The Cost of Treating COPD Patients With Long-term Oxygen Therapy in a French Population*

Nathalie Pelletier-Fleury, MD; Jean-Louis Lanoe, PhD; Bernard Fleury, MD; and Michèle Fardeau, PhD

Objective: In greater Paris and its surroundings (as it is in all France), oxygen is home delivered by not-for-profit (NP) associations or profit-making (PM) health organizations. Both are financed by the national health insurance. This dual context and the current economic climate justify an economic evaluation of all respiratory care for patients with COPD receiving long-term oxygen therapy (LTO). This pragmatic approach identifies the variables that have the greatest impact on direct medical costs and estimates the annual cost for respiratory care per COPD patient.

Design: Retrospective study.

Setting: Health insurance scheme for self-employed professionals (CANAM).

Patients and methods: Between July 1985 and March 1994, 234 patients registered in CANAM files began LTO, 24% in the PM sector, 76% in the NP sector, mainly using concentrator (78%), mean age of 74±10 years, male predominance (74%), PaO$_2$ of 56.2±10.5 mm Hg, FEV$_1$/FVC of 43±15%, and 51% having 1 or more severe illness(es) associated. The economic appraisal was performed on a representative sample of 61 patients and measured the total resources consumption for respiratory care per COPD patient and per year (physician visits and tests, drugs, physiotherapy, oxygen therapy, hospitalizations for acute respiratory failure, transport costs).

Results: A quarter of the patients in each sector did not meet the LTO prescription guidelines (PaO$_2$ >60 mm Hg). For patients having their oxygen delivered by NP sector, the total ambulatory cost for respiratory care was lower ($4,506 per patient and per year vs $5,399) because they mainly used concentrator, all the other direct ambulatory costs being equal. The total annual cost for respiratory care of a COPD patient receiving LTO amounted to $11,672 (NP and PM sectors merged). Oxygen therapy represented 73% of the total ambulatory cost. In a multiple linear regression model, hospitalization represented the largest share of cost, significantly higher when PaO$_2$ was 55 mm Hg or less ($2,287 per patient per year vs $8,717). In contrast, none of the covariates (age, sex, PaO$_2$, FEV$_1$/FVC) influenced at a significant level the total cost of visits, tests, drugs, and physiotherapy, amounting to $1,507.

Conclusion: As oxygen treatment plays an important role in the variation of costs, further pragmatic studies should help to better understand what are the real motivations to choose one mode of oxygen administration more than another and should determine factors that may lead physicians sometimes not to comply with clinical guidelines.

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Key words: COPD; domiciliary oxygen therapy; economic evaluation

Abbreviations: CANAM=health insurance scheme covering self-employed professionals; LTO=long-term oxygen therapy; NP=not-for-profit; PM=profit-making; SS=Sécurité Sociale

In the United States in 1990, respiratory diseases (mainly chronic bronchitis and emphysema) constituted the third cause of tobacco-related death (mortality rate equal to 3.25 per 100,000), behind cardiovascular diseases and lung cancer.1 In France in 1990, 21,648 persons died from COPD, excluding asthma (mortality rate equal to 3.81 per 100,000), twice as many as from road traffic accidents.2 From the public health point of view, COPD is thus a potentially fatal and disabling disease. Oxygen supplementation has been proved to increase the life expectancy of these patients with COPD.3,4 In France, long-term oxygen therapy (LTO) is carried out in the patient’s home by private institutions that may be either not-for-profit (NP) associations or profit-making (PM) health orga-
nizations. The NP structures were created in 1981, under the aegis of the Caisse Nationale d’Assurance Maladie pour les Travailleurs Salarisés (CNAMTS), to improve the follow-up of COPD patients receiving home oxygen therapy and to reduce the financial heterogeneity of this treatment that existed in France at this time. (CNAMTS is a health insurance scheme covering salaried employees.) These associations were initially hospital based. There are now 33, spread all over the territory and gathered at a national level in the Association Nationale pour le Traitement a Domicile de l’Insuffisance Respiratoire (ANTADIR). (ANTADIR negotiates the purchase of oxygen therapy equipment for all the NP structures and has a national register for all their patients receiving LTO.) Later on, competitive PM structures emerged with similar objectives of home oxygen delivery. On the one hand, the services offered, the follow-up of patients, and especially the forms of LTO financing by the Sécurité Sociale (SS) differ in the two sectors. (SS is the national health insurance, including the CNAMTS, the CANAM [health insurance scheme, part of SS, for self-employed professionals], and other insurance schemes.) On the other hand, the two sectors manifest preferred modes of oxygen administration (concentrator, compressed gas, or liquid oxygen) in which utilization costs vary significantly depending on their particular constraints. Physicians refer patients to one or the other of the two sectors depending on their local presence and the way they care for patients.

