Queensland Lung Surgery Quality Index

Indicators of
safe, quality cancer care

Cancer surgery in public and
private hospitals

2005 - 2014

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Contents

Message from the Clinical Lead

Across Australia all states are examining the results from complex surgical procedures with the aim to ensure the best outcomes for patients. We present the latest - *"Queensland Lung Surgery Quality Index: Indicators of safe, quality cancer care. Cancer surgery in public and private hospital 2005-2014"*. This new look report, continues to monitor the patterns of surgery for patients with Non-small cell lung cancer (NSCLC) at public and private, teaching and non-teaching, metropolitan and regional hospitals between 2005 - 2014. Lung cancer is the 6th highest incidence of cancer in Queensland, but has the highest mortality rate of any cancer in Queensland, with surgery offering the best chance for survival for early stage NSCLC. The management of patients with Lung cancer is complex and require care from a multidisciplinary team to ensure they receive the appropriate treatment that will lead to the best outcomes. There are many factors that influence the clinician and patient's choice of treatment for lung cancer, including where treatment is best provided. By providing information on the patterns of surgery and outcomes this report should help guide these decisions.

This report reveals variation in outcomes between hospitals which may not be obvious in daily clinical practice but become clear with this type of analysis. Patients undergoing a lung resection for cancer in hospitals that perform higher volumes of these operations continue to have better outcomes. The relationship between volume of surgery and outcome is complex. It relates to both the surgeon and the institution. The data from this analysis supports the thesis that outcomes are better when the surgery is performed in a higher volume facility. Further, it highlights the importance of tracking outcome data beyond the usual in hospital or 30 day. The information from this report offers insights to guide recommendations and future practice.

I encourage you to consider how this information will inform how lung cancer is managed in your facility in Queensland. Lung cancer surgery in Queensland will continue to be monitored with a focus on ensuring the best possible outcomes for our patients.

I wish to acknowledge the commitment of the members of QCCAT in providing the information, analysis, statistics and engagement of the clinicians that have led to this report. As well it is important to recognise the input of clinicians that have been involved in the discussion and development of the recommendations in the management of lung cancer.

Morgan Windsor
Clinical Lead, Queensland Lung Cancer Working Group
Queensland Cancer Control Safety and Quality Partnership

What is the Queensland Lung Surgery Quality Index?

The Lung Surgery Quality Index has been developed for public and private cancer services in Queensland. It is an initiative of the Queensland Cancer Control Safety and Quality Partnership (The Partnership) (https://qccat.health.qld.gov.au). The report tracks Queensland's progress delivering safe, quality cancer care and will be provided to all public and private hospitals that perform lung cancer surgery. The Lung Surgery Quality Index highlights areas for improvement and identifies the areas where cancer services are performing well. At present the Lung Surgery Quality Index has five dimensions and 16 indicators.

Quality Dimension	
Effective	Achieving the best outcomes for Queenslanders with cancer.
Efficient	Optimally using resources to achieve desired outcomes.
Safe	Avoiding and preventing adverse outcomes or injuries by healthcare management.
Accessible	Making health services available in the most suitable setting in a reasonable time.
Equitable	Providing care and ensuring health status does not vary in quality because of personal characteristics (age, socioeconomic status and rurality).

The Lung Surgery Quality Index reports on ten years of data from 2005-2014, however there may have been changes more recently that are not captured by the time periods reported. Regardless, the Lung Surgery Quality Index provides an important baseline for monitoring current investments in cancer care and changes in clinical practice. It also enables us to reflect on past surgery improvement programs and identify areas where a renewed effort or new approach may be required.

This report uses the Australian Institute of Health and Welfare (AIHW) hospital peer groupings to aggregate and present hospital results. Appendix 1 provides a description of each hospital peer grouping.

Why develop The Lung Surgery Quality Index?

Performance indicators linked to clinical outcomes that align with national benchmarking is a key service action in the Cancer Care State-wide Health Service Strategy, 2014. The Lung Surgery Quality Index has been developed by the Queensland Cancer Control Analysis Team (QCCAT), Lung Surgery Lead clinicians and participants under the auspices of the Queensland Cancer Control Safety and Quality Partnership (The Partnership). Together, they support a clinician-led, safety and quality program for cancer across Queensland. The Partnership was gazetted as a quality assurance committee under Part 6, Division 1 of the Hospital and Health Boards Act 2011 in 2004. A key role of The Partnership is to provide cancer clinicians, Hospital and Health Services (HHS), Hospitals and Queensland Health with cancer information and tools to deliver the best patient care.

The Lung Surgery Quality Index is a tool for reviewing and, comparing information on the safety and quality of cancer surgery and outcomes. The Partnership has prepared the Lung Surgery Quality Index to assist cancer clinicians and administrators to improve patient care. In some cases it may prompt a change in the delivery and organisation of cancer services to improve health outcomes and performance. The Lung Surgery Quality Index includes public and private cancer care services.

Where has the data come from?

Since 2004 QCCAT have compiled and analysed a vast amount of information about cancer incidence, mortality, surgical survival and surgery. Key to QCCAT's program of work is the ability to match and link population based cancer information on an individual patient basis. This matched and linked data is housed in the Queensland Oncology Repository (QOR), a resource managed by QCCAT. This centralised repository compiles and collates data from a range of source systems including the Queensland Cancer Registry, hospital admissions data, death data, treatment systems, public and private pathology, hospital clinical data systems and QOOL™. QOR contains approximately 40 million records between 1982 – 2014. Our matching and linking processes provide the 520,000+ matched and linked records of cancer patients between 2005-2014 which provide the data for the Lung Surgery Quality Index.

For the purposes of this report Lung cancer refers to Non-small cell lung cancer (NSCLC), see Appendix 8.

The Lung Surgery Quality Index should be interpreted in the context of following previous publications by The Partnership; Surgery for Non-Small Cell Lung Cancer Cancer in Qld: Infocus – access and flows 2013 and the Lung Cancer in Queensland 2012.These publications provide information on cancer incidence, mortality and surgical survival, surgery rates and patient flows which is important information for understanding the indicators reported in The Lung Surgery Quality Index. To access these reports go to https://qccat.health.qld.gov.au/reports.

What indicators are included?

Quality Dimension		Indicator	Definition
1 | Effective			
	1.1	Population Survival	What percentage of people with lung cancer are living 5 years after their diagnosis?
	1.3	Surgery	How many Queenslanders with lung cancer receive a major resection?
2 | Efficient			
	2.1	Hospital stay	How long do people with lung cancer stay in hospital after a major resection?
3 | Safe			
	3.1	In-hospital mortality	What percentage of people with lung cancer die in hospital after a major resection?
	3.2	30 day mortality	What percentage of people with lung cancer die within 30 days of a major resection?
	3.3	90 day mortality	What percentage of people with lung cancer die within 90 days of a major resection?
	3.4	1-yr surgical survival	What percentage of patients are alive one year after a major resection?
	3.5	2-yr surgical survival	What percentage of patients are alive two years after a major resection?
4 | Accessible			
	4.1	Timeliness **(where surgery is first treatment received)**	What percentage of patients receive lung surgery within 45, 46-90 or 91+ days of diagnosis?
	4.2	Remoteness	What percentage of patients living outside a metropolitan area received lung cancer surgery within 45 days of diagnosis?
5 | Equitable			
	5.1	Over 75 years	What percentage of patients aged ≥75 receive a major resection within 45 days from diagnosis?
	5.2	Aboriginal and Torres Strait Islander	What percentage of Aboriginal and Torres Strait Islander patients receive a major resection within 45 days from diagnosis?
	5.3	Socio-economically disadvantaged	What percentage of socio-economically disadvantaged patients receive a major resection within 45 days from diagnosis?
	5.4	In-flows by remoteness	What percentage of patients with lung cancer reside outside a metropolitan area?
	5.5	Remoteness	What percentage of patients with lung cancer reside outside my HHS?
	5.6	Out-flows	What percentage of patients underwent a major resection outside of the HHS that they reside in?

Queensland hospitals quality index overview

Diagnosis year 2010-2014

Diagnosis Year

2010-2014

Crude indicator rate comparison

Indicators	Principal referral hospitals	Group A hospitals	Group B hospitals	Other hospitals	Public	Private	**Qld**
Length of stay (median days)	7	7	8	7	7	7	**7**
In-hospital mortality	0.3% (3/898)	0.8% (5/627)	2.9% (3/104)	6.1% (2/33)	0.3% (3/904)	1.3% (10/758)	**0.8% (13/1662)**
30 day mortality	0.6% (5/898)	1.1% (7/627)	2.9% (3/104)	0.0% (0/33)	0.6% (5/904)	1.3% (10/758)	**0.9% (15/1662)**
90 day mortality	1.7% (15/898)	2.7% (17/627)	4.8% (5/104)	6.1% (2/33)	1.7% (15/904)	3.2% (24/758)	**2.3% (39/1662)**
1 year surgical survival	93%	90%	84%	88%	93%	89%	**91%**
2 year surgical survival	86%	81%	66%	70%	86%	78%	**82%**
Received surgery* ≤ 45 days	57% (488/858)	83% (484/583)	87% (85/98)	94% (29/31)	57% (491/863)	84% (595/707)	**69% (1086/1570)**
Received surgery* between 46 - 90 days	34% (291/858)	14% (80/583)	12% (12/98)	6% (2/31)	34% (292/863)	13% (93/707)	**25% (385/1570)**
Received surgery* > 90 days	9% (79/858)	3% (19/583)	1% (1/98)	0% (0/31)	9% (80/863)	3% (19/707)	**6% (99/1570)**
Received surgery* ≤ 45 days for those aged ≥75 years	46% (74/160)	80% (136/171)	79% (15/19)	100% (10/10)	46% (74/160)	80% (161/200)	**65% (235/360)**
Received surgery* ≤ 45 days by Aboriginal and Torres Strait Islander status	62% (13/21)	100% (1/1)	100% (1/1)		62% (13/21)	100% (2/2)	**65% (15/23)**
Received surgery* ≤ 45 days by disadvantaged status	54% (122/224)	87% (92/106)	79% (23/29)		54% (122/224)	85% (115/135)	**66% (237/359)**
In-flows of rural & remote patients	12% (111/898)	6% (35/627)	55% (57/104)	0% (0/33)	12% (111/904)	12% (92/758)	**14% (203/1662)**

*Includes only patients where lung cancer surgery was first treatment received
Refer to Appendix 1 for hospital grouping definitions

1 | Effective

Achieving the best outcomes for Queenslanders with lung cancer.

1.1 | Population survival

Diagnosis year 2005-2009 and 2010-2014

1.1.1 | What percentage of people with lung cancer are living 5 years after their diagnosis?

	Diagnosis Year	
Relative Survival	2005-2009	2010-2014
(% of people who would have survived if cancer was the only cause of death)	NSCLC	
Had major resection*~	54%	66%
No major resection~	5%	6%
All	14%	17%

1.1.2 | 5 year relative survival by treatment.
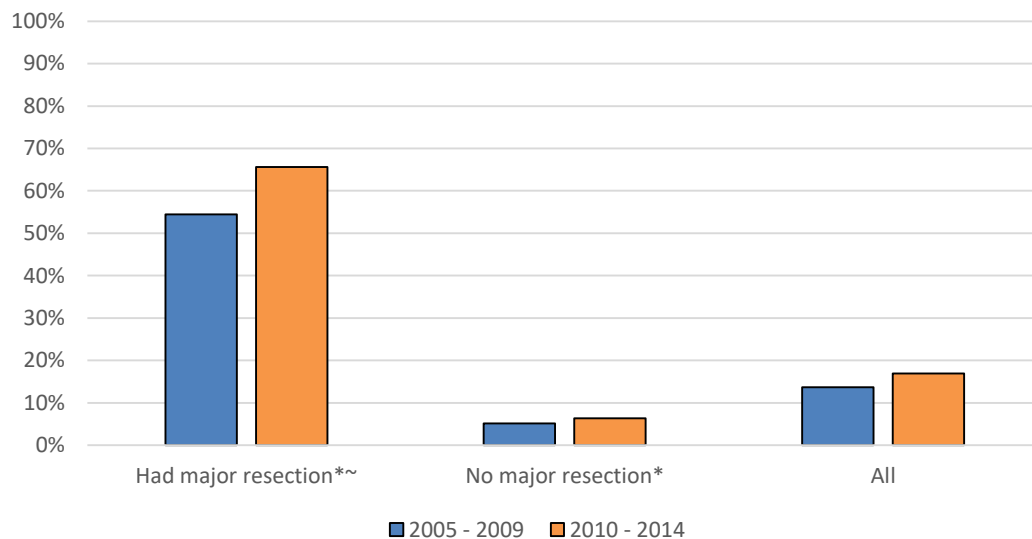
~Had major lung resection
*Patients may have had other treatment such as radiotherapy, systemic therapy or none

1.1 | Population survival

1.2 | Hospitals performing lung cancer surgery

Diagnosis year 2005-2014

1.2.1 | Which hospitals perform lung cancer surgery?

