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Factors affecting hospital costs in lung cancer patients in the United Kingdom

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ABSTRACT

Introduction: Rising healthcare costs and financial constraints are increasing pressure on healthcare budgets. There is little published data on the healthcare costs of lung cancer in the UK, with international studies mostly small and limited by data collection methods. Accurate assessment of healthcare costs is essential for effective service planning.
Methods: We conducted a retrospective, descriptive cohort study linking clinical data from a local electronic database of lung cancer patients at a large UK teaching hospital with recorded hospital income. Costs were adjusted to 2013–2014 prices.
Results: The study analysed secondary care costs of 3274 patients. Mean cumulative costs were £5852 (95% CI, £5694 to £6027) at 90 days and £10,009 (95% CI, £9717 to £10,278) at one year. The majority of costs (58.5%) were accumulated within the first 90 days, with acute inpatient costs the largest contributor at one year (42.1%). The strongest predictor of costs was active treatment, especially surgery. Costs were also affected by age, route to diagnosis, clinical stage and cell type.
Discussion: Successful early diagnosis initiatives that increase radical treatment rates and improve outcomes may significantly increase the secondary care costs of lung cancer management. The use of routine NHS clinical and financial data can enable efficient and effective analyses of large cohort health economic data.

1. Introduction

Lung cancer is the second most common cancer in England and is the most common cause of cancer death in the England and Wales [1,2]. Lung cancer survival in the UK is inferior to other developed countries [3].

Rising healthcare costs and financial constraints are increasing pressure on international healthcare budgets. In the UK, cancer and tumours are associated with the third largest NHS expenditure of all disease groups. During the three years from 2009/10 to 2012/13, the budget for all cancer services increased below the rate of inflation at 0.7% per year, while the budget for lung cancer services reduced by 11.5% per year. The diagnosis, treatment and follow-up of lung cancer predominantly occur within secondary care, which accounts for 82.6% of the lung cancer budget [4].

New developments to improve early detection, rates of radical treatment and outcomes in lung cancer are often associated with a significant financial cost. In order to provide the highest quality care in a system of scarce resources and financial constraint, it is imperative to have a detailed understanding of the factors that affect costs in the management of patients with lung cancer.

Data for UK healthcare costs in lung cancer are limited. A study of factors affecting the costs of 724 patients in Northern Ireland in 2008 remains the only published data [5]. This study was performed using a manual case note review. It reported that inpatient stays were the largest resource cost and that costs were affected by lung cancer stage, co-morbidities, age and social deprivation.

More recent studies of factors affecting costs in lung cancer have been published in Europe [6–9], Australia [10] and the USA [11]. The sources for cost data include manual case note review [8,9], insurance claims [10,11], hospital episode statistics [7] (cost data derived from the expected resource utilisation for patients based on primary diagnosis and comorbidities) and patient level statistics [6] (cost data derived from actual resources used by an individual patient). Most of these studies are small, with fewer than 250 patients [5,6,8–10], however two larger studies, conducted in

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Europe and USA, have included more than 10,000 patients [7,11]. Inpatient admission and treatment costs commonly account for the greatest cost components [5–7,9–11], and costs are higher in comparable western European countries (such as Germany and France) than in the UK [7].

This study evaluated the direct costs of hospital care in the diagnosis and management of lung cancer in a single large UK teaching hospital using routine NHS data, and aimed to identify factors that were predictive of high costs.

2. Materials and methods

2.1. Data collection

The National Health Service (NHS) provides publicly funded healthcare in the United Kingdom. Services in England are commissioned locally by Clinical Commissioning Groups (CCGs) or centrally through specialist commissioning and are funded via an internal market established in the 1990s according to a national Payment by Results tariff. NHS trusts are required to regularly provide clinical coding data for care episodes, which is processed using the Payment by Results (PbR) grouper software to describe care spells for an individual patient and then coded by Human Resource Group (HRG). Each HRG spell is allocated a cost in pounds based on the national PbR tariff. HRG version 3.5 was used prior to April 2008 with HRG4 (core and unbundled) being used from April 2008 onwards. The HRG-coded data is returned to the NHS trust to guide income claims that are then reimbursed by CCGs.

The recorded income (or 'sold activity') for Leeds Teaching Hospitals NHS Trust (LTHT) was used to represent direct costs per patient. These costs include all emergency, inpatient and outpatient services with the exception of some specially funded services (e.g. hospital palliative care and PET-CT), and included the cost of high-value drugs, including tyrosine kinase inhibitors. Finance data was collected in December 2014 for all care spells from January 2008 to October 2014. HRG codes and tariffs are year-specific and are based on the HRG version and PbR tariff in use during that year. All costs were adjusted for inflation to a common base-year of 2013–2014 using the Personal Social Services Research Unit Hospital and Community Health Services Pay and Prices Index [12]. Costs assigned to each care spell were assumed to be incurred on the end date of that spell. Data was not collected on the use or costs of primary care or social services.