Given its chronic nature and its repeated acute respiratory failures, the costs related to the care of patients with COPD are a priori high (inpatient hospital care, oxygen therapy, ambulatory care, and medical goods). The current economic climate and the dual context of home oxygen delivery in France justify an economic evaluation of all respiratory care (including home oxygen delivery) for these patients with COPD receiving LTO. Aiming to optimize the resources allocation and reduce the financial heterogeneity of this treatment that existed in France at this time, (CNAMTS is a health insurance scheme covering salaried employees.) These associations were initially hospital based. There are now 33, spread all over the territory and gathered at a national level in the Association Nationale pour le Traitement a Domicile de l’Insuffisance Respiratoire (ANTADIR). (ANTADIR negotiates the purchase of oxygen therapy equipment for all the NP structures and has a national register for all their patients receiving LTO.) Later on, competitive PM structures emerged with similar objectives of home oxygen delivery. On the one hand, the services offered, the follow-up of patients, and especially the forms of LTO financing by the Sécurité Sociale (SS) differ in the two sectors. (SS is the national health insurance, including the CNAMTS, the CANAM [health insurance scheme, part of SS, for self-employed professionals], and other insurance schemes.) On the other hand, the two sectors manifest preferred modes of oxygen administration (concentrator, compressed gas, or liquid oxygen) in which utilization costs vary significantly depending on their particular constraints. Physicians refer patients to one or the other of the two sectors depending on their local presence and the way they care for patients.

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**Materials and Methods**

Following physician’s prescription, 234 patients with COPD registered in CANAM files began LTO (with daily hours of oxygen prescribed ≥15) between July 1985 and March 1994. The entry criteria for these patients, retrospectively included in the study, were only that none of them received home ventilator treatment and that chronic bronchitis and emphysema were the initial cause of their obstructive respiratory illness. The degree of hypoxemia was not a selection criterion, even if physicians did not always comply with clinical practice guidelines for these patients. Actually, one fourth of the patients treated and involved in the study had a PaO₂ level over 60 mm Hg. This pragmatic approach is very relevant to give information on the real modalities of performing LTO, and allows us to calculate the costs of COPD care in France out of a context of randomized trial.

**Patients**

All the characteristics of the 234 patients were collected from CANAM files. These patients were rather old, 74 ± 10 years, with a normal weight, body mass index of 24.55 ± 5.5 kg/m², and a male predominance (74%). At the beginning of treatment, PaO₂ was equal to 56.2 ± 10.5 mm Hg (median, 55.4 mm Hg) and FEV₁/FVC was 43 ± 15%. Forty-nine percent of the patients had only COPD, and 51% had 1 or more severe illness(es) associated (including lung or bladder tumors, myocardial infarction, diabetes, arterial hypertension). Patients mainly used a concentrator (76%), 14% used compressed gas, and 8% used liquid oxygen. Twenty-four percent of the patients had their oxygen home delivered by the PM sector (55 patients) and 76% (179 patients) by the NP sector. At the close date of the study, 104 patients were dead, and 130 patients were still alive (32 in PM sector and 98 in NP sector). None of the patients were withdrawn from LTO due to causes other than death, eg, improvement of hypoxemia or lack of cooperation with use of LTO. To analyze economic data, for reasons linked to the storage of invoices, we could work only on patients still alive at the end of the study. Thus, the whole 32 patients still alive and treated through the PM sector and a random sample of 32 of the 98 patients still alive and treated through the NP sector were selected. Three patients were withdrawn (two patients were dead in the NP sector and we did not have access to their economic data, and the reference of one file in the PM sector was lost). Table 1 refers to the comparison of the different characteristics of the patients selected for the economic appraisal in NP and PM sectors. The two groups were different only in terms of mode of oxygen administration: in the NP sector, the use of a concentrator prevailed, in the PM sector, less than half of patients used a concentrator as the others used gas cylinder. The usage of liquid oxygen remained little developed in both sectors. Moreover, the 30 patients in the NP sector selected for the economic analysis were similar to the initial population of 179 patients in terms of age, sex, PaO₂, FEV₁/FVC, number of other severe disease(s) of use of a concentrator vs other modes of oxygen administration, and especially length of follow-up (27.3 ± 22.9 months vs 27.1 ± 23.4 months). The 31 patients treated through the PM sector compared with the initial population of 55 patients were also similar.