Annual average lung surgeries

Legend: ■ Lobectomy ■ Partial resection ■ Pneumonectomy
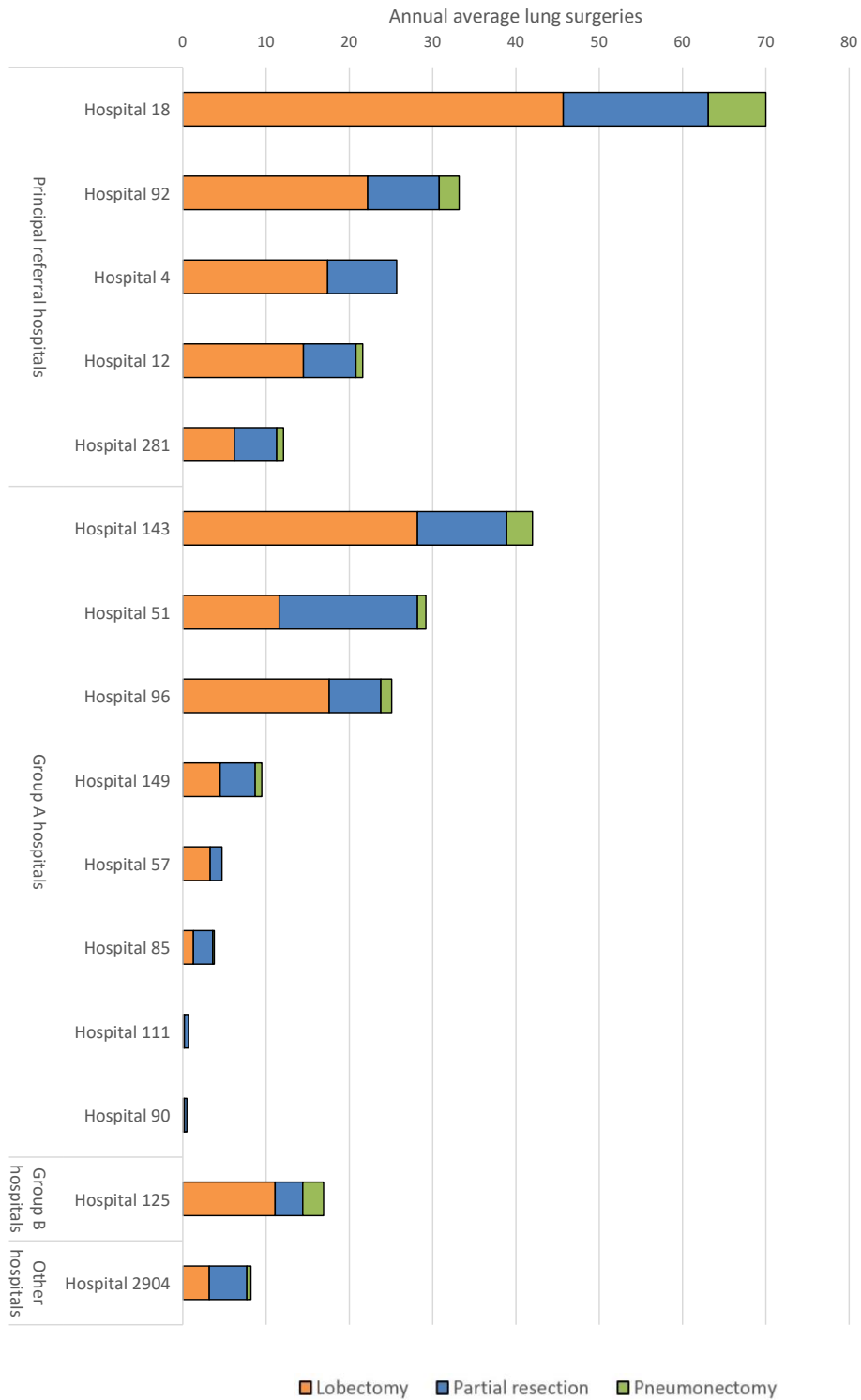
1.3 | Queenslanders receiving cancer surgery

Diagnosis year 2005-2009 and 2010-2014

1.3.1 | How many Queenslanders with lung cancer receive surgery by HHS of residence?

Surgery rate *(% of patients receiving lung cancer surgery)*	**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Cairns and Hinterland	15% (61/400) [14%, 11-18, 0.125]	17% (83/476) [17%, 14-21, 0.288]
Central Queensland	11% (43/392) [11%**, 8-14, 0.001]	14% (58/408) [14%*, 11-18, 0.023]
Central West	14% (6/42) [14%, 7-29, 0.609]	28% (8/29) [30%, 17-55, 0.126]
Darling Downs	13% (58/443) [14%*, 11-17, 0.046]	14% (71/500) [15%*, 12-18, 0.024]
Gold Coast	17% (171/978) [18%, 16-21, 0.492]	20% (206/1050) [20%, 17-23, 0.471]
Mackay	16% (45/284) [15%, 12-20, 0.341]	22% (60/269) [21%, 17-27, 0.285]
Metro North	19% (291/1514) [20%*, 18-22, 0.032]	22% (361/1628) [22%**, 20-25, 0.001]
Metro South	18% (295/1614) [18%, 16-21, 0.295]	18% (326/1780) [18%, 16-20, 0.499]
North West	7% (3/46) [6%, 2-17, 0.052]	18% (9/49) [18%, 10-32, 0.821]
South West	10% (6/60) [10%, 5-22, 0.168]	15% (10/65) [16%, 9-28, 0.542]
Sunshine Coast	20% (145/734) [20%, 17-23, 0.098]	19% (168/892) [19%, 17-22, 0.75]
Torres and Cape	7% (2/30) [6%, 2-22, 0.115]	4% (2/47) [4%*, 1-14, 0.017]
Townsville	20% (81/409) [18%, 15-23, 0.52]	21% (90/434) [20%, 17-25, 0.424]
West Moreton	16% (64/402) [15%, 12-19, 0.287]	16% (73/457) [15%, 12-19, 0.051]
Wide Bay	18% (97/550) [18%, 15-22, 0.66]	19% (137/717) [19%, 16-22, 0.86]
Queensland	**17% (1368/7898)**	**19% (1662/8801)**

Adjusted by age and sex. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

1.4 | Patient characteristics

Diagnosis year 2005-2009

1.4.1 | What are the characteristics of patients with cancer who receive lung cancer surgery?

Surgery Number		2005-2009 Diagnosis year						
(Number of cancer patients receiving lung cancer surgery)		Median Age at Diagnosis	% Male	% Age 75+	% Rural & Remote	% Disadvantaged	% Indigenous	% With Comorbidity
Principal referral hospitals	Hospital 281	65 yrs	44%	19%	0%	9%	0%	22%
	Hospital 92	65 yrs	57%	21%	2%	26%	1%	35%
	Hospital 4	65 yrs	68%	18%	2%	31%	5%	44%
	Hospital 18	66 yrs	64%	16%	8%	27%	1%	48%
	Hospital 12	62 yrs	63%	9%	92%	32%	4%	32%
Group A hospitals	Hospital 96	69 yrs	70%	35%	2%	19%	0%	47%
	Hospital 143	67 yrs	61%	20%	8%	16%	0%	49%
	Hospital 149	69 yrs	42%	27%	0%	4%	0%	12%
	Hospital 85	65 yrs	54%	15%	12%	35%	0%	58%
	Hospital 90	64 yrs	25%	50%	0%	0%	0%	25%
	Hospital 57	67 yrs	63%	16%	5%	21%	0%	79%
	Hospital 51	67 yrs	56%	23%	12%	21%	0%	66%
Group B hospitals	Hospital 125	65 yrs	63%	17%	94%	29%	0%	37%
Other hospitals	Hospital 2904	71 yrs	65%	41%	0%	8%	0%	35%
Queensland		**67 yrs**	**62%**	**20%**	**16%**	**23%**	**1%**	**45%**

Refer to Appendix 1 for hospital grouping definitions

Diagnosis year 2010-2014

1.4.2 | What are the characteristics of patients with cancer who receive lung cancer surgery?

Surgery Number *(Number of cancer patients receiving lung cancer surgery)*		2010-2014 Diagnosis year						
		Median Age at Diagnosis	% Male	% Age 75+	% Rural & Remote	% Disadvantaged	% Indigenous	% With Comorbidity
Principal referral hospitals	Hospital 281	67 yrs	44%	17%	0%	7%	0%	28%
	Hospital 92	65 yrs	56%	16%	4%	26%	1%	38%
	Hospital 4	66 yrs	50%	21%	5%	28%	3%	34%
	Hospital 18	67 yrs	58%	20%	5%	32%	2%	47%
	Hospital 12	66 yrs	54%	13%	92%	28%	8%	37%
Group A hospitals	Hospital 96	71 yrs	66%	35%	5%	18%	1%	44%
	Hospital 143	69 yrs	55%	27%	5%	15%	0%	44%
	Hospital 149	71 yrs	46%	36%	3%	1%	0%	28%
	Hospital 111	65 yrs	33%	0%	0%	0%	0%	67%
	Hospital 85	68 yrs	75%	17%	8%	17%	0%	42%
	Hospital 90	54 yrs	100%	0%	0%	100%	0%	100%
	Hospital 57	69 yrs	75%	11%	7%	32%	0%	61%
	Hospital 51	69 yrs	57%	27%	9%	27%	0%	51%
Group B hospitals	Hospital 125	67 yrs	67%	19%	92%	29%	1%	50%
Other hospitals	Hospital 2904	70 yrs	36%	30%	0%	3%	0%	42%
Queensland		**68 yrs**	**56%**	**22%**	**17%**	**23%**	**1%**	**43%**

Refer to Appendix 1 for hospital grouping definitions

1.5 | Queenslanders receiving lung cancer surgery

Diagnosis year 2005-2009 and 2010-2014

1.5.1 | How many lung surgeries are performed by each hospital?

Surgery Number *(Number of cancer patients receiving lung cancer surgery)*		2005-2009 Diagnosis year Surgery number	2010-2014 Diagnosis year Surgery number
Principal referral hospitals	Hospital 281	32	89
	Hospital 92	129	203
	Hospital 4	106	151
	Hospital 18	368	332
	Hospital 12	93	123
Group A hospitals	Hospital 96	127	124
	Hospital 143	201	218
	Hospital 149	26	69
	Hospital 111		6
	Hospital 85	26	12
	Hospital 90	4	1
	Hospital 57	19	28
	Hospital 51	123	169
Group B hospitals	Hospital 125	65	104
Other hospitals	Hospital 2904	49	33
Queensland		**1368**	**1662**

Refer to Appendix 1 for hospital grouping definitions.

1.6 | Hospitals performing lung cancer surgery

Diagnosis year 2000 – 2014

1.6.1 | Number of hospitals performing lung cancer surgery by year

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
◆ All	14	13	12	11	12	13	11	14	14	12	13	13	12	14	14
■ Public	6	4	4	4	4	4	4	5	5	5	5	5	5	5	6
● Private	8	9	8	7	8	9	7	9	9	7	8	8	7	9	8
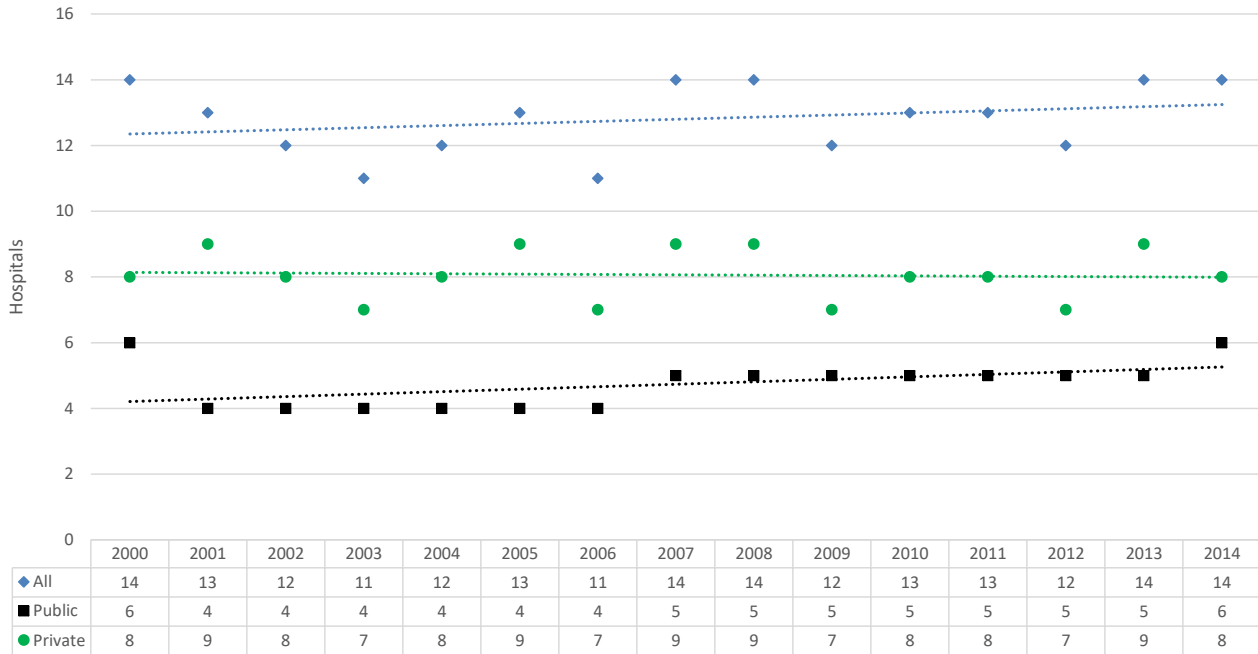
Linear trend lines have been used to approximate the slope and direction of hospital numbers over time

◆ Total unique facilities = 17

■ Total unique public facilities = 7

● Total unique private facilities = 10

2000 - 2004 | Total surgeries: 1240 | N = 15 hospitals

Annual average surgery volume

● Public ● Private
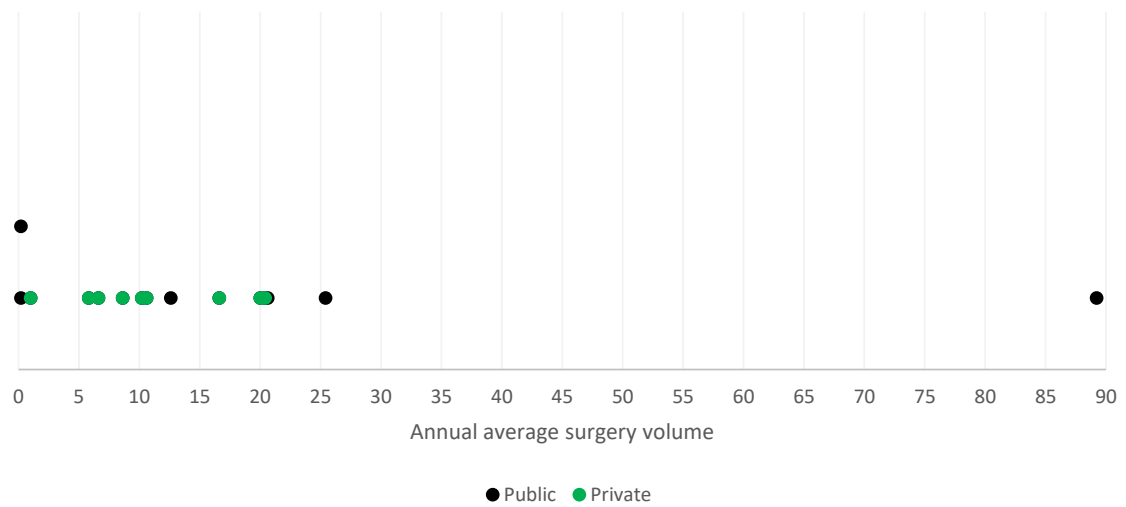
2005 - 2009 | Total surgeries: 1368 | N = 14 hospitals

