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Expert Review of Respiratory Medicine

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ierx20

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To cite this article: Ravina Barrett , Eugene Catangui & Railton Scott (2020): Acute oxygen therapy: a cross-sectional study of prescribing practices at an English Hospital immediately before COVID-19 pandemic., Expert Review of Respiratory Medicine, DOI: 10.1080/17476348.2021.1826316

To link to this article: https://doi.org/10.1080/17476348.2021.1826316

Accepted author version posted online: 18 Sep 2020.

Publisher: Taylor & Francis & Informa UK Limited, trading as Taylor & Francis Group

Journal: *Expert Review of Respiratory Medicine*

DOI: 10.1080/17476348.2021.1826316

Article type: Original Research

Acute oxygen therapy: a cross-sectional study of prescribing practices at an English Hospital immediately before COVID-19 pandemic.

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Abstract

Background: Approximately 14% of UK hospital in-patients receive supplemental oxygen therapy, but only 57% have valid prescriptions. Oxygen must be optimally prescribed to ensure maximal therapeutic response whilst minimising adverse outcomes (including fatality). This study investigates prescription compliance.

Methods: All adults admitted to medical wards (18th February - 3rd March 2020) were included. Analyses present proportions, descriptive statistics and hypothesis testing. Ethical approval was not required for this audit.

Results: Of the 636 patients admitted, 66 (10%) were receiving oxygen therapy. Ages ranged from 34-100 years with 36 (54.5%) males and 30 (45.5%) females. The prescription was not documented in the oxygen section of the drug chart (n=37, 56.1%, p=0.389), nor did it have the physicians signature (n=40, 60.6%, p=0.110) nor date (n=46, 69.7%, p=0.002). Thirteen chronic obstructive pulmonary disease (COPD) patients (19.7%) were at risk of hypercapnic failure ($p=1.582x10^{-6}$). Target oxygen saturation (SpO2) range had been documented for 30 (45.5%) patients. A target SpO2 range of 88-92% was documented for 9 patients (13.6%), a 94-98% range documented for 11 patients (16.7%). All patients had an invalid prescription.

Conclusion: We present real-world practice in naturalistic settings, immediately before pandemic-lockdown. Enhanced compliance is advocated to reduce risks of harm and mortality.

Keywords: Oxygen; Hypercapnia; Inpatients; Oxygen Inhalation Therapy; Oximetry; Hypoxia; Pulmonary Disease, Chronic Obstructive; Dyspnea; Iatrogenic Disease.

Article highlights

- Despite oxygen's ubiquitous use in the acute setting, current prescribing practice is demonstrably sub-optimal. It is of grave concern that not a single patient prescribed oxygen therapy had a fully valid oxygen prescription.
- The lack of prescribing and signing of oxygen during drug rounds is congruent with the literature, giving further credence to the suggestion that HCPs disregard oxygen as a drug equivalent.
- Previous studies have implemented interventions to combat poor prescribing practice, mandatory educational sessions, pharmacist reviews and prompting prescribers to prescribe oxygen on charts by other healthcare professionals, which have shown positive improvements in line with guideline recommendations.
- Our study presents authentic real-world data from naturalistic settings in an English hospital. A limitation of our study is its modest sample size and potential subjectivity when interpreting clinical notes.
- We specifically recommend that at the point of writing a prescription, the physician or pharmacist must identify whether the patient uses oxygen at home, what the acceptable range for SpO2 is, what percentage of pure oxygen is required with appropriate flow rate, its intended purpose (e.g. continuous, at night, ambulatory, 'as required'), the intended duration (e.g. for six hours postoperatively), the mechanism of delivery (e.g. nasal cannula) and the level of humidification along with identifiable signatures and date.

