END-OF-LIFE COST FOR LUNG CANCER PATIENTS IN GREECE: A HOSPITAL-BASED RETROSPECTIVE STUDY

KOURLABA GEORGIA[1], KOKKOTOU ELENI[2], PAPASPILIOU AGGELIKI[2], STEFANOU GARYFALLIA[1], STOURNARA LAMPRINI[2], SYRIGOS KOSTAS[2]

[1] *ECONCARE LP, Athens, Greece.*
[2] *Oncology Unit, 3rd Department of Medicine, Athens Medical School, National & Kapodistrian University of Athens, Athens, Greece*

/ PCN209

BACKGROUND

- Lung cancer is a major public health problem worldwide since it remains the most common cancer diagnosed and greatest cause of cancer-related death. Lung cancer accounts for almost 12% of all cancers and represents 18% of all cancer-related deaths.[1]
- Greece is one of the European countries in which lung cancer is a leading cause of death with almost 8,300 people having died from lung cancer in 2018.[1]
- Lung cancer poses a substantial economic burden worldwide. In Europe, the direct cost of care for lung cancer patients amounts to more than €3 billion per year.[2]
- Cancer care costs vary by clinical care phase, with the highest costs observed in the initial period following diagnosis and in the last year of life (end-of-life (EOL) period), consistent with increases in intensity of care.[3-5]
- EOL cancer care has become increasingly more aggressive over the past decade,[6] and cancer decedents have consumed more healthcare resources than decedents with other diseases.[7-9]
- More aggressive medical care has been associated with increased cost and worst patients' quality of life.[10,11]
- Therefore, estimating EOL cost and how it varies depending on patient characteristics is critical for healthcare policy makers in order to guide effective interventions for minimizing the impact on both patients and society.
- In Greece, limited data are available regarding the EOL cost of lung cancer patients.[12]

OBJECTIVES

To estimate the EOL care cost for patients with lung cancer in Greece and to identify patient characteristics that might affect this cost.

METHODS

A hospital-based retrospective study was conducted in the Oncology Unit of "Sotiria" Hospital, in Athens, Greece. All lung cancer patients who died between 1/1/2015 and 21/12/2018, with at least 6 months of follow-up, were enrolled in the study.

Healthcare resource utilization data, such as hospitalization, therapy (i.e. chemotherapy/immunotherapy, radiotherapy and surgery), and laboratory/imaging tests during the last 6 months before death were extracted from a registry kept in the Unit. This data was combined with the corresponding local unit costs, as reimbursed by the public payer, to calculate the 6-month EOL cost (in €, 2019). Similarly, the 3-month and 1-month EOL was calculated, as well. Patients' demographic characteristics, medical history and diagnosis-related data were also extracted. Patients were categorized into those diagnosed with non-small-cell lung cancer (NSCLC), including adenocarcinoma and squamous, and those diagnosed with small-cell lung cancer (SCLC).

Cost data is presented as mean and 95% confidence interval (CI) using the bias-corrected and accelerated (BCa) CI (adjusted for ties) as obtained from 5,000 nonparametric bootstrapped resamples. To determine factors associated with EOL cost we applied generalized linear models (GLM) with gamma family and a log link function, which best fit the expenditure data according to the Box-Cox test and the modified Park test.[13] Robust standard errors were computed to account for the fact that clinicians treating patients in the same hospital may share the same clinical practices. Gamma coefficients generated by the regression model were exponentiated to retransform them into relative cost estimates.

