

# Home oxygen therapy assessment for COPD patients discharged from hospital: Respiratory NP Model of Care

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### Author statement

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## KEYWORDS

home oxygen therapy, COPD, hypoxia, discharge, nurse practitioner

## ABSTRACT

### Objectives

The research aim was to examine the impact of the introduction of the Chronic Respiratory Disease Nurse Practitioner (CRD NP) Model of Care (MOC) on the assessment for short term oxygen therapy (STOT), provision of care, and patient outcomes for patients discharged with oxygen therapy post an acute exacerbation of chronic obstructive pulmonary disease (COPD).

### Design

A retrospective uncontrolled comparative clinical audit was conducted in two six-month periods pre (2009) and post (2011) the introduction of the CRD NP MOC.

### Setting

Tertiary referral centre in central Victoria, Australia.

### Subjects

A total of 301 patient admissions with a discharge diagnosis of COPD were examined for hypoxia at rest and on exertion prior to discharge.

### Main outcome measures

The audit focused on the incidence of assessment for STOT prior to discharge, supply of STOT where indicated on discharge, and incidence of re-admission within 28 days of discharge with COPD related symptoms.

### Results

A statistically significant increase in the proportion of appropriate patients assessed with arterial blood gas analysis for eligibility of STOT from 7.7% in 2009 to 45% in 2011. Provision of STOT on discharge increased from 26.7% to 44.4%. Re-admission to hospital within 28 days of discharge for patients with STOT decreased from 25% in 2009 to 12.5% in 2011.

### Conclusion

Since the introduction of the CRD NP MOC there has been an increase in patient assessment for STOT, provision of STOT, reduction in hospital re-admissions, improved adherence to procedure protocols, improved patient outcomes and cost savings for the hospital.

## INTRODUCTION

Oxygen is a drug that has been used for centuries for its therapeutic purposes (McDonald and Crockett 2009) and was first used in the treatment of lung disease in 1922 (Ringbaek 2006). With increasing fiscal pressure to discharge patients as early as is practicable from hospital it is common practice worldwide to discharge patients who have been admitted for chronic obstructive pulmonary disease (COPD) and remain hypoxic at the time of discharge with short term oxygen therapy (STOT) (Ringbaek 2005; Eaton et al 2001). These patients traditionally have been assessed for STOT according to the guidelines for the provision of long term oxygen therapy (LTOT) that applies to their respective country. It is expected many of these patients who are assessed for STOT will be clinically stable and will not fulfil the criteria for LTOT when reassessed within one to two months of discharge. Therefore STOT provides optimal medical management that appropriately balances patient care and timely discharge (Eaton et al 2001).

At a regional health facility in Central Victoria, Australia it was recognised that potential enhancement could be made in the areas of access, provision of care and improved client outcomes. Consequentially, a Model of Care (MOC) that could address the gap in service to improve patient outcomes was proposed and one of the authors was appointed to the position of Chronic Respiratory Disease Nurse Practitioner (CRD NP) in 2008. Subsequently, a CRD NP MOC was developed in 2009 which included the assessment and management of COPD patients who required home oxygen therapy on discharge from hospital. With the introduction of the CRD NP MOC in 2010 the existing hospital policy and procedure for home oxygen therapy was revised to specify that medically stable patients who remain hypoxic should be assessed appropriately for STOT within the 48-hour time period prior to discharge from hospital.