1. Introduction

Oxygen is one of the most widely available and used therapeutic agents in the world. Oxygen is intended for treatment of hypoxaemia and not breathlessness.[1] About 14% of UK hospital patients received supplemental oxygen therapy on any given day, but only one-third of these patients had any type of 'prescription' or 'written order' for oxygen in 2008. This had risen slowly but was still only 57% as recorded in the 2015 national audit.[1]

Appropriate prescribing of oxygen therapy can be potentially life-saving by reversing hypoxaemia, by increasing oxygen delivery to tissues and subsequently preventing tissue hypoxia.[1] However, it is essential that clinicians acknowledge that oxygen is a drug with specific biochemical and physiologic actions, a distinct range of effective doses and well-defined adverse effects at escalating doses. The human body responds differently depending on the type of exposure to supplemental oxygen. Short exposures to high partial pressures at greater than atmospheric pressure leads to central nervous system toxicity, as seen in divers or in hyperbaric oxygen therapy. Pulmonary and ocular toxicity results from longer exposure to elevated oxygen levels at normal atmospheric pressure.[2] Recent research delineates the negative consequences associated with excessive oxygen supplementation i.e. the physiological state of hyperoxia. Negative effects of hyperoxia include; absorption atelectasis, the formation of reactive oxygen species (ROS), reduced cardiac output and induction of cerebral, retinal and coronary vasoconstriction.[3,4]

Oxygen has a role in hypoxaemic patients but has little symptomatic benefit to non-hypoxaemic breathless patients[3] including in cancer[5], chronic heart failure[6], acute myocardial infarction [7] and palliative care.[8] Patients should therefore only receive oxygen if presenting with hypoxia as confirmed by arterial blood gas (ABG) analysis, except in emergency situations.[1]

Stolmeijer et al. found a single study demonstrating a transient protective effect of hyperoxemia after traumatic brain injury (TBI). However, other studies revealed higher mortality rates after cardiac arrest, stroke, and TBI treated with oxygen supplementation leading to hyperoxemia. Approximately half of the studies showed no association between hyperoxemia and clinically relevant outcomes. Hence, they concluded that liberal, injudicious oxygen therapy potentially results in hyperoxemia which may negatively affect survival after acute illness. Consequently, aiming for normoxemia may limit negative clinical effects of oxygen therapy in patients with acute illness.[9] Similarly, Chu et al. found that in acutely ill adults, high-quality evidence shows that liberal oxygen therapy increases mortality without improving other patient-important outcomes. Supplemental oxygen might become unfavourable above an oxygen saturation (SpO2) range of 94-96%, thus supporting conservative administration of oxygen therapy.[10]

When hypoventilation progresses with certain flow rates of supplemental oxygen, escalating carbon dioxide (CO_2) retention may go undetected by pulse oximetry monitoring until very late when lethal levels of CO_2 have already accumulated.[48–50] This masking effect from supplemental oxygen may result in increased morbidity and mortality.[11]

Titration of supplemental oxygen to normoxia is advised to avoid the negative effects of both hyperoxia and hypoxia in acutely ill adult patients.[12] An awareness that oxygen is only indicated in hypoxaemia and not breathlessness, is lacking amongst both clinicians and patients.[13] Kelly et al. find a set of fixed beliefs regarding oxygen exists amongst healthcare professionals' (HCPs) and patients, including the perception that oxygen is a universal remedy.[14] They also established that HCPs use oxygen for symptom relief, and more broadly, that HCPs levels of knowledge and understanding could be substantially and significantly enhanced.[15]

In 2010, Austin et al. confirmed high-flow oxygen therapy administered to chronic obstructive pulmonary disease (COPD) patients inadvertently releases sequestered carbon dioxide leading to respiratory acidosis with an associated increased mortality risk.[16] Titrating oxygen therapy to achieve saturations of 88–92% is recommended in patients with an acute exacerbation of COPD to avoid hypoxemia and reduce the risk of oxygen-induced hypercapnia.[17] Echevarria et al. state that such an intervention would both simplify prescribing and may improve outcome.[18]

