Variability in the rate of prescription and cost of domiciliary oxygen therapy in Australia

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ABSTRACT

Objectives: To determine the rate of prescription of and government expenditure for domiciliary oxygen therapy (DOT) in Australia, and to identify interstate differences in rates, costs and service provision.

Design: Retrospective observational study.

Participants and setting: Government departments and health services (state and federal) that funded DOT in Australia in the 2004–05 financial year (including the Department of Veterans' Affairs [DVA] and the Department of Health and Ageing [DoHA]).

Main outcome measures: Prescription rates, cost of DOT in 2004–05, and services provided in each jurisdiction.

Results: In 2005, 20 127 patients were using DOT, giving a national prevalence of 100 prescriptions per 100 000 population. The total cost was about $31 million. State governments, the DVA and the DoHA funded 13 899 (69%), 4084 (20%) and 2144 (11%) patients, respectively. Prescription rates varied threefold between the states, ranging from 44 (Northern Territory) to 133 (Tasmania) per 100 000 population. Cost per patient per year varied fourfold between the DVA and the DoHA. All jurisdictions funded oxygen according to the clinical criteria of the Thoracic Society of Australia and New Zealand, but considerable variability in service provision was identified.

Conclusion: DOT prescription rates and costs vary considerably between jurisdictions. An urgently needed national DOT register would enable the current variability to be understood and allow service planning and benchmarking of clinical outcomes.

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Domiciliary oxygen therapy (DOT) involves providing oxygen equipment for ongoing home use. It is prescribed as long-term oxygen therapy (at least 15 hours a day) for chronic hypoxaemia, or to prevent oxygen desaturation associated with exercise or sleep.[1,2] DOT provides mortality and morbidity benefits for patients with chronic hypoxaemia caused by chronic obstructive pulmonary disease (COPD),[1,3-5] but it constitutes a prolonged commitment of resources to individual patients. A study from one Australian state found a mean survival of 2.9 years for patients with COPD who were prescribed DOT, but other countries have reported longer survival times.[6] By extrapolation from prevalence and cost data in one state, DOT in Australia was estimated to cost $30.4 million in 2001.[7]

DOT is funded by all Australian states and territories (Box 1), and two federal government departments: the Department of Veterans' Affairs (DVA) and the Department of Health and Ageing (DoHA). The DVA funds clinically eligible war veterans,[8] and the DoHA pays oxygen subsidies to federally funded, residential aged care facilities.[9]

The position statement *Adult domiciliary oxygen therapy* by the Thoracic Society of Australia and New Zealand provides an evidence base for DOT services.[1] Service provision is reported to vary between jurisdictions, but the extent and impact of this is unclear.[1,7] The many funding sources and departments administering DOT programs make it difficult to assess accurately the rate of prescription and the total cost of these programs in Australia.

Our study aimed (i) to determine the rate of prescription and the total cost of government-funded DOT in Australia; (ii) to identify differences between jurisdictions in prescription rates, costs and service provision; and (iii) to evaluate the adequacy of available data to explain any differences.

METHODS

Data collection

Data were compiled from all DOT services in Australia (the DVA, the DoHA, state health departments and regional equipment programs) to compare service provision, patient numbers, eligibility criteria, costs and equipment options. Centralised departments managing state budgets for DOT provided costs (for the financial year 2004–05) and patient numbers (point prevalence in 2005). If centralised data were not available, regional departments administering DOT services were contacted. Each decentralised service described their catchment to ensure that all geographical regions were represented.

Costs

Costs were defined as "equipment only" (fees paid to oxygen companies) or "equipment and administrative" (wages and non-labour costs of administering programs included). Services provided the cost data routinely collected in administering their programs and were not asked to estimate other indirect costs (eg, clinician time and pathology tests). Medicare provided the number of patients prescribed DOT in residential aged care facilities and the cost of oxygen subsidies paid by the DoHA in 2004–05.