Annual average surgery volume

● Public ● Private
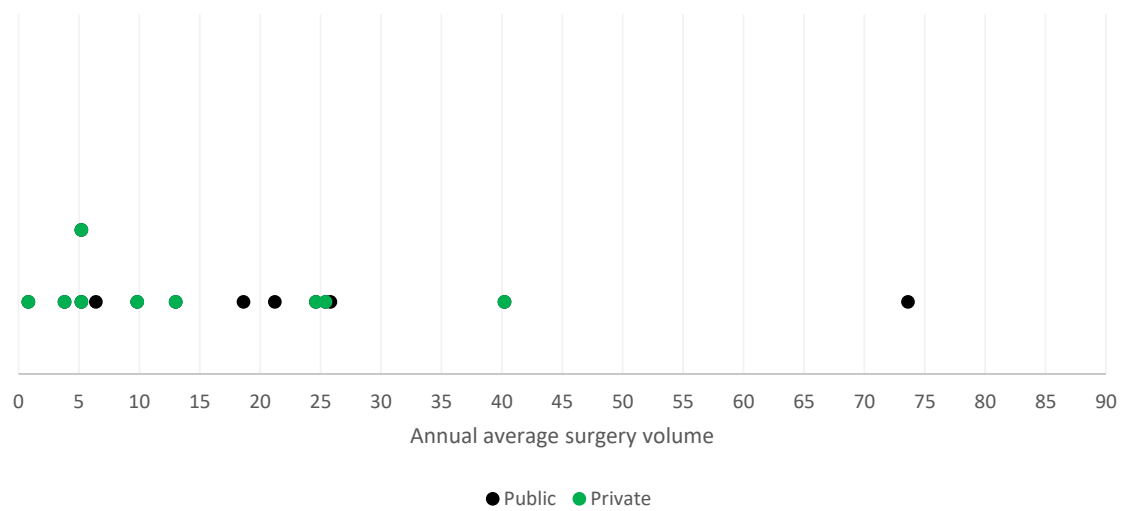
2010 - 2014 | Total surgeries: 1662 | N = 15 hospitals

Annual average surgery volume

● Public ● Private
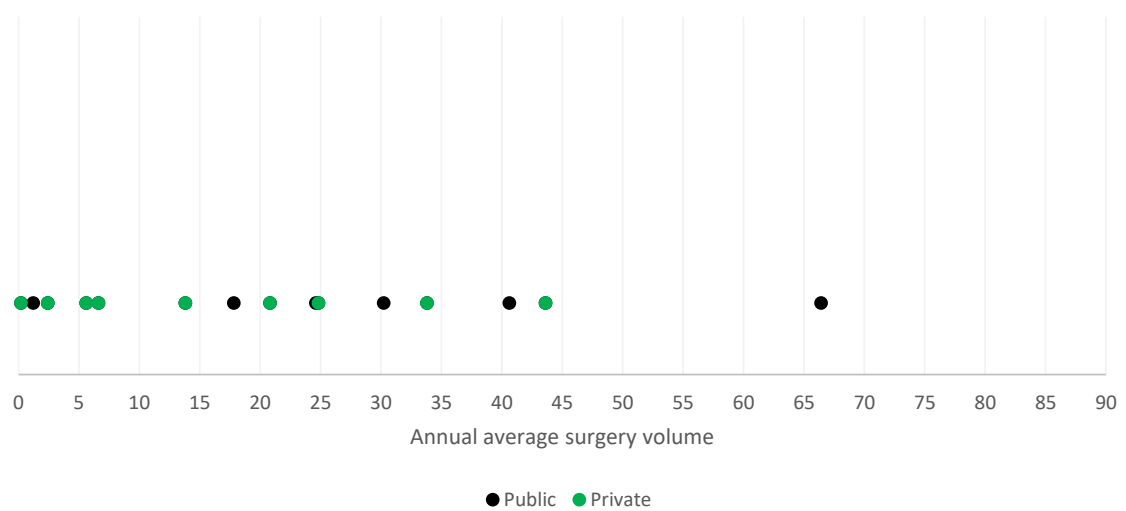
2 | Efficient

Optimally using resources to achieve desired outcomes.

2.1 | Hospital stay

Diagnosis year 2005-2009 and 2010-2014

2.1.1 | How long do people having lung cancer surgery stay in hospital?

Length of stay *(Median length of stay for patients receiving lung cancer surgery)*		2005-2009 Diagnosis year Median (IQR)*	2010-2014 Diagnosis year Median (IQR)*
Principal referral hospitals	Hospital 281	8 (7-12)	7 (6-11)
	Hospital 92	5 (4-7)	5 (4-7)
	Hospital 4	7 (5-9)	6 (5-8)
	Hospital 18	8 (7-9)	7 (6-9)
	Hospital 12	7 (6-11)	7 (6-10)
Group A hospitals	Hospital 96	10 (8-14)	7 (6-10)
	Hospital 143	7 (6-9)	7 (6-8)
	Hospital 149	9 (8-12)	8 (6-11)
	Hospital 111		6 (3-10)
	Hospital 85	9 (8-12)	11 (6-25)
	Hospital 90	6 (5-15)	28 (28-28)
	Hospital 57	14 (10-27)	13 (8-19)
	Hospital 51	6 (5-8)	9 (6-13)
Group B hospitals	Hospital 125	7 (7-10)	8 (6-12)
Other hospitals	Hospital 2904	10 (7-13)	7 (5-9)
Queensland		7 (4-9)	7 (6-10)

* For a description on Interquartile range (IQR) - refer to definitions
Refer to Appendix 1 for hospital grouping definitions
Blank spaces indicate that no surgery occurred

3 | Safe

Avoiding and preventing adverse outcomes or injuries caused by healthcare management.

3.1 | In-hospital mortality

Diagnosis year 2005-2009 and 2010-2014

3.1.1 | What percentage of patients die in hospital after lung cancer surgery?

| *In-Hospital mortality* *(% patients who die in hospital following lung cancer surgery)*		**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	3.1% (1/32) [4%, 1-30, 0.331]	0% (0/89) [0%, 0-100, 1]
	Hospital 92	0.8% (1/129) [0.8%, 0-6, 0.59]	0% (0/203) [0%, 0-100, 1]
	Hospital 4	0.9% (1/106) [0.9%, 0-7, 0.623]	0.7% (1/151) [0.8%, 0-6, 0.993]
	Hospital 18	0.5% (2/368) [0.5%, 0-2, 0.175]	0.6% (2/332) [0.7%, 0-3, 0.825]
	Hospital 12	3.2% (3/93) [3.5%, 1-12, 0.166]	0% (0/123) [0%, 0-100, 1]
Group A hospitals	Hospital 96	3.9% (5/127) [3.4%, 1-9, 0.092]	0% (0/124) [0%, 0-100, 1]
	Hospital 143	0% (0/201) [0%, 0-100, 1]	0% (0/218) [0%, 0-100, 1]
	Hospital 149	0% (0/26) [0%, 0-100, 1]	4.3% (3/69) [5%**, 1-18, 0.004]
	Hospital 111		0% (0/6) [0%, 0-100, 1]
	Hospital 85	0% (0/26) [0%, 0-100, 1]	0% (0/12) [0%, 0-100, 1]
	Hospital 90	0% (0/4) [0%, 0-100, 1]	0% (0/1) [0%, 0-100, 1]
	Hospital 57	5.3% (1/19) [5.2%, 1-39, 0.213]	3.6% (1/28) [3.4%, 0-27, 0.155]
	Hospital 51	4.9% (6/123) [5.3%**, 2-13, 0.006]	0.6% (1/169) [0.6%, 0-5, 0.798]
Group B hospitals	Hospital 125	0% (0/65) [0%, 0-100, 1]	2.9% (3/104) [2%, 0-9, 0.225]
Other hospitals	Hospital 2904	0% (0/49) [0%, 0-100, 1]	6.1% (2/33) [7.1%**, 2-32, 0.004]
Queensland		**1.5% (20/1368)**	**0.8% (13/1662)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

3.1.2 | In-hospital mortality following lung cancer surgery by hospital volume
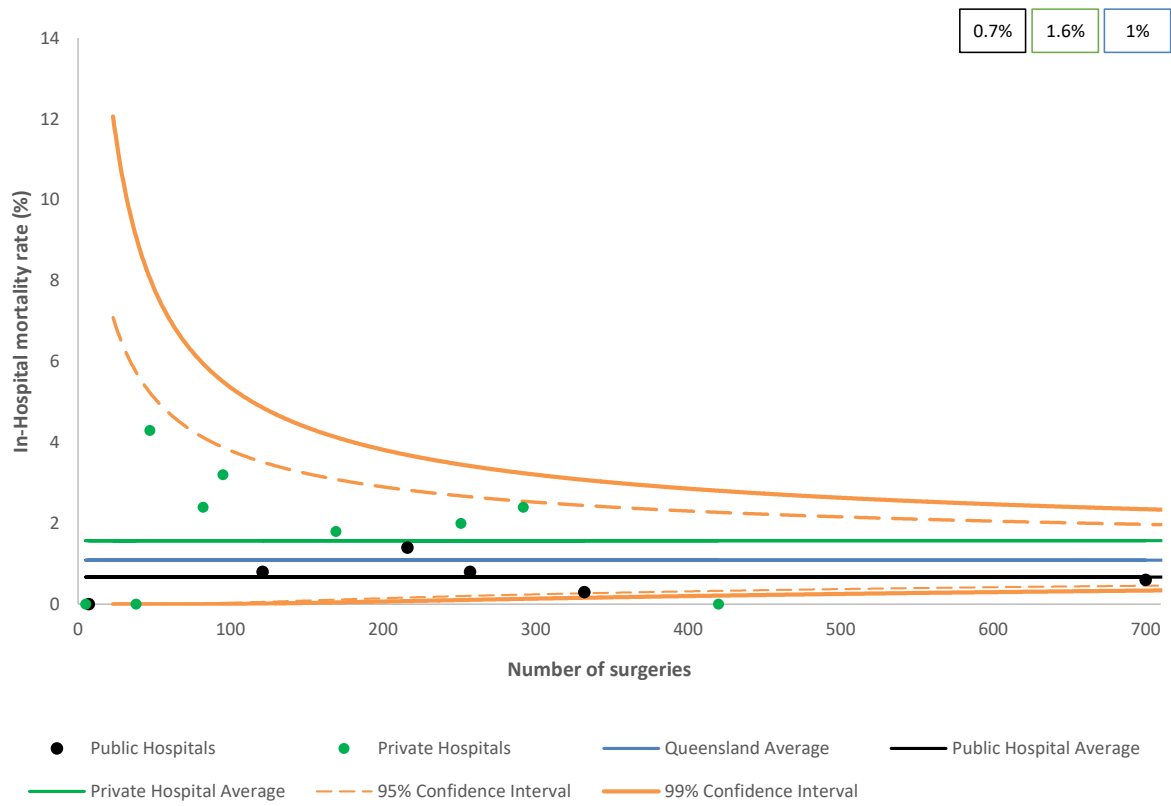
Diagnosis year 2005-2014

Crude rates, 10 years combined

3.1.3 | Relative risk of in-hospital mortality following lung cancer surgery

Better outcomes   Poorer

Age per 10 yr — 1.0

Male — 3.4

SocioDisadvantaged — 0.9

Rural — 0.8

Comorbidity = 1 — 1.1

Comorbidity = 2+ — 3.8

ASA 3+ — 3.1

Public Hospital — 0.5

0.01   1   100

The above graph (forest plot) is a graphical display of the hazard ratios for each covariate in the analysis. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. The central vertical line represents no effect, if the confidence intervals for an estimate cross this central vertical line then the effect is considered not to be statistically significant.

Aboriginal and Torres Strait Islander status has been excluded due to low numbers.

Refer to Appendix 1 for hospital grouping definitions

3.2 | 30 day mortality

Diagnosis year 2005-2009 and 2010-2014

3.2.1 | What percentage of patients die within 30 days of lung cancer surgery?

30 day mortality *(% patients who die ≤ 30 days following lung cancer surgery)*		2005-2009 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]	2010-2014 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	0% (0/32) [0%, 0-100, 1]	0% (0/89) [0%, 0-100, 1]
	Hospital 92	1.6% (2/129) [1.7%, 0-7, 0.986]	0.5% (1/203) [0.6%, 0-4, 0.651]
	Hospital 4	0.9% (1/106) [0.9%, 0-7, 0.534]	0.7% (1/151) [0.8%, 0-6, 0.9]
	Hospital 18	0.8% (3/368) [0.8%, 0-3, 0.241]	0.3% (1/332) [0.3%, 0-3, 0.33]
	Hospital 12	3.2% (3/93) [3.7%, 1-13, 0.196]	1.6% (2/123) [2%, 0-9, 0.3]
Group A hospitals	Hospital 96	3.9% (5/127) [3.2%, 1-9, 0.191]	0.8% (1/124) [0.7%, 0-5, 0.764]
	Hospital 143	1% (2/201) [1%, 0-4, 0.469]	0% (0/218) [0%, 0-100, 1]
	Hospital 149	0% (0/26) [0%, 0-100, 1]	5.8% (4/69) [6.8%**, 2-21, 0]
	Hospital 111		0% (0/6) [0%, 0-100, 1]
	Hospital 85	0% (0/26) [0%, 0-100, 1]	0% (0/12) [0%, 0-100, 1]
	Hospital 90	0% (0/4) [0%, 0-100, 1]	0% (0/1) [0%, 0-100, 1]
	Hospital 57	0% (0/19) [0%, 0-100, 1]	3.6% (1/28) [3.3%, 0-25, 0.214]
	Hospital 51	4.9% (6/123) [5.2%*, 2-13, 0.014]	0.6% (1/169) [0.6%, 0-4, 0.667]
Group B hospitals	Hospital 125	0% (0/65) [0%, 0-100, 1]	2.9% (3/104) [1.9%, 0-8, 0.328]
Other hospitals	Hospital 2904	2% (1/49) [1.6%, 0-12, 0.966]	0% (0/33) [0%, 0-100, 1]
Queensland		**1.7% (23/1368)**	**0.9% (15/1662)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