It is now accepted that respiratory failure types II (T2RF) and COPD patients require controlled, low-dose oxygen therapy, aiming for a lower target oxygen saturation range, as measured by pulse oximetry, to achieve a SpO2 of 88–92% vs. 94–98% in non-COPD patients.[1,19] Low concentration oxygen therapy (controlled oxygen therapy) is reserved for patients at risk of hypercapnic respiratory failure, which is more likely in those with a history of T2RF, COPD , advanced cystic fibrosis; severe non-cystic fibrosis bronchiectasis; severe kyphoscoliosis or severe ankylosing spondylitis; severe lung scarring caused by tuberculosis; musculoskeletal disorders with respiratory weakness, especially if on home ventilation; an overdose of opioids, benzodiazepines, or other drugs causing respiratory depression.

This permits adequate tissue oxygenation, without precipitating acidosis or worsening hypercapnia.[20] Although there is now a well-recognised risk with high-flow oxygen administration in COPD patients, audit data still shows that over-oxygenation is twice as likely than under-oxygenation.[1]

Given this background, we present a medical-ward research-audit at a regional teaching hospital in England (East Surrey Hospital has 697 beds and provides acute and complex services, ranging from outpatient, diagnostic to planned services), which focuses on oxygen prescriptions compliance with Trust guidelines to ensure patient safety.

Study objectives were to:

a) Identify whether the oxygen prescription is fully documented in the medication chart and that prescription is signed and dated by the prescriber;
b) Identify whether an indication* is specified;
c) Identify whether the patient is at risk of hypercapnic failure. If so, are these COPD patients, morbidly obese (BMI>40), does the patient have a chest wall deformity or suffer from neuromuscular disease;
d) Identify whether the patient has a documented target SpO2 range. What is the SpO2 range? (88 - 92%, 94 - 98%; Other or N/A)
e) Identify whether a delivery device has been stipulated (Nasal cannula, Venturi mask, Humidified, Non-rebreathe mask or Non-invasive ventilation - e.g. BIPAP, CPAP, Optiflow);
f) Identify whether a flow rate been stated (pro re nata (PRN) or continuous), the domiciliary oxygen status, humidification status.
g) Identify whether the medication chart been signed and dated by a nurse following administration;
h) Identify whether an SpO2 been documented during medical review and
i) Identify whether the patient is within their target range (documented SpO2).

*Patients' medical notes were used to identify the indication for initiating oxygen therapy as there is no dedicated section on the oxygen prescription for recording the indication.

2. Methods

2.1 Study design

All adult patients admitted to fourteen medical wards between 18th February and 3rd March 2020 were included in this clinical audit. We focused only on the oxygen prescription, and not post-operative use of oxygen. Paediatric wards were excluded as no oxygen guidelines exist for patients under the age of 16 years. Surgical and gynaecology wards were excluded due to time constraints.

2.2 Setting

To identify patients suitable for this audit, the ward handover sheet was utilised. We noted the reason for admission to the ward, patients' past medical history and the proposed treatment plan.

2.3 Participants

The ward handover sheet was used to identify patients receiving oxygen. Nurses responsible for each bay were informed of the proposed audit and were asked to identify patients receiving oxygen therapy at the time of data collection. Patients that had received oxygen therapy during their admission, but not during the data collection period were excluded.

2.4 Bias

Exclusion of these patients was to minimise bias and to ensure the homogeneity of each sample between wards as well as ensuring a systematic and consistent data collection approach. Each patient's oxygen prescription (on the drug charts) was assessed for errors or omissions as per local guidelines.

2.5 Study size

No formal power calculations were conducted because all prescriptions should be compliant with hospital guidelines. Patients' bedside notes containing National Early Warning Score (NEWS) observational charts were evaluated to obtain information regarding oxygen saturations during the latest observation round. This was done to determine whether each oxygen patient was being maintained within their prescribed SpO2 target range or a range that is clinically appropriate, if one was not documented (for example we assumed an SpO2 range of 88–92% for patients at risk of hypercapnia e.g. COPD patients).