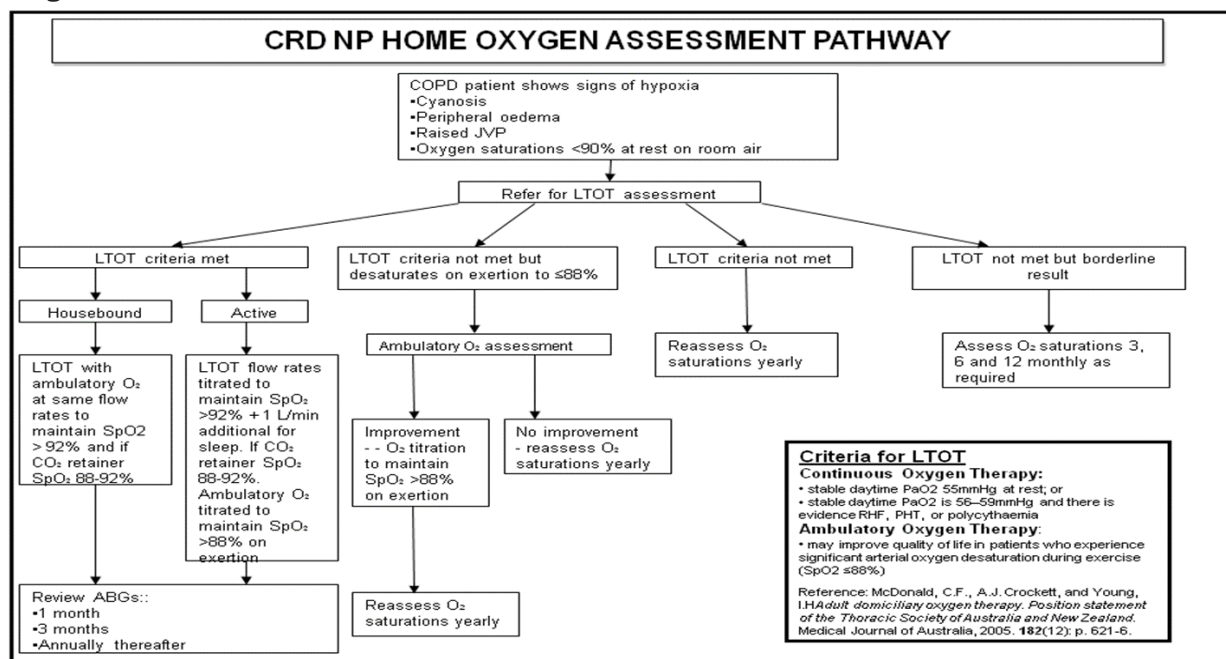
The CRD NP reviews patients discharged home with STOT at one and three weeks post discharge for oxygen titration, education of home oxygen therapy and to ascertain the need for assessment of long term oxygen therapy. The CRD NP refers patients who remain hypoxic for the required arterial blood gases (ABG) on room air and on oxygen and also for a Six Minute Walk Test (6MWT) prior to their review appointment at approximately four weeks, however this time frame may be longer to ensure the patient is medically stable when assessed. An Outpatient Department Oxygen Clinic (OPD OC) was established to review patients discharged with STOT in 2010. At the OPD OC the patient's results were reviewed by the CRD NP in collaboration with either of the two respiratory physicians, and eligibility for LTOT was determined. If the patient initially was only eligible for portable oxygen therapy then they may be reviewed in the clinic at three, six or twelve months for assessment for an oxygen concentrator depending on the degree of chronic hypoxaemia present.

## BACKGROUND

COPD is a slow progressive disease that is characterised by a reduction in airflow that is not fully reversible which may lead to severe disabling breathlessness on minimal exertion and often leads to chronic hypoxaemia and respiratory failure, increased hospital admission and premature death. Chronic hypoxaemia, is defined by O'Driscoll et al (2008) as a low oxygen tension or partial pressure of oxygen  $\text{PaO}_2 < 60$  mmHg in the blood, or  $\text{SpO}_2 < 90\%$  on room air. Chronic lower respiratory tract disease is expected to be the third leading cause of death by the year 2020 (Crockett et al 2002). Worldwide, COPD is a major cause of morbidity and mortality and in Australia it is estimated that there are approximately two million people with a diagnosis of COPD, with 1.2 million people suffering from moderate to severe COPD (McKenzie et al 2011). It is estimated that 14% of Australian adults over the age of 40 years have some degree of COPD when assessed under the Global Initiative for Obstructive Lung Disease (GOLD) criteria and with an aging population the burden of disease is likely to increase (Toelle et al 2013). COPD has been ranked as the fifth highest contributor to the overall burden of disease estimated by the Australian Institute of Health and Welfare (Australian Institute

of Health and Welfare 2008). COPD death rates in Australia are now ranked sixth for both men and women as common causes of death and in the indigenous population death rates are five times higher than that of non-indigenous Australians (Access Economics 2008; Australian Institute of Health and Welfare 2008). COPD is also associated with other conditions such as heart disease, lung cancer, stroke, pneumonia and depression (Abramson et al 2015).