**Table 1—Characteristics of the 61 COPD Patients Receiving LTO Selected for the Economic Analysis**

<table>
<thead>
<tr>
<th>PM Sector (n=31)</th>
<th>NP Sector (n=30)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td>76.3±11</td>
<td>74.9±10.2</td>
</tr>
<tr>
<td>Sex, M/F</td>
<td>20/11</td>
<td>22/8</td>
</tr>
<tr>
<td>PaO₂, mm Hg</td>
<td>55.7±10.1</td>
<td>55.3±9.3</td>
</tr>
<tr>
<td>FEV₁/FVC, %</td>
<td>51.5±18.4</td>
<td>43.1±13.3</td>
</tr>
<tr>
<td>Follow-up, mo</td>
<td>24.51±18</td>
<td>27.3±22.9</td>
</tr>
<tr>
<td>None or ≥1 other(s) illness(es) associated with COPD*</td>
<td>16/15</td>
<td>18/12</td>
</tr>
<tr>
<td>O₂C/O₂G/O₂L¹</td>
<td>14/13/4</td>
<td>28/0/2</td>
</tr>
<tr>
<td>Portable system, yes/no</td>
<td>3/29</td>
<td>8/22</td>
</tr>
</tbody>
</table>

*Most of them being linked to nicotine addiction (myocardial infarction, lung tumors, etc.).

⁰O₂C=concentrator; O₂G=compressed gas; O₂L=liquid oxygen.
Methods

The economic evaluation measured the total annual resources consumption of respiratory care per patient (direct medical and nonmedical costs). This charge was reimbursed 100% to the COPD patient by the SS. Actually in France, a certificate of medical necessity for home oxygen therapy must be completed by physicians so that all COPD care may be reimbursed entirely to the patients.

For these 61 patients, we obtained the actual cost reimbursed by CANAM to the patients for their medical expenses for the last 2 years. These costs included physician (general practitioners and chest specialists) visits and tests prescribed (chest radiograph, blood gas measurement, lung function tests), drugs, and respiratory physiotherapy. To calculate the cost of LTO, we used the tariff rates prevalent in 1994 (Table 2). The NP sector has agreements with the SS and is remunerated for services provided to patients on the basis of prices per day that are set on a district basis and according to the mode of oxygen administration (concentrator, compressed gas, or liquid oxygen), while the PM sector is paid via the SS for services provided on the basis of tariffs set by state regulation. The latter are fixed on a weekly basis and vary subject to the volume of oxygen delivered (more or less than 5 L/min) and also depend on whether a portable system was provided. We also collected the number of days spent in hospital. Hospitalization cost was calculated multiplying the number of stays in the hospital by an estimation of their cost according to the diagnosis-related group. Nonmedical costs, essentially due to transports, were also drawn from CANAM files, as they are reimbursed entirely to patients by the SS. We assumed the relatively weak impact on total expenses of the indirect costs (absenteeism at work and invalidity pensions), given the average age of patients with COPD receiving LTO, mostly retired persons. The costs were expressed in 1995 US dollars ($US1=FF5.5).

Statistical Analysis

The statistical analysis was carried out with the help of a statistical program (SAS Institute; Cary, NC). The results were expressed as means±SD. Student’s t test permitted the comparison of quantitative criteria. Multivariate statistical methods (multiple linear regression) were used to explain the different expenditure headings.

RESULTS

Direct Medical Cost in Univariate Analysis

The annual direct medical and nonmedical cost per patient is presented in Table 3. For the 61 patients, the dominant item was hospitalization, accounting for a little less than 50% of the total cost. Physician visits, however, accounted for 3% of the cost. Oxygen therapy amounted to the major fraction of ambulatory costs (73%).