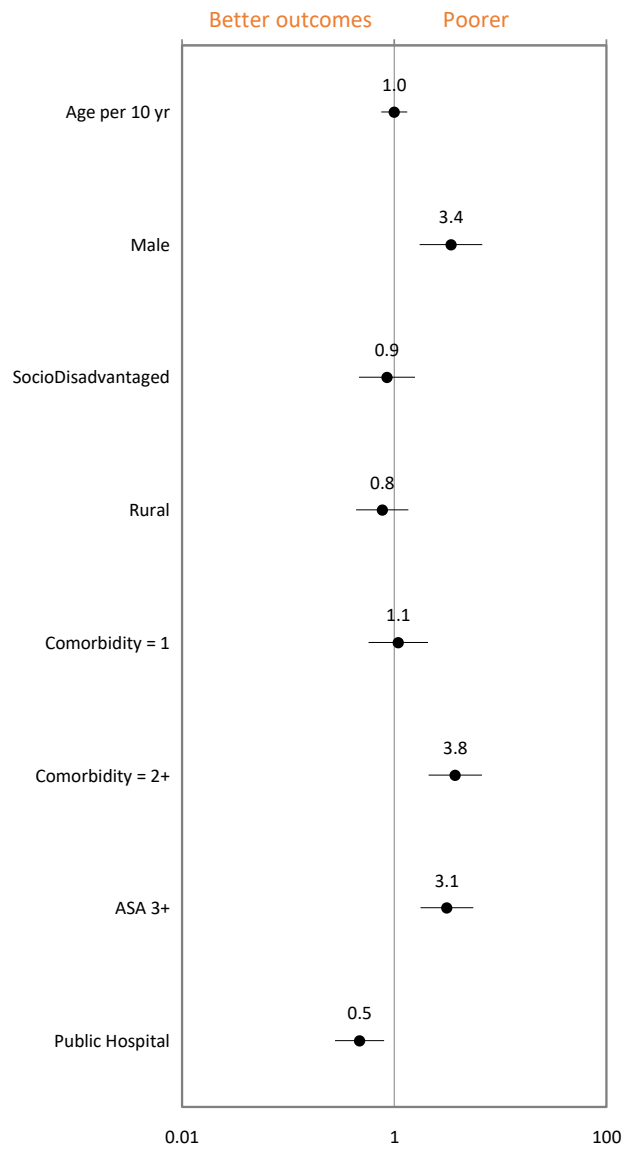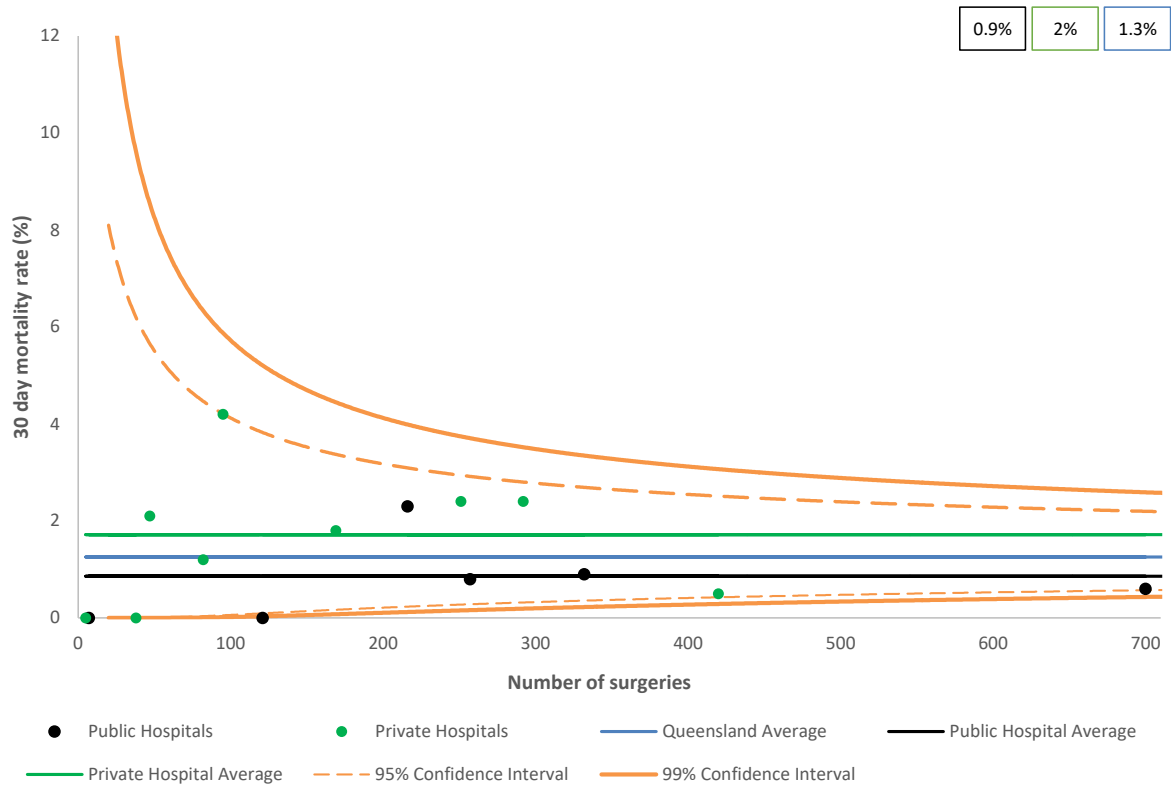Diagnosis year 2005-2014

Crude rates, 10 years combined

3.2.2 | 30 day mortality following lung cancer surgery by hospital volume

Diagnosis year 2005-2014

Crude rates, 10 years combined

3.2.3 | Relative risk of 30 day mortality following lung cancer surgery
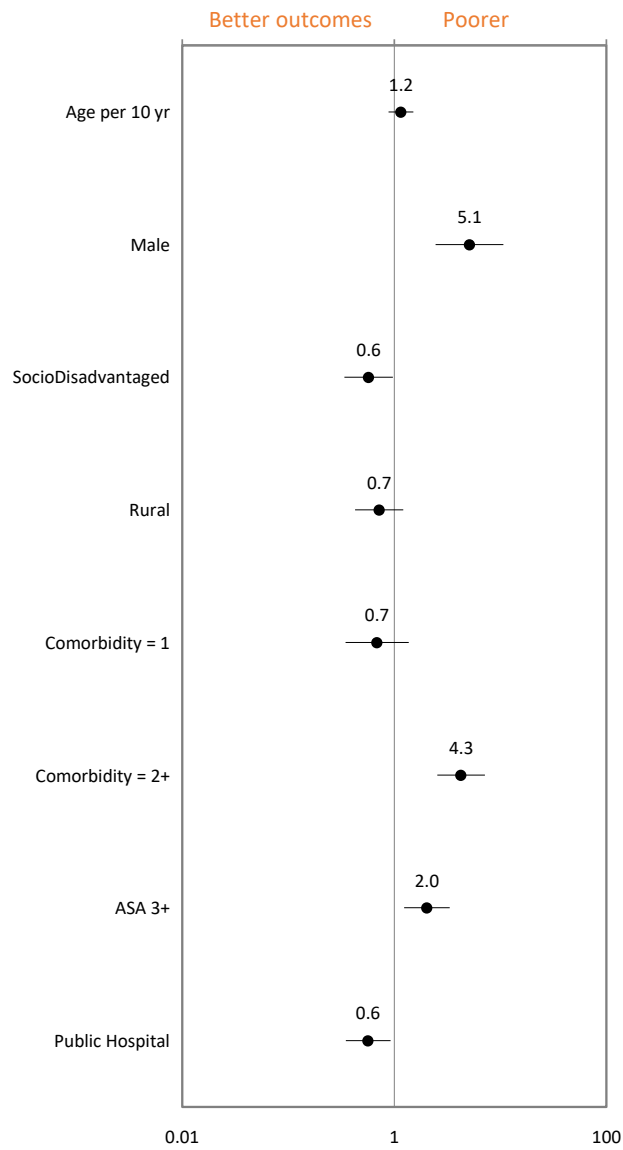
The above graph (forest plot) is a graphical display of the hazard ratios for each covariate in the analysis. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. The central vertical line represents no effect, if the confidence intervals for an estimate cross this central vertical line then the effect is considered not to be statistically significant.

Aboriginal and Torres Strait Islander status has been excluded due to low numbers.

3.3 | 90 day mortality

Diagnosis year 2005-2009 and 2010-2014

3.3.1 | What percentage of patients die within 90 days of lung cancer surgery?

90 day mortality *(% patients who die ≤ 90 days following lung cancer surgery)*		**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	3.1% (1/32) [3.7%, 1-27, 0.951]	0% (0/89) [0%, 0-100, 1]
	Hospital 92	2.3% (3/129) [2.5%, 1-8, 0.593]	2% (4/203) [2.1%, 1-6, 0.848]
	Hospital 4	0.9% (1/106) [0.9%, 0-7, 0.19]	1.3% (2/151) [1.5%, 0-6, 0.53]
	Hospital 18	2.2% (8/368) [2.2%, 1-5, 0.243]	1.2% (4/332) [1.2%, 0-3, 0.225]
	Hospital 12	5.4% (5/93) [6.4%, 3-16, 0.186]	4.1% (5/123) [4.6%, 2-12, 0.159]
Group A hospitals	Hospital 96	5.5% (7/127) [4.6%, 2-10, 0.466]	3.2% (4/124) [2.7%, 1-8, 0.808]
	Hospital 143	1% (2/201) [1%, 0-4, 0.082]	1.4% (3/218) [1.4%, 0-4, 0.362]
	Hospital 149	15.4% (4/26) [17.4%**, 6-48, 0.002]	5.8% (4/69) [6.7%*, 2-19, 0.046]
	Hospital 111		0% (0/6) [0%, 0-100, 1]
	Hospital 85	0% (0/26) [0%, 0-100, 1]	0% (0/12) [0%, 0-100, 1]
	Hospital 90	25% (1/4) [31.8%*, 4-100, 0.029]	0% (0/1) [0%, 0-100, 1]
	Hospital 57	10.5% (2/19) [10.8%, 3-44, 0.113]	3.6% (1/28) [3.1%, 0-23, 0.782]
	Hospital 51	6.5% (8/123) [6.8%, 3-14, 0.075]	3% (5/169) [2.9%, 1-7, 0.681]
Group B hospitals	Hospital 125	3.1% (2/65) [3.1%, 1-13, 0.87]	4.8% (5/104) [3.6%, 1-10, 0.408]
Other hospitals	Hospital 2904	6.1% (3/49) [4.9%, 2-16, 0.551]	6.1% (2/33) [7.5%, 2-31, 0.11]
Queensland		**3.4% (47/1368)**	**2.3% (39/1662)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

3.3.2 | 90 day mortality following lung cancer surgery by hospital volume
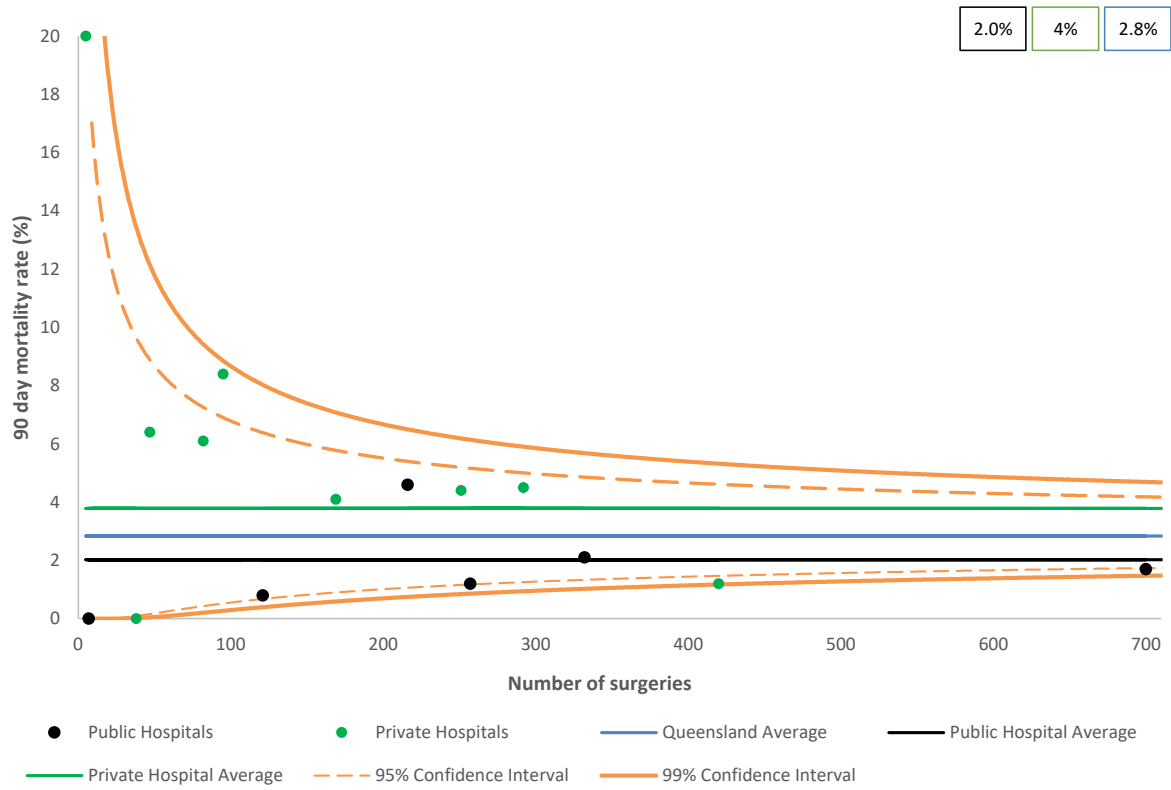
Diagnosis year 2005-2014

Crude rates, 10 years combined

3.3.3 | Relative risk of 90 day mortality following lung cancer surgery
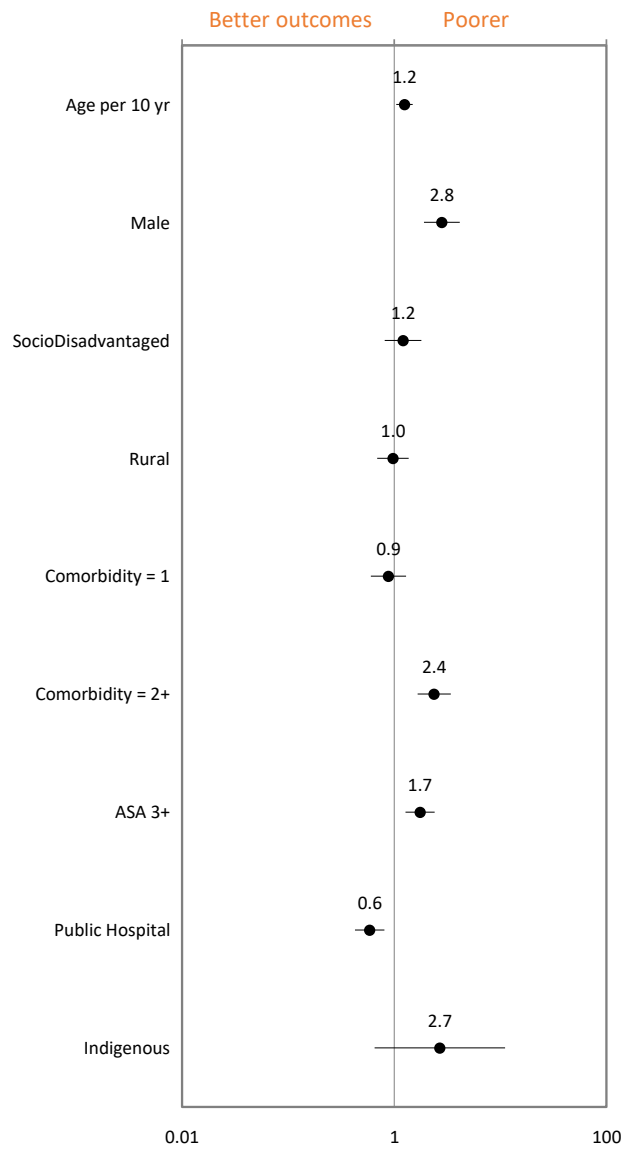
The above graph (forest plot) is a graphical display of the hazard ratios for each covariate in the analysis. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. The central vertical line represents no effect, if the confidence intervals for an estimate cross this central vertical line then the effect is considered not to be statistically significant.

