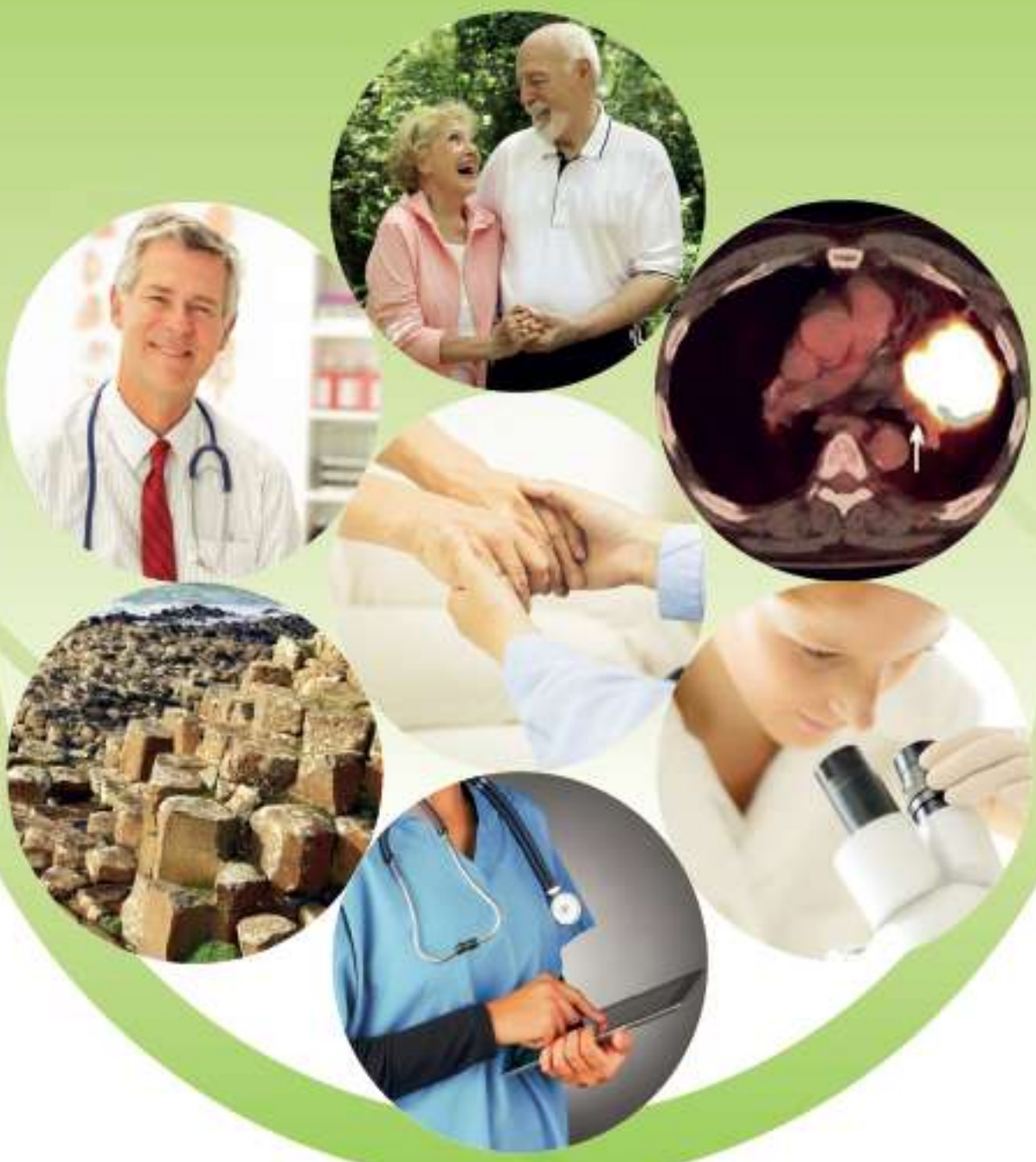
N. Ireland Cancer Registry

Care of lung cancer patients in Northern Ireland diagnosed 2014 (with comparisons to findings reported 1996, 2001 and 2006 and in the National Lung Cancer Audit for patients diagnosed 2014)



Queen's University Belfast

GAIN

The Regulation and Quality Improvement Authority

HSC Public Health Agency

Care of lung cancer patients in Northern Ireland diagnosed 2014

(with comparisons to findings reported 1996, 2001 and 2006 and in the National Lung Cancer Audit for patients diagnosed 2014).

Analysis by Christine McKee, Gerard Savage, editing by Christine McKee and Anna Gavin

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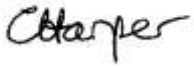
Contents

Foreword

Improving outcomes for cancer patients is a goal for all who work in the service. Improving outcomes can be facilitated by comparing our services through audit with other centres and over time. The information presented in this report allows us to compare outcomes for N. Ireland patients who were diagnosed in 2014 with those included in the National Audit of Lung Cancer in England, Scotland and Wales. It also allows us to see how services have improved over time, with reference back to 1996 when changes to the organisation of cancer services were made by the then Chief Medical Officer, Dr Henrietta Campbell. This work is possible only because of the high quality data collected by the N. Ireland Cancer Registry.



Dr Carolyn Harper

Executive Medical Director/

Director of Public Health

March 2017

Acknowledgements

This report has been compiled in collaboration with the NI Cancer Network (NICaN) Lung Cancer Group. I am grateful to the clinicians who helped with determining the data items to collect, their interpretation and final presentation.

The N. Ireland Cancer Registry is funded by the Public Health Agency and this audit work was facilitated by a grant from the Guideline and Audit Implementation Network (GAIN).

The quality of data in this project is a result of the work of the Registry Tumour Verification Officers, Brid Morris, Jackie Kelly, Jacqui Napier and Marsha Magee who meticulously extracted detailed information from the clinical records for analysis and presentation in this report. Data abstraction was facilitated by Colin Fox of the Registry's IT group. The analysis of data was undertaken initially by Dr Christine McKee as part of her Masters in Public Health QUB dissertation with further analysis by Gerard Savage, Eileen Morgan and Victoria Cairnduff.

The work of the N. Ireland Cancer Registry including the production of this report is the result of the work of the Registry team. I wish also to record my thanks to the Steering Group and the Council of the Registry who guide that work. This work used data provided by patients and collected by the NHS as part of their care and support.

Anna Gavin

Director, NICR

March 2017

Introduction

Background

Lung cancer is the most common cancer in the developed world and also the most frequent cause of cancer mortality worldwide.[1] Within the UK and N.Ireland (NI), excluding the common non melanoma skin cancer, lung cancer is the second most common cancer in both males after prostate cancer, and females after breast cancer, and is the highest cause of cancer mortality in both males and females[2,3]. In NI from 2010-2014, every year on average 656 men and 509 women were diagnosed with cancer of the lung and on average 544 men and 397 women died annually from this cancer (*Figure 1*). In the period 2006-2010 on average in NI there were three males diagnosed with lung cancer for every two females however in the period 2010-2014 this ratio had narrowed to five males for every four females[4], largely due to increased numbers of females diagnosed with lung cancer. Cancer of the lung annually accounts for 10.3% of cancer cases and 23.7% of cancer deaths in males, and 8.6% of cancer cases and 21.1% of cancer deaths in females in NI. Lung cancer in NI is by far the most common cause of cancer death in males and since the late 1990s has become the most common cause of cancer death in females, ahead of breast cancer.

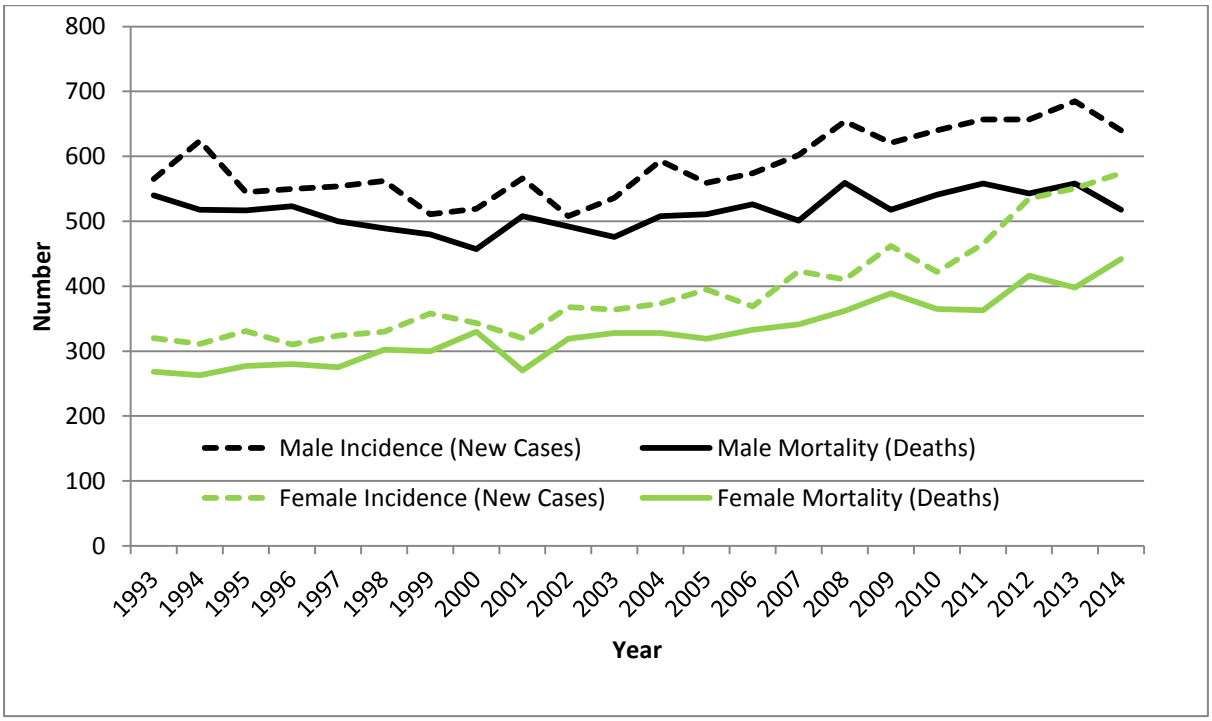


Figure 1: N. Ireland: Lung Cancer Incidence and Mortality cases by sex 1993 – 2014[4]

Over time lung cancer incidence rates in the UK have slowly declined (*Figure 2*). This highlights a concerning gender disparity. Incidence in men has decreased over the last 40 years related to smoking cessation[2]. Unfortunately, this is accompanied by an increase in incidence in women reflecting the later social trend of smoking observed in women historically. *Figure 3* displays the same trend for NI data since 1993[5].

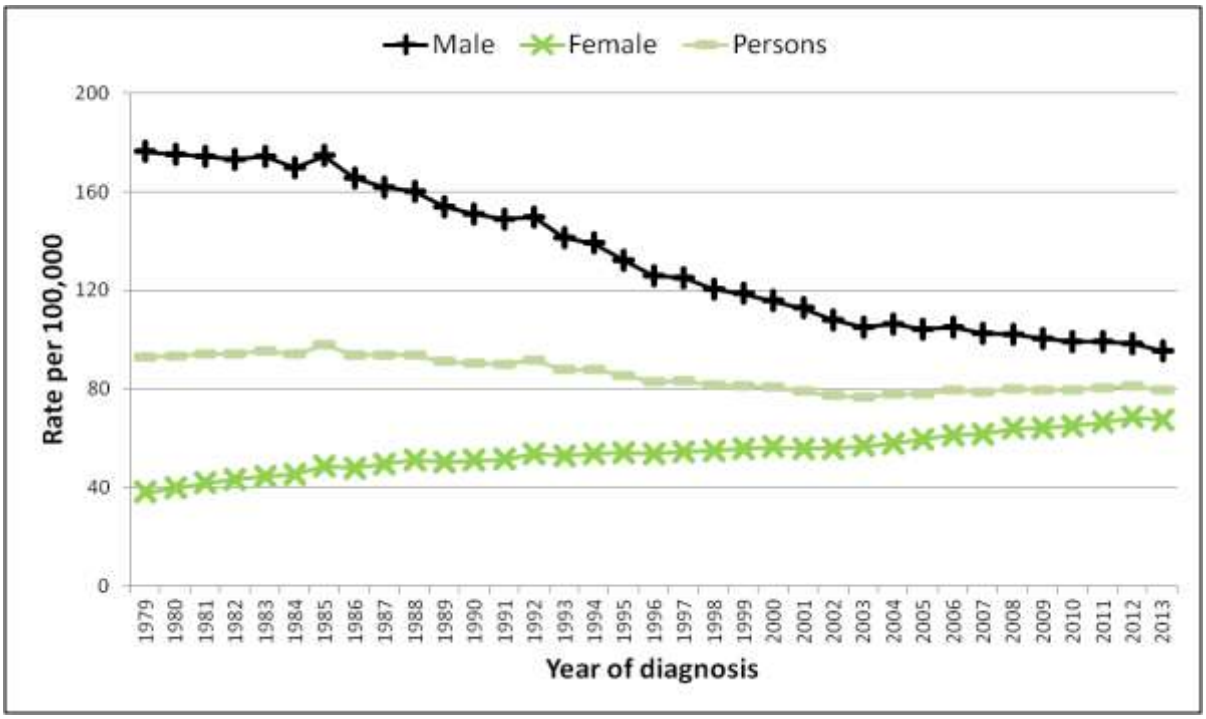


Figure 2: Lung Cancer European Age-Standardised Incidence Rates, Great Britain, 1979-2013[2]

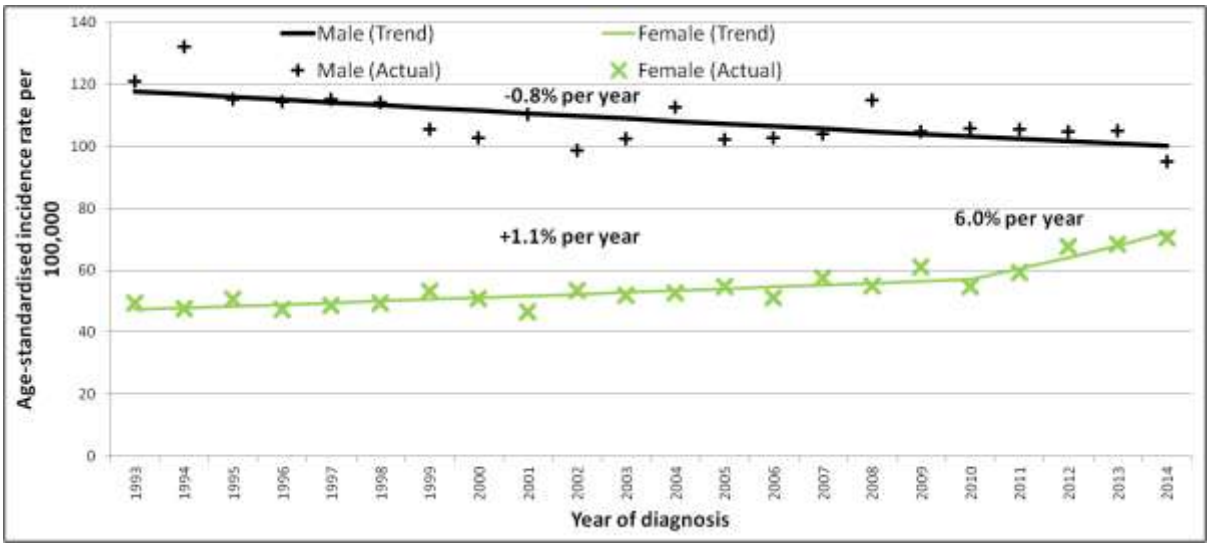


Figure 3: N. Ireland trends in lung cancer incidence rates by sex: 1993-2014[5]

Lung Cancer Risk Factors

There are several risk factors associated with the development of lung cancer. Smoking is the main causal factor and at least 85% lung cancers are attributable to cigarette smoking.[6,7,8] Age is also a significant risk factor, with incidence rates increasing significantly with age.[2] Within NI on average 73% of patients are diagnosed over the age of 65 years.