The main result of the comparison between NP and PM sectors (Table 3) was that oxygen therapy was 28% cheaper in the NP sector, explaining the significant difference in the total ambulatory cost between the 2 sectors, all other direct medical costs being similar. Patients in both sectors were similar in terms of annual number of physician visits and days of hospitalization (Table 4).

The annual direct ambulatory costs (including oxygen therapy) and the annual hospitalization cost, according to other covariates (sex, age, etc.), are summarized in Table 5. Hospitalization was the dominant item in all groups, accounting for between 44% (in men group) and 64.2% (in PaO2 ≤55 mm Hg group) of total costs. Another common characteristic of all groups was the relatively small proportion represented by physician visits. The smallest share of costs attributable to visits (1.7%) was found in the group of women. Compared with men, women significantly consumed less drugs $860±$1,019 vs $468±$486 (p=0.04) and had less physician visits $341±$264 vs $197±$209 (p=0.03). The largest share of costs attributable to drugs was found in patients with the most severe conditions (FEV1/FVC ≤50%) (10.2% of total cost) and in the group of patients who had begun their LTO for less...
than 6 months (14.6%). In the group of patients with severe disease, we found the biggest share of cost attributable to respiratory physiotherapy (3.6%).

Direct Medical Cost in Multivariate Analysis

The cost of oxygen therapy varied only with the mode of oxygen administration and the usage of portable systems; this cost was independent of age, sex, PaO₂, FEV₁/FVC, number of other severe illness(es), and length of follow-up. We investigated the variation in the total annual direct medical cost, including physician visits, tests, drugs, and physiotherapy. None of the previous covariates significantly influenced this cost, amounting to $1,507 per patient. Hospitalization cost was significantly higher when PaO₂ was 55 mm Hg or less, $8,717± $12,247 vs $2,287± $5,342 when PaO₂ was greater than 55 mm Hg; other covariates had no influence on this expenditure.

Nonmedical Costs

The annual travel costs per capita are shown in Table 3.

Estimation of the Total Annual Direct Cost for Respiratory Care of a COPD Patient Receiving LTO

We calculated the total annual direct cost for respiratory care on the basis of the previous results of the economic study (61 patients) that we extrapolated to the 234 initial patients, as these 2 populations were comparable with respect to age, sex, PaO₂, FEV₁/FVC, and repartition of the mode of oxygen administration in NP and PM sectors. The ambulatory direct medical cost (excluding oxygen therapy) reached $1,507 per patient per year and did not vary with any covariate. The annual hospitalization cost amounted to $8,717 per patient for the those having a PaO₂ of 55 mm Hg or less (50%) and $2,287 for those having a PaO₂ greater than 55 mm Hg (50%) (median PaO₂ being 55 mm Hg in the initial population). The cost of oxygen therapy in the NP sector amounted to $2,814 ($7.71×365 days) for the 158 patients using a concentrator, to $5,449 ($14.93×365 days) for the 8 patients using gas oxygen, and to $6,814 ($18.67×365 days) for the 13 patients using liquid oxygen; this cost in the PM sector amounted to $3,975 ($10.89×365 days) for the 49 patients without a portable system and to $7,085 ($19.41×365 days) for the 6 patients with a portable system (Table 2). The annual transport cost was $1,184 per patient. Thus, the total annual direct cost for respiratory care of a patient with COPD receiving LTO amounted to $11,672 (see Appendix).

Discussion

This economic analysis asserts the considerable costs of respiratory care for patients with COPD receiving LTO. This appraisal probably underestimates costs, as it is based on data concerning living patients and therefore does not include expenditures for respiratory care in the premortem period, a priori higher, mostly in terms of hospitalization. However, some of the patients enrolled in the economic study were not far from their death (as the mean of follow-up of dead patients

Table 4—Annual Physician Visits and Days Spent in Hospital for Respiratory Care per Patient With COPD Receiving LTO, in a French Population

<table>
<thead>
<tr>
<th></th>
<th>PM</th>
<th>NP</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>General practitioner</td>
<td>6.2±6.0</td>
<td>8.3±7.4</td>
<td>0.22</td>
</tr>
<tr>
<td>Chest specialist</td>
<td>2.2±3.3</td>
<td>2.3±3.4</td>
<td>0.69</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>11±22.8</td>
<td>15.9±27.4</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Table 5—Annual Direct Medical Costs for Respiratory Care per Patient With COPD Receiving LTO, by Group, in a French Population