Oxygen saturations were also used to identify patients at risk of iatrogenic hypercapnia. COPD patients' SpO2 that exceeded the recommended upper threshold of 92% by ≥2% were deemed to be at risk of oxygen-induced hypercapnia.[21]

As this was a clinical audit, ethical approval was not required as confirmed by the Medicines Research Council and the National Health Service (NHS) Health Research Authority. The clinical audit was conducted according to the principles of the World Medical Association Declaration of Helsinki.[22]

2.6 Statistical methods

Analyses were undertaken using SPSS v0.26[23] to present proportions, descriptive statistics and conduct hypothesis testing using the binomial test [24] at 95% confidence level and 5% significance assuming a '50% chance' of an outcome as in a coin toss for dichotomous outcomes. Hypothesis testing using Chi-Square (χ^2) test[25] was used for categorical quantities and documented SpO2 ranges were assessed for normality (one-sample Kolmogorov-Smirnov test[26]). Missing data are presented, any sub-group analysis is descriptive.

2.7. No Patient and Public Involvement.

We did not involve patients or the public in our audit. We used the STROBE cross sectional reporting guidelines.[27]

3. Results

Of the 636 patients admitted across the 14 wards, 66 (10%) patients were receiving oxygen therapy and were included in our analysis. Data was collected from prescription charts, medical and bedside notes. Respiratory wards contributed the highest proportion of patients prescribed oxygen. Ages ranged from 34-100 years (mean 76 years, standard deviation 15.385 years), there were 30 (45.5%) females and 36 (54.5%) males.

These patients were admitted to the wards (see Table 1)

3.1 Objective aIn most cases, the oxygen prescription was not documented in the oxygen section of the drug chart (Yes n=29, 43.9%, No n=37, 56.1%, binomial test p=0.389), nor did it have the physicians signature (Yes n=26, 39.4%, No n=40, 60.6%, binomial test p=0.110) or date which was statistically significant (Yes n=20, 30.3%, No n=46, 69.7%, binomial test p=0.002).

3.2 Objective b

The documented indication are presented in Figure 1. Patients are distributed unequally across indications, with more indicated for community acquired pneumonia and respiratory failure (type I) which is significant (χ^2 test $p=1.582x10^{-6}$).

3.3 Objective c and d

Off the 66 patients prescribed oxygen, 13 (19.7%) were at risk of hypercapnic failure which was statistically significant (binomial test $p=1.582x10^{-6}$), all were COPD patients. The target SpO2 range had been documented for 30 (45.5%), but not for 36 (54.5%) patients, binomial test p=0.538. A target SpO2 range of 88-92% was documented for 9 patients (13.6%), a 94-98% range was documented for 11 patients (16.7%). Ten patients (15.2%) were labelled as 'Other' and 36 (54.5%) were labelled as 'N/A'. Patients are distributed unequally across SpO2 ranges, which is significant (χ^2 test $p=9.148x10^{-7}$).Those labelled as 'Other' had a target SpO2 of >90% (n=2), >92% (n=3), >94% (n=1) and 90-94% (n=4), χ^2 test p=0.001.

3.4 Objective e and f

A delivery device had been stated for 10 (15.2%) patients which was statistically significant (binomial test $p=3.040x10^{-8}$). All were using a nasal cannulae which was statistically significant (binomial test $p=1.204x10^{-7}$). Of these, a flow rate has been stated for 8 (12.1%) patients (binomial test $p=1.625x10^{-9}$). The as required or continuous section was completed for 12 (18.2%) patients (binomial test $p=4.494x10^{-7}$).

Domiciliary oxygen use section was completed for a single (1.5%) patient (binomial test $p=8.882x10^{-15}$). The Humidification section completed for 10 (15.2%) patients (binomial test $p=3.040x10^{-8}$). All 66 (100%) patients had an incomplete prescription prior to checking signatures.