Our review did not capture data on costs (or patient numbers) for DOT funded by palliative care services, private health funds, patients or hospitals (in the first month after discharge); or the indirect clinical costs of assessment, education and support for patients receiving DOT.

As cost data for 2004–05 were not available from all jurisdictions, we used 2003–04 data for Vic and 2001 data for rural WA. State-funded costs for DOT in NSW in 2004–05 significantly underestimated actual

1 Abbreviations for Australian states and territories

ACT = Australian Capital Territory
NSW = New South Wales
NT = Northern Territory
Qld = Queensland
SA = South Australia
Tas = Tasmania
Vic = Victoria
WA = Western Australia ◆

2 Domiciliary oxygen therapy (DOT) services in Australia, patients prescribed DOT, and costs, by source of funding (2005)

	States and territories	DVA	DoHA*	Total
No. of services	57	1	1	59
No. of patients (%)	13 899 (69%)	4 084 (20%)	2 144 (11%)	20 127 (100%)
No. of prescriptions per 100 000 population	69	20	11	100
Total costs in 2004–05	$20 806 000	$3 439 682	$6 837 939	$31 083 621
Average cost per patient per year	$1 497	$842†	$3 189†	$1 544

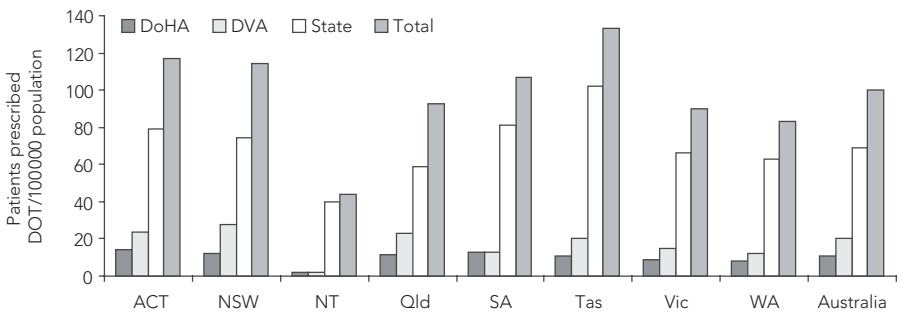
DVA = Department of Veterans' Affairs. DoHA = Department of Health and Ageing. *Subsidies paid to 1213 residential aged care facilities. † Excludes administrative costs. ◆

3 Number of patients prescribed domiciliary oxygen therapy in Australian states and territories, by source of funding (2005)

Funding source	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
State	256	5 000	80	2 282	1 243	493	3 300	1 245	13 899
DVA	77	1 851	4	889	198	97	724	245	4 084
DoHA	47	819	4	441	193	53	428	159	2 144
Total	380	7 670	88	3 612	1 634	643	4 452	1 649	20 127

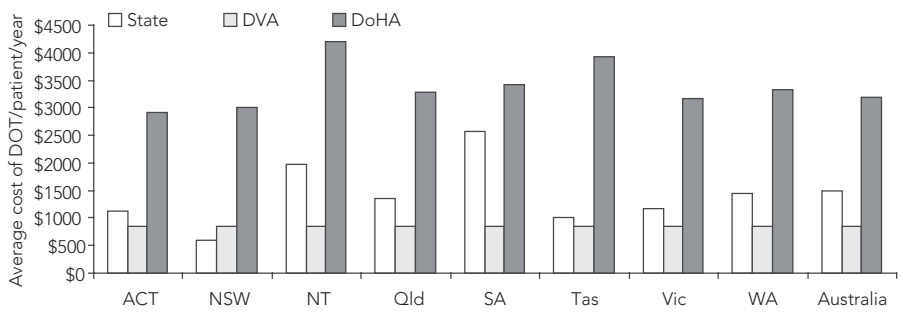
DVA = Department of Veterans' Affairs. DoHA = Department of Health and Ageing. ◆