<table>
<thead>
<tr>
<th></th>
<th>Ambulatory Costs $US</th>
<th>Hospitalization $US</th>
<th>Total Direct Costs $US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥66</td>
<td>5,196±388</td>
<td>4,892±8,994</td>
<td>10,088±9,196</td>
</tr>
<tr>
<td>&gt;66</td>
<td>4,759±1,654</td>
<td>4,890±9,306</td>
<td>9,675±9,361</td>
</tr>
<tr>
<td>Women</td>
<td>4,626±1,392</td>
<td>6,697±11,843</td>
<td>11,322±11,957</td>
</tr>
<tr>
<td>Men</td>
<td>5,111±2,015</td>
<td>4,054±7,564</td>
<td>9,194±7,697</td>
</tr>
<tr>
<td>LTO, mo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥6</td>
<td>5,384±2,728</td>
<td>5,139±11,900</td>
<td>10,770±10,719</td>
</tr>
<tr>
<td>&gt;6</td>
<td>4,905±1,728</td>
<td>4,863±9,079</td>
<td>9,768±9,135</td>
</tr>
<tr>
<td>PaO₂ mm Hg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤55</td>
<td>4,815±1,951</td>
<td>8,717±12,247*</td>
<td>13,574±12,351*</td>
</tr>
<tr>
<td>&gt;55</td>
<td>5,177±1,918</td>
<td>2,287±5,342</td>
<td>7,464±5,354</td>
</tr>
<tr>
<td>FEV₁/FVC, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤50</td>
<td>5,693±2,283†</td>
<td>5,838±9,409</td>
<td>11,531±9,466</td>
</tr>
<tr>
<td>&gt;50</td>
<td>4,076±909</td>
<td>6,079±11,923</td>
<td>10,166±11,839</td>
</tr>
<tr>
<td>O₂ concentrator</td>
<td>4,543±1,560</td>
<td>5,226±9,961</td>
<td>9,794±9,814</td>
</tr>
<tr>
<td>O₂ gas or liquid</td>
<td>5,982±2,123</td>
<td>4,167±7,149</td>
<td>10,048±7,959</td>
</tr>
</tbody>
</table>

* p<0.05.  † p<0.005.
was not statistically different from the mean of follow-up of the still living patients) at the close date of our study and at least for ambulatory care, there is no reason to consider that an underestimation is of great importance. After hospitalization, oxygen therapy represents the largest share (37%) of the total direct medical costs, largely distinguished from drugs, respiratory physiotherapy, and physician visit costs. The per capita annual direct medical cost for respiratory care is estimated at $11,672. This figure reaches as high as seven times the average medical expenditures of a French citizen per year.\textsuperscript{12} Facing such a situation, detailed knowledge of the variation in health-care costs for these patients may provide guidance toward more efficient utilization of resources. Most of the previous economic studies gave partial information on this topic; they were limited to the cost-benefit comparison of aerosol bronchodilator delivery methods,\textsuperscript{13} to the evaluation of pulmonary rehabilitation programs,\textsuperscript{14,15} to the comparison of cost-effectiveness ratios of home care vs institutional or physician’s office care,\textsuperscript{16-18} or to the comparison of 2- vs 6-month reevaluation intervals on both clinical outcome and cost.\textsuperscript{19}