Age	Male	Female	Total
0 to 49	19 ***(2.9%)***	15 ***(2.9%)***	35 ***(3%)***
50 to 64	147 ***(22.4%)***	125 ***(24.6%)***	272 ***(23.3%)***
65 to 74	238 ***(36.3%)***	165 ***(32.4%)***	403 ***(34.6%)***
75 and over	251 ***(38.3%)***	201 ***(39.5%)***	452 ***(38.8%)***
All ages*	656 ***(100%)***	509 ***(100%)***	1,165 **(100%)**

* Due to rounding of yearly averages, 'All ages' may not equal the sum of age categories in table.

Table 1: N. Ireland average number of lung cancers diagnosed per year by sex and age: 2010-2014

The highest age-specific incidence rates occur in male patients aged 85-89 and in female patients aged 75-79 years (*Figure 4*)[5]. Several occupational risk factors are known with up to 13% of lung cancer cases in the UK felt to be secondary to occupational exposures.[9] Occupational and environmental risk factors include asbestos, silica, exhaust exposures, organic dust exposure (related to work involving animals or plants), air pollution and radon gas.[9,10] Radon, a naturally occurring form of ionising radiation, is the underlying cause of an estimated 0.5% UK cases of lung cancer however an interactive effect with smoking results in significantly higher risk.[9]

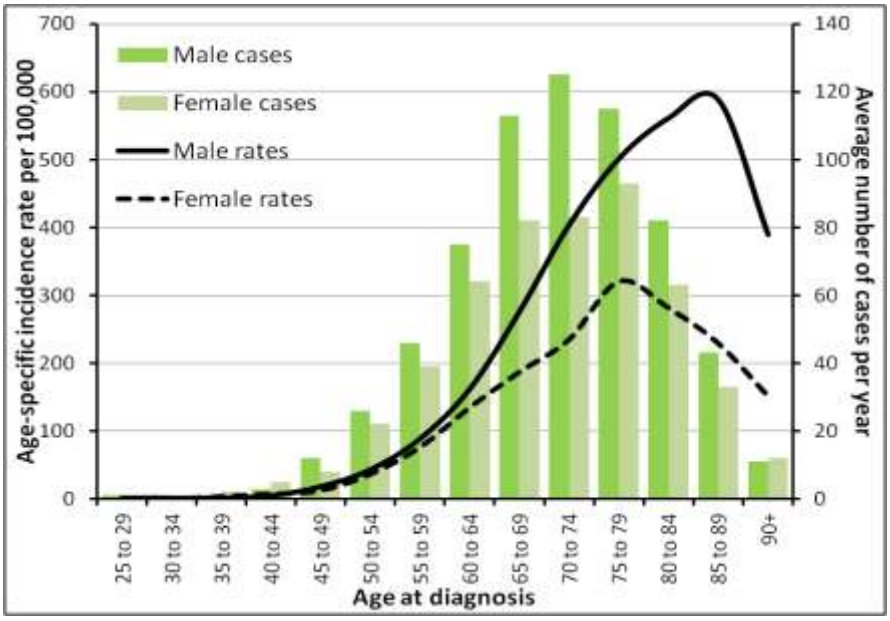


Figure 4: N. Ireland incidence of lung cancer by age and sex: 2010-2014[5]

Lung cancer is associated with deprivation (see *Figure 5*). In NI the standardised incidence ratio for men living in the most deprived areas is 69% higher than the NI average.[4] Tobacco use is the main cause of this difference. Smoking and health inequalities differ from many other factors such as genetics as they are potentially preventable by behaviour or societal change. It is estimated that 230 fewer men and 190 fewer women would be diagnosed each year in NI if the lung cancer incidence rates (in years 2010-2014) in the least deprived regions applied to all NI. Whilst health inequalities are known to be potentially preventable this is an extremely challenging task as evidenced by several landmark reviews in the UK including the Acheson and the Marmot Reviews.[11,12] Subsequent evaluations have noted worsening of inequalities.[13] This is especially important as NI has higher levels of deprivation compared with the UK overall.[14]

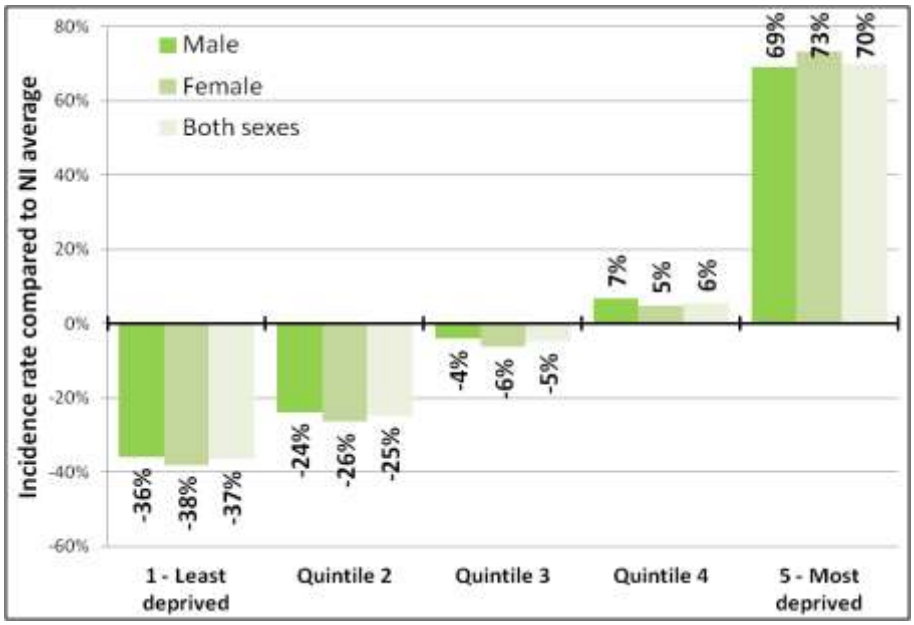


Figure 5: N. Ireland lung cancer incidence rates compared to the NI average by sex and deprivation quintile: 2010-2014(Deprivation based on area of residence)[5]

The genetic basis of lung cancer is complex and multifactorial including gene-to-gene interactions, gene-environment interactions and epigenetics.[15] Up to 15% of smokers develop lung cancer implying a genetic susceptibility exists. Research notes an adjusted 1.5-fold increased risk for first-degree relatives of those diagnosed with lung cancer.[16] This is an important area for both epidemiological and clinical medicine with NICE (National Institute of Health and Care Excellence) guidelines incorporating the use of some therapies based on genetic testing results (Gefitinib and Erlotinib).[17,18]

Individuals with a history of lung disease have an increased risk of lung cancer. This extends beyond Chronic Obstructive Pulmonary Disease (COPD) to other infective conditions such as pneumonia and tuberculosis.[19] Associations with inflammation are described with an increased risk in men with elevated serum C-Reactive Protein (CRP) levels.[20] Immunosuppression is also associated with an increased risk of lung cancer.[9]

Trends in Lung Cancer Cell Type

The main histological classifications of lung cancer are: NSCLC (non-small-cell lung cancer), SCLC (small-cell lung cancer) and carcinoid tumours. NSCLC represent the majority of cases (over 80%) and can occur in several cell types, eg. squamous cell or adenocarcinoma.[21] SCLC represent less than 20% of lung cancer cases and are typically more aggressive tumours with poorer survival. Carcinoid tumours are a type of neuroendocrine tumour, a quarter of which originate in the lung.[22] They represent less than one in a hundred (1%) of lung cancers. They have different characteristics, generally developing at a younger age and are typically slow-growing with improved prognosis and better survival. Over a third of carcinoids occur under age 50 compared with 3% of other types of lung cancer.

Cell Type

	NSCLC		Non Microscopically Verified / NSCLC NOS	SCLC	Carcinoid	Total
	Adeno-carcinoma	Squamous				
All ages	297 **(25.5%)**	252 **(21.6%)**	457 ***(39.2%)***	145 ***(12.5%)***	14 ***(1.2%)***	1,165

Table 2: N. Ireland average number of lung cancers diagnosed by histology classification: 2010-2014

The Northern Ireland Cancer Registry (NICR) has monitored trends in adenocarcinoma, squamous cell and other types of lung cancer by morphology group and sex from 1993 until 2014. Sex specific age-standardised rates are shown due to different lung cancer trends in males and females, largely due to differences in historical trends in smoking between the two sexes.

Small-cell and non-small cell lung cancers all showed a gradual increase in incidence rates each year. This increase was non-significant for males (except for squamous 2002-2014) but significant for females with an annual percentage increase of 1.9% (small cell), 2.7% (non small cell) and 1.5% (squamous) (*Figures 6, 7 and 8*).

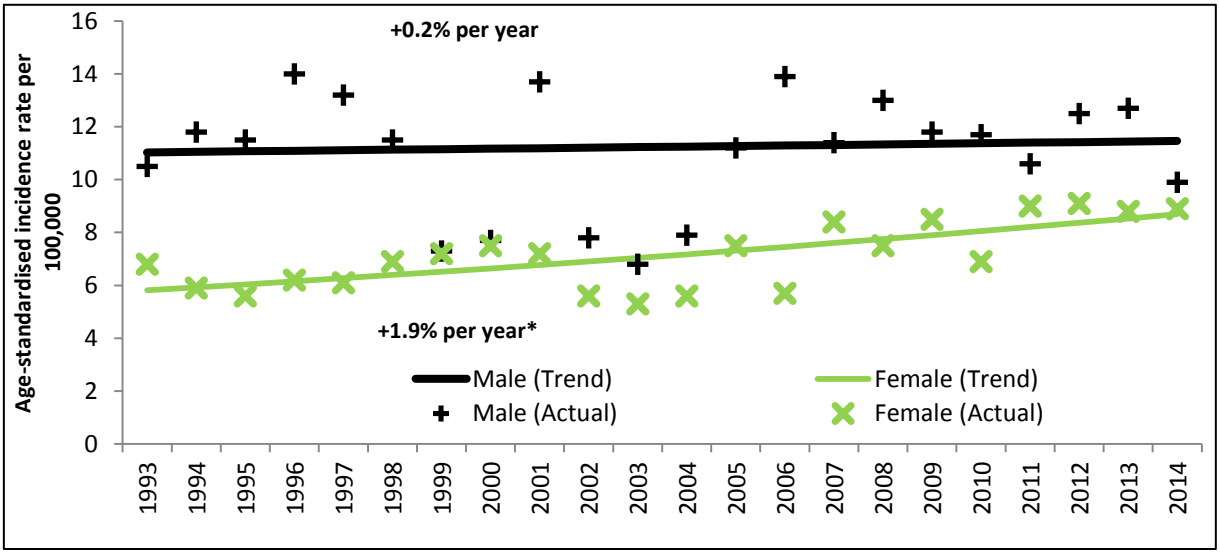


Figure 6: N. Ireland trends in ***Small Cell carcinoma*** *incidence rates by sex: 1993-2014*

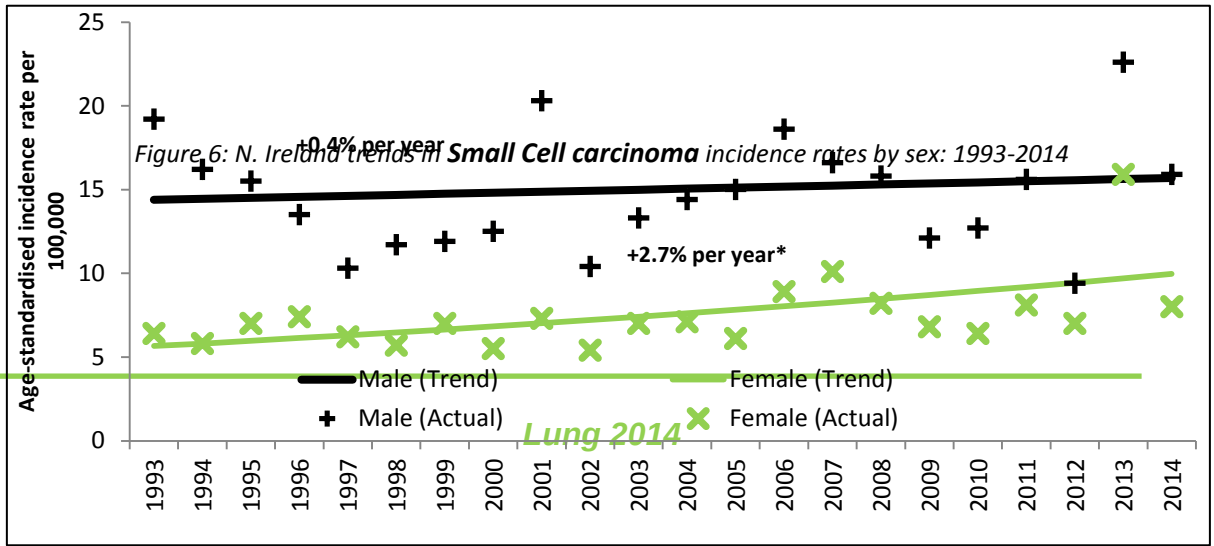


*Figure 7: N. Ireland trends in **Non Small Cell carcinoma** incidence rates by sex: 1993-2014*