RESULTS

- A total of 122 patients met the inclusion criteria. The mean age at diagnosis was 68.2 years with 78.7% of patients being male and 55.0% diagnosed at stage IV. 81.1% of patients had been diagnosed with NSCLC (Table 1). Almost all patients except for two had metastases at the time of diagnosis.
- The median (1st – 3rd quartile) overall survival of these patients was 10.8 (8 - 13) months. Almost 60% had died within 12 months since diagnosis.
- Table 2 presents the resource utilization during the EOL periods. During the last 6 months before death, 89% of patients received drug therapy, while this percentage reduced to 75% at 3 months and 41.8% at 1 month before death.
- The mean cost/patient in the last 6 months, 3 months, and 1 month before death were €7,855, €3,540, and €1,198, respectively. Pharmaceutical cost was the key driver of the total cost (75% of the total 6-month) followed by radiation therapy (15.8%; Table 3).
- The 6-month EOL cost was found to be statistically significantly higher among patients diagnosed with adenocarcinoma compared to those diagnosed with squamous and SCLC (Figure 1).
- The 6-month EOL cost was found to be almost 60% higher in males compared to females (p=0.001). Moreover, a 10-year increase in the patient's age at diagnosis was found to be associated with an almost 20% lower cost (p=0.015), and patients diagnosed with SCLC were found to be associated with a 35% lower cost compared to those diagnosed with adenocarcinoma (Table 4).

STUDY LIMITATIONS

The main study limitation is that this analysis is based on data extracted from a hospital-based registry and not a national population-based registry. This means that this data might come from a non-representative sample of lung cancer patients in Greece. Second, only direct medical costs were considered in our analysis and not costs incurred by reduced productivity of patients/caregivers, transportation or other intangible costs. Third, although the data was extracted from a registry, the outpatient resource utilization data was collected through interviews with patients or caregivers during the planned visits. This means that outpatient EOL cost is subject to self-reported bias and might hence be underestimated.

CONCLUSIONS

The findings of the present study indicate that lung cancer treatment incurs high costs in Greece even at the EOL phase, and these costs are mainly attributed to pharmaceutical expenses. Our findings may provide useful insight into the design and implementation of interventions aiming to raise clinicians' awareness about the importance of not providing aggressive EOL to high-risk care lung cancer patients, in Greece.

REFERENCES

1. International Agency for Research on Cancer. Global Cancer Observatory. 2018; Available from: https://gco.iarc.fr/.
2. European Respiratory Society, The economic burden of lung disease, in European Lung White Book, L.R. Gibson GJ, Sibille Y, Sheffield LB, Editor. 2013: United Kingdom. p. 16-27.
3. Chastek, B., et al., J Oncol Pract, 2012. 8(6): p. 75s-80s.
4. Yabroff, K.R., et al., J Natl Cancer Inst, 2008. 100(9): p. 630-41.
5. Yabroff, K.R., et al., Nat Clin Pract Oncol, 2007. 4(11): p. 643-56.
6. Earle, C.C., et al., J Clin Oncol, 2008. 26(23): p. 3860-6.
7. Gielen, B., et al., Health Policy, 2010. 97(1): p. 53-61.
8. Langton, J.M., et al., Br J Cancer, 2016. 114(11): p. 1293-302.
9. Polder, J.J., et al., Soc Sci Med, 2006. 63(7): p. 1720-31.
10. Schnipper, L.E., et al., J Clin Oncol, 2012. 30(14): p. 1715-24.
11. Wright, A.A., et al., JAMA, 2008. 300(14): p. 1665-73.
12. Souliotis, K., et al., Health Serv Res Manag Epidemiol, 2019. 6: p. 2333392819841223.
13. Moran, J.L., et al., J Eval Clin Pract, 2007. 13(3): p. 381-9.

Table 1: Demographic and diagnostic characteristics of lung cancer decedents in Greece

Demographic and diagnostic characteristics	N=122
Gender, n (%)	
Female	26 (21.3)
Male	96 (78.7)
Age at the time of diagnosis, years	
Median (1st, 3rd quartile)	68.2 (63.7, 74.3)
Smoking status, n (%)	
Current smoker	60 (51.3)
Former smoker	51 (43.6)
Non-smoker	6 (5.1)
Histological or cytological diagnosis n (%)	
Adenocarcinoma	64 (52.5)
Squamous	35 (28.7)
Small-cell lung cancer	23 (18.9)
Stage of cancer at diagnosis, n (%)	
Early disease (stages I & II)	9 (7.4)
III	45 (37.6)
IV	66 (55.0)
Number of comorbidities, n (%)	
0	11 (9.02)
1	28 (23.0)
2	36 (29.5)
≥3	47 (38.5)
Performance status at baseline, n (%)	
Normal activity	23 (29.5)
Restricted but light work	36 (46.2)
Self-caring. Unable to work. Mobile>50% working hours	16 (20.5)
Limited self-care only. Mobile<50% working hours	3 (3.9)