**Diagram 1**



LTOT benefits have been demonstrated in two landmark randomised clinical trials by the Nocturnal Oxygen Treatment Trial (NOTT) group and Medical Research Council (MRC) working party in the early 1980's (Nocturnal Oxygen Therapy Trial 1980; Medical Research Council Working Party 1981). As a result of the NOTT and MRC trials, guidelines for the prescription of LTOT have been implemented in many countries around the world with the first guidelines being developed in the United Kingdom (UK) in 1985 (Kelly and Lynes 2008). The American Thoracic Society (ATS), European Respiratory Society (ERS), British Thoracic Society (BTS) and the Thoracic Society of Australia and New Zealand (TSANZ) have all established their own similar criteria for LTOT in patients with COPD based on these two multicentre studies (Wijkstra et al 2001). In Australia the guidelines for the management of LTOT recommend that it is prescribed for at least 18 hours per day and it has been found to be the only component in the management of COPD patients with severe daytime hypoxaemia that improves survival, quality of life and reduces mortality (McDonald et al 2014).

In Australia the major cause of chronic hypoxia is COPD, but is a feature of many other cardio-respiratory diseases. Oxygen is prescribed according to the adult domiciliary oxygen therapy position statement of the TSANZ. This position statement is a 'consensus statement' that was first developed in 1998, then revised in 2005 and again in 2014 (McDonald et al 2014; McDonald et al 2005). The TSANZ suggest that home oxygen therapy is beneficial for patients with evidence of chronic hypoxia but also for patients whose resting oxygen levels are satisfactory during the day however desaturate on exertion and at night when sleeping despite the lack of strong evidence to support this practice (McDonald et al 2014). STOT and LTOT are prescribed differently across the various states and territories within Australia due to varying policies and funding bodies (Serginson et al 2009).

As a result of an acute exacerbation of COPD, patients may be prescribed STOT on discharge from hospital if hypoxaemia persists. The criteria that has been traditionally used for the assessment for STOT is the same as for LTOT. If the patient is hypoxic ( $\text{SpO}_2 < 90\%$ ) when awake, at rest and breathing room air, then an ABG sample should be obtained for assessment of hypoxaemia. If the arterial oxygen pressure is low,  $\text{PaO}_2 \leq 55$  mmHg (7.3 kPa), or if  $\text{PaO}_2$  is from 56 to 59 mmHg (7.4–7.9 kPa) together with clinical evidence of pulmonary hypertension, cor pulmonale or polycythemia (hemoglobin level  $> 170\text{g/l}$ ), then the patient would qualify for STOT that is funded by the hospital. These patients require reassessment within one to two months when their condition is stable and on optimal medical management for LTOT. COPD patients that are most likely to benefit are those who have an increased arterial  $\text{PaCO}_2 > 45\text{mmHg}$  (6 kPa). The criteria for patients requiring ambulatory oxygen are that during exercise they may experience a significant arterial oxygen desaturation of  $\text{SpO}_2 \leq 88\%$ . Criteria for nocturnal oxygen therapy is  $\text{SpO}_2 \leq 88\%$  ( $\text{PaO}_2 < 55$  mm Hg or 7.3 kPa) for more than a third of the night and who have evidence of hypoxia-related sequelae. Absolute contraindication for assessment or provision of STOT or LTOT is current smoking of cigarettes (McDonald et al 2014; McDonald et al 2005).

## AIMS

The aim of the study was to examine the impact of the introduction of the CRD NP MOC on the assessment for STOT, provision of care, and patient outcomes for patients discharged post an acute exacerbation of COPD at a regional hospital in central Victoria, Australia.

## ETHICAL CONSIDERATIONS

Ethical approval for this study was obtained from the Bendigo Health Human Research Ethics Committee (HREC) and was assessed as being low risk. Patient consent was not required as it was a clinical audit.