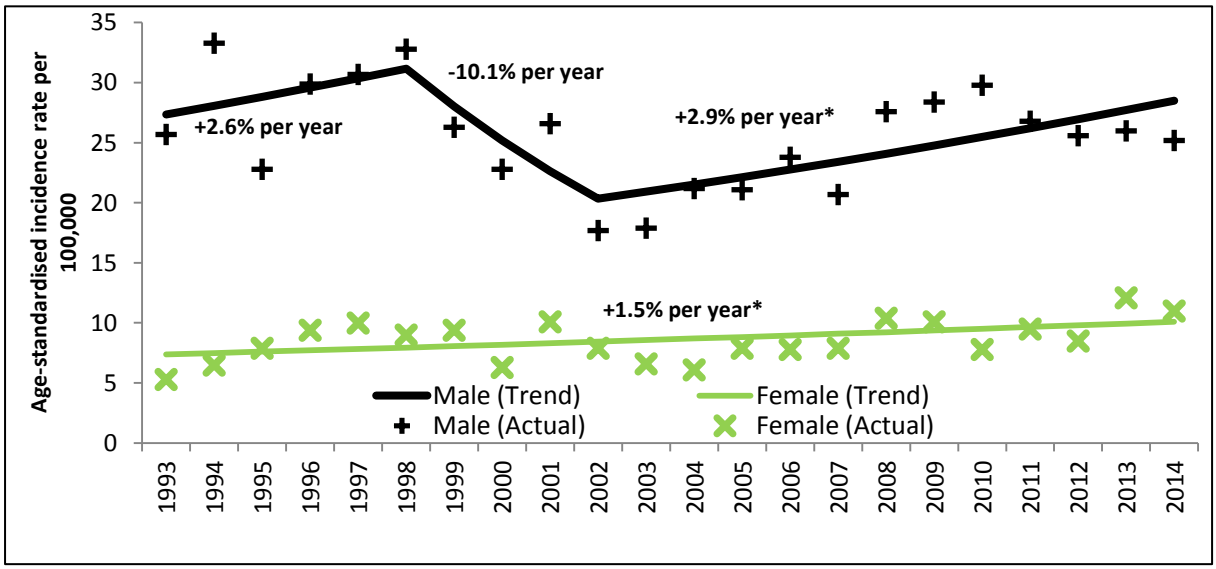


*Figure 8: N. Ireland trends in **Squamous carcinoma** incidence rates by sex: 1993-2014*

Trends in the incidence of adenocarcinomas remained relatively stable until 2002 when there was a significant increase in incidence rates in both males and females of 9.6% and 12.8% per year, respectively (*Figure 9*). It is likely that this significant increase in adenocarcinomas is due to more cases having a histological classification resulting in a decrease in unspecified cases and an increase in documented adenocarcinomas. This is indicated through the observed decrease in incidence rates of unspecified cancers occurring around the same time as the increase in adenocarcinomas (*Figure 10*). When adenocarcinomas and unspecified are combined there is a more stable pattern in the incidence trends of lung cancer, with a significant decrease of 1.5% each year in males and a 1.6% increase each year in females, as expected (*Figure 11*).

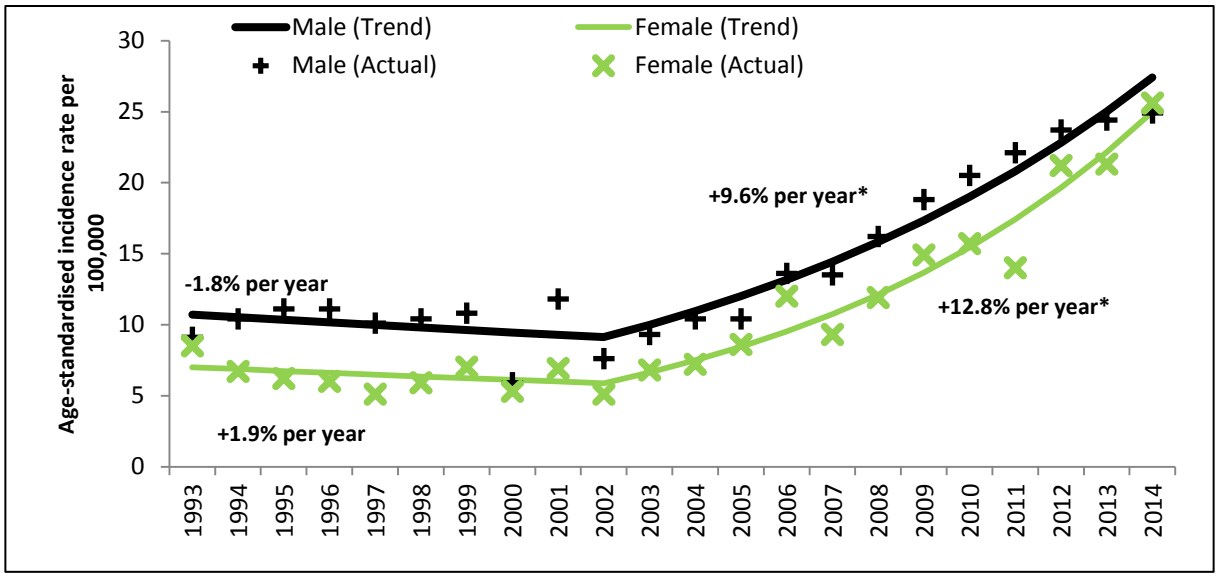
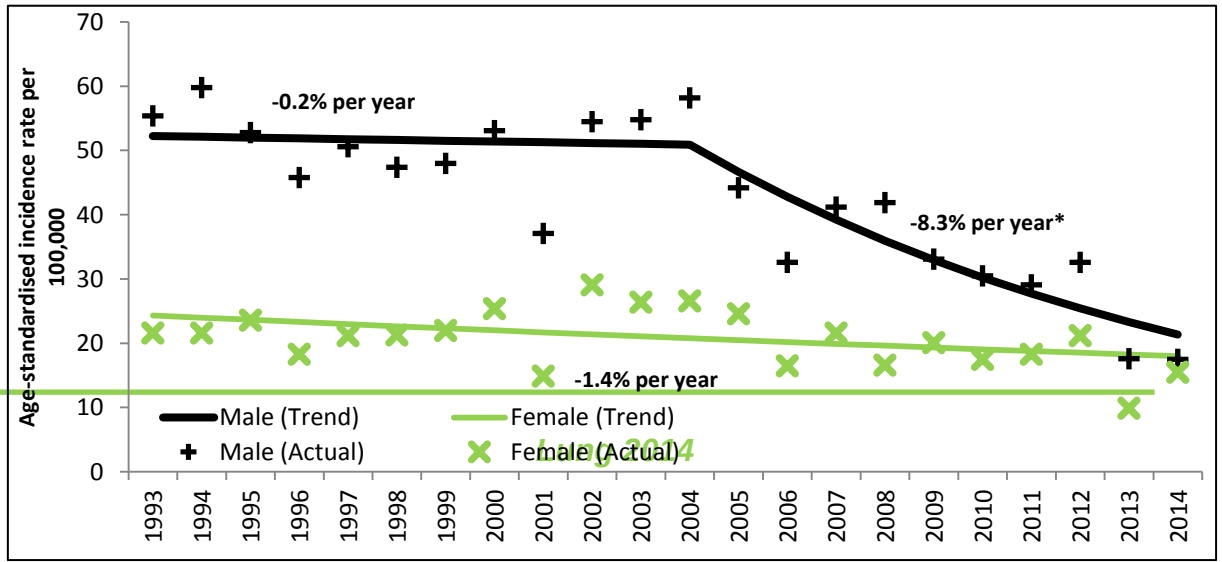


*Figure 9: N. Ireland trends in **Adenocarcinoma** incidence rates by sex: 1993-2014*

*Figure 10: N. Ireland trends in incidence rates for cancers of the lung with **No Histological Verification** by sex: 1993-2014*



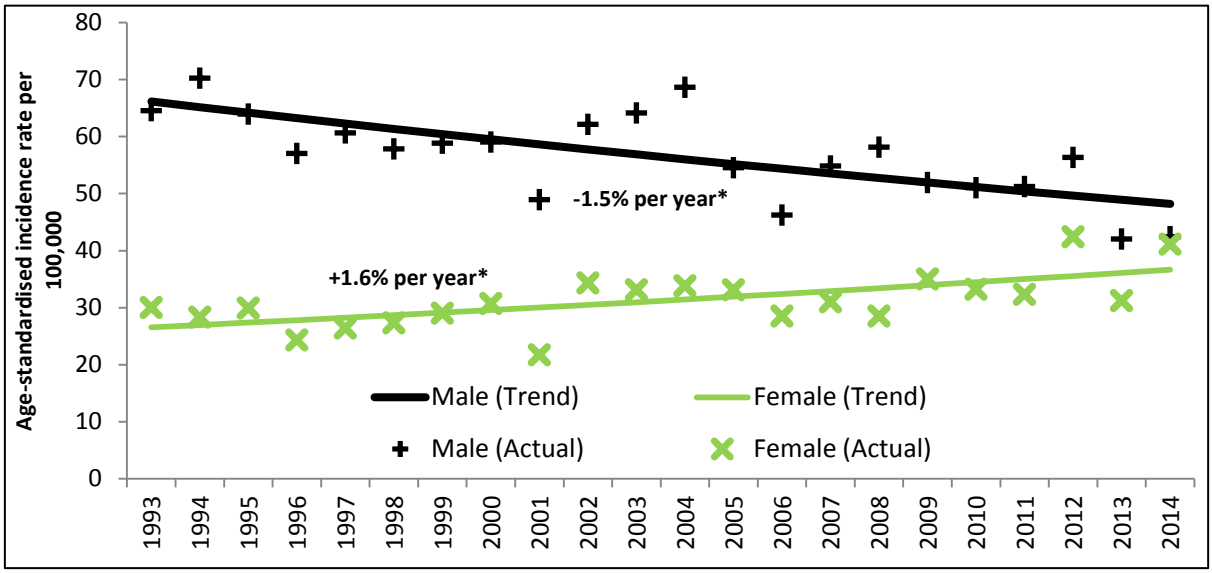


Figure 11: N. Ireland trends in incidence rates for ***Adenocarcinoma and Non Histologically Verified / Unspecified combined*** *by sex: 1993-2014*

Guidelines for Lung Cancer Diagnosis

NICE (National Institute of Health and Care Excellence) have published guidelines on the diagnosis and management of lung cancer.[23,24] Lung cancer symptoms can range from a persistent cough, shortness of breath and/or haemoptysis to symptoms of advanced disease including weight loss and neurological symptoms. However most cases occur in smokers who often have symptoms of chronic chest disease and who may not recognise a worsening or new symptom as being related to a possible lung cancer. In a previous 2006 NICR lung cancer audit report almost one-quarter of NI patients reported a symptom lasting at least six months and 15% reported a symptom lasting at least one year[25] indicating poor recognition of symptoms among the public. The Public Health Agency for NI recently acknowledged the need for further intervention in highlighting awareness of lung cancer symptoms as part of their 'Be Cancer Aware' 2015 campaign.[26]

NICE guidelines also recommend that all patients with a likely diagnosis of lung cancer should be referred to a member of a lung cancer MDT (Multi Disciplinary Team - usually a chest physician) and that the care of all patients with a working diagnosis of lung cancer should be discussed at a lung

cancer MDT meeting where all appropriate diagnostic and management options can be discussed and appraised.

NICE and SIGN (Scottish Intercollegiate Guidelines Network) guidelines include investigation recommendations for suspected lung cancer cases, such as all patients should undergo a contrast-enhanced CT (computerised tomography) scan and patients who are for planned curative treatment should undergo PET-CT (Positron emission tomography combined with computerised tomography) scanning.[24,27] Histological confirmation is recommended, with options of bronchoscopy (for centrally located tumours) or radiologically-assisted biopsies (for peripherally located tumours). CT scanning should precede bronchoscopy or any other biopsy-related procedure. Genetic testing should be considered in appropriate cases. All patients should have their disease staged according to the TNM classification system (see *Appendix i*).[28] SCLC is typically classified differently, into either limited or extensive disease, with extensive disease representing the late Stage IV disease and all other stages grouped as limited disease.[29] Patient support is valued with recommendations that lung cancer nurse specialists (LCNS) should be available to all patients at the time of diagnosis and throughout their treatment journey.[24]

Guidelines for Lung Cancer Management

Management decisions should be an interactive process between the patient and clinicians. Considerations include tumour characteristics and disease stage along with overall physical condition, which is reported as PS (performance status, see *Appendix ii*).[30] Active anticancer treatment is any treatment that has an effect on the tumour, generally grouped into surgery, chemotherapy and radiotherapy (curative or palliative).[31]

Curative first-line NSCLC treatment options include surgical resection or radical radiotherapy. Chemotherapy can have an important role as either neoadjuvant (before other treatments), adjuvant treatment (after treatment) or for advanced disease. Guidelines recommend all NSCLC patients with an advanced stage and good PS (PS 0-1) should be offered chemotherapy.[24] Gefitinib, a selective inhibitor of EGFR-TK (epidermal growth factor receptor tyrosine kinase), is licensed for the first line treatment of NSCLC lung cancer with locally advanced or metastatic disease in patients with activating mutations of EGFR-TK.[17] The most common first-line treatment for SCLC is chemotherapy.[24] Surgical resection is recommended in early stage disease.

