

# How much do new junior doctors in emergency medicine understand about oxygen therapy?

**Oxygen is routinely prescribed in hospital practice. It should be prescribed like any other drug, specifying delivery device, flow rate and desired inspired concentration. There appears to be continued deficiency in the provision of guidance for, and understanding of, the principles of oxygen therapy.**

Oxygen, although a normal constituent of the atmosphere, is classed as a drug for the purposes of hospital practice. Prescription of oxygen therapy should follow some basic underlying principles: the choice of appropriate device, and of appropriate flow rate in order to deliver a pre-determined, but approximate, oxygen concentration.

Doctors prescribing oxygen should be able to appropriately deliver optimal inspired concentrations of the gas, tailored to the clinical condition being treated. Previous personal teaching and examining experience at life support courses and at objective structured clinical examinations respectively, at both undergraduate and postgraduate levels, has demonstrated some deficiencies in this area. A survey of junior doctors' knowledge of some aspects of acute care has shown, among other deficiencies, a lack of a clear understanding of oxygen therapy (Smith and Poplett, 2002). Anecdotal evidence also suggests that these deficiencies translate into sub-optimal clinical practice.

The aim of this study was to determine the baseline knowledge of oxygen prescription and delivery in senior house officers about to commence work in the emergency department.

## Subjects and methods

An anonymized questionnaire was distributed to a cohort of 100 newly appointed senior house officers in emergency medicine belonging to six NHS trusts in south-

east England in February 2006. These doctors were attending an induction course for senior house officers in emergency medicine when the questionnaire was administered. The course was conducted over the second and third weekends in February, a different cohort of doctors attending on separate weekends.

The aim of the questionnaire was to test an understanding of the mode of delivery of fixed concentrations of oxygen, and of the correct use of oxygen therapy in various forms of respiratory failure. Two of the questions involved hypothetical clinical situations in which arterial blood gases were available at the time of oxygen prescription to the patient.

The doctors were presented with the questionnaire (Table 1) during the first morning of the induction programme on two successive weekends, and were given 5 minutes to read through and answer the

questions. They were also asked to indicate the number of years post-graduation experience and whether this was their first emergency medicine position. The desired responses to the questions have been added as a footnote to Table 1.

## Results

One hundred questionnaires were distributed, out of which 47 were returned completed. The relatively low response rate was associated with logistic problems of coordinating the handouts and collating the responses. Of the 47 respondents, 22 (47%) gave the desired response to question 1, 13 (28%) to question 2, 25 (53%) to question 3, and 17 (36%) to question 4.

Of the respondents, one (2%) gave the desired response to all four questions, 10 (21%) answered three to the desired standard, 12 (26%) answered two as required, and 18 (38%) gave the appropriate response

**Table 1. Oxygen prescription questionnaire**

For each of the questions below, please choose a single best answer:

1 60% oxygen is delivered by:	a. Nasal cannula at 6 litres/minute b. Simple face mask at 6 litres/minute c. A green Venturi adaptor at 15 litres/minute d. Simple face mask at 4 litres/minute e. A red Venturi adaptor at 15 litres/minute
2 A 60-year-old woman attends the emergency department with an acute exacerbation of COPD. Her blood gases, on room air, are pH 7.2; $paO_2$ 7 kPa, $paCO_2$ 8 kPa; $HCO_3$ 22 mmol/litre on arrival. The maximum safe initial oxygen prescription in the light of these findings should be:	a. 28% oxygen b. 35% oxygen c. 40% oxygen d. 60% oxygen
3 A 75-year-old man attends the emergency department with an acute exacerbation of COPD. His blood gases, on room air, are pH 7.3; $paO_2$ 6.5 kPa; $paCO_2$ 9 kPa; $HCO_3$ 30 mmol/litre. The safest initial oxygen prescription in the light of these findings should be:	a. 28% b. 35% c. 40% d. 60%
4 You are required to provide a patient a fixed concentration of 24% oxygen. The correct means of providing this is:	a. Nasal cannula at 2 litres/minute b. Simple face mask at 2 litres/minute c. Venturi blue adaptor at 2 litres/minute d. Face mask + reservoir bag at 2 litres/minute

Desired responses: 1 (c), 2 (d), 3 (a), 4 (c). COPD = chronic obstructive pulmonary disease;  $HCO_3$  = bicarbonate concentration;  $PaCO_2$  = partial pressure of carbon dioxide in arterial blood;  $PaO_2$  = partial pressure of oxygen in arterial blood

Dr David Mbamalu is Consultant, Dr Ashis Banerjee is Consultant, and Dr Geoff Hinchley is Consultant in the Emergency Department, Chase Farm Hospital, Enfield EN2 8JL and Dr Akin Idowu is Consultant in the Emergency Department, Oldchurch Hospital, Romford

Correspondence to: Dr A Banerjee

to one question. Six respondents (13%) answered all four questions incorrectly.