3.4 | 1 year surgical survival

Diagnosis year 2005-2009 and 2010-2014

3.4.1 | What percentage of patients are alive one year after lung cancer surgery?

1 year surgical survival *(% patients alive 1 year after lung cancer surgery)*		**2005-2009** **Diagnosis year** Crude rates [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	84% [82%, 57-93, 0.504]	94% [94%, 85-97, 0.46]
	Hospital 92	90% [90%, 82-94, 0.388]	93% [92%, 87-95, 0.625]
	Hospital 4	92% [93%, 85-96, 0.1]	96% [96%, 91-98, 0.069]
	Hospital 18	88% [88%, 83-91, 0.734]	93% [93%, 89-95, 0.358]
	Hospital 12	85% [84%, 72-90, 0.412]	88% [87%, 77-92, 0.134]
Group A hospitals	Hospital 96	85% [86%, 78-91, 0.79]	90% [92%, 85-95, 0.871]
	Hospital 143	92% [92%, 87-95, 0.061]	93% [93%, 88-96, 0.418]
	Hospital 149	77% [73%, 40-88, 0.089]	88% [88%, 75-94, 0.344]
	Hospital 111		100% [100%, 0-100, 1]
	Hospital 85	100% [100%, 0-100, 1]	100% [100%, 0-100, 1]
	Hospital 90	75% [70%, 0-96, 0.401]	100% [100%, 0-100, 1]
	Hospital 57	68% [65%*, 21-84, 0.018]	89% [91%, 70-97, 0.914]
	Hospital 51	84% [83%, 73-89, 0.272]	87% [87%, 80-92, 0.1]
Group B hospitals	Hospital 125	83% [83%, 68-91, 0.367]	84% [85%*, 75-91, 0.04]
Other hospitals	Hospital 2904	73% [73%*, 53-85, 0.014]	88% [87%, 63-95, 0.405]
Queensland		**87%**	**91%**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

3.4.2 | 1 year surgical survival following lung cancer surgery by hospital volume
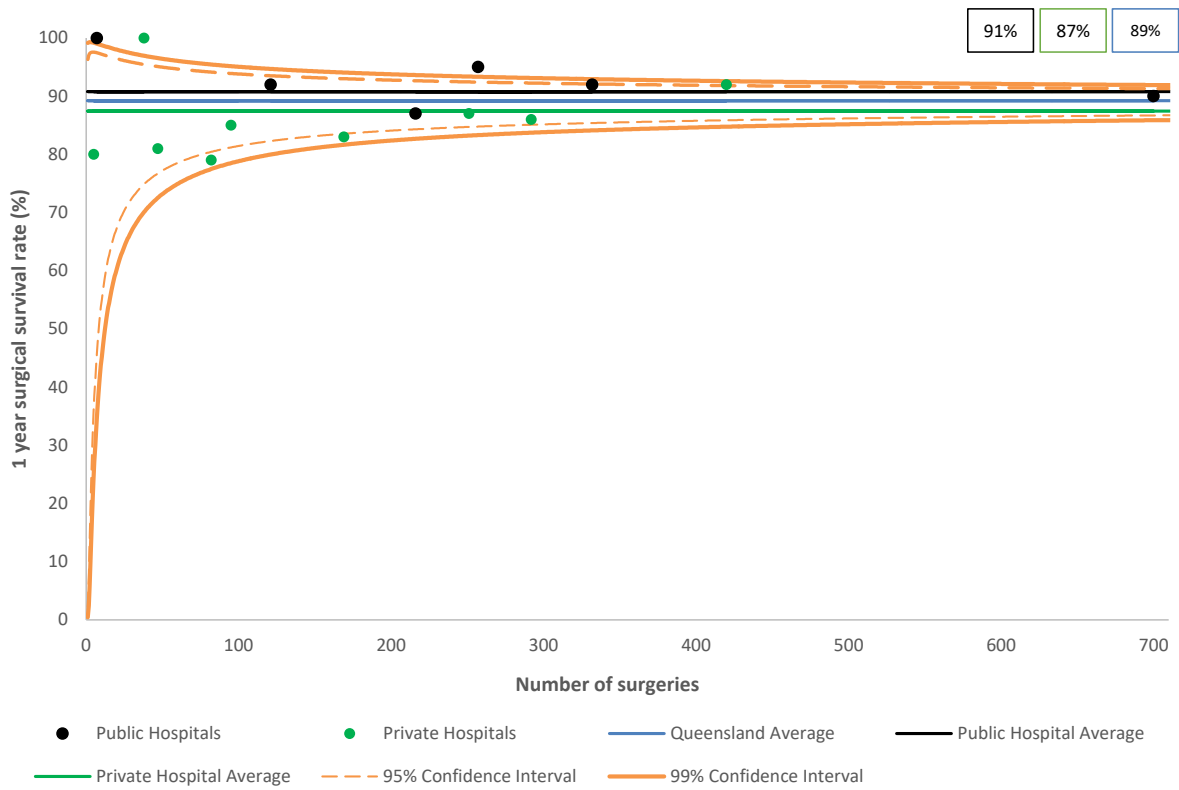
Diagnosis year 2005-2014

Crude rates, 10 years combined

3.4.3 | 1 year survival following lung cancer surgery

Better outcomes   Poorer

Age per 10 yr	1.1
Male	1.7
SocioDisadvantaged	1.2
Rural	1.2
Comorbidity = 1	1.2
Comorbidity = 2+	2.5
ASA 3+	1.3
Public Hospital	0.8
Indigenous	1.7

0.01   1   100

The above graph (forest plot) is a graphical display of the hazard ratios for each covariate in the analysis. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. The central vertical line represents no effect, if the confidence intervals for an estimate cross this central vertical line then the effect is considered not to be statistically significant.

3.5 | 2 year surgical survival

Diagnosis year 2005-2009 and 2010-2014

3.5.1 | What percentage of patients are alive two years after lung cancer surgery?

| *2 year surgical survival* *(% patients alive 2 year after lung cancer surgery)*		**2005-2009** **Diagnosis year** Crude rates [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	72% [69%, 40-84, 0.638]	90% [89%, 79-95, 0.131]
	Hospital 92	80% [80%, 70-87, 0.168]	85% [85%, 78-90, 0.387]
	Hospital 4	78% [80%, 69-87, 0.223]	89% [90%*, 83-94, 0.041]
	Hospital 18	74% [74%, 68-80, 0.782]	86% [86%, 81-90, 0.115]
	Hospital 12	75% [74%, 60-83, 0.971]	78% [77%, 65-84, 0.166]
Group A hospitals	Hospital 96	71% [72%, 61-80, 0.718]	80% [81%, 72-88, 0.787]
	Hospital 143	80% [81%, 73-86, 0.058]	83% [84%, 77-88, 0.678]
	Hospital 149	73% [70%, 36-86, 0.73]	83% [82%, 68-90, 0.961]
	Hospital 111		83% [77%, 0-97, 0.782]
	Hospital 85	81% [81%, 55-92, 0.437]	92% [93%, 48-99, 0.375]
	Hospital 90	50% [35%, 0-84, 0.209]	100% [100%, 0-100, 1]
	Hospital 57	47% [36%**, 0-66, 0.005]	82% [84%, 60-93, 0.873]
	Hospital 51	67% [66%, 52-75, 0.11]	76% [76%, 67-83, 0.074]
Group B hospitals	Hospital 125	63% [61%, 41-74, 0.061]	66% [65%**, 50-75, 0]
Other hospitals	Hospital 2904	61% [58%, 34-74, 0.053]	70% [67%*, 37-82, 0.049]
Queensland		**74%**	**82%**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
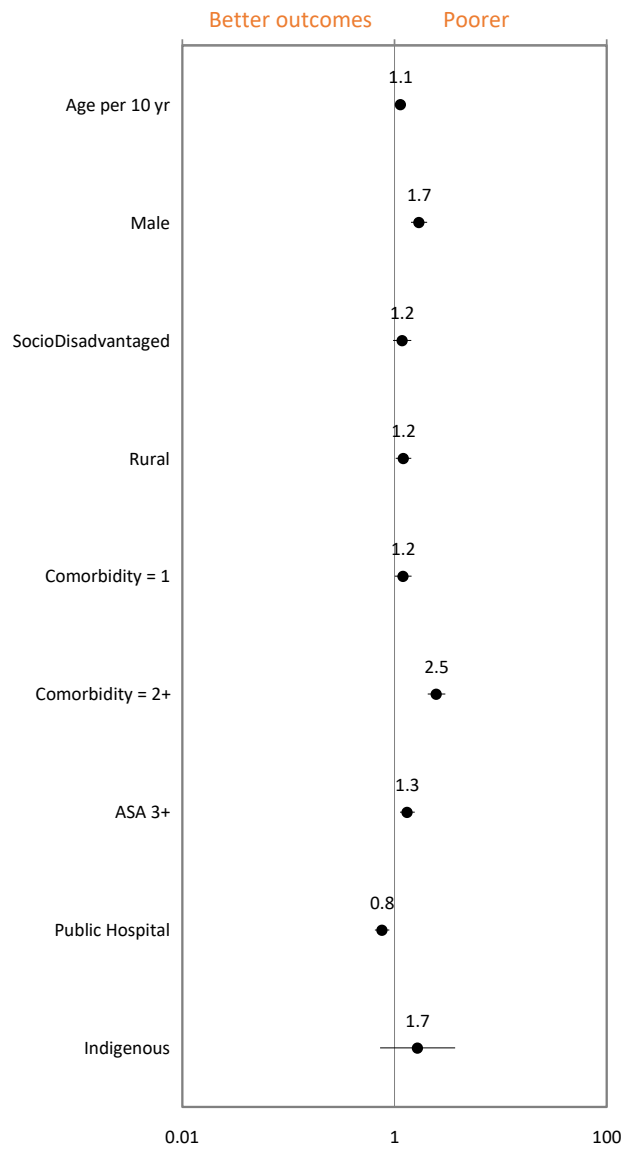Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

3.5.2 | 2 year surgical survival following lung cancer surgery by hospital volume
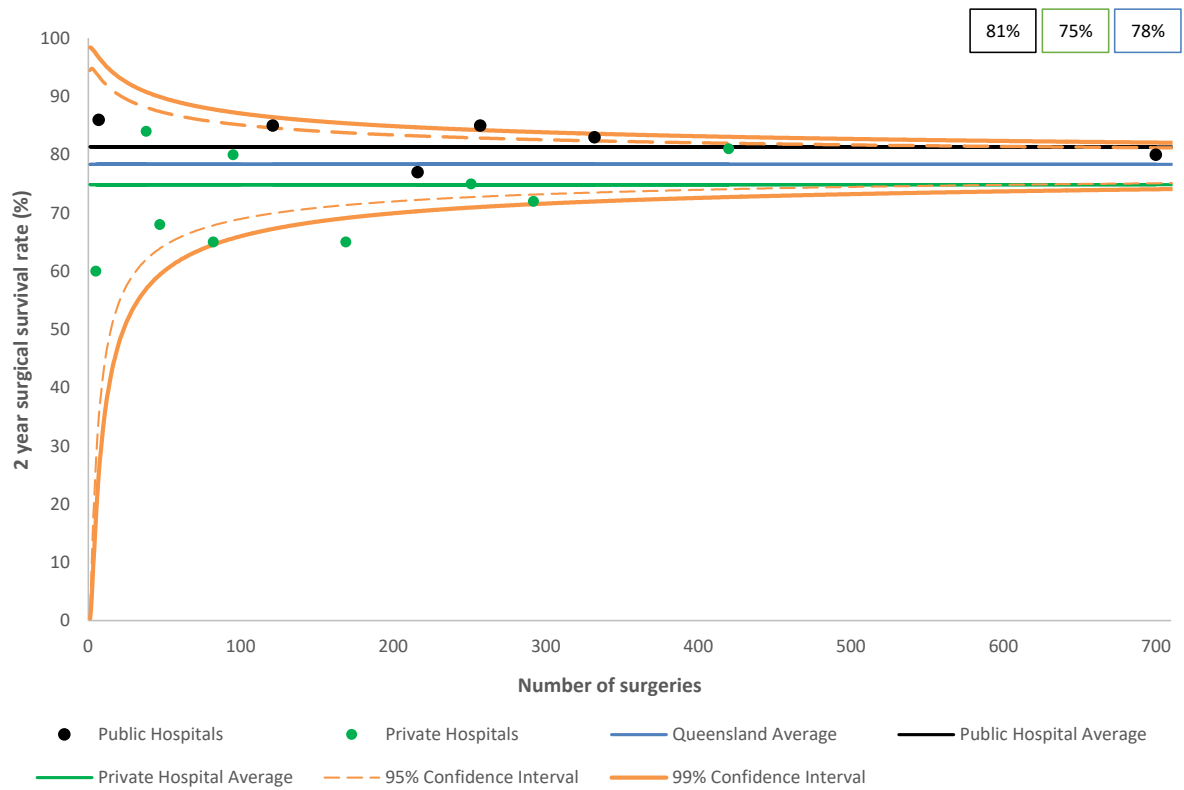
Diagnosis year 2005-2014