The National Lung Cancer Audit (NLCA) 2015 recommended that the following standards in lung cancer care be achieved.

a) All Hospitals/Trusts/Health Boards should **participate**
b) All Hospitals/Trusts/Health Boards should submit data for organisational audit
c) Data completeness for key fields should exceed 85% and for MDT completeness should exceed 95%
d) Data completeness for the comorbidity field should exceed 85%, and for patients with Stage I-II and PS 0-1, completeness for FEV1 and FEV1% should exceed 75%
e) Maintain the level of **95%** patients submitted to the audit being **discussed at MDT**
f) **Pathological confirmation rates** below **75%** should be reviewed to determine whether best practice is being followed and whether patients have access to the whole range of biopsy techniques
g) **NSCLC not-otherwise-specified (NOS) rates** of more than **20%** should be reviewed to ensure that best practice pathological diagnostic techniques including immunohistochemistry are being followed, in order that patients receive appropriate chemotherapy regimens
h) At least **80%** patients are seen by a **Lung Cancer Nurse Specialist (LCNS)**; at least 80% should have a LCNS present at the time of diagnosis
i) For patients undergoing **bronchoscopy**, at least **95%** should have a **CT scan prior** to procedure
j) **Surgical resection rates for NSCLC** below **16%** should be reviewed. Furthermore, for **early-stage disease**, rates below **52%** should be reviewed to ensure that patients on the margins of operability/resectability are being offered access to specialist thoracic surgical expertise (including second opinions)
k) **Active anticancer treatment rates** below **60%** should be reviewed
l) **Chemotherapy rates for SCLC** below **70%** should be reviewed
m) **Chemotherapy rates for good PS (0-1) Stage IIIB/IV NSCLC** below **60%** should be reviewed

Study Aim

To collect and analyse data on lung cancer cases diagnosed in 2014 for comparison with the UK National Lung Cancer Audit (NLCA), (2014 diagnosed cases) and with data collected on N.Ireland patients diagnosed 1996, 2001 and 2006.

Methods

All 2014 Diagnosed Lung Cancer Patients

Routinely available information from the NI Cancer Registry (NICR) database was collated on all 1,226 cases of lung cancer diagnosed in 2014. These were linked with the hospital MDT administration system - Cancer Patient Pathway System (CaPPS), the Clinical Oncology Information System (COIS) and additional sources using the unique patient Health and Care Number. Additional data sources included laboratory histology reports, Operation Procedure Code Supplement (OPCS) codes on the hospital Patient Administration System (PAS) - for surgical procedure codes, chemotherapy and radiotherapy treatment codes, and radiotherapy service database (ARIA). These systems are felt to represent complete service performance data. Cases excluded were patients where the only source of diagnosis was from a death certificate (DCO cases, n=12) or PAS. This resulted in 1,214 cases included in the analysis.

Enhanced Study Patients

Detailed information was extracted from CaPPS and COIS on the first 382 cases of lung cancer diagnosed in 2014 by Tumour Verification Officers (TVOs) in NICR. After exclusions, 376 patients had sufficient data to be included. Fields significantly enhanced by this process included referral source and date, diagnosis date, stage, discussion at MDT meeting, Performance Status (PS) and CT scan details regarding whether patients had undergone a CT scan prior to bronchoscopy. They also established treatment details in patients where a planned treatment was indicated and no further details were recorded within the data. Where patients underwent bronchoscopy but no documented CT scan was noted on the original dataset, these cases were TVO-reviewed and if there

was evidence of the case having a CT scan prior to bronchoscopy where a lung cancer was suspected, this was classified as yes. For patients with incomplete treatment details, if the case had a documented treatment plan e.g. surgery and there were no details of a procedure but there were subsequent details of another form of active treatment (eg. chemotherapy or radiotherapy), this treatment was noted and no further review was completed. In cases where there was a planned active treatment e.g. surgery but no details of a procedure or other form of active treatment, only cases where patients did not die within three months of their diagnosis of lung cancer were then further reviewed by the TVOs on the CaPPS and COIS systems to identify any forms of active treatment received.

These datasets were analysed and compared with findings of the National Lung Cancer Audit (NLCA) which investigates UK variation in lung cancer services. Here lung cancer services in NI were reviewed with reference to the NLCA.

In this audit we were able to assess the recommendations of the NLCA except in relation to comorbidity, which was also not recorded in England, or completeness of the lung function test FEV1.

Data definitions

Cancer type was defined as Non Small Cell Lung Cancer (NSCLC), Small Cell Lung Cancer (SCLC) or carcinoid. Any cases which were not histologically confirmed (n = 38) were assigned a diagnosis of NSCLC NOS. The exception to this were a small number of SCLC cases (n<5) which were diagnosed on the basis of characteristic appearance on imaging. Histological confirmation relates to a case where the basis of diagnosis was either histology or cytology. The basis of diagnosis was determined using a registry-derived classification system as to whether the diagnosis was based on histology, imaging, clinical opinion or another basis.

Cancer stage was classified using UICC (Union for International Cancer Control) 7th edition TNM Classification of Malignant Tumours (see *Appendix i*).[28] Within this audit stage refers to pre-treatment stage. PS was determined using the ECOG (Eastern Cooperative Oncology Group) classification (see *Appendix ii*).[30]

Active anticancer treatment relates to any treatments for lung cancer that have an effect on the tumour itself, not just on symptoms and therefore included palliative chemotherapy and radiotherapy. Chemotherapy treatment was defined as evidence of any anti-cancer drug regime.

Surgical procedures included the most current OPCS surgical procedure codes (i.e. used in NLCA 2016 report)[32] that represent curative procedures only (see *Appendix iii*). Therefore, in this audit non-curative procedures (as indicated by the procedure name only, eg. pleurodesis, open and close procedures) were excluded. All active treatments were included after the date of diagnosis of lung cancer. Extrapulmonary treatments (eg. brain radiotherapy) were included in order to keep the data as complete as possible, as the site of radiotherapy for the majority of patients was not noted, and in keeping with the definition of active anticancer treatment including palliative treatments.

To enable Trust-specific analysis, patients were assigned to the Trust where the patient was first seen. This was chosen because it was completed for the majority of cases and this should enable analysis of variation in access to treatments across NI as some treatments, such as radiotherapy and surgery are only available in specialised centres.

When reviewing data for the timing of CT scan in relation to bronchoscopy, patients with a CT and bronchoscopy performed on the same day were assigned as having a CT before bronchoscopy.

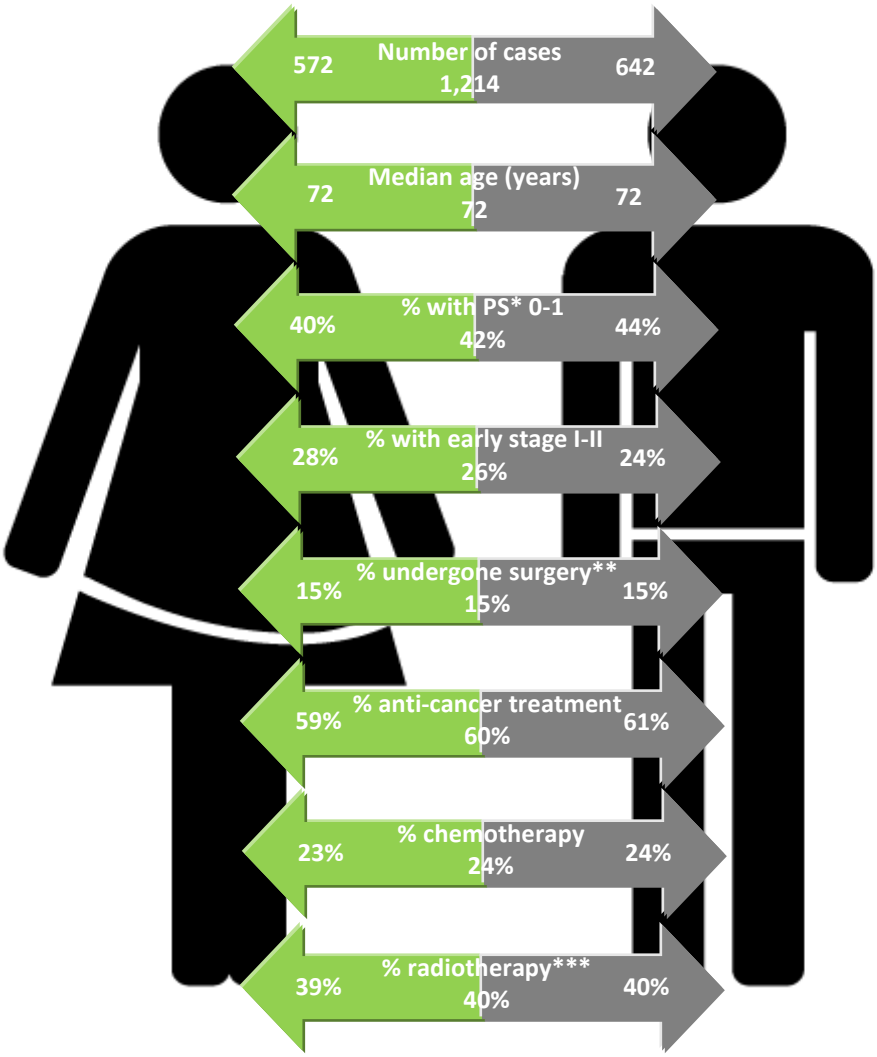
Analysis

The Joinpoint regression program[33], specifically designed for surveillance of trends in cancer incidence to identify the points where linear trends change significantly in direction or magnitude was used to assess trends over time.

Survival analysis was performed using the Kaplan-Meier method on 1,194 patients and excluded carcinoid cases. The Mantel-Cox log-rank test was used to test differences in survival between groups. An 'end of follow-up' date was created for each case using either the date of death, which was available from NICR and GRO (General Register Office), or the end of the follow-up period (assigned as 31st December 2015). This date was selected as comprehensive mortality information was available for this time period and this ensured that all cases had a minimum of 12 months' follow-up for the survival analysis. The data were compared with the GRO system on 28/07/16 to update the mortality data. The Cancer Registry had received automatic updates for death data up to the end of October 2015, and the remaining cases were individually searched for in the GRO records to ascertain any further dates of death in November and December 2015. These checks highlighted several cases where the date of death in the original dataset did not match the GRO records. In these cases, the GRO date of death was taken preferentially.

Observed survival estimates were noted on all audit years for one-month (equivalent to 30 days), two-month (60 days), six-month, and twelve-month periods for subgroups, which included cancer cell type, surgery patients and stage of disease. Further analysis by method of presentation (emergency/other) was also carried out for the 2014 patients.

Results of Lung Cancer Audit (2014 Diagnosed Patients)



* Performance status (PS) was determined using the ECOG (Eastern Cooperative Oncology Group) classification (Appendix ii).[30] ** Surgery includes only curative procedures (as indicated by the procedure name (*Appendix iii*)). *** Radiotherapy treatment reports both curative and palliative care.

Figure 12: Summary Infographic of Lung Cancer in NI in 2014

Study Patients

Table 3: Description of lung cancer patients included in audits by time.

Study Patients	Number of patients				
	1996	2001	2006	2014 All patients	2014 Study Patients*
Total number of patients	860	888	895	1,226	382
Carcinoids (excluded 1996/2001/2006)	3	4	5	20**	10**
Exclusions – Death Certificate Only	13	7	10	-	-
Exclusion – Lack of information	139	161	46	-	-
Total exclusions	155	172	61	12^	6^
Total reported on (% of all patients)	705 **(82%)**	716 **(81%)**	834 **(93%)**	1,214 **(99%)**	376 **(98%)**
Total reported on – Male (%)	462 **(65.5%**)	463 **(64.7%)**	513 **(61.5%)**	642 **(53 %)**	200 **(53%)**
Total reported on – Female (%)	243 **(34.5%)**	253 **(35.3%)**	321 **(38.5%)**	572 **(47%)**	176 **(47%)**
Average age at diagnosis – Male	70.0	69.6	70.2	70.7	69.7
Average age at diagnosis – Female	68.2	69.2	69.7	71.1	71.0

* Additional data items were collected from examination of clinical records by Registry Tumour Verification Officers (TVOs). These patients represented all patients with a confirmed diagnosis from 01/01/2014 to 30/04/2014 and were not randomly sampled.** For the purposes of this 2014 audit carcinoid tumours were included in analysis unless indicated otherwise. ^ Due to small numbers 2014 exclusions are combined.

- In 2014 the registry identified 1,226 patients with a lung cancer diagnosis, a 37% increase from 2006 lung cancer registrations. The increase was three times greater for women (78%) than men (25%). Some of this increase is accounted for by the ageing population see *Figure 3* page 6.
- The majority of cases were aged 65 - 80 years old (58%, n=700), with no difference between the age of diagnosis for men and women (χ^2= 2.02, p-value 0.365).
- The proportion of lung cancer patients who were over 80 years of age increased from 12% in 1996 to 16% in 2006 and further to 17% in 2014.
- The ratio of women to men with lung cancer has narrowed from almost 1:2 in 1996 to an almost even 1:1 split in 2014.

Referral sources

Table 4: Source of referral 2014 diagnosed lung cancers NI.

2014 All patients source of referral	Number of Patients	(%)	Referral Type	(%)
GP referral	388	31.8%	**Elective**	52.6%
Consultant referral	251	20.7%		
Following emergency admission	203	16.7%	**Emergency**	19.3%
Following A + E attendance	31	2.6%		
Other source of referral	226	18.6%	**Other/Unknown**	28.1%
Unknown source	115	9.5%		
Total	1,214	100%		

- The most common source of referral in 2014 was via a GP (32%).
- In 2014 over half of lung cancer patients had an elective referral.
- Almost one in 5 patients presented as an emergency admission (19.3%).

Table 5: Source of referral 2014 diagnosed lung cancer NI – by cell type.

2014 All patients source of referral by cancer type n (% of cancer type)				Total
Cancer Type	Elective	Emergency	Other/Unknown	
NSCLC Microscopically Verified	420 **(59%)**	129 **(18%)**	162 **(23%)**	711
NSCLC Non MV*	132 **(39%)**	69 **(20%)**	141 **(41%)**	342
SCLC**	74 **(52.5%)**	36 **(25.5%)**	31 **(22%)**	141
Carcinoid	13 **(65%)**	-	7 **(35%)**	20
Total	*639* ***(52.6%)***	*234* ***(19.3%)***	*341* ***(28.1%)***	*1,214*

** Non MV' = 'non-microscopically verified; these tumours have the same morphology codes as 'unspecified', but their basis of diagnosis was not histology or cytology.** 2014 SCLC includes (n < 5) non-microscopically verified tumours.*

- Just over half of NSCLC and SCLC cases were referred electively.
- Although a higher proportion of SCLC than NSCLC were referred as an emergency (26% compared with 19%) this was not significant ($\chi^2 = 4.92$, p-value 0.085).
- Carcinoids were more likely to be referred electively (65%) than other cell types.