## METHODS

A retrospective uncontrolled comparative study was conducted based on a clinical audit of the medical records for all patients discharged from hospital with a primary diagnosis of COPD during two six month periods. The first period was prior to the introduction of the CRD NP (pre-NP), from 1 January to 30 June 2009 and the second was the corresponding period in 2011, after the CRD NP MOC was implemented (post-NP). A total of 301 patient admissions during the two periods for patients with a discharge diagnosis of J44.0 (COPD with acute lower respiratory infection), J44.1 (COPD with acute exacerbation unspecified), J44.8 (other specified COPD) or J44.9 (COPD unspecified) were examined. Records for patients who were discharged to other units and health facilities for ongoing management or for convalescence were excluded from the analysis, as were those for patients already commenced on LTOT and receiving both an oxygen concentrator and portable oxygen cylinders. Records for patients who were identified as smokers (and hence ineligible for STOT) were initially included but removed from the analysis once it was evident that the TSANZ guidelines on domiciliary oxygen had been applied stringently and no smokers were provided with STOT.

## DATA CAPTURE

The key data that was extracted from each record and examined were the following:

- Oxygen saturations at rest and on room air within 48 hours prior to discharge.
- If resting oxygen saturations  $\leq 90\%$  was an ABG sample taken for analysis of hypoxaemia within 48 hours prior to discharge.

- If patients had a functional walk test (performed by the physiotherapist over a 40 metre distance) and oxygen saturations on exertion  $\leq 88\%$  within 48 hours of discharge.
- Whether or not the patient was eligible for STOT.
- Whether or not the patient was discharged with STOT.
- Whether or not the patient was re-admitted within 28 days with a COPD diagnosis.

The data was transcribed into the Statistical Packages for Social Science, version 19 (SPSS) software for analysis. Evidence of differences in treatment practice and/or patient outcomes between the pre NP and post NP periods were examined using Fisher's exact test.

## RESULTS

In the analysis there were a total of 182 patient admissions: 82 in the pre-NP period (2009) and 100 in the post-NP period (2011). However due to some patients having multiple admissions in total there were 221 individual presentations and admissions (91 pre-NP and 130 post-NP). Whether or not treatment practice or patient outcomes correspond to different episodes for the same patient is unimportant in this analysis so the numbers and proportions that are provided correspond to 'patient admissions'. However, it is convenient in the discussion that follows to refer to them simply as 'patients'.

Table 1 lists the numbers and proportions of (non-smoking) COPD patients with rest  $\text{SpO}_2 \leq 90\%$  in the two six month periods for whom an ABG sample was taken within the 48 hour period prior to discharge. In the six month period in 2009, prior to the introduction of the CRD NP role, one patient (7.7%) had an ABG sample taken of the 13 patients with rest  $\text{SpO}_2 \leq 90\%$  for whom an ABG sample was warranted according to hospital guidelines. In the six month period in 2011 with the implementation of the CRD NP MOC, nine of 20 qualifying patients (45%) had ABG samples taken. This represents a statistically significant increase in the proportion of qualifying patients being appropriately assessed (using ABG) for eligibility for STOT (Fisher's exact test,  $p = 0.026$ ).

**Table 1: Qualifying COPD Patients for whom an ABG was taken**

Year	Qualifying patients (Resting $\text{SpO}_2 \leq 90\%$ )	ABG taken	
		Yes	No
2009 (pre NP)	13	1 (7.7%)	12 (93.3%)
2011 (post NP)	20	9 (45.0%)	11 (55.0%)
Total	33	10	23

In 2009 during the first six months, 26.7% of COPD patients who met eligibility criteria for STOT (based on outcomes of ABG and/or functional walk test) were provided with STOT on discharge (table 2). In 2011 the proportion of patients meeting the criteria increased to 44.4% during the same six month period. The increase in the proportion of eligible patients being provided with STOT is not statistically significant (Fisher's exact test,  $p = 0.245$ ).

**Table 2: Eligible COPD patients provided with STOT on discharge**

Year	Patients eligible for STOT	STOT provided	
		Yes	No
2009 (pre NP)	15	4 (26.7%)	11 (73.3%)
2011 (post NP)	18	8 (44.4%)	10 (55.6%)
Total	33	12	21

The numbers of patients in each six month period who were discharged with STOT and who were subsequently re-admitted to hospital within 28 days for further treatment of COPD are given in table 3. As the numbers observed in both years examined were relatively small there was not a statistically significant difference observed (Fisher's exact test,  $p = 0.576$ ).