4 Prescription rates per 100 000 population for domiciliary oxygen therapy (DOT) in Australian states and territories, by source of funding (2005)



DoHA = Department of Health and Ageing. DVA = Department of Veterans' Affairs. ◆

5 Average cost of domiciliary oxygen therapy (DOT) per patient prescribed per year in Australian states and territories, by source of funding (2005)



DVA = Department of Veterans' Affairs. DoHA = Department of Health and Ageing. NSW state data exclude capital equipment purchases and administrative costs. ◆

expenditure, because they excluded the cost of previously purchased oxygen concentrators (the predominant type of oxygen delivery system, which extracts oxygen from room air), and administrative costs (which were included in our data from all other states). The average cost per patient per year for all other state-funded services was therefore substituted for NSW costs when estimating the national cost of state-funded and all DOT services in Australia.

Guidelines for prescription of DOT

Respiratory nurses or thoracic physicians supporting decentralised DOT services were contacted, and DOT guidelines for each state or territory, and for the DVA and the DoHA, were discussed with each jurisdiction.

Data analysis

Demographic and DOT service data for patients funded by the DVA in 2005 were available for NSW, Qld and Vic only (ie, for 85% of veterans using DOT). To approximate the missing 15% of data, 2007 data for the other states and territories were used after adjusting for the percentage change from 2005.

For each jurisdiction, the average cost per patient per year was derived by dividing the total cost of DOT prescriptions by the number of patients, and patient numbers and costs were summed to calculate national DOT data. Projected demographic data for June 2006, published in 2003 by the Australian Bureau of Statistics, were used for population-based results.[10]

Associations between the prescription rate of DOT and the following variables in each state were tested using the Spearman rank correlation coefficient, rho (ρ): proportion of the population older than 64 years; proportion of the population with an accessibility–remoteness index of 0–2.4 (ie, living in inner regional areas or cities); admission rates for COPD per 100 000 population (International classification of diseases, 10th revision [ICD-10], code J44); smoking rates in those aged > 14 years; and number of practising thoracic physicians per 10 000 population.[11-14]

Ethics approval

Ethics approval was obtained from The Prince Charles Hospital Human Research Ethics Committee.

RESULTS

Prescriptions and costs

In 2005, Australian governments funded DOT for 20 127 patients (100 patients per

100 000 population) through 59 different services, at a cost of over $31 million (Box 2). Box 3 lists the number of patients prescribed DOT within each state or territory and in Australia as a whole, by the source of funding. Prescription rates for DOT per 100 000 population within each state ranged from 44 (NT) to 133 (Tas), a three-fold difference (Box 4). Costs of DOT per patient prescribed per year funded by individual states and territories (excluding NSW, in which cost data underestimated expenditure) ranged from $1014 in Tas to $2574 in SA (Box 5).

DOT prescription rates in the states or territories were not associated with the population age profile; smoking rates; access to thoracic physicians; or admission rates for COPD (all $P > 0.05$ [Box 6]); nor with the proportion of the population living in cities or inner regional areas ($\rho = 0.317$; $P = 0.4$).

Funding models

State governments used two broad funding models (Box 7). Centralised services (a single body administering the program) were used in the ACT, metropolitan WA, Qld and the NT. In the other states, funds were distributed to regional health authorities, or to aids and equipment programs aligned with health areas.

Variations in equipment and costs

DOT equipment was funded as specified by the prescriber to meet the patient's clinical need in SA, WA, the ACT and parts of Tas (some portable oxygen was available in the remainder of Tas). In Vic, DOT equipment was limited to $200 per patient per month. In Qld, NSW and the NT, prescribers selected from preset equipment packages linked to eligibility criteria.

The cost of oxygen concentrators averaged $85 per month (range, $29–$109), portable oxygen ranged from $16 to $35 per month without refills, and, with a conserver included, $55 (two refills) to $166 (unlimited refills) per month. (A conserver delivers a short pulse of oxygen as inspiration commences, rather than continuously.)