Smoking Status

Table 6: Smoking status 2014 diagnosed lung cancer patients N.Ireland.

2014 All patients smoking status n (% of cancer type by smoking status recorded)				
Cancer Type	**Smoker**	**Ex-Smoker**	**Non/Never Smoked**	**Total status recorded**
NSCLC*	396 **(47.8%)**	386 **(46.7%)**	46 **(5.5%)**	828
SCLC**	65 **(55.6%)**	50 **(42.7%)**	< 5 **(<2%)**	117
Carcinoid	5 **(31.3%)**	6 **(37.5%)**	5 **(31.3%)**	16
Total	*466* ***(48.5%)***	*442* ***(46.0%)***	*53* ***(5.5%)***	*961*

** 2014 NSCLC includes 342 non-microscopically verified tumours.** 2014 SCLC includes (n < 5) non-microscopically verified tumours.*

- Smoking history was recorded for 79% of patients. In the 376 study patients a record of smoking status was found for 89%.
- 95% of lung cancer patients with a recorded smoking status were noted to be a current or ex-smokers, with almost half (49%) as a current smoker. This same proportion was observed within the 376 patients with enhanced clinical data.
- Patients with carcinoid tumours were less likely to have smoked (31%).

Table 7: Hospital of presentation 2014 diagnosed lung cancer patients N.Ireland.

Hospital of presentation	Number of patients (% of total)			
	1996 (n = 705)	2001 (n = 715)	2006 (n = 834)	2014 (n= 1,214)
Belfast City Hospital (BCH)*	157 **(22%)**	127 **(18%)**	119 **(14%)**	179 **(15%)**
Royal Victoria Hospital (RVH)*	82 **(12%)**	54 **(8%)**	80 **(10%)**	55 **(5%)**
Mater Infirmorum Hospital (MIH)	46 **(7%)**	49 **(7%)**	63 **(8%)**	52 **(4%)**
Other/ unknown	5 **(<1%)**	5 **(<1%)**	1 **(<1%)**	1 **(<1%)**
	- **(-)**	- **(-)**	- **(-)**	33 **(3%)**
TOTAL BELFAST TRUST	***290 (41%)***	***235 (33%)***	***263 (32%)***	***320 (26%)***
The Ulster Hospital (UH)**	61 **(9%)**	77 **(11%)**	116 **(14%)**	178 **(15%)**
Lagan Valley Hospital (LVH)	16 **(2%)**	27 **(4%)**	26 **(3%)**	32 **(3%)**
Other	37 **(5%)**	21 **(3%)**	24 **(3%)**	7 **(<1%)**
Unknown	- **(-)**	- **(-)**	- **(-)**	- **(-)**
TOTAL SOUTH-EASTERN TRUST	***114 (16%)***	***125 (17%)***	***166 (20%)***	***217 (18%)***
Antrim Hospital (ANT)**	51 **(7%)**	62 **(9%)**	69 **(8%)**	156 **(13%)**
Causeway (Coleraine) Hospital (CAU)	26 **(4%)**	32 **(4%)**	43 **(5%)**	60 **(5%)**
Other	42 **(6%)**	39 **(5%)**	31 **(4%)**	9 **(<1%)**
Unknown	- **(-)**	- **(-)**	- **(-)**	8 **(<1%)**
TOTAL NORTHERN TRUST	***119 (17%)***	***133 (19%)***	***143 (17%)***	***233(19%)***
Craigavon Area Hospital (CAH)**	31 **(4%)**	50 **(7%)**	65 **(8%)**	124 **(10%)**
Daisy Hill Hospital (DHH)	20 **(3%)**	37 **(5%)**	47 **(6%)**	57 **(5%)**
Other	34 **(5%)**	13 **(2%)**	8 **(1%)**	5 **(<1%)**
Unknown	- **(-)**	- **(-)**	- **(-)**	21 **(2%)**
TOTAL SOUTHERN TRUST	***85 (12%)***	***100 (14%)***	***120 (14%)***	***207 (17%)***
Altnagelvin Hospital (AH)**	65 **(9%)**	82 **(11%)**	91 **(11%)**	110 **(9%)**
Erne Hospital (ERN)	13 **(2%)**	21 **(3%)**	30 **(4%)**	17 **(1%)**
Tyrone County Hospital (TCH)	12 **(2%)**	16 **(2%)**	14 **(2%)**	13 **(1%)**
South West Acute Hospital	- **(-)**	- **(-)**	- **(-)**	53 **(4%)**
Unknown	- **(-)**	1 **(-)**	- **(-)**	4 **(<1%)**
TOTAL WESTERN TRUST	***90 (13%)***	***120 (17%)***	***135 (16%)***	***197 (16%)***
Ulster Independent Clinic (UIC)/ North-West Independent Clinic (NWC)	5 **(<1%)**	- **(-)**	<5 **(<1%)**	- **(-)**
Not Recorded	***2 (<1%)***	***2 (<1%)***	***4 (<1%)***	***40 (3%)***

** RVH/BCH work collaboratively as the Cancer Centre for lung cancer from 2006. ** Cancer Unit*

- Two thirds of patients (67% in 2014) presented to a Cancer Unit or the Cancer Centre irrespective of the year of audit.
- Over the audit years there was a significant ($p < 0.001$) decline in the proportion of patients presenting in the Belfast Trust, from 41% to 26% .

ECOG Status

Eastern Cooperative Oncology Group (ECOG) performance status (PS)[30] is used by doctors and clinical researchers to assess how a patient's disease is progressing, assess how the disease affects the daily quality of life for patients and determine appropriate treatment and prognosis. The performance status (PS) grades range from being fully active to completely disabled (*Appendix ii*)[30]. The National Lung Cancer Audit target for PS recording is ≥ 95% for MDT completeness (≥ 85% for key fields only), England recorded 89% (see also page 47).

Table 8: ECOG status recording for lung cancer patients in N.Ireland over time.

ECOG recorded	Number of patients (%)				
Number of audit patients	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
Yes	28 **(4%)**	169 **(24%)**	437 **(52%)**	964 **(79%)**	328 **(87%)**
No	677 **(96%)**	547 **(76%)**	397 **(48%)**	250 **(21%)**	48 **(13%)**

- By 2014 four fifths of lung cancer patients had an ECOG performance status recorded, a significant increase from earlier years.
- For study patients with enhanced information collected the record of ECOG performance status increased to 87%.

Table 9: ECOG status scores recorded lung cancer patients in N.Ireland over time.

ECOG status	Number of patients (% of total)				
	1996 (n = 28)	2001 (n = 169)	2006 (n = 437)	2014 All patients (n = 964)	2014 Study patients (n = 328)
0 (Fully active)	4 **(14%)**	42 **(25%)**	76 **(17%)**	129 **(13%)**	45 **(14%)**
1	10 **(36%)**	44 **(26%)**	141 **(32%)**	378 **(39%)**	127 **(39%)**
2	9 **(32%)**	44 **(26%)**	117 **(27%)**	241 **(25%)**	82 **(25%)**
3	5 **(18%)**	36 **(21%)**	82 **(19%)**	176 **(18%)**	56 **(17%)**
4 (Completely Disabled)	0 **(-)**	3 **(2%)**	21 **(5%)**	40 **(4%)**	18 **(5%)**

- Of those with an ECOG performance status (PS) recorded in 2014, only 1 in 7 patients were considered as being fully active.
- Just over half were noted to have a good PS (PS 0-1) (53%, n= 507).
- One in twenty patients had a status of completely disabled in 2014.

Investigations

Table 10: Investigations recorded in notes lung cancer patients time trends N.Ireland.

Investigation combination	Number of patients (%)				
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
CT Scan	498 **(70%)**	638 **(89%)**	787 **(94%)**	1,144 **(94%)**	365 **(97%)**
Bronchoscopy	477 **(67%)**	528 **(73%)**	574 **(68%)**	534 **(44%)**	215 **(57%)**
CT scan before bronchoscopy*	126 **(18%)**	228 **(32%)**	365 **(44%)**	484 **(40%)**	196 **(52%)**
Bronchoscopy before CT scan	159 **(23%)**	205 **(29%)**	122 **(15%)**	26 **(2%)**	15 **(4%)**
No CT scan/bronchoscopy combination	329 **(47%)**	229 **(32%)**	270 **(32%)**	680 **(56%)**	161 **(43%)**
CT scan or bronchoscopy timing unrecorded	91 **(13%)**	54 **(8%)**	77 **(9%)**	24 **(2%)**	4 **(1%)**

*(NOTE: Patients may have had more than one type of investigation) * Proportions calculated using total yearly patient numbers.*

- The levels of CT remain high at over 90% since 2006.
- Bronchoscopy levels recorded for the study patients were at 57%, a decrease from previous years. This may reflect increased use of CT scan before bronchoscopy.
- Of those patients who had a bronchoscopy (n = 534), 91% (484/534) were recorded as having had their CT scan first. This compares with the target of ≥ 95% for NCLA. This figure was unavailable for 2014 data for England (see page 47 Table 31) however for patients diagnosed in England 2015[32] the level was 91%.

Histology Sub Type

Table 11: Histology subtype lung cancer trends N.Ireland.

Sub type*	Number of patients			
	1996 (n=705)	2001 (n=716)	2006 (n=834)	2014* (n=1,194)
Non-small cell (NSCLC) Microscopically Verified	396 **(56%)**	443 **(62%)**	515 **(61%)**	711 **(60%)**
Small cell (SCLC)^	106 **(15%)**	121 **(17%)**	120 **(14%)**	141 **(12%)**
Non MV / Unspecified**	203 **(29%)**	152 **(21%)**	199 **(24%)**	342 **(28%)**

**Note carcinoid of the lung are excluded from the above table (n = 20 in 2014). ** 'Non MV' = 'non-microscopically verified; these tumours have the same morphology codes as 'unspecified', but their basis of diagnosis was not histology or cytology.^ 2014 SCLC includes (n < 5) mon-microscopically verified tumours.*

- Over time lung cancer cases had better histopathology coding with less cases coded as unspecified.
- As expected non-small cell lung cancer was the most common histological type (60%).

Staging

Using the UICC 7th edition TNM staging classification[28] for 2014 cancer patients, the recording of stage for lung cancer patients has improved over the years with 93% of all 2014 lung cancer patients being staged. When stage was not recorded and there was sufficient information available in the clinical notes, Registry staff assigned a stage group.

Table 12: Trends in staging lung cancers N.Ireland.

Stage (All patients)	Number of patients (%)				
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
Stage I	68 **(9%)**	95 **(13%)**	109 **(13%)**	216 **(18%)**	76 **(20%)**
Stage II	35 **(5%)**	39 **(5%)**	45 **(5%)**	102 **(8%)**	30 **(8%)**
Stage IIIA	34 **(5%)**	45 **(6%)**	51 **(6%)**	169 **(14%)**	57 **(15%)**
Stage IIIB	84 **(12%)**	40 **(6%)**	83 **(10%)**	114 **(9%)**	35 **(9%)**
Stage IV	232 **(33%)**	250 **(35%)**	396 **(48%)**	532 **(44%)**	155 **(41%)**
Stage Unknown	252 **(36%)**	247 **(35%)**	150 **(18%)**	81 **(7%)**	23 **(6%)**

- The proportion of patients staged increased to 93% by 2014. In 1996 & 2001, around one in three patients did not have sufficient information in their notes for a stage to be determined. By 2014, this proportion declined to around one in fifteen patients (7%).
- Over half of 2014 lung cancer patients (51%) were late Stage IV or stage unknown.
- Over a quarter (26%) of patients were early Stage I/Stage II at diagnosis in 2014.
- SCLC cases more often had extensive disease (Stage IV) at diagnosis compared with NSCLC (61% and 42% respectively).

Table 13: Trends in staging for lung cancer surgery patients N.Ireland.

Stage (Surgery patients)	Number of patients (% of all patients in that stage)				
n = numbers in 2014	1996 (n = 110)	2001 (n = 89)	2006 (n = 104)	2014 Patients undergoing surgery All patients (n = 180)	2014 Patients undergoing surgery Study patients (n = 60)
Stage I (early) n=216	45 **(66%)**	37 **(39%)**	45 **(41%)**	98 **(45%)**	31 **(41%)**
Stage II n=102	15 **(43%)**	19 **(49%)**	22 **(49%)**	47 **(46%)**	15 **(50%)**
Stage IIIA n=169	11 **(32%)**	12 **(27%)**	11 **(22%)**	32 **(19%)**	14 **(25%)**
Stage IIIB n=114	10 **(12%)**	5 **(13%)**	8 **(10%)**	- **(-)**	- **(-)**
Stage IV (late) n=532	16 **(7%)**	5 **(2%)**	14 **(4%)**	<5 **(<2%)**	- **(-)**
Stage Unknown n=81	13 **(5%)**	11 **(4%)**	4 **(3%)**	<5 **(<2%)**	- **(-)**

- In 2014 99% of patients undergoing surgery were staged.
- By 2014 almost half of Stage I and Stage II patients (45% and 46% respectively) were having surgery.

Cases with no documented Stage by Trust First Seen

Table 14: Unstaged lung cancer by Trust where patient was first seen – N.Ireland

Trust first seen	Number of unstaged patients (% patients first seen in that Trust)	
	2014 All patients (n = 81)	2014 Study patients (n = 23)
Belfast Trust	15 **(5%)**	6 **(7%)**
Northern Trust	12 **(5%)**	3 **(4%)**
Southern Trust	11 **(5%)**	3 **(4%)**
South Eastern Trust	11 **(5%)**	8 **(10%)**
Western Trust	6 **(3%)**	- **(-)**
Trust Unknown	26 **(65%)**	3 **(100%)**
All N.Ireland unstaged patients	81 **(7%)**	23 **(6%)**

- There was little variation in the proportion of unstaged patients by Trust of presentation.

Table 15: Trends in staging by age group – lung cancer diagnosed N.Ireland.