Clinical staging, outcomes and demographic data were retrospectively collected from a local electronic database of all patients diagnosed with lung cancer at LTHT. This database is based on the National Lung Cancer Audit Database (LUCADA) and National Registry data. All patients who were first seen at LTHT between 01/01/08 to 31/10/13 were included.

The clinical and healthcare costs databases were linked deterministically using the NHS number as a unique identifying reference with 99.9% (3274/3276) successful linkage of records. Day zero was defined as the date a patient was first seen by a member of the lung cancer team, and all patients had 12 months of healthcare costs data from the date they were first seen.

2.2. Statistical analysis

All statistical analyses were carried out using the R statistical software package version 3.1 [13].

90 day and 1 year cumulative costs were calculated. Ordinary least squares regression analysis was undertaken on log-costs which were approximately normally distributed. More complex models were avoided in an attempt to allow easy interpretation and back-calculation in future cost-effectiveness modelling. Data with no associated cost was allocated a nominal £0.001 cost to permit analysis. Confidence intervals were calculated using the bootstrap method.

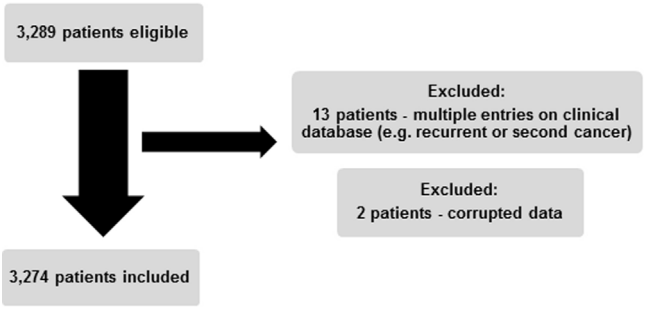

Fig. 1. Flowchart of eligible patients.

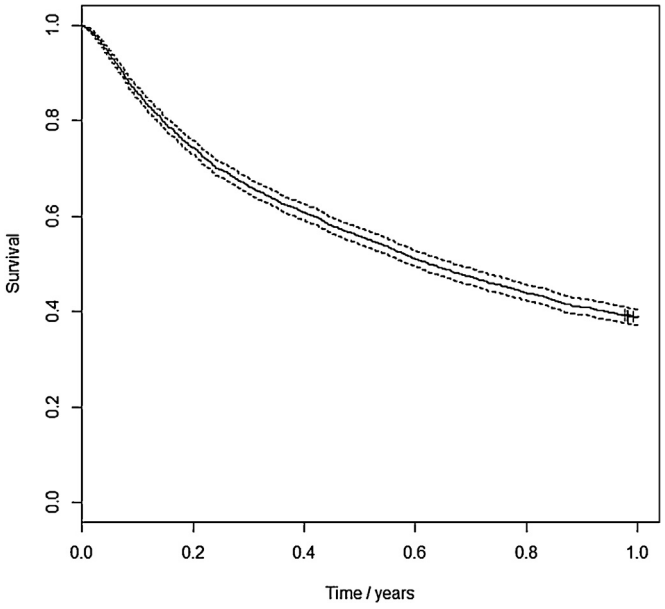

Fig. 2. Kaplan-Meier survival curve.

3. Results

3.1. Patient characteristics

There were 3289 patients first seen between January 2008 and October 2013 at LTHT. Of these, 15 patients were excluded (13 second or recurrent lung cancers and 2 corrupted data); Fig. 1.

The remaining 3274 patients were included for analysis. The mean age was 72.5 years (95% CI: 72.1–72.9 years). There were 1883 (57.5%) patients with non-small cell lung cancer, 406 (12.4%) with small cell lung cancer, 25 (0.8%) with carcinoid tumours, and 960 (29.3%) with an unknown cell type. All patients had at least one year of follow-up and one year survival was 38.6% (95% CI: 37.1–40.4%); Fig. 2. Table 1 describes characteristics of patients in the study. Treatment categories are not mutually exclusive and some patients may have received multiple treatment modalities.

Epidermal growth factor receptor (EGFR) mutation analysis was performed on 465 (23.8%) patients with stage IIIB and IV lung cancer, with 45 (9.7% of tests) sensitising EGFR mutations detected.