

The Impact of Long Term Oxygen Therapy on South Australian  
Patients with Chronic Lung Disease.

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## STATEMENT OF ORIGINALITY

This thesis contains material that has been published in peer-reviewed scientific journals. I have acted as the principal author of the scientific publications that form the main body of the thesis.

This work has not been accepted for the award of any other degree or diploma in any other University or tertiary institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to a copy of this thesis being made available for loan and photocopying following its deposition in the University Library.



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Alan J Crockett

18<sup>th</sup> August,2005

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## ABSTRACT

The peer-reviewed publications contained within this thesis describe studies that have contributed significantly to the understanding of long-term oxygen therapy (LTOT) for Australian Chronic Obstructive Pulmonary Disease (COPD) patients. My personal contribution to each of these studies ranged from the initial development of the hypotheses and design and execution of the investigations, submission of research grants applications to fund the studies through to preparation of the manuscripts for publication.

When LTOT was first introduced into Australia I was fortunate to meet the key experts in LTOT including Professors Tom Petty, Nick Anthonisen, David Flenley, Pierre Levi-Valensi and Peter Howard. At that time all were involved in randomised controlled trials of oxygen therapy. (1, 2), 3). I also visited several oxygen concentrator and oxygen supply companies in the USA and UK. It was during these visits that I became convinced that the concentrator provided a more economical and efficient method of LTOT delivery.

In 1980, an oxygen concentrator was imported to Australia by the spouse of one of our patients suffering from emphysema who was receiving long term oxygen via cylinders. In 1982, two oxygen concentrators were donated to FMC by two different manufacturers (DeVilbiss and Marx) based in the USA. These instruments were trialled on a male and female patient receiving LTOT in the Southern Adelaide metropolitan area. The initial acceptance of this device by these patients led to a submission to the South Australian Department of Health for a grant to purchase 40 units. Funds were finally obtained for the purchase of 34 concentrators by FMC and these were rolled out to the then existing patients who were receiving LTOT in 1984.

Up to this point in time the only published guidelines or recommendations for LTOT came from the American College of Chest Physicians in 1973(3) and the American Thoracic Society in

1977(4). In 1982, the staff of the Respiratory Unit, FMC held a workshop where it was agreed that patients' would be assessed for home oxygen therapy using the 1977 American Thoracic Society Guideline.

The late Professor Ann Woolcock presented a paper during a 1983 symposium titled "Long Term Oxygen Therapy: A World View" during a 1983 symposium held in Toronto, Canada where she estimated that at that time 2,100 patients were receiving oxygen in New South Wales for an average of 1 hour per day. She further reported that the use of cylinders ranged from 1 cylinder a year to 14 cylinders per week. Physicians were reported to have been conservative in their approach to oxygen therapy and that only 50 people were on long term oxygen therapy in New South Wales. Presumably the vast majority of these patients were receiving intermittent oxygen therapy. Woolcock mentioned that oxygen concentrators were available but provided no specific detail of their use in Australia(5).

The first Australian guideline for the provision of domiciliary long-term oxygen therapy appeared in 1985. This guideline was developed at the request of the Thoracic Society of Australia and New Zealand.(6). In the same year I published my first paper relating to the provision of oxygen therapy via an oxygen concentrator based on our initial experiences with this technology(7). In the following year I published a paper documenting the analysis of the costs for providing home oxygen therapy. I also reported how Cost-Centre Management led to the introduction of practical measures for improved clinical decision making and improved expenditure control resulting in substantial cost savings(8). This publication led to a paper reporting the rationalization of the supply of home oxygen in the Hunter region of New South Wales.(9). This paper also reported the one to five year survival rates for their patients. At that time only between 5 and 12% of patients were receiving LTOT oxygen via an oxygen concentrator.



At best, oxygen therapy is cumbersome with the patient 'tethered' to the oxygen source that, in the past, limited the movement of the patient due to the size and weight of the oxygen cylinders. Oxygen concentrators provided a partial answer to these problems.

The introduction of this new technology led to ongoing evaluation of the impact on patient care and acceptance of the intervention and whether the expected outcomes increased survival and quality of life, were achieved(10). In 1991 I published the first detailed Australian data on survival for patients receiving home oxygen therapy. The results of this study indicated that the mortality rate for COPD with respiratory failure at 1 year was twice the rate reported by the Medical Research Council Working Party and the Nocturnal Oxygen Therapy multicentre trials. This was in spite of the baseline physiological parameters for our patients being similar to the patients in these benchmark studies. I was later able to show that survival of our long term oxygen patients was no better than the control group of the original MRC study(11-13).The second significant observation was that females survived longer than males(14).

In 1992 a further paper was published and reported that in spite of strict prescription criteria and the introduction of a cost-saving new technology oxygen concentrators, the budget for this intervention remained under pressure. This was largely due to a rapidly increasing demand from eligible patients(10).A further analysis of the longitudinal data resulted in a report of an association between home oxygen therapy with a reduction in respiratory admissions and bed days(15).

At this time there was a relative paucity of information about the trends of mortality in COPD in Australia. To further understand the burden of disease (COPD) and changing trends in mortality over time a research project was undertaken that indicating that the mortality of females from COPD was increasing whilst it was decreasing in males(16).

The relatively poor survival outcomes for our home oxygen patients prompted further attempts to understand the costs and benefits in terms of quality of life and the evaluation of two generic health related quality of life questionnaires available at that time (1996). The results of the study suggested that the sole use of the SF-36 as a health outcome measure in COPD patients might fail to provide information about the mental domains of their quality of life. Decreased cognitive function, anxiety and depression were shown in Australian COPD patients(17).

A series of papers published in Europe describing the observations made on Australian home oxygen patients were published between 1996 and 2000 at the request of the International Oxygen Club. The membership of this club included Professors Tom Petty, David Flenley , Pierre Levi-Valensi, Peter Howard, Heinrich Matthys and Roland Keller(11, 18, 19, 20 ). Further attempts to rationally allocate resources in the management of COPD in the acute care setting were reported in 1999 using Program Budgeting and Marginal Analysis.(21).

I undertook a systematic Cochrane Review of the five randomized controlled trials of the use of home or long term oxygen therapy in COPD demonstrating that this intervention improved survival in a selected group of severely hypoxaemic COPD patients (22). However, this intervention does not appear to provide any benefit for patients with moderate hypoxaemia or nocturnal desaturation. (20) This review has been translated into several languages and is cited as the basis of many of the more recent guidelines regarding LTOT.

More recently a NH&MRC funded study report was published reviewing the impact of evidence based clinical practice concerning LTOT. This report resulted in several peer reviewed papers being published where we explored the relationship between the evidence and the observed outcomes in terms of both survival and quality of life(13, 23, 24).

Finally, we conducted a study of the relative survival of our patients compared to those patients with similar characteristics in France. We demonstrated that our patients' relative survival was less than their French counterparts(25). At the time of publication this was only the second paper to be ever-published using relative survival analysis in COPD and the first in Australia. This difference is hard to explain by the level of severity, number of pack years or level of lung function impairment. Other possible factors contributing to the excess mortality in South Australian COPD patients need to be investigated.