Age groups in years	Number of unstaged patients (% of all patients in that age group)			
	1996	2001	2006	2014 All patients
0 – 64	57 **(28%)**	54 **(25%)**	30 **(11%)**	9 **(3%)**
65 – 74	104 **(34%)**	97 **(35%)**	49 **(17%)**	12 **(3%)**
75 +	91 **(48%)**	96 **(43%)**	71 **(25%)**	60 **(12%)**
All unstaged patients	252	247	150	81

- Three quarters (74%) of unstaged patients in 2014 were over 75 years of age. Within the 2014 study patient group 83% (19/23), of unstaged patients were over 75 years of age.
- When comparing the unstaged patients by gender no differences were found.

Multidisciplinary Team (MDT) discussions

Multidisciplinary team meetings (MDT) involve a group of healthcare professionals with a range of expertise in cancer patient management meeting to discuss the diagnosis, planning and implementation of treatment plans for cancer patients.

Table 16: Multidisciplinary discussions by Trust first seen 2014 diagnosed lung cancer patients.

Trust first seen	Number of patients having a MDT recorded in their notes (% all patients first seen in that trust)	
	2014	
	All patients (n = 1,161)	Study patients (n = 360)
Belfast Trust	313 **(98%)**	85 **(92%)**
Northern Trust	232 **(99%)**	78 **(99%)**
Southern Trust	206 **(99%)**	67 **(99%)**
South Eastern Trust	213 **(98%)**	74 **(95%)**
Western Trust	197 **(100%)**	56 **(100%)**
Trust Unknown	- **(-)**	- **(-)**
All N.Ireland patients with a MDT discussion	1,161 **(96%)**	360 **(96%)**

- By 2014 almost all patients (96%), had a record of discussion at MDT - a steady increase from only two thirds in 2006.
- All surgery patients (n=180) were discussed at MDT.

Table 17: Trends in MDT discussions lung cancer patients N.Ireland.

Stage of disease	Number of patients having a MDT recorded in their notes (% all patients with that stage)				
n = numbers in 2014	1996	2001	2006	2014 All patients	2014 Study patients
Stage I n=216	34 **(50%)**	63 **(66%)**	81 **(74%)**	214 **(99%)**	75 **(99%)**
Stage II n=102	10 **(29%)**	28 **(72%)**	36 **(80%)**	102 **(100%)**	30 **(100%)**
Stage IIIA n=169	11 **(32%)**	29 **(64%)**	43 **(84%)**	167 **(99%)**	56 **(98%)**
Stage IIIB n=114	12 **(14%)**	23 **(58%)**	71 **(86%)**	114 **(100%)**	35 **(100%)**
Stage IV (late) n=532	24 **(10%)**	84 **(34%)**	235 **(59%)**	517 **(97%)**	152 **(99%)**
Stage Unknown n=81	44 **(17%)**	111 **(45%)**	71 **(47%)**	47 **(58%)**	12 **(52%)**
Total	135 **(19%)**	338 **(47%)**	537 **(64%)**	1,161 **(96%)**	360 **(96%)**

- There were significant increases in the proportions of lung cancer patients discussed at MDT so that by 2014 almost all staged patients and over half of patients with unknown stage (n = 47) had a discussion at MDT.

Treatments

Surgery

(NOTE: See Appendix iii for included procedures)

Table 18: Trends in surgery for lung cancer patients N.Ireland.

Surgery (All audit patients)	Number of patients (%)				
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
Yes Surgery Performed	110 **(16%)**	89 **(12%)**	104 **(12%)**	180 **(15%)**	60 **(16%)**
Curative Intent Recorded*	67 **(10%)**	72 **(10%)**	93 **(11%)**	128 **(11%)**	60 **(16%)**
No Surgery	441 **(63%)**	623 **(87%)**	710 **(85%)**	927 **(76%)**	292 **(78%)**
Fact of Surgery Not Recorded	154 **(22%)**	4 **(<1%)**	20 **(2%)**	107 **(9%)**	24 **(6%)**

** Proportions calculated using total yearly patient numbers, except for 2014 study patients.*

- By 2014, one in seven (15%) patients had surgical treatment, up from 12% in 2001 & 2006.
- The percentage of patients who had surgery with curative intent recorded in their notes changed little at 10% - 11%, however with the availability of extra information for the study patients diagnosed in 2014, a record of surgery with curative intent was found for 16% of patients.
- Over the last 18 years there has been little change in the proportion of patients over the age of 70 (10%) who received surgery.

Table 19: Trends in surgical intent for lung cancer patients N.Ireland.

Surgical Procedure intent	Number of surgery patients (%)				
	1996 (n = 110)	2001 (n = 89)	2006 (n = 104)	2014 All patients (n = 180)	2014 Study patients (n = 60)
Curative	67 **(61%)**	72 **(81%)**	93 **(89%)**	128 **(71%)**	60 **(100%)**
Diagnostic	12 **(11%)**	13 **(15%)**	9 **(9%)**	- **(-)**	- **(-)**
Palliative	7 **(6%)**	2 **(2%)**	1 **(<1%)**	- **(-)**	- **(-)**
Staging	4 **(4%)**	- **(-)**	- **(-)**	- **(-)**	- **(-)**
Not Recorded	20 **(18%)**	2 **(2%)**	1 **(<1%)**	52 **(29%)**	- **(-)**

- The proportion of surgery patients receiving surgery with recorded curative intent has decreased from 89% in 2006 to 71% in 2014, possibly reflecting more realistic staging with advances in technology.
- Procedure intent not recorded has increased to more than 1 in every 4 patients (29%).

Chemotherapy

Table 20: Trends in chemotherapy for lung cancer patients N.Ireland.

Chemotherapy	Number of chemotherapy patients (%)				
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
Yes	91 **(13%)**	136 **(19%)**	235 **(28%)**	287 **(24%)**	96 **(26%)**
No	503 **(71%)**	576 **(80%)**	501 **(60%)**	927 **(76%)**	280 **(74%)**
Fact of Chemotherapy not Recorded	111 **(16%)**	4 **(<1%)**	98 **(12%)**	- **(-)**	- **(-)**

- While the number of lung cancer patients receiving chemotherapy has increased the proportions have decreased to 24% of patients in 2014 from a high level of 28% in 2006.

Radiotherapy

Table 21: Trends in radiotherapy for lung cancer patients N.Ireland.

Radiotherapy	Number of radiotherapy patients (%)				
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014 All patients (n = 1,214)	2014 Study patients (n = 376)
Yes	304 **(43%)**	327 **(46%)**	352 **(42%)**	484 **(40%)**	163 **(43%)**
No	342 **(49%)**	387 **(54%)**	392 **(47%)**	730 **(60%)**	213 **(57%)**
Fact of Radiotherapy not Recorded	59 **(8%)**	2 **(<1%)**	90 **(11%)**	- **(-)**	- **(-)**

- The number of patients receiving radiotherapy (curative or palliative) has increased over time, with the proportions remaining steady at just over 40%.

Table 22: Trends in treatment for lung cancer patients N.Ireland.

Treatment Summary	Number of patients (%)			
	1996 (n = 705)	2001 (n = 715)	2006 (n = 834)	2014 (n= 1,214)
Surgery alone	53 **(7%)**	58 **(8%)**	49 **(6%)**	134 **(11%)**
Chemotherapy alone	22 **(3%)**	44 **(6%)**	66 **(8%)**	76 **(6%)**
Radiotherapy alone	130 **(18%)**	227 **(32%)**	194 **(23%)**	287 **(24%)**
Combination chemo & radio	33 **(5%)**	76 **(11%)**	129 **(15%)**	177 **(15%)**
Combination chemo & surgery	2 **(<1%)**	10 **(1%)**	26 **(3%)**	29 **(2%)**
Combination radio & surgery	28 **(4%)**	15 **(2%)**	7 **(<1%)**	12 **(1%)**
Combination chemo, radio & surgery	8 **(1%)**	5 **(<1%)**	9 **(1%)**	5 **(<1%)**
No chemo, radio or surgery treatment	206 **(29%)**	273 **(38%)**	241 **(29%)**	387 **(32%)**
Not Recorded*	223 **(32%)**	8 **(1%)**	113 **(14%)**	107 **(9%)**

** Of the 'Not Recorded' 126/223 (57%) in 1996 did get some definite treatment, i.e. at least either chemotherapy, radiotherapy, or surgery was recorded but not all three; this was 5/8 (63%) in 2001, 30/113 (29%) in 2006 and 3/107 (3%) in 2014.*

- Recording fact of treatment has improved.
- Almost a third of all 2014 patients had a record of not receiving chemotherapy, radiotherapy or surgery.
- By 2014 the proportion of patients having surgery only had increased to 11%.

No Active Treatments explored

Table 23: Reasons for no active lung cancer treatment 1996 – 2014 N.Ireland.

	% with no Active Treatment recorded				
Number of patients with no active treatments recorded by audit year	1996 (n = 206)	2001 (n = 273)	2006 (n = 241)	2014 (n = 387)	2014 Study patients (n = 119)
Stage IV	71 **(34%)**	111 **(41%)**	134 **(56%)**	201 **(52%)**	51 **(43%)**
Aged over 80 years at diagnosis	41 **(20%)**	60 **(22%)**	58 **(24%)**	138 **(36%)**	40 **(34%)**
Died within 2 weeks of diagnosis	49 **(24%)**	89 **(33%)**	48 **(23%)**	51 **(13%)**	17 **(14%)**

- 68% of patients in the 2014 study group had a record of treatment.
- Of those patients diagnosed in 2014 who had no record of receiving any active treatment, over half had Stage IV cancers, an increase over time possibly reflecting better staging in recent years.
- Also around one in three were over 80 years at diagnosis, an increase over time from one in five.
- The proportion of patients that did not receive treatment and died within 2 weeks was lower in 2014 (14%) than in previous years.

Survival

Lung cancer survival is poor however improvements have been noted. In NI age-standardised one-year survival improved from 26.2% in the period 1993-1999 to 34.8% in 2010-2013.[4] Modest improvements are noted in five-year survival from 8.6% in the period 1993-1999 to 10.5% in 2005-2009. Male five year survival has increased by 2 percent points with female survival increasing by 1.6 points (see below) in the same time periods.

Table 24: Five year lung cancer survival by period of diagnosis and sex N.Ireland.

Period of Diagnosis	Male	Female	Both Sexes
1993-1999	8.0%	9.8%	8.6%
2000-2004	8.7%	9.9%	9.2%
2005-2009	10.0%	11.4%	10.5%

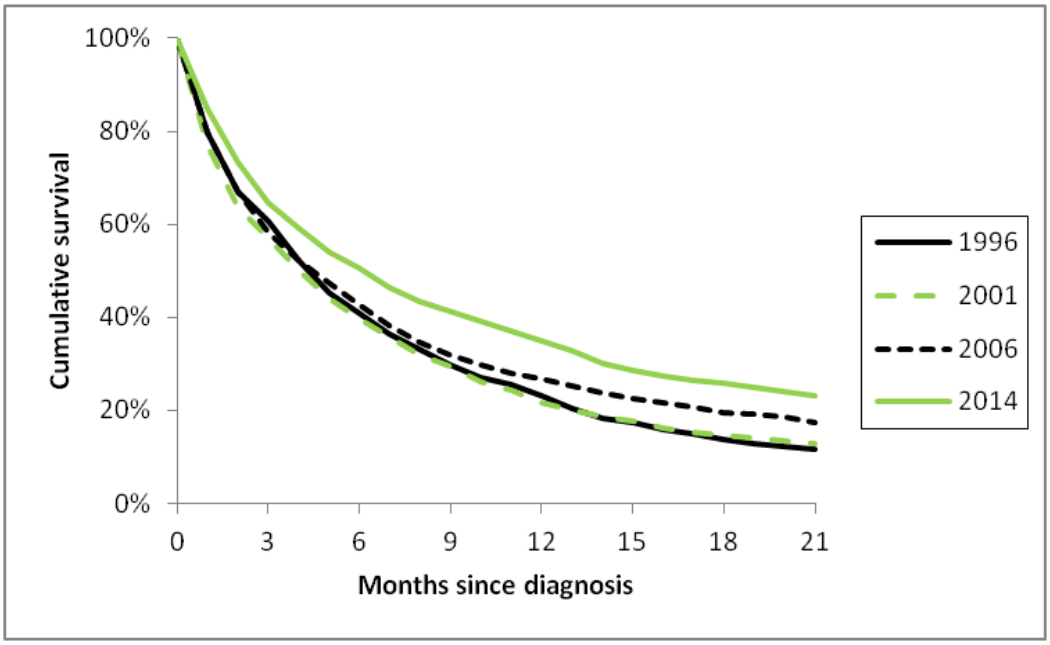


Figure 12. N. Ireland lung cancer observed survival by year of diagnosis (all patients)

All patients - percentage alive at various times after diagnosis

Table 25: Survival trends lung cancer N.Ireland 1996 – 2014.

Time	All Patients			
	1996 (n = 705)	2001 (n = 716)	2006 (n = 834)	2014* (n = 1,194)
30 days	**80%**	**77%**	**80%**	**85%**
60 days	**67%**	**64%**	**67%**	**73%**
6 months	**41%**	**40%**	**43%**	**51%**
12 months	**23%**	**22%**	**27%**	**35%**
21 months	**11%**	**13%**	**17%**	**23%**

**Note carcinoid of the lung are excluded from the above table for all years (n = 20 in 2014).*

Surgery patients - percentage alive at various times after diagnosis

Table 26: Survival trends lung cancer – surgery patients 1996 – 2014 N.Ireland.