**Table 3: Re-admission rates for patients discharged with STOT**

Year	Discharged with STOT	Re-admitted within 28 days	
		Yes	No
2009 (pre NP)	4	1 (25.0%)	3 (75.0%)
2011 (post NP)	8	1 (12.5%)	7 (87.5%)
Total	12	2	10

## DISCUSSION

At the time of writing this paper there is a lack of research in the area relating to COPD and STOT. Currently there are no evidence based Australian or international guidelines that refer to the assessment and provision of STOT for patients with COPD prior to discharge from hospital. Abramson et al (2015, p.76) states that "although effective, it is a potentially expensive therapy that should only be prescribed for those in whom there is evidence of benefit". In the 2011 COPD-X Plan, McKenzie et al (2011, p.64), states that "patients should be weaned off supplementary oxygen therapy as soon as possible, with none for 24-48 hours before discharge, unless home oxygen is prescribed". However, as stated in the new revised version of the COPD-X Plan 2015, the above statement has been omitted from the document and replaced with a statement by Abramson et al (2015, p.97), that indicates a patient's readiness for discharge is when "oxygen delivery has ceased for 24 hours (unless home oxygen therapy is indicated)". Neither these guidelines indicate when an optimal time for ABG sampling prior to discharge would be appropriate.

In the BTS Guideline for emergency oxygen use in adult patients (O'Driscoll et al 2008) it is suggested that a small number of patients who may have experienced a major respiratory or cardiac injury will need to be provided with STOT to facilitate a safe discharge from hospital. Oxygen therapy is aimed at achieving oxygen saturations between 88-92%. The criteria for assessment prior to discharge from hospital after an exacerbation has been determined by the Royal College of Physicians – "clinical guideline for domiciliary oxygen" (1999), which is in line with other countries for assessment of LTOT when the patient is clinically stable (O'Driscoll et al 2008). Again, this document does not specify the optimal time to assess patients need for home oxygen therapy prior to discharge from hospital. In a UK study by Gruffydd-Jones et al (2007) on the needs of patients following discharge from hospital after an acute exacerbation of COPD, nine out of 24 patients (38%) had oxygen saturations  $\leq 92\%$  on room air, however only three patients (12.5%) were discharged from hospital with home oxygen therapy. Gruffydd-Jones et al (2007) suggest there was a possible under-referral for assessment for oxygen therapy and the patients perceived that there was a need for oxygen therapy but were uncertain as to why it had not been provided.



In contrast, in the United States of America, under the current health system 'Medicare', it is a requirement that a patient is assessed with qualifying data within 48 hours prior to discharge. It is an expectation that after an admission with an acute exacerbation of COPD that acute hypoxaemia will improve (Department of Health and Human Services Centers for Medicare and Medicaid Services 2011; Gronkiewicz and Borkgren-Okonek 2004). The need for oxygen is assessed as per the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Standards for the management of COPD using the existing criteria set out for the assessment of LTOT (Global Initiative for Chronic Obstructive Lung Disease 2014; Gronkiewicz and Borkgren-Okonek 2004). The GOLD Standards have discharge criteria that state the patient must be clinically stable and that ABG assessments have also been stable for 12-24 hours. It also states that prior to discharge from hospital after an exacerbation, patients that remain hypoxaemic should be assessed with either ABG and/or pulse oximetry and then reassessed within three months. The standards do not indicate the level of hypoxaemia that would not be considered acceptable for discharge and the need for oxygen is assessed as per LTOT criteria (Global Initiative for Chronic Obstructive Lung Disease 2014).

After the introduction of the CRD NP MOC, and the subsequent redevelopment of the hospital policy for home oxygen therapy, there has been a significant increase in the number of ABG's being obtained for assessment of hypoxaemia in patients with COPD prior to discharge from hospital (table 1). The revised policy stated the patient must be medically stable and ABG's obtained on room air within 48 hours prior to discharge. This decision to specify that the assessment must be performed within this timeframe was to ensure (1) the patient was medically stable, (2) to provide the oxygen distributor adequate notice that the patient would require home oxygen therapy at discharge and to ensure that patients living outside of a locality also received the service in a timely manner, and (3) for the CRD NP to provide education and resource material to patient (and carer if available) prior to discharge and to make follow up arrangements one week post discharge for assessment and oxygen titration.