The majority (23) of the respondents were in their second year post-graduation, five failing to state their level of experience (Table 2). For 33 of the respondents, this was their first emergency medicine position. Six failed to reply to this question.

## Discussion

Our study of a cohort of 47 newly appointed senior house officers in emergency medicine, of whom some had already worked shifts in an emergency department, demonstrates a widespread lack of knowledge about oxygen prescription. Only one respondent provided the desired response to all four questions, and one-fifth of respondents provided the correct response to three questions.

The prescription and provision of oxygen therapy is one of the most common duties undertaken in emergency practice. There would appear to be little formal training in oxygen prescription provided for in many existing curricula, although oxygen therapy now forms part of the core curriculum for foundation year training. The prescription of oxygen is given a short description in the *British National Formulary* (Joint Formulary Committee, 2005), and given incomplete coverage in the life support course manuals. However, among other reports, the National Confidential Enquiry into Patient Outcome and Deaths (2005) report reiterates in its recommendations the need for improvements in oxygen prescription for the critically ill. The content of induction programmes for new entrants to relevant foundation year 2 and specialist training year 1 specialties should focus on areas

that are identified to be a source of concern at present.

Questions 1 and 4 were designed to test an understanding of the choice of oxygen delivery systems available, and the recognition of fixed delivery systems. Specifically, it is well recognized that nasal cannulae provide variable and unpredictable oxygen concentrations and can only be used to reliably deliver low inspired oxygen concentrations (28% and under) (Bazuaye et al, 1992).

In this study, questions 2 and 3 were designed to test an understanding of oxygen prescription in the presence of an acute exacerbation of chronic obstructive pulmonary disease. The correct response to question 2 would allow the safe delivery of a higher inspired oxygen concentration (60% oxygen in the options provided) as this represents acute uncompensated type 2 respiratory failure with a normal range serum bicarbonate concentration on arterial blood gases. In this situation, the fear of suppression of a hypoxic drive to alveolar ventilation with a high initial oxygen concentration is unfounded. However, only 13 out of 47 (28%) respondents gave this as the preferred choice.

For question 3, where controlled oxygen therapy commencing at 28% concentration would be appropriate as this represents chronic type 2 partially compensated respiratory failure with a raised serum bicarbonate concentration, 25 out of 47 (53%) of respondents provided the appropriate response. In this group there is a definite risk of suppression of the hypoxic drive in a sub-set of patients, with the resultant development of carbon dioxide narcosis in the presence of higher initial inspired oxygen concentrations. This message appears to be more widely understood and accepted.

There is an unfounded fear of administering initial high oxygen concentrations in the presence of an acute exacerbation of chronic obstructive pulmonary disease when it is known that only a subset of patients, with chronic partially compensated type 2 respiratory failure, are at risk of suppression of the hypoxic drive.

The optimal strategy for improving standards of oxygen prescription in the emergency setting remains unclear. In one study performed in a respiratory medicine setting, the introduction of a lecture on oxygen delivery and prescription, combined with a dedicated prescription chart, improved oxygen delivery (Dodd et al,

2000). However, in another study based on the provision of verbal and written guidelines for oxygen therapy in a district general hospital, there appeared to be no significant improvement in oxygen prescription by junior doctors (Akbar and Campbell, 2006). Following this study, the authors suggest that a before-and-after audit of oxygen prescription is needed, using an intervention that acts as an aide memoire for junior doctors to the prescribing process. There is certainly a need for a prescriptive guide to the provision of desired (fixed or variable) inspired oxygen concentrations.

## Conclusions

Oxygen therapy is a common intervention in emergency practice. There appears to be a lack of consistent understanding among junior doctors of the underlying principles of oxygen prescription, including the choice of delivery device and of flow rate.

Induction of newly appointed senior house officers in emergency medicine should include verbal and written guidance on oxygen prescription, and this skill should be tested in the course of their stay in the department. There is a useful source to reference oxygen prescription in the article by Dodd et al (2000). **BJHM**

*Conflict of interest: Dr Idowu organised the induction course at which the questionnaire was administered.*

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## KEY POINTS

- Safe oxygen prescription is necessary for optimal care of ill patients.
- There is a need for training focused on the principles of oxygen delivery.
- Oxygen should be prescribed in a standardized and reproducible fashion.

**Table 2. Level of experience of junior doctor**

Number of years post-graduation	Number in group
1	6
2	23
3	6
4	2
5	1
6	1
9	1
10	2