unit.

At approximately 20:05 hours on Terry's second day after admission, Terry called for help using his call bell. The ward was extremely busy at this time because of a staff shortage, coupled with competing clinical priorities and a new patient arriving on the ward with more admissions expected. A nurse was putting on her personal protective equipment ready to enter Terry's room and looked through the observation window. She could see Terry lying unmoving on the floor with his head under the bed. The CPAP machine and other alarms, which would normally alert staff to a potential problem, could not be heard outside of the side room.

On entering the side room, the nurse pressed the emergency buzzer and asked for the resuscitation team to be called. Terry still had the CPAP mask on his face but the tubing was disconnected. Terry did not respond to resuscitation attempts and died.

National investigation

During the peaks of the COVID-19 pandemic, increased numbers of people required admission to hospital because of respiratory failure. There was a corresponding increase in patients requiring non-invasive respiratory support with CPAP. CPAP is an aerosol-generating procedure, meaning it can result in the release of airborne particles (aerosols) from the respiratory tract (that is, the organs involved in breathing). When someone is suspected or known to be suffering from an infectious agent such as COVID-19, these particles pose a risk of infection to others. Therefore, patients with suspected or known COVID-19

who needed CPAP were treated in special areas to reduce the chance of infecting others. Such areas included negative pressure side rooms (that is, a room where the air pressure inside the room is lower than that outside the room) or specific clinical areas, such as a respiratory support unit, to which groups of patients requiring CPAP could be moved.

The Healthcare Safety Investigation Branch (HSIB) contacted the hospital where the reference event occurred. The trust at which the reference event took place (referred to in this report as ‘the Trust’) welcomed HSIB’s involvement and collaborated with information gathering. Early evidence gathering found that national bodies had recently developed guidance and recommendations in relation to the use of CPAP outside of critical care settings. The Chief Investigator authorised a national safety investigation to identify if the guidance and recommendations from the national bodies addressed the safety issues identified from the reference event.

The investigation highlights areas that have been recognised as significant during the NHS response to the COVID-19 pandemic to date, in particular:

- workforce gaps and skills needed to meet demand, both on general wards and in critical care environments
- challenges with delivering treatment outside normal clinical areas
- challenges for staff working outside their normal clinical areas
- the use of equipment that may have design limitations, particularly if used outside the environment for which it was intended.

Findings

The investigation found the following:

- Patients with COVID-19 who are treated with CPAP require close monitoring and observation. Caring for such acutely unwell patients in side rooms on general wards poses a safety risk as, unless there is central monitoring (that is, where staff at the central nurses’ station can observe patients via monitors that duplicate the bedside monitors screens and alarms), staff will not be able to easily see the patient. Furthermore, equipment alarms designed to alert staff to a problem often cannot be heard outside of the room.
- There are staffing challenges and other pressures associated with caring for acutely unwell patients who require non-invasive respiratory support, such as CPAP, outside of critical care or high-dependency units.

- During the first and second waves of the COVID-19 pandemic, staffing levels were affected by the need for staff to self-isolate. More recent Public Health England guidance produced during the HSIB investigation – which removes the need for fully vaccinated people (provided certain criteria is met) to self-isolate after contact with a person with COVID-19 – may mitigate against the staffing challenges seen during the reference case.
- Staff caring for patients with COVID-19 requiring CPAP on general wards need training and competency assessment to feel confident in delivering care.
- National guidelines define a mandatory nurse-to-patient ratio for patients receiving acute non-invasive ventilation (NIV) of 1:2 (that is, one nurse should care for no more than two patients) until the patient is weaned to nocturnal (night-time) NIV only. This ratio reflects the fact that patients receiving acute NIV are at risk of deterioration, unplanned admission to a critical care unit and death. The national guidance is clear that although the nurse-to-patient ratio in a respiratory support unit would be 1:4, increased acuity of illness requires additional staff on the unit. In the reference event, it was not possible to achieve these nurse-to-patient ratios on a medical ward.
- National guidance documents from the Intensive Care Society, the British Thoracic Society, Getting It Right First Time and others published during the HSIB investigation make recommendations that addressed the safety risks identified. The published guidance includes the following:
 - Hospitals should establish respiratory support units that are staffed in line with existing national recommendations. This includes a minimum nurse-to-patient ratio of 1:4, with nurses trained in administering CPAP and high-flow nasal oxygen.
 - Patients requiring non-invasive respiratory support such as CPAP should be centrally monitored. Central monitoring allows patients to be observed and equipment alarms to be heard at the central nurses' station.
 - Hospitals should have protocols that define the frequency of nursing review (that is, how often a nurse checks on a patient), especially for acutely unwell patients located in side rooms.
 - Hospitals should have checklists for the safe use of CPAP/NIV outside of critical care and high-dependency units. For example, the British Thoracic Society and Intensive Care Society (2021a) guidance on establishing respiratory support units includes a checklist for the safe use of CPAP/NIV outside of critical care and high-dependency units.

- Minimum safe staffing levels should be followed when caring for patients who require non-invasive respiratory support.
- Where possible, organisations should procure CPAP devices that allow remote monitoring.
- Staff caring for patients requiring non-invasive respiratory support outside of critical care settings should meet training and competency requirements.

Because recommendations have already been made by national bodies in recently published guidance, this report makes no safety recommendations. HSIB encourages organisations to act on the national guidance and resultant recommendations when caring for patients with COVID-19 requiring non-invasive respiratory support, including CPAP, outside of a critical care setting.

Based on the above findings:

HSIB asks healthcare providers to consider the following safety questions

Safety question 1:

Do you have an operational policy that includes the areas of the hospital where non-invasive respiratory support can be provided? Does your operational policy include the minimum safe level of staff competencies, the minimum nurse-to-patient ratio for patients receiving non-invasive respiratory support on the ward, and the minimum frequency of clinical review? Standard requirements that should be included in an operational policy can be found in the 'Inspiring change' report (National Confidential Enquiry into Patient Outcome and Death, 2017), joint guidance by the British Thoracic Society and Intensive Care Society (2021a) on developing and implementing respiratory support units, and the Getting It Right First Time (2021) review of respiratory medicine.

Safety question 2:

Do you use side rooms to care for patients requiring non-invasive respiratory support? If so, how do you ensure that monitors and alarms can be seen and heard by staff when outside of the room? Do you have central monitoring?

Safety question 3:

Do your continuous positive airway pressure (CPAP) devices have the capability for remote monitoring?

Safety question 4:

Do you have the required staff and skill mix to care for patients requiring non-invasive respiratory support in side rooms on a general ward? How are issues with staffing and workload escalated and responded to? Are senior trust personnel aware and involved?

Safety question 5:

Do your staff have the required training and competency assessments to care for patients requiring non-invasive respiratory support? Examples of appropriate training and competency assessments include the 'COVID-19 skills preparation course' (European Society of Intensive Care Medicine, 2021) and the 'National competency framework for registered practitioners: level 1, patients and enhanced care areas' (National Outreach Forum and Critical Care Networks - National Nurse Leads, 2018).

Safety question 6:

Do your staff complete a checklist (for example, the 'SAFER NIV/CPAP - a checklist for use in pandemic response and on respiratory support units' or similar) (British Thoracic Society and Intensive Care Society, 2021a) when a decision has been made to initiate non-invasive ventilation/continuous positive airway pressure (CPAP) and at every shift change?



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