Crude rates, 10 years combined

3.5.3 | 2 year survival following lung cancer surgery
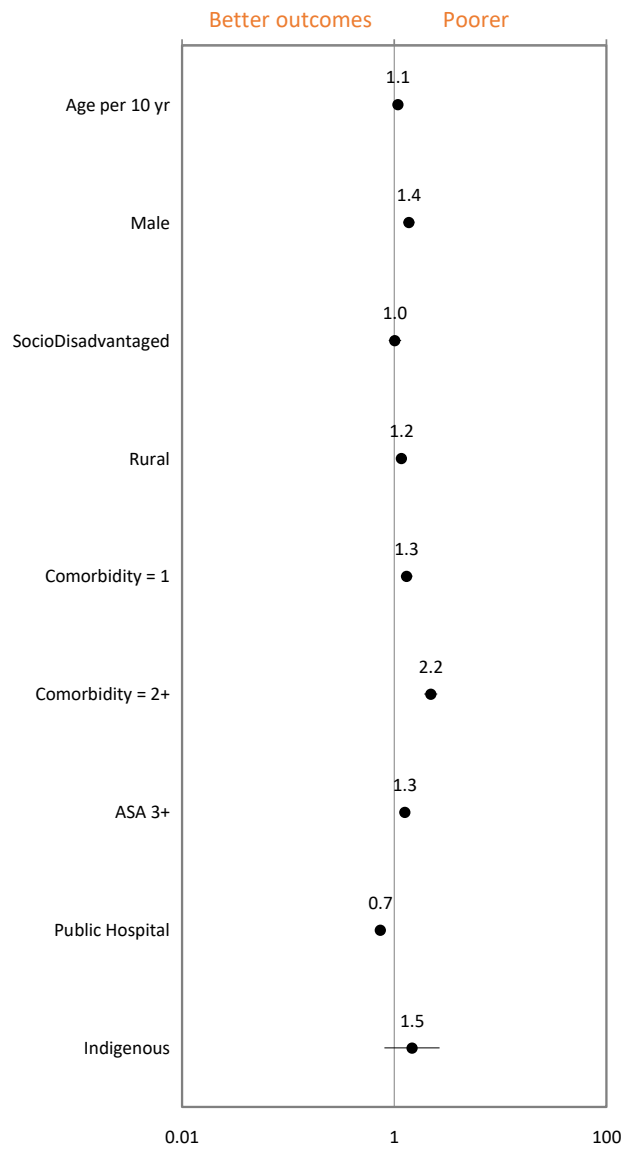
The above graph (forest plot) is a graphical display of the hazard ratios for each covariate in the analysis. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. The central vertical line represents no effect, if the confidence intervals for an estimate cross this central vertical line then the effect is considered not to be statistically significant.

4 | Accessible

Making health services available in the most suitable setting in a reasonable time.

Timeliness – cohort definition

Diagnosis year 2005-2009 and 2010-2014

How many patients received lung cancer surgery as their first treatment following diagnosis?

Cancer incidence	Diagnosis year	
by treatment first received	2005-2009	2010-2014
Lung surgery as first treatment	1,247	1,570
Other* as first treatment	121	92
Total lung surgery	**1,368**	**1,662**

*Other includes systemic therapy, radiotherapy or both

All subsequent tables in section 4 and 5 include patients where lung cancer surgery was first treatment received.

4.1 | Timeliness

Diagnosis year 2005-2009 and 2010-2014

4.1.1 | What percentage of patients receive lung cancer surgery within 45 days of diagnosis?
Includes patients where lung cancer surgery was first treatment received.

Received surgery within 45 days (% patients whose time from diagnosis to lung cancer surgery is ≤45 days)		2005-2009 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]	2010-2014 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	55% (17/31) [54%*, 39-75, 0.038]	59% (52/88) [58%, 49-69, 0.053]
	Hospital 92	55% (70/127) [55%**, 47-64, 0]	34% (68/199) [34%**, 28-41, 0]
	Hospital 4	63% (67/106) [63%*, 55-73, 0.015]	65% (95/147) [64%, 57-72, 0.219]
	Hospital 18	68% (221/327) [68%**, 62-73, 0.005]	59% (179/304) [59%**, 53-65, 0.001]
	Hospital 12	66% (55/83) [66%, 56-77, 0.066]	78% (94/120) [77%*, 70-86, 0.027]
Group A hospitals	Hospital 96	89% (109/122) [90%**, 84-97, 0]	79% (96/121) [81%**, 74-89, 0.001]
	Hospital 143	90% (164/182) [90%**, 85-95, 0]	76% (145/192) [76%*, 70-83, 0.028]
	Hospital 149	96% (23/24) [96%**, 87-100, 0]	90% (62/69) [90%**, 83-98, 0]
	Hospital 111		60% (3/5) [59%, 29-100, 0.645]
	Hospital 85	100% (25/25) [100%**, 96-100, 0]	75% (9/12) [75%, 53-100, 0.668]
	Hospital 90	100% (4/4) [100%**, 96-100, 0]	100% (1/1) [100%**, 89-99, 0]
	Hospital 57	100% (16/16) [100%**, 97-100, 0]	89% (25/28) [91%**, 80-100, 0]
	Hospital 51	89% (81/91) [89%**, 82-96, 0]	92% (143/155) [93%**, 88-99, 0]
Group B hospitals	Hospital 125	87% (53/61) [87%*, 78-96, 0.01]	87% (85/98) [87%**, 80-94, 0]
Other hospitals	Hospital 2904	88% (42/48) [89%**, 80-99, 0.005]	94% (29/31) [95%**, 85-100, 0]
Queensland		**76% (947/1247)**	**69% (1086/1570)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

4.1.2 | Patients receiving lung cancer surgery within 45 days of diagnosis by facility type
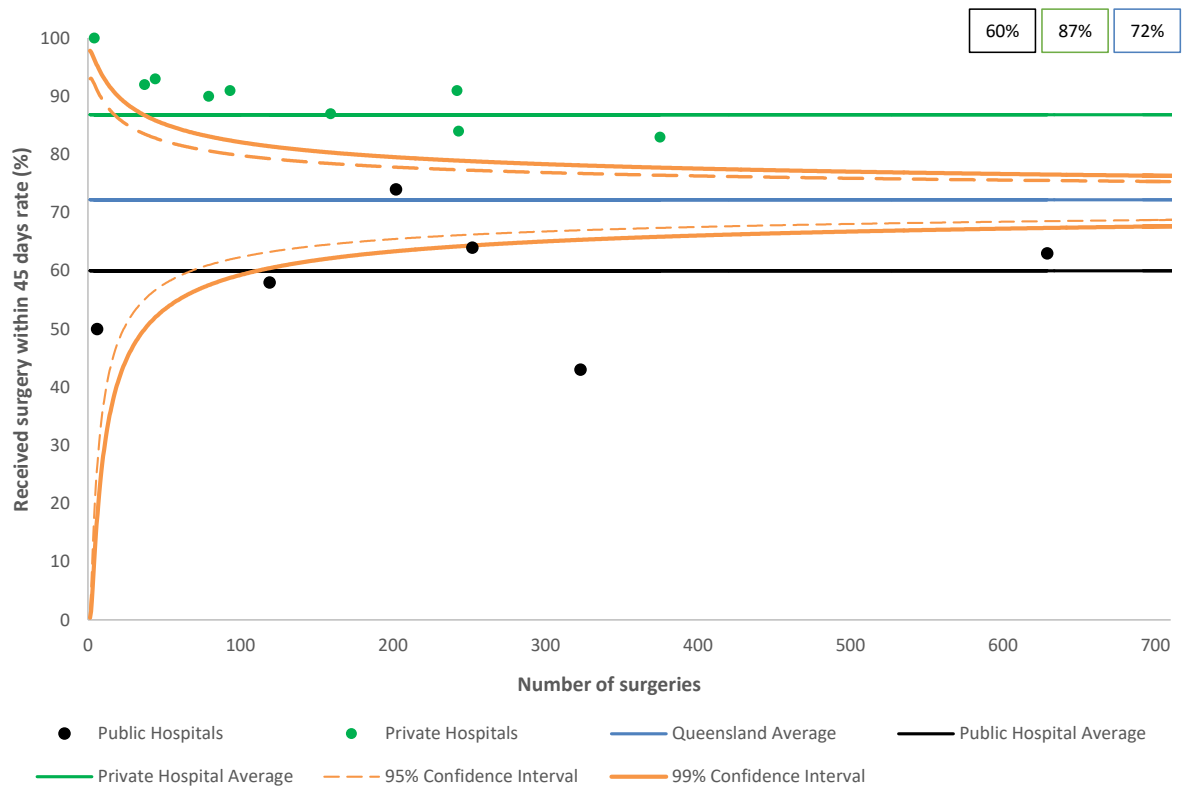
Diagnosis year 2005-2009 and 2010-2014

4.1.3 | What percentage of patients receive lung cancer surgery between 46 and 90 days from diagnosis?

Includes patients where lung cancer surgery was first treatment received.

Received surgery between 46 and 90 days		2005-2009 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]	2010-2014 Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]
(% patients whose time from diagnosis to lung cancer surgery is between 46 and 90 days)			
Principal referral hospitals	Hospital 281	39% (12/31) [41%**, 26-64, 0]	30% (26/88) [31%, 22-43, 0.184]
	Hospital 92	33% (42/127) [34%**, 25-44, 0]	50% (100/199) [51%**, 44-61, 0]
	Hospital 4	29% (31/106) [29%**, 21-40, 0.003]	31% (46/147) [32%*, 25-41, 0.039]
	Hospital 18	24% (78/327) [24%*, 19-30, 0.015]	34% (104/304) [34%**, 29-41, 0]
	Hospital 12	22% (18/83) [22%, 14-34, 0.34]	13% (15/120) [13%**, 8-21, 0.008]
Group A hospitals	Hospital 96	9% (11/122) [9%*, 5-16, 0.015]	16% (19/121) [15%*, 10-23, 0.021]
	Hospital 143	5% (10/182) [6%**, 3-10, 0]	21% (41/192) [21%, 16-28, 0.277]
	Hospital 149	4% (1/24) [4%, 1-29, 0.145]	9% (6/69) [9%**, 4-18, 0.007]
	Hospital 111		20% (1/5) [21%, 4-100, 0.88]
	Hospital 85	0% (0/25) [0%**, 0-0, 0]	25% (3/12) [25%, 9-69, 0.987]
	Hospital 90	0% (0/4) [0%**, 0-0, 0]	0% (0/1) [0%**, 0-0, 0]
	Hospital 57	0% (0/16) [0%**, 0-0, 0]	11% (3/28) [10%, 4-30, 0.113]
	Hospital 51	10% (9/91) [10%, 5-19, 0.074]	5% (7/155) [4%**, 2-9, 0]
Group B hospitals	Hospital 125	10% (6/61) [10%, 5-21, 0.126]	12% (12/98) [12%*, 7-21, 0.01]
Other hospitals	Hospital 2904	10% (5/48) [10%, 4-23, 0.178]	6% (2/31) [6%, 2-25, 0.05]
Queensland		**18% (223/1247)**	**25% (385/1570)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

4.1.4 | Patients receiving lung cancer surgery between 46 and 90 days of diagnosis by facility type

Diagnosis year 2005-2009 and 2010-2014

4.1.5 | What percentage of patients receive lung cancer surgery after 91 days from diagnosis?
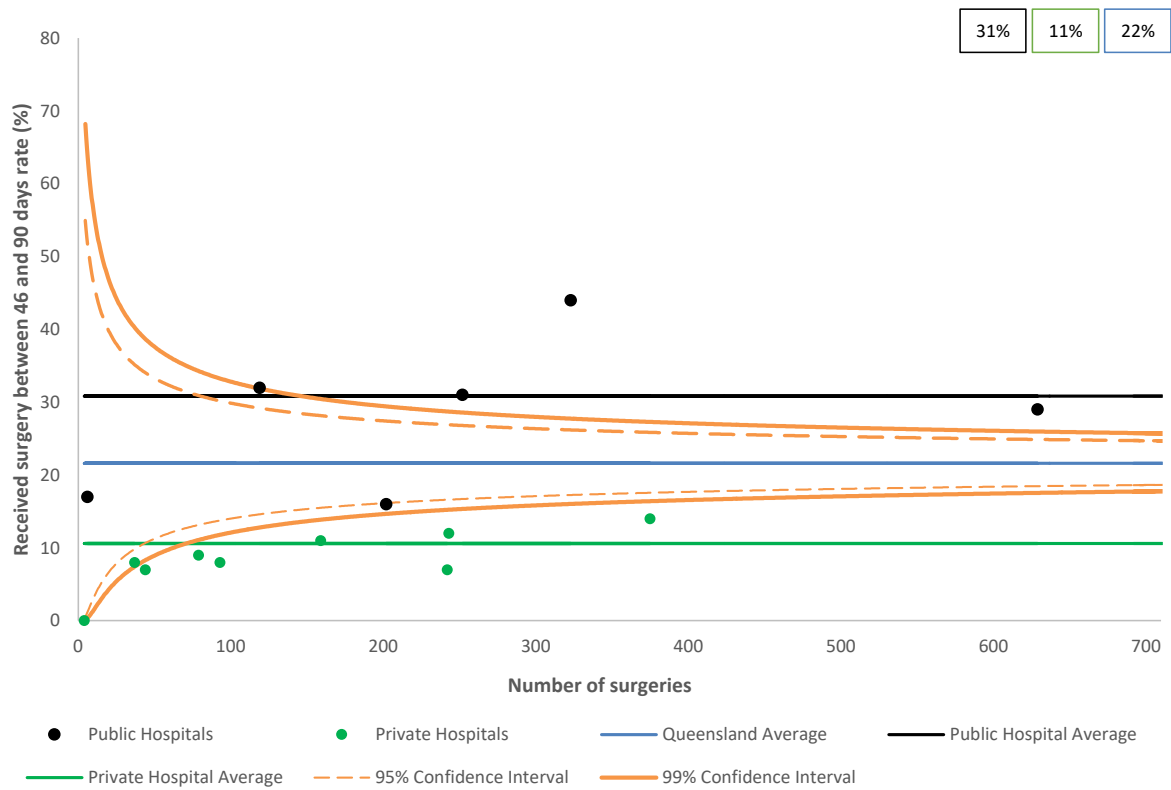**Includes patients where lung cancer surgery was first treatment received**.