Time	Surgery Only Patients			
	1996 (n = 110)	2001 (n = 89)	2006 (n = 104)	2014* (n = 163)
30 days	**100%**	**98%**	**97%**	**98%**
60 days	**96%**	**96%**	**95%**	**98%**
6 months	**78%**	**91%**	**90%**	**96%**
12 months	**64%**	**72%**	**82%**	**90%**
21 months	**44%**	**62%**	**74%**	**79%**

**Note carcinoid of the lung are excluded from the above table for all years.*

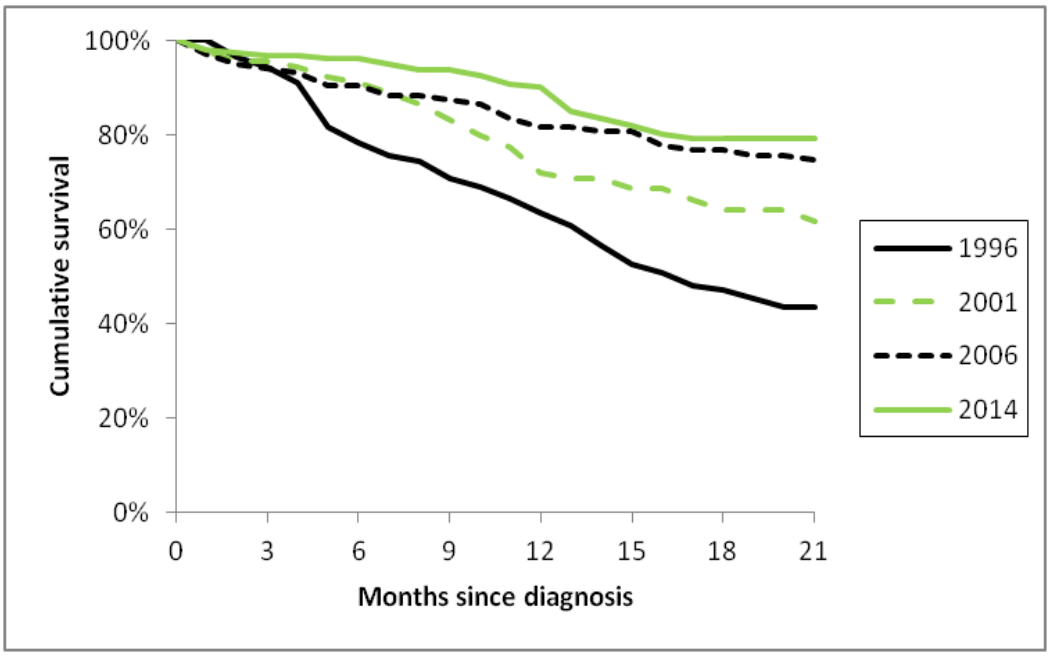


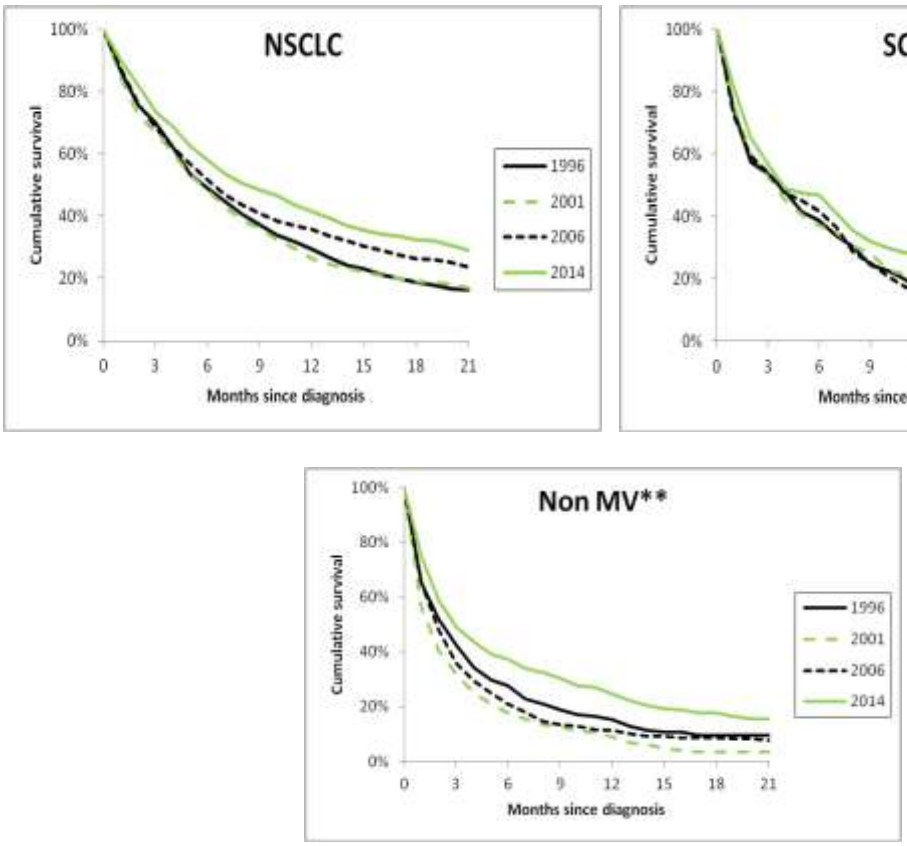
Figure 13 Surgery patients lung cancer observed survival by year of diagnosis

Table 27: Survival trends lung cancer by cell type – 1996 – 2014 N.Ireland.

Time	NSCLC Only Patients			
	1996 (n = 396)	2001 (n = 443)	2006 (n = 515)	2014* (n = 711)
30 days	**87%**	**84%**	**87%**	**90%**
60 days	**76%**	**73%**	**76%**	**82%**
6 months	**49%**	**49%**	**52%**	**58%**
12 months	**30%**	**26%**	**36%**	**42%**
21 months	**16%**	**17%**	**24%**	**29%**
	SCLC Only Patients			
	1996 (n = 106)	2001 (n = 121)	2006 (n = 120)	2014* (n = 141)
30 days	**75%**	**76%**	**73%**	**82%**
60 days	**58%**	**60%**	**59%**	**65%**
6 months	**39%**	**37%**	**42%**	**47%**
12 months	**16%**	**22%**	**16%**	**28%**
21 months	**2%**	**9%**	**8%**	**11%**
	Non MV Only Patients**			
	1996 (n = 158)	2001 (n = 148)	2006 (n = 196)	2014* (n = 342)
30 days	**65%**	**56%**	**65%**	**75%**
60 days	**52%**	**41%**	**48%**	**59%**
6 months	**28%**	**18%**	**21%**	**37%**
12 months	**15%**	**9%**	**11%**	**25%**
21 months	**10%**	**3%**	**8%**	**16%**

**Note carcinoid of the lung are excluded from the above table for all years (n = 20 in 2014). ** 'Non MV' = 'non-microscopically verified; these tumours have the same morphology codes as 'unspecified', but their basis of diagnosis was not histology or cytology.*

- Survival for all cell types had improved by 2014. Survival was best for non small cell lung cancer patients and poorest for patients without microscopic verification.



*** 'Non MV' = 'non-microscopically verified.*

Figure 14 Lung cancer observed survival by year of diagnosis and cell type for all patients

Table 28: Survival trends lung cancer by stage – 1996 – 2014 N.Ireland.

Time	Stage I Only Patients			
	1996 (n = 68)	2001 (n = 95)	2006 (n = 109)	2014* (n = 202)
30 days	**100%**	**96%**	**95%**	**98%**
60 days	**97%**	**92%**	**92%**	**94%**
6 months	**84%**	**78%**	**81%**	**89%**
12 months	**68%**	**59%**	**61%**	**76%**
21 months	**49%**	**44%**	**50%**	**66%**
	Stage II Only Patients			
	1996 (n = 35)	2001 (n = 39)	2006 (n = 45)	2014* (n = 100)
30 days	**97%**	**95%**	**91%**	**98%**
60 days	**94%**	**85%**	**91%**	**97%**
6 months	**80%**	**67%**	**76%**	**85%**
12 months	**54%**	**54%**	**62%**	**69%**
21 months	**26%**	**33%**	**49%**	**57%**
	Stage III Only Patients			
	1996 (n = 118)	2001 (n = 85)	2006 (n = 134)	2014* (n = 283)
30 days	**91%**	**88%**	**96%**	**94%**
60 days	**81%**	**82%**	**90%**	**83%**
6 months	**51%**	**59%**	**60%**	**61%**
12 months	**31%**	**34%**	**43%**	**45%**
21 months	**11%**	**18%**	**23%**	**24%**

Table 28: continued.

	Stage IV Only Patients			
	1996 (n = 232)	2001 (n = 250)	2006 (n = 396)	2014* (n = 531)
30 days	**69%**	**68%**	**72%**	**76%**
60 days	**50%**	**47%**	**55%**	**60%**
6 months	**25%**	**20%**	**27%**	**28%**
12 months	**10%**	**4%**	**10%**	**13%**
21 months	**3%**	**2%**	**5%**	**4%**
	Stage Unknown Only Patients			
	1996 (n = 252)	2001 (n = 247)	2006 (n = 150)	2014* (n = 78)
30 days	**76%**	**73%**	**72%**	**62%**
60 days	**64%**	**60%**	**53%**	**44%**
6 months	**35%**	**35%**	**31%**	**23%**
12 months	**18%**	**18%**	**23%**	**17%**
21 months	**8%**	**7%**	**13%**	**5%**

**Note carcinoid of the lung are excluded from the above table for all years.*

- Generally survival improvements were demonstrated for Stage I and II patients however there were also improvements for Stage IV patients up to one year.

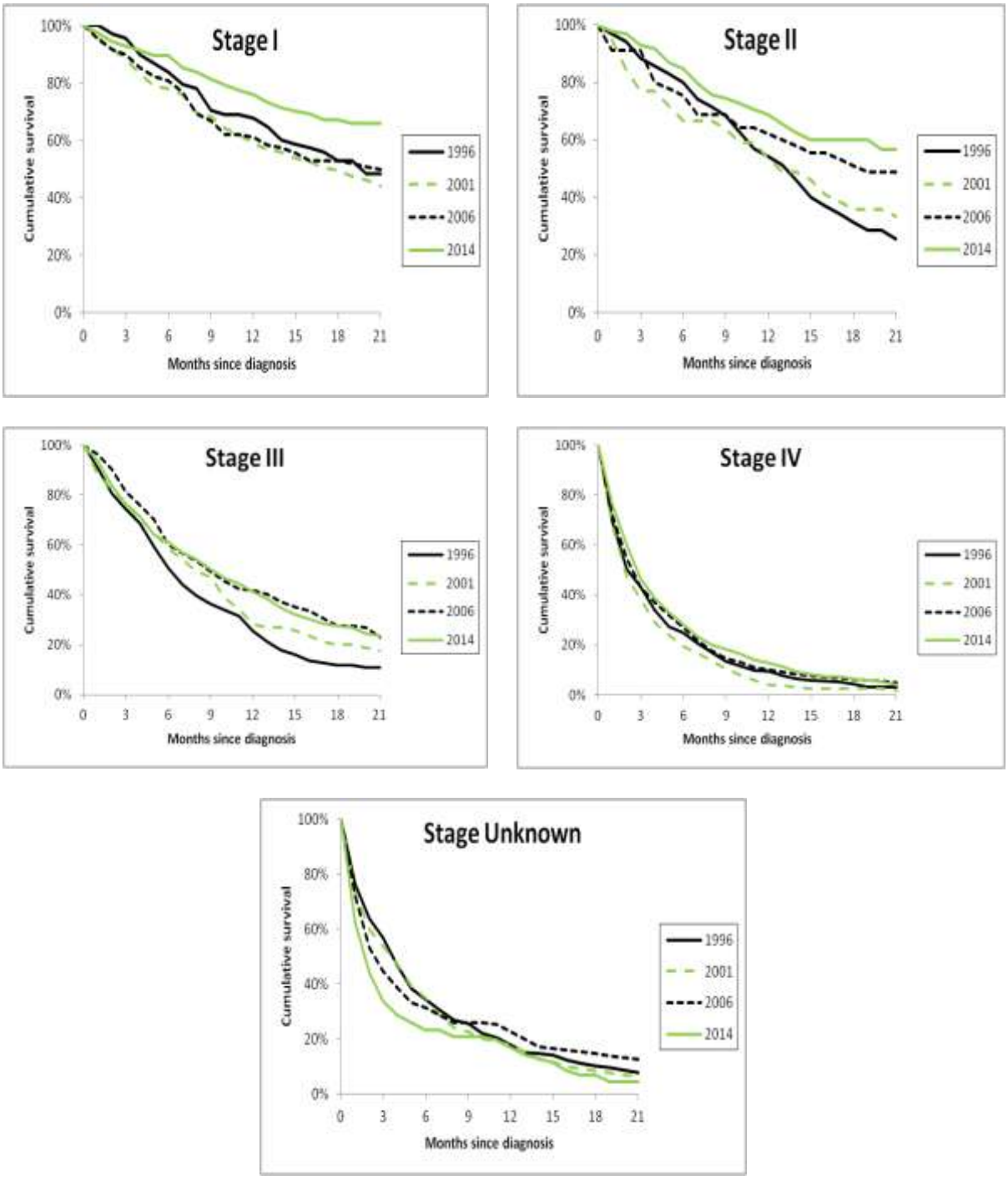


Figure 15 Lung cancer observed survival by year of diagnosis and stage for all patients

Table 29: Survival trends lung cancer by referral type – 2014 N.Ireland.

Time	2014 Patients Only		
	Elective* (n = 626)	Emergency* (n = 234)	Other/Unknown* (n = 334)
30 days	**93%**	**76%**	**76%**
60 days	**85%**	**60%**	**61%**
6 months	**62%**	**35%**	**40%**
12 months	**45%**	**18%**	**29%**
21 months	**31%**	**12%**	**16%**

**Note carcinoid of the lung are excluded from the above table for all years (n = 20 in 2014).*

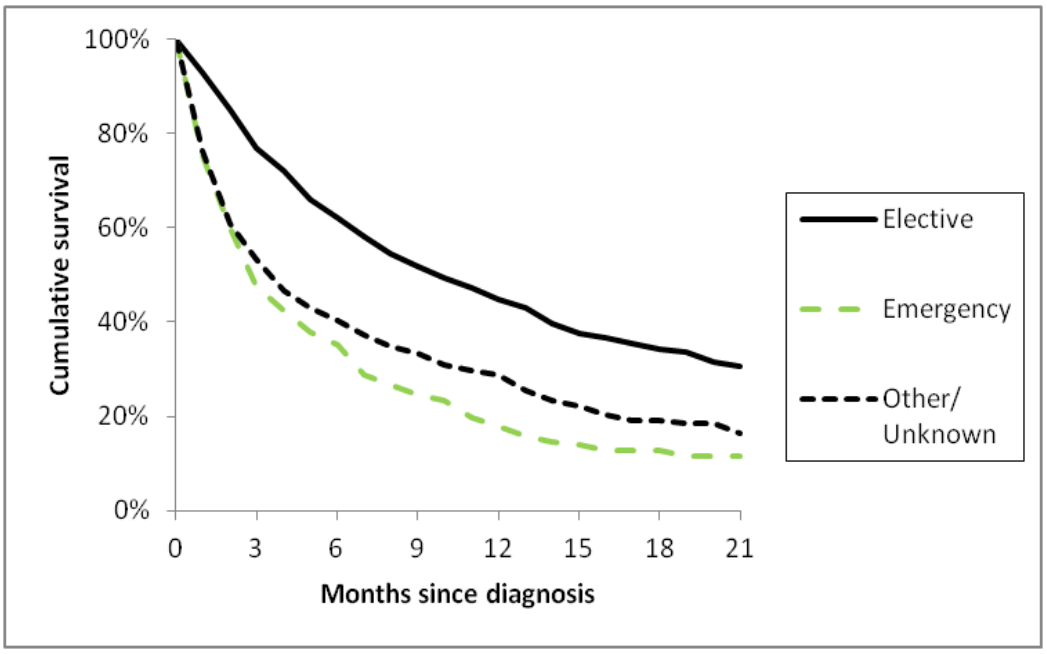


Figure 16 Lung cancer observed survival by referral type for 2014 diagnosed patients

- Patients who presented as an emergency had significantly (log rank test $p < 0.001$) poorer survival than those presented electively.