Which Mode of Oxygen Administration?\textsuperscript{2}

Recently in the United States, information concerning the number of claims and the total cost of oxygen therapy was provided from the Health Care Financing Administration.\textsuperscript{20} The incidence of usage of oxygen therapy was estimated to be 241 per 100,000 people. Medicare covers up to 80% of all these patients. About 15% of patients have oxygen therapy provided by Medicaid or the Department of Veterans Affairs and 5% by private insurance. In 1994 in France, 17,000 patients were receiving LTO carried out by the NP sector\textsuperscript{21} and about 7,000 patients by the PM sector (data provided by home-care companies spread all over the country). The incidence of usage of oxygen therapy could be estimated to 42 per 100,000 people. The SS covers all these patients. In our study, geographically limited to Paris and its surrounding area, the NP sector is less expensive than the PM sector for reasons linked to their preference for the usage of a concentrator (about 90% of the patients) and to their lower tariffs for portable systems. In the literature, three studies\textsuperscript{22-24} compared the costs of oxygen delivery by concentrator and compressed gas; they reached the overall conclusion that the concentrator was the least expensive. In the United States, 80% of Medicare patients receive their LTO from a concentrator; the charge is determined to be about $2,400 per patient and per year.\textsuperscript{20} Actually, under the Six-Point Plan, payment is not modulated by the various modes of oxygen administration but by the amount of oxygen being used;\textsuperscript{25} the higher cost of gaseous or liquid oxygen serves as a disincentive for most durable medical equipment suppliers to provide these modes of oxygen administration. In France, the allowed charge by the SS for the usage of a concentrator in the NP sector is quite similar, $2,800 per patient per year. Only an improvement in the survival and in the quality of life of the patients receiving gaseous or liquid oxygen might refute the choice of the NP sector. Strom and Boe\textsuperscript{26} did not find any significant difference in the survival of patients treated by concentrator vs compressed gas. In another study,\textsuperscript{27} the same authors compared the impact of these two treatments on the quality of life of patients, using the Sickness Impact Profile.

They did not find any significant difference between the mean Sickness Impact Profile scores in the two groups. From an economic point of view, these results support the choice of the NP sector mainly using a concentrator. Concerning the PM sector, if we apply to this sector the tariffs available for the NP sector, this leads to a daily expense of oxygen therapy equal to $12 per patient, \textit{i.e.}, 25% higher than in the NP sector ($9); this only demonstrates that the PM sector prefers the usage of compressed gas or liquid oxygen, \textit{a priori}, without any relevant sanitary benefits for the patients. Therefore, it is only under one of the two following assumptions that the PM sector could be chosen rationally: (1) gaseous or liquid oxygen at home further allows the patients to have a portable or ambulatory system when they leave home, improving their quality of life; however, the comparison with the usage of a concentrator at home (with a back-up oxygen cylinder for use if necessary) is not well documented in the literature; (2) independent of the type of oxygen therapy equipment provided by both sectors, a better follow-up and better services to patients are offered by the PM sector when compared with the NP sector. To our knowledge, no study has been performed yet in that direction.

What the Pragmatic Approach Points Out

According to guidelines for prescribing oxygen,\textsuperscript{5} the pragmatic approach of this study pointed out that a large proportion of COPD patients treated by LTO did not meet the criteria of a resting PaO\textsubscript{2} of 60 mm Hg or less at the entry in the LTO. Actually, in each of the 2 sectors, 25% of the patients had a PaO\textsubscript{2} level greater than 60 mm Hg. In 1 year, the CANAM would have theoretically saved $201,782, only on oxygen expenditure, if physicians had strictly complied with this PaO\textsubscript{2} criteria. But, we must be very careful in our analysis about how LTO is provided; we did not have any information about oxygen saturation or about clinical data such as congestive heart failure.\textsuperscript{5} However, the need is emphasized for rigorous control of the LTO prescription to avoid unnecessary treatment, which is
cumbersome for the patients and expensive for the collectivity.

CONCLUSION

A prospective pragmatic study, at a national level, should be necessary to extend our economic results to all the COPD patients receiving LTO in France. Moreover, this kind of pragmatic approach should permit better understanding of the real motivations of choosing one mode of oxygen administration over another, and it should determine factors that may sometimes lead physicians to make decisions that do not comply with clinical guidelines.27

ACKNOWLEDGMENTS: The authors would like to thank Dr. Rossignol and Dr. Vicrey from the CANAM for their help in the collection of data and their encouragement in preparing the manuscript.

APPENDIX

To estimate the total annual direct cost for respiratory care (T) of a COPD patient receiving LTO, we added the ambulatory cost of $1,507, the hospitalization cost of 50%×$8,717+50%×$2,287, the oxygen therapy cost of 158/234×$2,814+8/234×$5,449+13/234×$6,814+49/234×$3,975+6/234×$7,085 and the transport cost of $1,184. Thus, T = $1,507+(50%×$8,717+50%×$2,287)+(158/234×$2,814+8/234×$5,449+13/234×$6,814+49/234×$3,975+6/234×$7,085)+$1,184 = $11,672 per patient and per year.

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