Table 2: Resource utilization during the end-of-life periods among lung cancer patients, in Greece

	6 months before death	3 months before death	1 month before death
Resource utilization	**N (%)**	**N (%)**	**N (%)**
Drug therapy	109 (89.3)	92(75.4)	51(41.8)
Radiotherapy	42 (34.4)	24(19.7)	12(9.8)
Surgery	2 (1.6)	0(0)	0(0)
Hospitalization	20 (16.4)	17(13.9)	4(3.3)
Laboratory/imaging tests	121 (99.2)	119(97.5)	80(65.6)

Table 3: End-of-life cost (in €, 2019) for lung cancer patients in Greece

Cost components	6 month Mean (95% CI)	3 months Mean (95% CI)	1 month Mean (95% CI)
Overall cost per patient	7855 (6820 – 9164)	3540 (2944 – 4466)	1198 (811 – 2140)
Cost of therapy			
Drug therapy	5917 (5047 – 7090)	2360 (1953 – 3012)	775 (528 – 1594)
Radiotherapy	1244 (815 – 1750)	763 (457 – 1268)	314 (129 – 664)
Surgery	55 (0 – 138)	0 (0 – 0)	0 (0 – 0)
Laboratory/Imaging tests	330 (298 – 368)	170 (146 – 205)	66 (48 – 100)
Hospitalizations	309 (178 – 507)	247 (135 – 434)	43 (8 – 193)

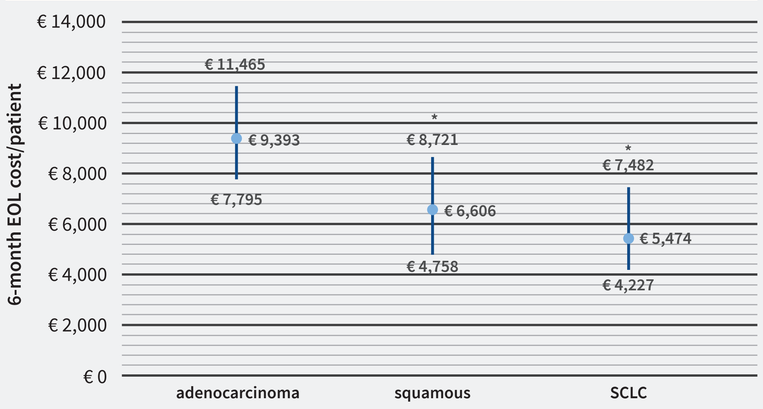
CI: confidence interval

Table 4: Determinants of 6-month end-of-life cost of care for lung cancer patients in Greece: Results from the multiple generalized linear model

	Exp(b)	95% CI	P-value
Time from diagnosis to death, months			
>6 and <=12 months	Ref		
>12 months	0.786	0.594, 1.041	0.098
Number of metastases	1.062	0.970, 1.173	0. 176
Age at diagnosis	0.980	0.961, 0.996	0.015
Gender			
Female	Ref		
Male	1.599	1.209, 2.117	0.001
Histology or cytology type			
Adenocarcinoma	Ref		
SCLC	0.650	0.467, 0.914	0.014
Squamous	0.726	0.501, 1.062	0.099

SCLC: small-cell lung cancer, CI: confidence interval

Figure 1: 6-month end-of-life (EOL) cost/lung cancer patient by histological type, in Greece



**p<0.05 compare to adenocarcinoma after Bonferroni corrections for multiple comparisons (Dunn's test), SCLC: small-cell lung cancer*

Contact details: g.kourlaba@econcare.gr, g.stefanou@econcace.gr