Table 30: Observed survival lung cancer patients by treatment type – 2014 N.Ireland.

Observed Survival (%)	1 month (%)	3 months (%)	6 months (%)	1 year (%)	Median (days)
Overall *	85	65	51	35	202
Any active treatment	96	83	68	50	370
Any Surgery	99	97	95	88	505
Lobectomy	98	97	96	91	511
Chemotherapy for SCLC	99	87	74	44	278
Stage IIIB/IV, PS 0-1 NSCLC chemotherapy	99	91	67	32	262
Radiotherapy	95	79	61	39	250
No active treatment	70	39	27	15	60

**Note carcinoid of the lung are excluded from the above table for all years (n = 20, 2014).*

- No statistically significant variation in Trust-specific survival (log rank test p-value 0.264)
- Survival improvement with younger age, earlier stage, improved PS, elective referral and all forms of active treatment.
- Poorer survival was recorded for patients with Stage IV (late) disease compared to patients with Stage I – II (Early) disease (HR 7.22, 95% CI 5.82-8.96).
- Poorer survival was recorded for patients with poor Performance Status (PS 3 – 4) compared to patients with good Performance Status (PS 0 – 1) (HR 3.26, 95% CI 2.71-3.92).
- Poorer survival was recorded for patients referred via an emergency source compared to patients referred electively (HR 2.19, 95% CI 1.85-2.59).

Comparisons of N.Ireland 2014 lung cancer data with National Lung Cancer Audit (NLCA)

Table 31: (Patients diagnosed in England and N.Ireland 2014)

Indicator (rate)	NI* (%)	BT* (%)	NT* (%)	ST* (%)	SET* (%)	WT* (%)	NLCA Target	UK (%)
CT before bronchoscopy	90.6	94.6	94.2	78.9	91.9	94.0	≥95%	-
Histologically confirmed	71.7	69.7	81.5	74.4	72.4	71.1	≥75%	69
Active anti-cancer treatment	60.1	60.9	65.7	66.7	54.4	62.4	≥60%	58
NSCLC surgical resection **	15.8	14.1	18.7	18.0	13.4	18.8	≥16%	15.4
Stage I-II NSCLC surgical resection **	43.3	37.8	50.7	39.3	40.5	49.0	≥52%	43
SCLC chemotherapy	60.3	60.0	62.9	57.7	61.5	61.5	≥70%	68
Stage IIIB/IV, PS 0-1 NSCLC chemotherapy	47.1	64.3	52.9	38.1	47.6	35.4	≥60%	58
LCNS assessment	62.7	27.8	76.0	76.3	75.6	87.8	≥80%	78
MDT discussion	95.6	97.8	99.6	99.5	98.2	100	≥95%	94
Documented stage	93.3	95.3	94.8	94.7	94.9	97.0	≥85% key fields	92
Documented PS	79.4	78.8	96.1	70.5	69.6	96.4	≥95% MDT completeness	89
Documented stage and PS	76.9	77.2	91.8	68.6	66.8	93.9		84

* NI = N.Ireland, BT = Belfast Trust, NT = Northern Trust, ST = Southern Trust, SET = South Eastern Trust, WT = Western Trust. ** *2014 Non Small Cell Lung Cancer (NSCLC) patients include 342 non-microscopically verified tumours.*

N.Ireland Trends

Table 32: Trends in key indicators for lung cancer – all patients 2009 – 2014 N.Ireland.

Indicator (rates)	Year				
	2009	2010	2011	2012	2014
CT before bronchoscopy	87%	84%	92%	95%	91%
Active treatment	65%	65%	60%	58%	61%
NSCLC surgical resection *	15%	19%	12%	11%	16%
SCLC chemotherapy	68%	54%	62%	58%	60%
Stage IIIB/IV, PS 0-1 NSCLC chemotherapy	-	51%	37%	41%	47%
Lung Cancer Nurse Specialist (LCNS) assessment	-	63%	64%	46%	63%
Histological confirmation	71%	75%	77%	70%	72%
Documented stage	71%	78%	84%	87%	93%
Documented Performance Status (PS)	64%	74%	78%	92%	79%

** 2014 Non Small Cell Lung Cancer (NSCLC) patients include 342 non-microscopically verified tumours.*

- Patients who received a histological diagnosis (72%) had increased odds of active anti-cancer treatment (OR 7.49, 95% CI 5.59-10.02).
- Patients assessed by LCNS (63%) had increased odds of active treatment (OR 2.02, 95% CI 1.58-2.58).
- Emergency referral was associated with advanced stage, poor PS and reduced odds of active treatment (OR 0.58, 95% CI 0.40-0.85)

Discussion

Lung cancer is a devastating disease with poor overall survival and the number of lung cancer cases continues to increase in N.Ireland. In 2014 1,226 patients had a lung cancer diagnosis, a 37% increase from 2006 lung cancer registrations. The increase was three times greater for women (78%) than men (25%). Age is a significant risk factor with incidence rates significantly increasing with age. Within NI on average 73% of patients are diagnosed over the age of 65 years. While the numbers of cases have increased, the proportion of lung cancer patients who were over 80 years of age increased from 12% in 1996 to 17% in 2014, reflecting the ageing population. Many of these patients have multiple comorbidities and poor ECOG/Performance Status which reduce treatment options.

Lung cancer is a disease which is more common in economically deprived populations. It is estimated that 230 fewer men and 190 fewer women would be diagnosed each year here if the lung cancer incidence rates (in years 2010-2014) in the least deprived groups applied to all of the population.

Tobacco is the major cause of lung cancer. Almost 90% of patients had a history of smoking with almost half current smokers at diagnosis. Patients with carcinoid tumours were less likely to have smoked (31%).

Patients with lung cancer often present late and almost one in five patients presented as an emergency admission (19.3%) with many not living long enough for active treatment. Survival for this group is lower than for patients who present electively.

Several patient factors are identified as significant factors in management decisions and survival including patient Performance Status (PS) and source of referral. Age and disease stage also play an important role.

Despite the increase in numbers, lung cancer services here have demonstrated marked improvements over time and these have been accompanied by improvements in survival.

These improvements are listed below:

- Better histological categorisation: Over time lung cancer cases had better histopathology coding with less cases coded as unspecified and more as adenocarcinomas. As expected, non-small cell lung cancer was the most common histological type (68% microscopically verified). NSCLC Not Otherwise Specified (n = 38) rates were good at only 3.6% (NCLA England 11%, for 2015 data).
- The proportion of patients staged increased to 93% by 2014. Almost one fifth of patients were early Stage I at diagnosis however over 40% of 2014 lung cancer patients were late Stage IV.
- While more lung cancers were staged in 2014, 75% of unstaged patients were over 75 years at diagnosis with later Stage IV more common in SCLC cases than NSCLC (61% and 42% respectively).
- By 2014 one in seven (15%) patients had surgical treatment, up from 12% in 2001 & 2006. Almost half of Stage I and Stage II patients (45% and 46% respectively) had surgery. Survival was higher than average for surgical patients.
- By 2014 almost all patients (96%), had a record of discussion at MDT - a steady increase from only two thirds in 2006. (NCLA target 95%, UK average 94%)
- Bronchoscopy levels recorded for the study patients were 57%, a decrease from previous years however this may reflect increased use of CT scan before bronchoscopy in line with guidelines.
- Overall active anti-cancer treatment rates reached the NLCA target of 60% (NI overall rate 60.1%).
- While the number of lung cancer patients receiving chemotherapy has increased to almost 300 per year the proportions had decreased to 24% of patients in 2014 from a high level of 28% in 2006.
- The number of patients receiving radiotherapy (curative or palliative) increased over time while proportions remained steady at about 40%.
- Lung cancer survival is poor however significant improvements have been noted. Age-standardised one-year survival improved from 26.2% in the period 1993-1999 to 34.8% in 2010-2013. Modest improvements were noted in five-year survival from 8.6% in the period 1993-1999 to 10.5% in 2005-2009. Male five year survival increased by 2 percent points with female survival increasing by 1.6 points in the same time periods.

Guidelines exist for the diagnosis and management of lung cancers and the National Lung Cancer Audit (NLCA) measures how these guidelines are met. We have compared the standards reached in NI for patients diagnosed in 2014 with these targets for each Trust of patient presentation and also with the English results (2014 diagnosed patients). See pages 47 and 48.

The following variations by Trust were noted:

- No Trust met the NLCA target of over 95% for the proportion of patients with a CT before bronchoscopy. The Southern Trust recorded the lowest proportion of 79%; NI average was 91%.
- For Lung Cancer Nurse Specialist (LCNS) assessment rates, only the Western Trust (88%) met the NLCA target of over 80%. The lowest levels were for Belfast Trust (28%); NI average was 63% (UK average 78%).
- Only the Northern Trust (82%) met the NLCA target of over 75% for histological confirmation rates. The lowest rates were for Belfast Trust (70%); NI average was 72% (UK average 69%).
- Both the Northern and Western Trusts (each 96%) achieved the desired NLCA target of over 95% for Performance Status documented; NI average was 79% (UK average 89%).
- For Stage IIIB/IV, PS 0-1 NSCLC patients the NLCA chemotherapy targets of over 60% were met only in the Belfast Trust (64%). The lowest rate was recorded in the Western Trust (35%); NI average was 47% (UK average 58%).
- Only the South Eastern Trust (54%) was lower than the NLCA target (over 60%) for active anti-cancer treatment rates; NI average was 60% (UK average 58%)

Recommendations

1. **Smoking prevention:** Further efforts should be made to reduce tobacco use.
2. **Northern Ireland data should be included routinely in NLCA**: Similar to the rest of the UK, Trust-level variation is present in various service areas. Inclusion in the NLCA audit can help to reduce variation as we strive to meet all of the NLCA targets
3. **Clinicians:** should complete fields in the multidisciplinary meetings CaPPS system to facilitate inclusions of NI datasets in National Audits.
4. **Earlier presentation**: Survival is best with earlier disease presentation. There should be investment in and evaluation of awareness campaigns and access to diagnostics to promote earlier presentation.

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Appendix i: TNM Stages for Lung Cancer[28]

Stage	T	N	M
IA	T1a,b	N0	M0
IB	T2a	N0	M0
IIA	T2b	N0	M0
	T1a,b	N1	M0
	T2a	N1	M0
IIB	T2b	N1	M0
	T3	N0	M0
IIIA	T1a,b, T2a,b	N2	M0
	T3	N1, N2	M0
	T4	N0, N1	M0
IIIB	T4	N2	M0
	any T	N3	M0
IV	any T	any N	M1

TNM Clinical Classification Summary

Classification	T – Primary Tumour
T1	Tumour 3cm or less in greatest dimension.
T1a	Tumour 2cm or less in greatest dimension.
T1b	Tumour more than 2cm but not more than 3cm in greatest dimension.
T2	Main bronchus 2cm or over from carina, invades visceral pleura, partial atelectasis.
T2a	Tumour more than 3cm but not more than 5cm in greatest dimension.
T2b	Tumour more than 5cm but not more than 7cm in greatest dimension.
T3	Tumour greater than 7cm in greatest dimension or one that invades chest wall, diaphragm pericardium, mediastinal pleura or main bronchus less than 2cm from carina or total atelectasis or separate nodule(s) in same lobe.
T4	Tumour of any size that invades mediastinum, heart, great vessels, carina, trachea, oesophagus, vertebra or separate tumour nodule(s) in a different ipsilateral lobe.
	N – Regional Lymph Nodes
N0	No regional lymph node metastasis.
N1	Metastasis in ipsilateral peribronchial or ipsilateral hilar.
N2	Metastasis in ipsilateral mediastinal or subcarinal.
N3	Metastasis in contralateral mediastinal or hilar, scalene or supraclavicular.
	M – Distant Metastasis
M0	No distant metastasis
M1	Distant metastasis

Appendix ii: ECOG Performance Status[30]

GRADE	ECOG PERFORMANCE STATUS
0	Fully active, able to carry on all pre-disease performance without restriction
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g. Light house work, office work
2	Ambulatory and capable of all self-care but unable to carry out any work activities; up and about more than 50% of waking hours
3	Capable of only limited self-care; confined to bed or chair more than 50% of waking hours
4	Completely disabled; cannot carry out any self-care; totally confined to bed or chair
5	Dead

Appendix iii: List of Curative Surgery Procedures Used

Procedure Code	Description
E391	Open excision of lesion of trachea
E398	Other specified partial excision of trachea
E399	Unspecified partial excision of trachea
E438	Other specified other open operations on trachea
E441	Carinal resection
E461	Sleeve resection of bronchus and anastomosis
E463	Excision of lesion of bronchus
E468	Other specified partial extirpation of bronchus
E541	Total pneumonectomy
E542	Bilobectomy of lung
E543	Lobectomy of lung
E544	Excision of segment of lung
E545	Partial lobectomy of lung
E548	Other specified excision of lung
E549	Unspecified excision of lung
E552	Open excision of lesion of lung
E554	Open destruction of lesion of lung
E558	Other specified open extirpation of lesion of lung
E559	Unspecified open extirpation of lesion of lung
T01	Partial excision of chest wall
T010	Partial excision of chest wall
T018	Other specified partial excision of chest wall
T019	Unspecified partial excision of chest wall

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