Received surgery more than 90 days *(% patients whose time from diagnosis to lung cancer surgery is more than 90 days)*		**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	6% (2/31) [7%, 2-26, 0.924]	11% (10/88) [12%*, 6-22, 0.048]
	Hospital 92	12% (15/127) [12%*, 7-20, 0.011]	16% (31/199) [16%**, 11-23, 0]
	Hospital 4	8% (8/106) [8%, 4-16, 0.534]	4% (6/147) [4%, 2-9, 0.313]
	Hospital 18	9% (28/327) [9%, 6-13, 0.109]	7% (21/304) [7%, 4-11, 0.668]
	Hospital 12	12% (10/83) [13%*, 7-25, 0.016]	9% (11/120) [9%, 5-17, 0.18]
Group A hospitals	Hospital 96	2% (2/122) [2%*, 0-6, 0.048]	5% (6/121) [5%, 2-11, 0.486]
	Hospital 143	4% (8/182) [4%, 2-9, 0.335]	3% (6/192) [3%, 1-7, 0.075]
	Hospital 149	0% (0/24) [0%**, 0-0, 0]	1% (1/69) [1%, 0-10, 0.132]
	Hospital 111		20% (1/5) [21%, 4-100, 0.175]
	Hospital 85	0% (0/25) [0%**, 0-0, 0]	0% (0/12) [0%**, 0-0, 0]
	Hospital 90	0% (0/4) [0%**, 0-0, 0]	0% (0/1) [0%**, 0-0, 0]
	Hospital 57	0% (0/16) [0%**, 0-0, 0]	0% (0/28) [0%**, 0-0, 0]
	Hospital 51	1% (1/91) [1%, 0-8, 0.082]	3% (5/155) [3%, 1-8, 0.119]
Group B hospitals	Hospital 125	3% (2/61) [3%, 1-13, 0.381]	1% (1/98) [1%, 0-7, 0.071]
Other hospitals	Hospital 2904	2% (1/48) [2%, 0-13, 0.232]	0% (0/31) [0%**, 0-0, 0]
Queensland		**6% (77/1247)**	**6% (99/1570)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2005-2014

Crude rates, 10 years combined

4.1.6 | Patients receiving lung cancer surgery after 91 days from diagnosis by facility type

Diagnosis year 2005-2014

Crude rates, 10 years combined

4.1.7 | Distribution of days from diagnosis to lung cancer surgery by facility type

Includes patients where lung cancer surgery was first treatment received.

Public | Median days = 38   Private | Median days = 13
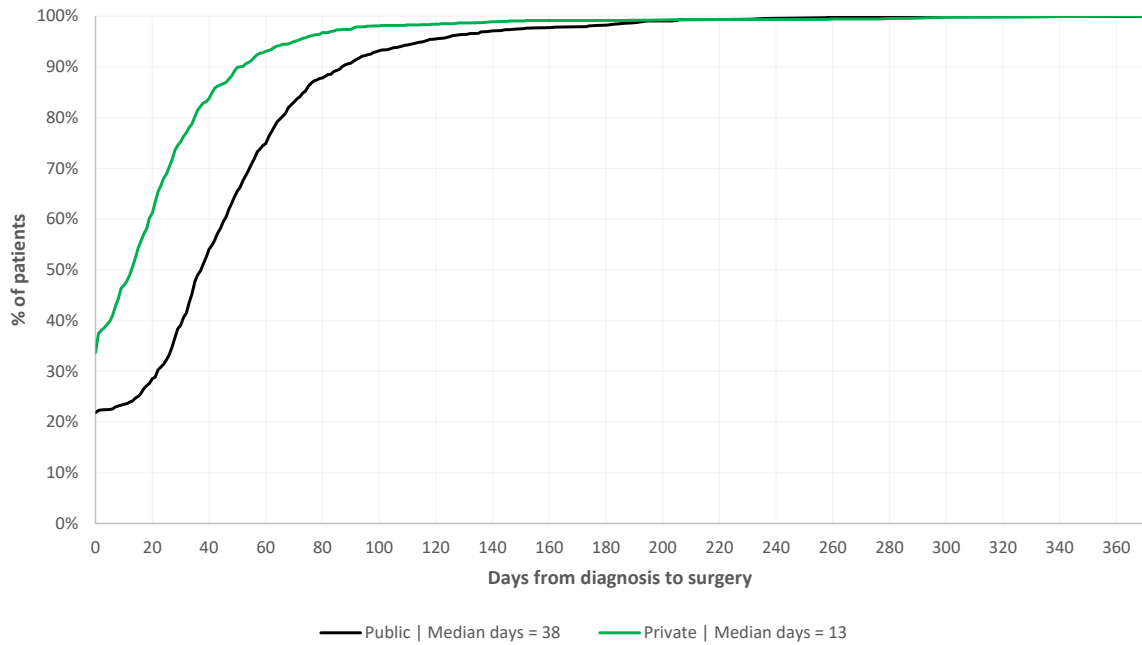
4.2 | Remoteness

Diagnosis year 2005-2009 and 2010-2014

4.2.1 | What percentage of patients living outside a metropolitan area received lung cancer surgery within 45 days of diagnosis?

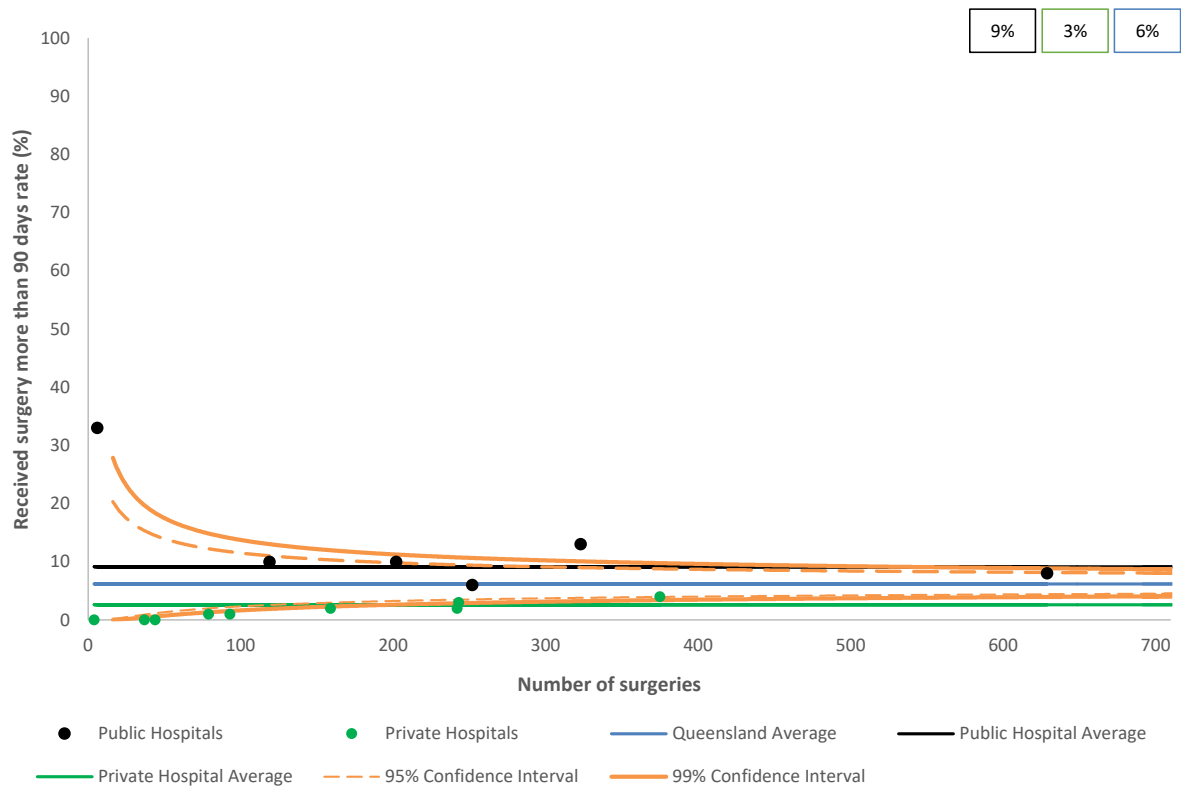**Includes patients where lung cancer surgery was first treatment received.**

Received surgery within 45 days *(% patients whose time from diagnosis to lung cancer surgery is ≤45 days)*	**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Rural	83% (113/136) [83%*, 76-90, 0.04]	83% (157/190) [83%**, 77-89, 0]
Regional	75% (194/257) [76%, 70-82, 0.957]	68% (235/344) [68%, 63-74, 0.803]
Metropolitan	75% (640/854) [75%, 71-79, 0.587]	67% (694/1036) [67%, 63-71, 0.232]
Queensland	**76% (947/1247)**	**69% (1086/1570)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

5 | Equitable

Providing care and ensuring health status does not vary in quality because of personal characteristics (age, socioeconomic status and rurality).
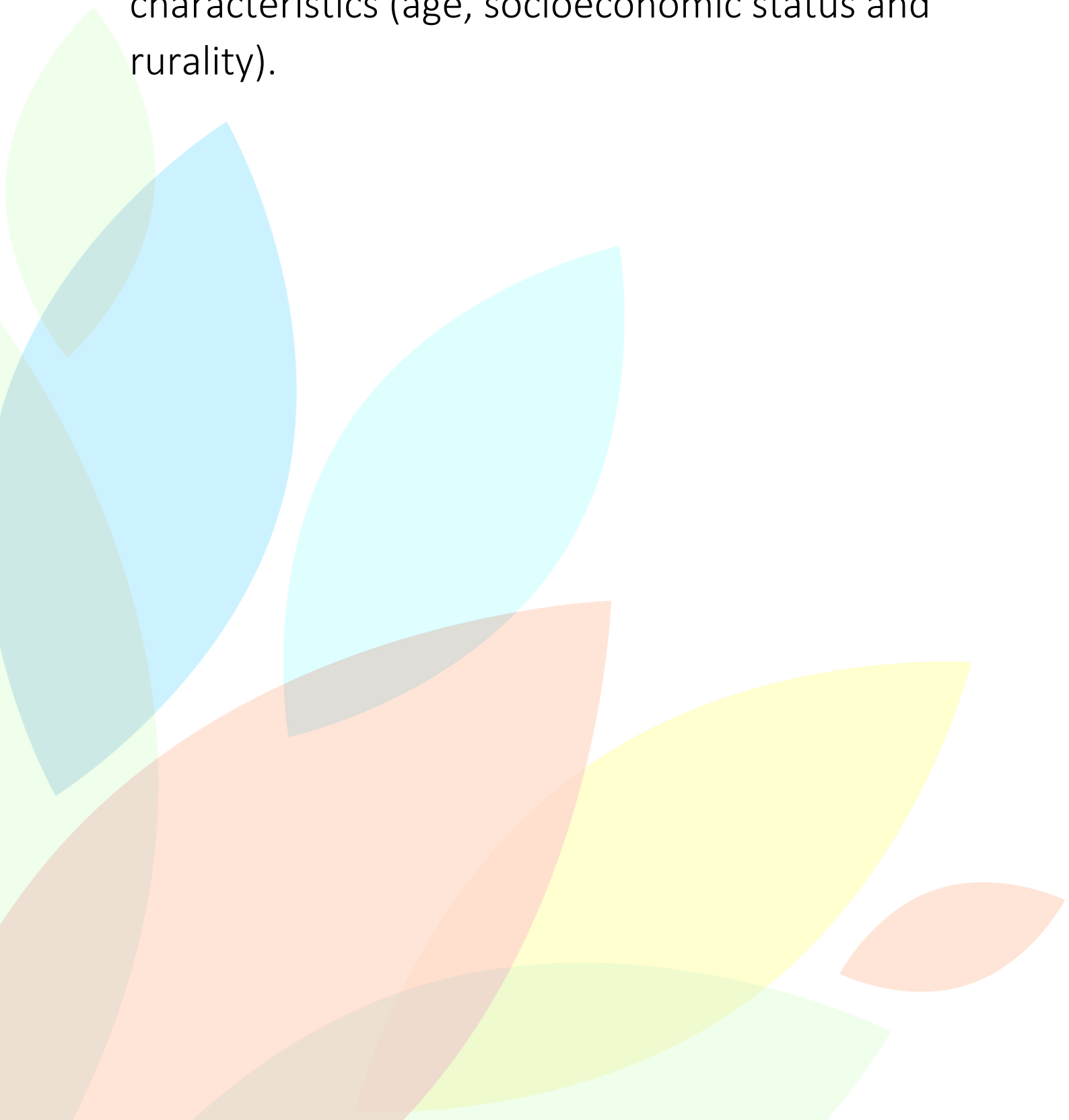
5.1 | Over 75 years

Diagnosis year 2005-2009 and 2010-2014

5.1.1 | What percentage of patients aged ≥75 receive lung cancer surgery within 45 days from diagnosis?
Includes patients where lung cancer surgery was first treatment received.