All services provided concentrators for home use. Portable oxygen was funded in all states except Qld (where it was limited to children and patients waiting for heart or lung transplants). An exercise test showing the benefit of ambulatory oxygen was required in Tas, Vic, Qld, NSW and WA. Patients in NSW were required to pay for oxygen refills. Funding for refills (delivery of new cylinders) varied between and within some states with decentralised services (Box 7). Liquid oxygen was used in SA to a limited extent (patients with high portability needs) at a cost of $230 per month.

The DVA funded any oxygen equipment indicated by the prescriber, including unlimited cylinder refills and deliveries for eligible veterans. The DoHA paid a monthly oxygen equipment subsidy via Medicare directly to residential aged care facilities for each resident prescribed DOT.[9]

Guideline variations

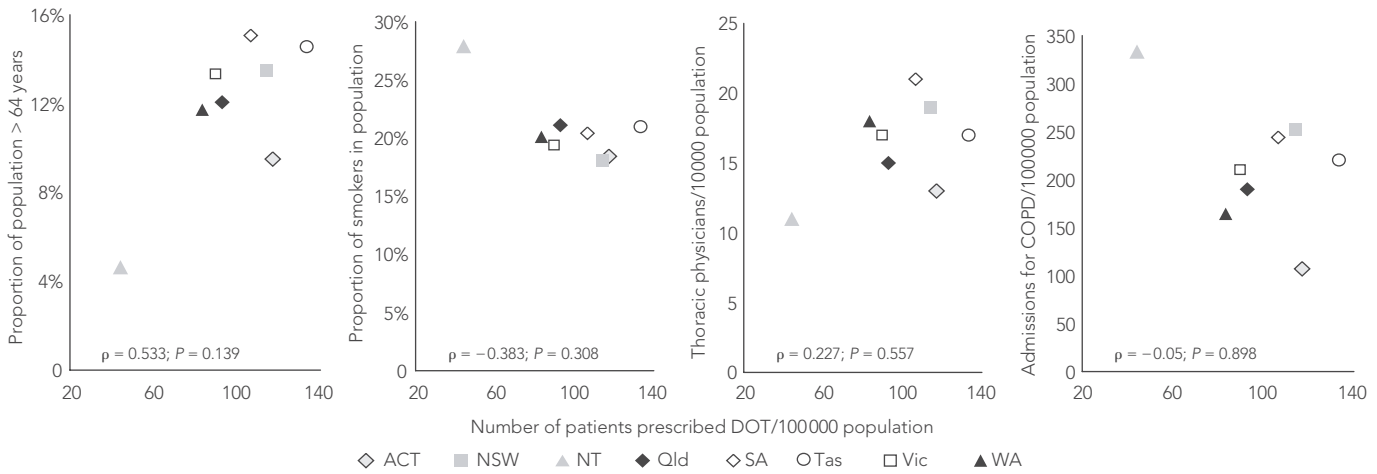
Guidelines required patients to be reassessed within 4 months of starting DOT (except in the ACT, the NT and Tas) and then annually (except in the NT). The first month of oxygen was funded by local hospitals in NSW and Vic, whereas guidelines in Tas precluded DOT being prescribed within a month of a patient being discharged from hospital for an exacerbation of COPD.

DISCUSSION

The total number and rate of DOT prescriptions in Australia, including data from the DVA, the DoHA and individual states and territories, have not been published previously. Our data for the number of patients whose DOT was state-funded, and the costs incurred, were lower than previous estimates. Jones et al extrapolated 2002–2004 data from Tas to arrive at an estimate of 21 000 patients using state-funded DOT, exceeding our result by 59%.[15] This difference is consistent with our finding that Tas had the highest rate of prescription of DOT.