3.5 Objective g

The prescription had been signed and dated by a nurse following administration for 9 (13.6%) patients (binomial test $p=7.238x10^{-9}$). The majority of patient's SpO2 had been within their target range (n=56, 84.8%, binomial test $p=3.040x10^{-8}$), while 10 (15.2%) were not.

3.6 Objective h

Patient's SpO2 were documented (86% Minimum, 98% Maximum, 93.98% Mean and 2.959% Std. Deviation) and are presented in Table 2. A one-sample Kolmogorov-Smirnov test shows it is not normally distributed ($p=7.265x10^{-7}$).

Sub-group analysis of the 13 COPD patients: oxygen was variously indicated for Acute Stroke, AECOPD, CAP, HAP, IECOPD, LRTI, T1RF and T2RF Of the 13 COPD patients, six patients had a target SpO2 specified, four patients had a target of 88 - 92%, two patients were coded as other (>92%, 90-94%) and seven labelled as 'not applicable'. For three patients, a delivery device had been stated, a nasal cannula was specified, a flow rate was stated, the PRN/Continuous section was complete, one had domiciliary use, two had humidification and none had a valid prescription before checking for signature and date.

3.7 Objective i

All had an SpO2 documented and four were within their target range, which ranged from 88.0% to 98.0%.

Overall, not a single patient was found to have a fully valid, optimally completed oxygen prescription. Hypoxaemia occurred in 2 (3.0%) patients, where in the first patient, SpO2 was 86%, no target range specified, but patient was not at risk of hypercapnic respiratory failure, so a target range of 94-98% was assumed. In the second case, SpO2 was 88%, a target range of 94-98% was prescribed but patient was not at risk of hypercapnia failure.

Hyperoxia occurred in 8 (12.1%) patients (detailed below), of which 4 were COPD patients.

1. Target range of 88-92% was prescribed, patient at risk of hypercapnic failure due to background of COPD and SpO2 was 96%.
2. Patient at risk of hypercapnic failure due to background of COPD, but no target range was prescribed, so 88-92% was assumed, SpO2 was 97%.
3. Patient at risk of hypercapnic failure due to background of COPD, but no target range was prescribed, so 88-92% was assumed, SpO2 was 96%.
4. Patient at risk of hypercapnic failure due to background of COPD, but no target range was prescribed, so 88-92% was assumed, SpO2 was 95%.
5. This was an error as a target range of >92% was prescribed, but patient was at risk of hypercapnic failure, SpO2 was 97%.
6. Target range of 90-94% prescribed, not at risk of hypercapnic failure, SpO2 was 96%.
7. Target range of 90-94% prescribed, not at risk of hypercapnic failure, SpO2 was 96%.
8. A target range of 88-92% was prescribed, patient was not at risk of hypercapnic failure, SpO2 was 94%.

'Breathlessness' was documented as an indication for 7 (10.6%) patients, despite the inconsistent evidence of efficacy of supplemental oxygen for breathless patients.

4. Discussion

Of the 636 patients admitted, 66 (10%) were receiving oxygen therapy. Ages ranged from 34-100 years. The oxygen prescription was not documented in the oxygen section of the drug chart (n=37, 56.1%, binomial test p=0.389), nor did it have the physicians signature (n=40, 60.6%, binomial test p=0.110) nor date (n=46, 69.7%, binomial test p=0.002). Thirteen COPD patients (19.7%) were at risk of hypercapnic failure (binomial test $p=1.582x10^{-6}$). Target SpO2 range had been documented for 30 (45.5%) patients. A target SpO2 range of 88-92% was documented for 9 patients (13.6%), a 94-98% range documented for 11 patients (16.7%). All patients had an invalid prescription.

It is important to note that our findings are not novel. Despite oxygen's ubiquitous use in the acute setting, current prescribing practice is demonstrably sub-optimal. It is of concern that not a single patient prescribed oxygen therapy had a fully valid oxygen prescription. Most prescriptions were indeed on the respiratory ward; therefore, the audit findings are particularly disappointing given the speciality indicating an intractable problem.