The CRD NP attributes the increase in patients being assessed appropriately for home oxygen therapy to an enhanced educative program regarding the home oxygen policy and STOT pathway for medical, nursing and allied health staff across the organisation aimed at improving patient outcomes post discharge, along with the implementation of a new assessment form designed to ensure that hospital policy is followed and the required assessments for ABG and functional walk test are performed. Each department across the organisation received education, targeting medical, nursing and allied health staff, on the new home oxygen policy. Education included a resource package with flow charts for assessment and referral to the CRD NP for STOT. The CRD NP also concurred that, as suggested by Gruffydd-Jones et al (2007) that under-referral for assessment for STOT may be due the high cost involved in supplying oxygen therapy to patients post discharge who may not be eligible for LTOT when reassessed at a later date.

The data in table 2 indicates an increase, from 26.7% in 2009 to 44.4% in 2011, in the proportion of patients assessed as eligible for STOT actually being provided with STOT on discharge. Whilst this increase is not statistically significant it does represent a substantial improvement in clinical terms. Nevertheless, there is clearly a need for continued action given the non-prescription for STOT of 55.6% of eligible patients. The CRD NP suggests that under referral for STOT prescription may also be due to an expectation that a patient experiencing a severe exacerbation may improve once discharged home from hospital and therefore not require oxygen for discharge. According to Eaton et al (2001, p.582), "there is an expectation that when clinically stable a proportion will not fulfil LTOT criteria". In a New Zealand study, 38% of patients when reassessed at the two month review were not eligible for LTOT (McDonald et al 2005). In another study by Andersson et al (2002), 70% of patients studied did not require oxygen therapy one month post discharge. Ringbaek (2006) acknowledges there are a number of patients who, when reassessed at three months post discharge, would

not fulfil the eligibility criteria for LTOT, the provision of STOT on discharge can therefore be justified due to symptoms of hypoxaemia and high mortality in the period of time post discharge from hospital.

In a study by Eaton et al (2006) who compared cylinder oxygen versus cylinder air versus usual care in patients who were discharged from hospital after an exacerbation found that those who were discharged home with cylinder oxygen represented to hospital for admission at a lower rate in the first month compared to cylinder air or usual care group. With the introduction of the CRD NP MOC and redesign of the hospital home oxygen policy patients are now being assessed more appropriately and considered for STOT. An important aspect of the CRD NP MOC involves follow-up assessment at one and three weeks post discharge and oxygen flow rates are adjusted to meet required oxygen target saturations for at rest and on exertion. As seen in table 3 the decline in re-admissions for these patients is attributed to this aspect of the MOC. As the numbers observed in both years examined were relatively small, if the observed proportions of re-admission rates are realistic then samples roughly 10 times larger would be required to achieve sufficient power to detect the difference at the 5% level of significance.

## LIMITATIONS

This study has some limitations. Sample size of patients being assessed and discharged home with oxygen was small in patients with a discharge diagnosis of COPD and it is not known whether the results would have been different had other lung diseases been included in the study that were discharged home with STOT. The study was performed in only one organisation over two six-month periods with no control.

## CONCLUSION

The analysis of data for COPD patients in two six-month periods, the first prior to the introduction of the CRD NP model of care and the second following the introduction, reveals improvements in patient outcome and service delivery measures at which the CRD NP role were targeted. A significant increase in the proportion of COPD patients with resting oxygen saturation  $\leq 90\%$  being assessed for STOT with ABG sampling within the specified 48 hours prior to discharge was observed. The proportion of COPD patients assessed as eligible for discharge with oxygen therapy for 30 days who were actually provided with STOT improved and a reduction in the re-presentation rate to hospital within 28 days of discharge occurred. Nevertheless, the audit reveals that whilst there is evidence of substantial improvement in practice adherence to policy it falls well short of 100% so continued emphasis of the required processes is important from the perspective of better patient outcomes and more effective service delivery.

This study heightens the awareness of the need to assess patients within a specified time prior to discharge with STOT for optimal medical management. The CRD NP recommends further research be carried out in this area to promote appropriate assessment of all COPD patients prior to discharge from hospital within a specified time for STOT.

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