Previous cost estimates for all state-funded services exceed ours by 46%–51%.[7,15] Crockett et al estimated the total cost for Australia to be $30.4 million in 2001 by extrapolating data on DOT prescriptions from one DOT service in SA to the whole of Australia (111 patients prescribed DOT per 100 000 population, costing $1400 per patient per year).[7] Our study found a lower state-funded rate in SA (83 per 100 000) and a higher cost per patient per year of $2574. This may be due to cost variability between services in SA, and the administrative costs included in our data from the Department of Health, SA. The prescription rate in Tas for DOT in 2002–2004 was found to be 102 per 100 000 population (comparable with our finding) at a cost of $1498 per patient per year (which extrapolates to a national figure of $31.5

6 Association between prescription rates of domiciliary oxygen therapy (DOT) in Australian states and territories and demographic variables



COPD = chronic obstructive pulmonary disease.

million).[15] While both these cost estimates approximate our findings, neither included data from the DVA or the DoHA. This highlights the potential for error when extrapolating, and the benefit that a national oxygen database would provide.

Our estimated national cost for DOT does not include administrative costs incurred by the DoHA and the DVA, nor the indirect clinical costs associated with assessment, reassessment, education and support of patients prescribed DOT. This represents a significant underestimation of the real cost of DOT. Appropriate assessment of patient suitability is needed to avoid unnecessary prescriptions, but requires clinician time (physiotherapist, physician, nurse) and resources (arterial blood gas analysis, overnight oximetry). Without this, poor adherence to prescribed DOT may negate benefit and waste expenditure.[16]

The lack of consistent definitions of data makes it difficult to interpret interstate variability. Factors that may influence cost include equipment type, delivery distance and frequency, and market competition. Some NSW state DOT services owned oxygen concentrators. Surprisingly, not all states with liberal cylinder refills (Box 7) incurred higher costs (costs were lowest in the ACT and Vic). More equitable provision of DOT may therefore be achievable.

Our study affirms that there is inequitable access to portable oxygen across jurisdictions. The costs of DOT provided by the DoHA exceeded by almost fourfold the DVA's costs, despite both groups having similar equipment, and administrative costs not being included in our cost data for either service. The DVA's costs for DOT were standard across the country, while the DoHA's costs varied by 31% between states and territories. The mechanisms of payment were different: the DVA was billed directly by oxygen suppliers, whereas the DoHA paid subsidies to residential aged care facilities, who then paid oxygen suppliers. If all DOT prescribed in Australia was funded at the DVA rate, $14 million (less administrative costs) would theoretically be saved annually. In Qld, administrative costs were estimated to comprise 10%–15% of state-funded oxygen costs (Mr John Vasil, Manager, Oxygen and Specialised Services, Medical Aids Subsidy Scheme, Qld Health, personal communication, 20 April 2009).

Rates of DOT prescription varied widely between states. Those with less urbanised populations and arguably less access to medical services may be expected to show lower rates of DOT, as was seen in the NT (44 per 100 000). However, we were unable to show an association between remoteness and prevalence of DOT prescription within each state using grouped state-level data. Regional variations in DOT prescription rates in Tas, and higher rates where access to respiratory specialists was limited, has been reported previously.[15] The NT data may be explained by the higher percentage of this population identifying as Indigenous and their increased prevalence of smoking. More NT patients may have benefited from DOT but, as smokers, they would have been ineligible.[7,17]

COPD was the most frequent diagnosis,[1,5,6,15] representing 57% of patients receiving DOT from the Medical Aids Subsidy Scheme in Qld in 2005, and 48% of patients prescribed DOT in Tas.[15] Geographical heterogeneity in the prevalence or severity of COPD could explain the variation in DOT usage; however, we did not find this association in state data. Variability in rates of DOT prescription between Danish counties was not explained by differences in COPD admissions, a crude surrogate for severe COPD.[18] Other factors that may have influenced variability in Australia include the means test for eligibility in NSW and Qld, differing reassessment requirements, and variable survival of patients (in part due to poor adherence).