We acknowledge that oxygen prescriptions are unlike that of other medicines - oxygen being perceived as 'different' to drug therapy, thus, perhaps lowering the propensity to complete the prescription. Equally, humidification can be a feature of the delivery mechanism or flowrate and so may not be considered important to specify. Prescribers may also specify required criteria but permit flexibility around delivery of those criteria by support staff that may result in incomplete documentation. For example, a prescriber may specify a flowrate of 3 litres per minute and assume that it will be given via nasal cannulae, while knowing that if 8 litres per minute of oxygen is required, then the delivery mechanism will be switched to a face mask. This practical heuristic used internationally, goes undocumented.

Guidelines are in place to ensure maximal efficacy and safety of oxygen prescribing. However, our results demonstrate poor compliance with guidelines. The lack of prescribing and signing of oxygen during drug rounds is congruent with the literature, giving further credence to the suggestion that HCPs disregard oxygen as a drug equivalent. The absence of complete oxygen prescriptions allows varied interpretation, which can result in errors in delivery and can ultimately expose patients to adverse clinical outcomes. Without valid, fully completed oxygen prescriptions, patients are at risk of getting too much or too little oxygen. Four COPD patients were found to be at risk of iatrogenic hypercapnia, as their oxygen saturations exceeded the 92% threshold by more than 2% i.e. increased risk of respiratory acidosis which can result in death.

The difficulty in modifying practice is compounded by the entrenched behaviours and beliefs (globally) associated with prescribing oxygen. It is unclear which interventions may improve the status quo e.g. making the prescription chart user-friendly, education, relieving time pressure and work constraints or other fundamental review.

It is important to praise nursing staff as they consistently document oxygen saturations during observation rounds. This impressively high uptake can be attributed to the introduction of a standardised NEWS chart, that has been widely implemented in practice since 2012.[28] An updated NEWS2 version takes into account patients at risk of hypercapnic respiratory failure, who require lower SpO2 target ranges, permitting appropriate scoring and reducing inappropriate use.[29]

4.1 Other audit comparisons and recommendations

Audits conducted in the United Kingdom and many other countries [1,30–33] have shown consistently poor performance for oxygen use and prescription, which is synonymous with the findings from our study.

Previous studies have implemented interventions to combat poor prescribing practice, mandatory educational sessions [34–36], pharmacist reviews[37] and prompting prescribers to prescribe oxygen on charts [34], which have shown positive improvements in line with guideline recommendations. Given that audits are cyclical, we recommend implementation of these interventions and a re-audit.

Previous studies have found that improving the oxygen prescription chart layout helps to produce real improvements in therapeutic oxygen use.[38] Therefore, a review of the layout of the prescription chart, essentially a simplification, is required. However, prescription rates are known to

be influenced by various factors ranging from types of patient, seasonality, and pandemics, all of which require careful thought and targeted interventions.

4.2 Implications for clinical practice

Improvement in oxygen prescriptions can provide clear instructions for nurses, as well as clear monitoring metrics, which will help to ensure patients are maintained within their optimal range, and reduce the risk of mortality (e.g. the 2009 NPSA report that poor prescribing practices lead to nine deaths[39]). Long-term oxygen therapy (LTOT) improves survival in patients with hypoxaemic COPD.[40] The survival of these patients is reduced compared to the general population of the same age and sex.[41] Patient's own level of disability and quality of life (QoL) maybe impacted longer-term. Hospital prescriptions are often continued in the community setting (post-discharge) without change. Resource utilisation considerations for both patients and hospitals should be assessed. If patients are rehabilitated and stabilised in their homes, this may reduce subsequent hospitalisation and healthcare resource utilisation.

