Patterns of care and emergency presentations for people with non-small cell lung cancer in New South Wales, Australia: A population-based study

Sarsha Yap[a], David Goldsbury[a,*], Mei Ling Yap[a,b,c,d], Susan Yuill[a], Nicole Rankin[a,e], Marianne Weber[a,b], Karen Canfell[a,b,f], Dianne L O'Connell[a,b,g]

[a] Cancer Research Division, Cancer Council New South Wales, PO Box 572 Kings Cross, Sydney, NSW, 1340, Australia
[b] School of Public Health, University of Sydney, Sydney, NSW, Australia
[c] Ingham Institute, University of New South Wales, Liverpool, NSW, Australia
[d] Liverpool and Macarthur Cancer Therapy Centres, University of Western Sydney, Campbelltown, NSW, Australia
[e] Sydney Catalyst, NHMRC Clinical Trials Centre, Sydney Medical School, University of Sydney, Sydney, NSW, Australia
[f] Prince of Wales Clinical School, UNSW, Sydney, NSW, Australia
[g] School of Medicine and Public Health, University of Newcastle, Newcastle, NSW, Australia

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ABSTRACT

Introduction: Little is known about population-wide emergency presentations and patterns of care for people diagnosed with non-small cell lung cancer (NSCLC) in Australia. We examined patients' characteristics associated with presenting to an emergency department around the time of diagnosis ("emergency presenters"), and receiving anti-cancer treatment within 12 months of diagnosis.

Materials and Methods: Participants in the 45 and Up Study who were newly diagnosed with NSCLC during 2006–2010 were included. We used linked data from population-wide health databases including Medicare and pharmaceutical claims, inpatient hospitalisations and emergency department presentations to follow participants to June 2014. Patients' characteristics associated with being an emergency presenter and receiving any anti-cancer treatment were examined.

Results: A total of 647 NSCLC cases were included (58.6% male, median age 73 years). Emergency presenters (34.5% of cases) were more likely to have a high Charlson comorbidity index score, be an ex-smoker who had quit in the past 15 years and to be diagnosed with distant metastases. Almost all patients had visited their general practitioner ≥3 times in the 6 months prior to diagnosis. Nearly one-third (29.5%) of patients did not receive any anti-cancer treatment, however, there were no differences between emergency and non-emergency presenters in the likelihood of receiving treatment. Those less likely to be treated were older, had no private health insurance, and had unknown stage disease recorded.

Conclusion: Our results indicate the difficulties in diagnosing lung cancer at an early stage and inequities in NSCLC treatment. Future research should address opportunities to diagnose lung cancer earlier and to optimise treatment pathways.

1. Introduction

Lung cancer is the leading cause of cancer death worldwide. In Australia, approximately 47,750 people died from cancer in 2017, with 19% of these due to lung cancer [1]. This number is higher than the combined number of deaths from the next two leading causes of cancer death, colorectal and prostate cancer [1]. Survival relative to the general population one and two years after a lung cancer diagnosis is 39% and 25% respectively [2]. For many lung cancer patients, poor survival is attributable to being diagnosed at an advanced stage [3].

The pathways to a lung cancer diagnosis are complex, due to these patients generally having a number of comorbidities and non-specific symptoms leading to diagnostic difficulty and delays in diagnosis [4,5]. A lengthy time interval from first symptomatic presentation to diagnosis often involves multiple GP consultations to rule out differential diagnoses [6]. One of the main pathways to diagnosis for lung cancer patients is presentation to an emergency department and this has been associated with poorer outcomes in the United Kingdom (UK), usually because the disease had progressed to an advanced stage [7–10].

In addition to advanced stage disease at diagnosis limiting the

opportunity for curative treatment, the treatment pathway is complex due to the disparities in guideline recommended treatment and treatment received in practice [4,11]. In developed countries this is often because patients included in lung cancer clinical trials on which the guidelines are based, are not representative of the general lung cancer population who tend to be older, have more comorbidities and poorer performance status [4,11,12]. Timeliness of initial treatment from diagnosis has also been shown to vary [4]. In Australia, those treated in public hospitals and who were older experienced the greatest delays in time to initial treatment and management [13]. Additionally, under-utilization of lung cancer treatments have been reported in various countries [4,12]

Despite the diagnostic route playing a critical role in disease progression and providing an opportunity for early intervention and curative treatments, there is limited evidence in Australia about the emergency route to a lung cancer diagnosis. Previous studies have focussed on the application and impact of treatments for NSCLC [11] and the timeliness of treatment after diagnosis in Australia [13].

This study aimed to provide greater understanding of the patterns of care for people newly diagnosed with non-small cell lung cancer (NSCLC) in New South Wales (NSW), Australia's most populous state, using a large population-based cohort with linked data from several health databases. We ascertained the proportion of NSCLC cases with an emergency presentation around the time of diagnosis, the types of initial treatment(s) received after diagnosis and patients' characteristics associated with these outcomes.