National DOT schemes operate in France, Sweden and, more recently, in England and Wales, with the capacity to benchmark rates of use, cost, clinical outcomes, access and adherence to guidelines.[1,19-22] The number of

7 Comparison of government-funded domiciliary oxygen therapy (DOT) services in Australia

Funding source and DOT services (no. of services)		Means tested	Power rebate	Back-up cylinder size*	Eligible for portable DOT	Exercise testing	Refills per month	Oxygen conserver
ACT:	ACT Equipment Scheme (1)	No	No	C	All patients	No	1	Yes
NSW:	Program of Appliances for Disabled People — in health areas (13)	Yes†	No	C	Some areas; some patients	No	0	Yes
NT:	Territory Independence and Mobility Equipment Scheme (1)	No	No	C	All patients	No	4	No
Qld:	Medical Aids Subsidy Scheme (1)	Yes†	Yes	E	Transplant list; all children	Yes	0	No
SA:	Metropolitan hospitals (6) and rural hospitals (multiple)	No	Yes	C; D or E (if rural)	All patients	No	4	Yes
Tas:	Regional hospitals (3)	No	No	C; D or E (if remote)	If required	Yes	1–2	Yes
Vic:	Aids and Equipment Program — in health regions (31)	No	No	C; E (if rural)	If required	Yes	1–6	Yes
WA:	Silver Chain — in metropolitan areas (1); rural hospitals (multiple)	No	Yes	D or E	If required	Yes	No limit	Yes
DVA:	Department of Veterans' Affairs (1)	Gold Card‡	Per state	C, D or E	If required	Yes	No limit	Yes
DoHA:	Medicare Australia (1)	No	No	C, D or E	If required	No	No limit	Yes

DVA = Department of Veterans' Affairs. DoHA = Department of Health and Ageing. * Cylinder size C (0.55 m^3, lasts about 3 h); cylinder size D (1.5 m^3, lasts about 11 h); cylinder size E (3.8–5.2 m^3, lasts about 30 h).[1] † Health care, pension or disability services card required. ‡ Or a White Card with a relevant, eligible disability. ◆

patients prescribed DOT in England and Wales (76 763) was first reported in 2007 after the National Health Service implemented a national oxygen service.[19]

Even without a unified scheme in Australia, a national oxygen register with data from all DOT services would enable strategic planning and benchmarking of costs and outcomes, and would support the more rational and equitable use of this expensive therapy. A national register would also provide much of the data necessary to evaluate the potential benefits and risks of a unified scheme in Australia (demographics, assessment results, diagnosis and severity, prescriptions and adherence, cost, duration of therapy and reason for ceasing).

Our study was limited by our inability to identify the number of patients whose DOT was privately (partially or fully) funded, or funded by health insurance. Patients are unlikely to be funding their own oxygen equipment, except in NSW and Qld where subsidised oxygen is means tested. Patients whose DOT is funded by palliative care services are also expected to represent small numbers because of their short life expectancy. As cost data were not available from all jurisdictions for the 2004–05 financial year, costs from other years were substituted. Within these limitations, our results provide a reasonable approximation of the rate of DOT prescription, and give an estimate of the direct costs of DOT in Australia. However, they do not explain the variability in prescription rates and costs.

Australia urgently requires national benchmarks for the provision criteria, costs and rates of prescription of DOT, as the current fragmentation precludes services from benchmarking the cost-effectiveness and the clinical outcomes of DOT. The development of a national database has the potential to promote equity of access and to determine whether guidelines are uniformly adhered to, particularly in rural or disadvantaged areas. It also offers the significant possibility for major improvements in service provision and a reduction in the cost of individual DOT services, at least in some states.

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COMPETING INTERESTS

The Medical Aids Subsidy Scheme (MASS), which provides the state-funded DOT service in Qld, funded and conducted the review, when reviewing its own services. Judy Gair is employed in the DVA Rehabilitation Appliances Program. All other authors are members of the MASS Oxygen Clinical Advisory Committee.

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