We present data collected prior to the COVID-19 pandemic (lockdown in England began on the 23rd of March 2020). Given the pandemic, we have seen COVID-19 patients prioritised, who have needed oxygen therapy. We have also seen de-prioritisation of the types of patients we have studied, which means these patients are cared for in the community during the pandemic, unless requiring hospitalisation. If hospital-initiated prescriptions roll-over to the community settings, then the implication for clinical practice is that patients are receiving sub-optimal care in the community.

4.3 Strengths and Limitations

Our study presents authentic real-world data in an English hospital that represents practice in naturalistic settings. A limitation of our study is its modest sample size, coupled with potential subjectivity when interpreting clinical notes. COPD patients should initially be maintained within a target SpO2 range of 88–92%, which can be adjusted to 94–98% following ABG analysis that subsequently confirms the absence of hypercapnia.[1] Due to absent ABG data, all COPD patients were assumed to be maintained within a target SpO2 range of 88–92%. Where thresholds deviated for COPD patients, they may not have truly been at risk of iatrogenic hypercapnia. Conversely, due to low portion of target SpO2 ranges documented, this assumption was necessary. We can therefore not be certain if patients were truly at risk of adverse events. Moreover, a retrospective observation of the oxygen saturations was not conducted, only a single oxygen saturation measurement by pulse oximetry was taken. Therefore, 'under-shoots' and 'over-shoots' may have only been short-lived. The sampling window also gives an indication of recent practice, which may not be representative of year-round practice.

5. Conclusion

We advocate enhanced compliance with international and local guidelines. We specifically recommend that at the point of writing a prescription, the physician or pharmacist must identify weather patient uses oxygen at home, what the acceptable range for SpO2 is, what percentage of pure oxygen is required with appropriate flow rate, its intended purpose (e.g. continuous, at night, ambulatory, 'as required'), the intended duration (e.g. for six hours postoperatively), the mechanism of delivery (e.g. nasal cannula) and the level of humidification along with identifiable signatures and date.

Ethical approval

As this was clinical audit, ethical approval was not required as confirmed by The Medicines Research Council and the Health Research Authority. The clinical audit was conducted according to the principles of the World Medical Association Declaration of Helsinki.[22]

Funding
Funding for this study was provided by the University of Brighton.

Declaration of interest
The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

Reviewer disclosures
Peer reviewers on this manuscript have no relevant financial or other relationships to disclose.

Author contributions
RS (first supervisor) & EC were involved in the conception and design, or analysis and interpretation of the data; RS & EC drafted the paper and RB (second supervisor) revised it critically for intellectual content, conducted statistical analysis; and the final approval of the version to be published; and that all authors agree to be accountable for all aspects of the work

Acknowledgements
We would like to thank staff at East Surrey hospital, part of the Surrey and Sussex Healthcare NHS Trust in England. We extend thanks to Dr Rohit Swankar at Weill-Cornell hospital, New York, USA for considering the reasons behind prescription-writing non-compliance.

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Tables

Table 1 Ward distribution of patients, presented by the highest percentages.

Type of ward	Number of residents	Patients prescribed oxygen (n)	Percent (%)
Medical (Respiratory)	50	13	19.7
Medical (Respiratory)	41	11	16.7
Acute Medical Unit (AMU)	89	8	12.1
Medical	49	8	12.1
Medical	46	7	10.6
Medical	42	6	9.1
Medical	54	4	6.1
Medical	40	2	3
Coronary Care Unit (CCU)	16	2	3
Medical	52	2	3
Medical	45	1	1.5
Medical	40	1	1.5
Medical	12	1	1.5
Total	576	66	100

Table 2 Oxygen saturation of patients.