2. Materials and methods

2.1. Study sample

The Sax Institute's 45 and Up Study is a cohort of around 267, 000 people in NSW, Australia aged 45 years and older. Participants were randomly sampled from the Department of Human Services (formerly Medicare Australia) enrolment database that has almost complete coverage of the population, including all citizens and permanent residents of Australia. Overall, the 45 and Up Study sample represents approximately 11% of the NSW population aged 45 years and older. Study participants completed a baseline questionnaire between January 2006 and December 2009 and consented to linkage of their records to population-wide health databases. The baseline questionnaire included measures of health status, health related behaviours, socio-demographic information and past medical history. Details of the study cohort and methods are described elsewhere [14].

The conduct of the 45 and Up Study was approved by the University of New South Wales Human Research Ethics Committee. The NSW Population and Health Services Research Ethics Committee (approval number 2014/08/551) approved the record linkage and analysis reported here.

2.2. Data sources and probabilistic record linkage

Baseline questionnaire data from study participants were linked to a number of population-wide health databases. This included information on: (1) the use of subsidised prescription drugs in the Pharmaceutical Benefits Scheme (PBS; Jun 2004 to Dec 2014) and (2) the use of outpatient medical services and some in-hospital procedures in the Medicare Benefits Schedule (MBS; Jun 2004 to Dec 2014) which are both administered and supplied by the Department of Human Services; (3) patient care delivered in public and private hospitals in the Admitted Patient Data Collection (APDC; July 2001 to June 2014); (4) emergency presentations to public hospitals in the Emergency Department Data Collection (EDDC; Jan 2005 to Dec 2014); (5) cancer diagnoses recorded in the NSW Cancer Registry (NSWCR; Jan 1994 to Dec 2010) which contains all notifications of primary cancer diagnosed or treated in NSW; (6) vital status recorded in the Register of Births,

Deaths and Marriages (RBDM; Feb 2006 to Dec 2014) covers all deaths that occur in NSW; and (7) cause of death recorded in the Australian Coordinating Registry Cause of Death Unit Record File (COD-URF; Feb 2006 to Dec 2012). Individual records were linked to health databases (1) and (2) by the Sax Institute using a unique identifier that was provided to the Department of Human Services, while individual records in databases (3) to (7) were probabilistically linked by the Centre for Health Record Linkage [15] using a best practice approach to linkage while preserving privacy [16].

2.3. Inclusion and exclusion criteria for people with NSCLC

There were 220 participants who were excluded because they entered the study in 2005 (i.e. the pilot study) or had linkages to health databases that could not be resolved (e.g. hospital admissions occurring after the recorded date of death). Of the remaining 266,794 participants, those with an incident (i.e. newly diagnosed) lung cancer up to 31 December 2010 were identified in the NSWCR dataset. We defined incident cancers as those diagnosed from the month of cohort entry onwards as day of diagnosis was not available in the NSWCR dataset. Lung cancers were coded as C34 based on the tenth revision of the International Classification of Diseases, Australian Modification (ICD10-AM). The two broad histological types of lung cancer, non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC) were differentiated based on the morphology codes from the third edition of the International Classification of Diseases for Oncology (ICD-O-3). Patients with a diagnosis of SCLC or who were missing responses for any of the characteristics of interest were excluded from the analyses.

2.4. Characteristics of people with NSCLC

Stage of disease at diagnosis was obtained from the NSWCR summary degree of spread grouping, which classifies the extent of spread as being: (1) localised; (2) regional spread to adjacent organs and/or regional lymph nodes; (3) distant metastases; or (4) unknown.

Socio-demographic characteristics analysed were age at diagnosis, gender, place of residence, education, country of birth, private health insurance and married or de-facto status (Table 1). Health characteristics that were self-reported at the time of completing the baseline questionnaire included smoking status, body mass index (BMI (kg/m^2)), the degree of physical function using the physical functioning component of the medical outcomes scale (MOSPF-10) [17,18] or a medical history of heart disease and diabetes. The presence of non-cancer comorbidities was measured using the Charlson Comorbidity Index (CCI) score derived from diagnosis codes in hospital admissions records [19]. Comorbidities that were recorded up to 5 years prior to diagnosis and up to 6 months after diagnosis were included.

2.5. Health services use

The number of General Practitioner (GP) consultations recorded in the MBS [20] was measured for two time intervals: (1) in the month of or the month prior to diagnosis and (2) up to 6 months prior to diagnosis.

Patients who were potentially diagnosed through an emergency route were identified as those who had presented to an emergency department in the month of or the month prior to diagnosis (i.e. 'emergency presenters').

The receipt of anti-cancer treatment was defined as lung cancer-specific treatment received in the first 12 months after diagnosis, including surgery, radiotherapy and systemic therapy (Table 2). Treatment combinations by stage of disease were based on the Australian Clinical Practice Guidelines for the Treatment of NSCLC [21].