Patient's SpO2	Number of patients	Percent
86%	1	1.5
88%	4	6.1
89%	2	3
90%	6	9.1
91%	1	1.5
92%	2	3
93%	4	6.1
94%	12	18.2
95%	6	9.1
96%	17	25.8
97%	8	12.1
98%	3	4.5
Total	66	100

Figure legends

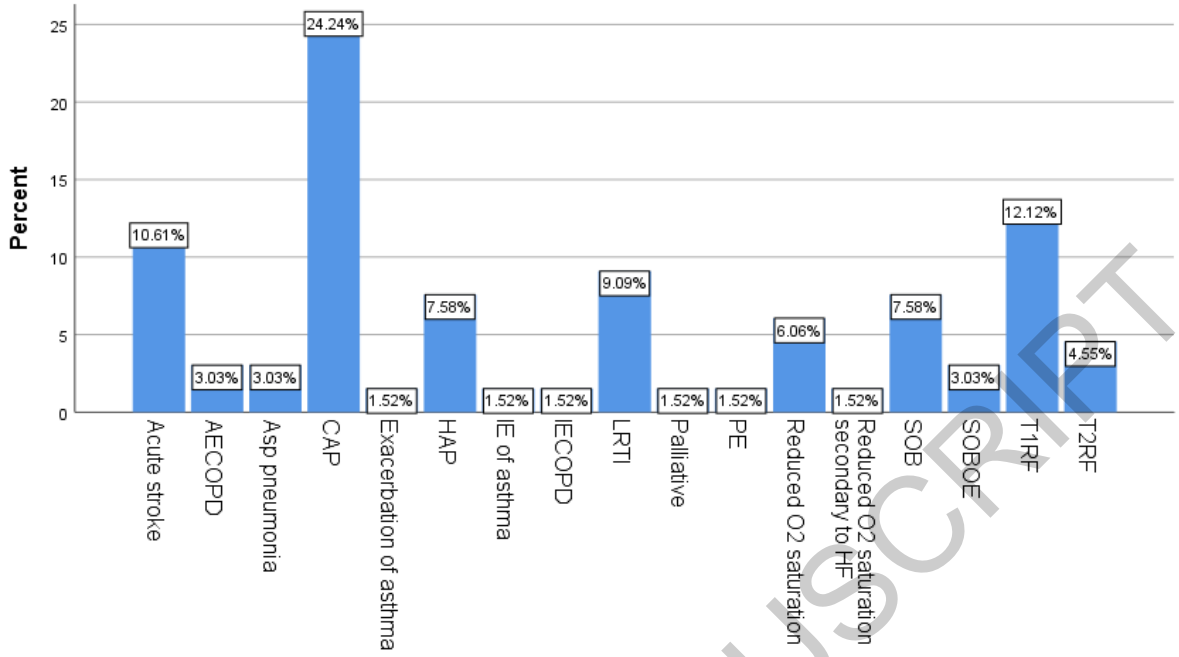

Figure 1 Indication documented on the oxygen prescription. Acronyms: acute exacerbation of chronic obstructive pulmonary disease (AECOPD), Aspiration (Asp), Community-acquired pneumonia (CAP), Hospital-acquired pneumonia (HAP), Infective exacerbation (IE) of Asthma, Infective exacerbation chronic obstructive pulmonary disease patients (IECOPD), Lower respiratory tract infection (LRTI), pulmonary embolism (PE), Reduced oxygen (O2) saturation, heart failure (HF), Shortness of breath (SOB), Shortness of breath on exertion (SOBOE), Respiratory failure types I and II (T1RF, T2RF).

Abbreviations list:

(ABG) arterial blood gas

(AECOPD) acute exacerbation of chronic obstructive pulmonary disease

(CAP) Community-acquired pneumonia

(COPD) chronic obstructive pulmonary disease

(CO2) escalating carbon dioxide

(HAP) Hospital-acquired pneumonia

(HCPs) healthcare professionals'

(IECOPD) Infective exacerbation chronic obstructive pulmonary disease patients

(LRTI) Lower respiratory tract infection

(LTOT) Long-term oxygen therapy

(SpO2) oxygen saturation

(PRN) pro re nata

(QoL) quality of life

(ROS) reactive oxygen species

(T1RF) Respiratory failure types I

(T2RF) Respiratory failure types II

(TBI) traumatic brain injury