Received surgery within 45 days *(% of patients aged ≥75 whose time from diagnosis to lung cancer surgery is ≤45 days)*		**2005 - 2009** Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010 - 2014** Diagnosis year Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	40% (2/5) [39%*, 0-73, 0.0027]	33% (5/15) [32%**, 1-53, 0]
	Hospital 92	56% (15/27) [56%*, 30-73, 0.017]	24% (8/33) [25%**, 4-41, 0]
	Hospital 4	68% (13/19) [69%, 38-85, 0.523]	55% (17/31) [54%, 30-70, 0.193]
	Hospital 18	60% (34/57) [59%*, 40-72, 0.011]	48% (31/65) [48%**, 32-60, 0.004]
	Hospital 12	57% (4/7) [58%, 0-83, 0.249]	81% (13/16) [81%, 47-93, 0.247]
Group A hospitals	Hospital 96	88% (38/43) [88%, 72-95, 0.088]	78% (32/41) [78%, 61-88, 0.113]
	Hospital 143	90% (35/39) [90%, 73-96, 0.073]	75% (41/55) [75%, 59-84, 0.203]
	Hospital 149	100% (6/6) [100%**, 100-100, 0]	80% (20/25) [79%, 54-91, 0.205]
	Hospital 111		
	Hospital 85	100% (4/4) [100%**, 100-100, 0]	50% (1/2) [52%, 0-88, 0.657]
	Hospital 90	100% (2/2) [100%**, 100-100, 0]	
	Hospital 57	100% (3/3) [100%**, 100-100, 0]	67% (2/3) [66%, 0-93, 0.989]
	Hospital 51	82% (18/22) [82%, 55-93, 0.519]	89% (40/45) [89%**, 74-95, 0.007]
Group B hospitals	Hospital 125	70% (7/10) [70%, 23-89, 0.709]	79% (15/19) [79%, 51-91, 0.243]
Other hospitals	Hospital 2904	90% (18/20) [90%, 61-97, 0.193]	100% (10/10) [100%**, 100-100, 0]
Queensland		**75% (199/264)**	**65% (235/360)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

5.2 | Aboriginal and Torres Strait Islander

Diagnosis year 2005-2009 and 2010-2014

5.2.1 | What percentage of Aboriginal and Torres Strait Islander patients receive lung cancer surgery within 45 days from diagnosis?
Includes patients where lung cancer surgery was first treatment received.

Received surgery within 45 days *(% of Aboriginal and Torres Strait Islander patients whose time from diagnosis to lung cancer surgery is ≤45 days)*		**2005-2009** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]	**2010-2014** **Diagnosis year** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281		
	Hospital 92	100% (1/1) [100%**, 100-100, 0]	100% (2/2) [100%**, 100-100, 0]
	Hospital 4	80% (4/5) [87%, 87-87, 0.642]	100% (4/4) [100%**, 100-100, 0]
	Hospital 18	75% (3/4) [87%, 87-87, 0.523]	20% (1/5) [29%, 0-66, 0.062]
	Hospital 12	100% (4/4) [100%**, 100-100, 0]	60% (6/10) [60%, 0-84, 0.779]
Group A hospitals	Hospital 96		100% (1/1) [100%**, 100-100, 0]
	Hospital 143	100% (1/1) [100%**, 100-100, 0]	
	Hospital 149		
	Hospital 111		
	Hospital 85		
	Hospital 90		
	Hospital 57		
	Hospital 51		
Group B hospitals	Hospital 125		100% (1/1) [100%**, 100-100, 0]
Other hospitals	Hospital 2904		
Queensland		**87% (13/15)**	**65% (15/23)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

5.3 | Socio-economic status

Diagnosis year 2005-2009

5.3.1 | What percentage of socio-economically disadvantaged patients receive lung cancer surgery within 45 days from diagnosis?
Includes patients where lung cancer surgery was first treatment received.

Received surgery within 45 days		Diagnosis year: 2005-2009		
(% of socio-economically disadvantaged patients whose time from diagnosis to lung cancer surgery is ≤45 days)		**Disadvantaged** Crude rates (n/N) [Adjusted rates, CI%, P value]	**Middle** Crude rates (n/N) [Adjusted rates, CI%, P value]	**Affluent** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	50% (1/2) [48%, 0-88, 0.276]	56% (15/27) [55%**, 30-71, 0.008]	50% (1/2) [1%*, 0-81, 0.046]
	Hospital 92	64% (21/33) [63%, 38-78, 0.068]	52% (43/83) [51%**, 37-62, 0]	55% (6/11) [47%**, 0-74, 0.003]
	Hospital 4	70% (23/33) [69%, 46-82, 0.297]	59% (34/58) [59%**, 43-70, 0.003]	67% (10/15) [70%, 37-85, 0.208]
	Hospital 18	67% (60/89) [67%, 52-77, 0.053]	69% (144/210) [69%, 60-75, 0.066]	61% (17/28) [60%**, 32-77, 0.007]
	Hospital 12	78% (21/27) [77%, 53-89, 0.944]	61% (34/56) [60%**, 43-72, 0.008]	
Group A hospitals	Hospital 96	91% (21/23) [92%, 68-98, 0.139]	87% (68/78) [88%*, 78-93, 0.018]	95% (20/21) [96%, 73-99, 0.113]
	Hospital 143	96% (24/25) [96%, 73-99, 0.069]	87% (109/125) [87%**, 80-92, 0.004]	97% (31/32) [96%, 75-100, 0.093]
	Hospital 149	0% (0/1) [0%**, 0-13, 0]	100% (22/22) [100%**, 100-100, 0]	100% (1/1) [100%**, 100-100, 0]
	Hospital 111			
	Hospital 85	100% (9/9) [100%**, 100-100, 0]	100% (12/12) [100%**, 100-100, 0]	100% (4/4) [100%**, 100-100, 0]
	Hospital 90		100% (4/4) [100%**, 100-100, 0]	
	Hospital 57	100% (3/3) [100%**, 100-100, 0]	100% (9/9) [100%**, 100-100, 0]	100% (4/4) [100%**, 100-100, 0]
	Hospital 51	89% (16/18) [89%, 61-97, 0.242]	88% (44/50) [88%, 74-94, 0.06]	91% (21/23) [91%, 68-98, 0.239]
Group B hospitals	Hospital 125	100% (18/18) [100%**, 100-100, 0]	81% (34/42) [81%, 64-90, 0.376]	100% (1/1) [100%**, 100-100, 0]
Other hospitals	Hospital 2904	50% (2/4) [45%, 0-79, 0.084]	93% (40/43) [93%*, 80-98, 0.018]	0% (0/1) [0%**, 14-59, 0]
Queensland		**77% (219/285)**	**75% (612/819)**	**81% (116/143)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

Diagnosis year 2010-2014

5.3.1 | What percentage of socio-economically disadvantaged patients receive lung cancer surgery within 45 days from diagnosis?
Includes patients where lung cancer surgery was first treatment received.

Received surgery within 45 days		Diagnosis year: 2010-2014		
(% of socio-economically disadvantaged patients whose time from diagnosis to lung cancer surgery is ≤45 days)		**Disadvantaged** Crude rates (n/N) [Adjusted rates, CI%, P value]	**Middle** Crude rates (n/N) [Adjusted rates, CI%, P value]	**Affluent** Crude rates (n/N) [Adjusted rates, CI%, P value]
Principal referral hospitals	Hospital 281	50% (3/6) [45%, 0-76, 0.253]	59% (48/81) [58%*, 45-68, 0.04]	100% (1/1) [100%**, 100-100, 0]
	Hospital 92	36% (18/50) [33%**, 13-49, 0]	34% (43/128) [31%**, 20-41, 0]	38% (8/21) [39%**, 5-60, 0]
	Hospital 4	63% (26/41) [61%, 41-74, 0.511]	63% (51/81) [63%, 50-72, 0.246]	72% (18/25) [71%, 41-85, 0.389]
	Hospital 18	53% (50/94) [53%*, 40-63, 0.011]	60% (115/193) [59%*, 51-67, 0.01]	82% (14/17) [82%, 50-94, 0.724]
	Hospital 12	76% (25/33) [75%, 54-87, 0.31]	80% (67/84) [79%, 68-87, 0.061]	67% (2/3) [60%, 0-93, 0.486]
Group A hospitals	Hospital 96	86% (19/22) [87%, 63-96, 0.069]	74% (53/72) [75%, 62-83, 0.285]	89% (24/27) [89%, 69-96, 0.196]
	Hospital 143	82% (23/28) [83%, 61-92, 0.104]	76% (99/131) [76%, 67-82, 0.093]	70% (23/33) [70%, 46-83, 0.241]
	Hospital 149	100% (1/1) [100%**, 100-100, 0]	89% (57/64) [89%**, 78-95, 0.003]	100% (4/4) [100%**, 100-100, 0]
	Hospital 111		50% (2/4) [48%, 0-80, 0.304]	100% (1/1) [100%**, 100-100, 0]
	Hospital 85	100% (2/2) [100%**, 100-100, 0]	67% (6/9) [67%, 12-87, 0.898]	100% (1/1) [100%**, 100-100, 0]
	Hospital 90	100% (1/1) [100%**, 100-100, 0]		
	Hospital 57	100% (9/9) [100%**, 100-100, 0]	94% (15/16) [94%, 59-99, 0.092]	33% (1/3) [41%*, 0-73, 0.012]
	Hospital 51	86% (37/43) [87%*, 72-94, 0.012]	92% (58/63) [92%**, 82-97, 0.001]	98% (48/49) [98%*, 86-100, 0.017]
Group B hospitals	Hospital 125	79% (23/29) [79%, 58-90, 0.163]	91% (58/64) [91%**, 80-96, 0.002]	80% (4/5) [79%, 0-97, 0.966]
Other hospitals	Hospital 2904		94% (29/31) [94%*, 75-98, 0.021]	
Queensland		**66% (237/359)**	**69% (701/1021)**	**78% (149/190)**

Adjusted by age, sex, socioeconomic status, rurality, comorbidity, ASA and Aboriginal and Torres Strait Islander status. Adjusted results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1% for those marked ** and less than 5% for those marked *.

Refer to Appendix 1 for hospital grouping definitions.
Blank spaces indicate that no surgery occurred.

5.4 | In-flows by remoteness (hospital)

Diagnosis year: 2005-2009

5.4.1 | What percentage of patients in my hospital live outside a major city?

Surgery rate		2005-2009		
		Rural & Remote	Regional	Metropolitan
		Crude rates	Crude rates	Crude rates
(% of patients receiving lung cancer surgery)		(n/N)	(n/N)	(n/N)
Principal referral hospitals	Hospital 281	0% (0/32)	3% (1/32)	97% (31/32)
	Hospital 92	2% (3/129)	10% (13/129)	88% (113/129)
	Hospital 4	2% (2/106)	21% (22/106)	77% (82/106)
	Hospital 18	8% (28/368)	32% (117/368)	61% (223/368)
	Hospital 12	55% (51/93)	8% (7/93)	38% (35/93)
Group A hospitals	Hospital 96	2% (3/127)	15% (19/127)	83% (105/127)
	Hospital 143	9% (17/201)	28% (56/201)	64% (128/201)
	Hospital 149	0% (0/26)	0% (0/26)	100% (26/26)
	Hospital 111			
	Hospital 85	12% (3/26)	27% (7/26)	62% (16/26)
	Hospital 90	0% (0/4)	0% (0/4)	100% (4/4)
	Hospital 57	5% (1/19)	47% (9/19)	47% (9/19)
	Hospital 51	11% (14/123)	24% (29/123)	65% (80/123)
Group B hospitals	Hospital 125	54% (35/65)	6% (4/65)	40% (26/65)
Other hospitals	Hospital 2904	0% (0/49)	2% (1/49)	98% (48/49)
Queensland		**11%** **(157/1368)**	**21%** **(285/1368)**	**68%** **(926/1368)**

Refer to Appendix 1 for hospital grouping definitions.

Diagnosis year: 2010-2014

5.4.2 | What percentage of patients in my hospital live outside a major city?

Surgery rate (% of patients receiving lung cancer surgery)		2010-2014		
		Rural & Remote Crude rates (n/N)	Regional Crude rates (n/N)	Metropolitan Crude rates (n/N)
Principal referral hospitals	Hospital 281	0% (0/89)	3% (3/89)	97% (86/89)
	Hospital 92	4% (8/203)	10% (20/203)	86% (175/203)
	Hospital 4	5% (8/151)	41% (62/151)	54% (81/151)
	Hospital 18	5% (18/332)	36% (121/332)	58% (193/332)
	Hospital 12	63% (77/123)	7% (9/123)	30% (37/123)
Group A hospitals	Hospital 96	5% (6/124)	11% (13/124)	85% (105/124)
	Hospital 143	4% (9/218)	30% (65/218)	66% (144/218)
	Hospital 149	3% (2/69)	0% (0/69)	97% (67/69)
	Hospital 111	0% (0/6)	0% (0/6)	100% (6/6)
	Hospital 85	8% (1/12)	17% (2/12)	75% (9/12)
	Hospital 90	0% (0/1)	0% (0/1)	100% (1/1)
	Hospital 57	7% (2/28)	64% (18/28)	29% (8/28)
	Hospital 51	9% (15/169)	33% (55/169)	59% (99/169)
Group B hospitals	Hospital 125	55% (57/104)	8% (8/104)	38% (39/104)
Other hospitals	Hospital 2904	0% (0/33)	3% (1/33)	97% (32/33)
Queensland		**12%** **(203/1662)**	**23%** **(377/1662)**	**65%** **(1082/1662)**

Refer to Appendix 1 for hospital grouping definitions.

5.5 | In-flows by remoteness (HHS)

Diagnosis year 2005-2009 and 2010-2014

5.5.1 | What percentage of lung cancer surgery patients reside outside my HHS?

In-flows	2005-2009 Diagnosis year		2010-2014 Diagnosis year	
(% of patients travelling for surgery)	Hospital count	Rates (n/N)	Hospital count	Rates (n/N)
Gold Coast	4	2% (2/111)	4	2% (4/192)
Metro North	5	65% (533/817)	5	61% (549/898)
Metro South	3	30% (84/282)	4	24% (82/345)
Townsville	2	52% (82/158)	2	61% (138/227)
Queensland	**14**	**51%** (701/1368)	**15**	**47%** (773/1662)

5.6 | Out-flows

Diagnosis year 2005-2009 and 2010-2014

5.6.1 | What percentage of patients underwent lung cancer surgery outside of the HHS that they reside in?

Out-flows (% of patients receiving surgery outside of their HHS of residence)	2005-2009 Diagnosis year Crude rate (n/N)	2010-2014 Diagnosis year Crude rate (n/N)
Cairns and Hinterland	100% (61/61)	100% (83/83)
Central Queensland	100% (43/43)	100% (58/58)
Central West	100% (6/6)	100% (8/8)
Darling Downs	100% (58/58)	100% (71/71)
Gold Coast	36% (62/171)	9% (18/206)
Mackay	100% (45/45)	100% (60/60)
Metro North	2% (7/291)	3% (12/361)
Metro South	33% (97/295)	19% (63/326)
North West	100% (3/3)	100% (9/9)
South West	100% (6/6)	100% (10/10)
Sunshine Coast	100% (145/145)	100% (168/168)
Torres and Cape	100% (2/2)	100% (2/2)
Townsville	6% (5/81)	1% (1/90)
West Moreton	100% (64/64)	100% (73/73)
Wide Bay	100% (97/97)	100% (137/137)
Queensland	**51%** **(701/1368)**	**47%** **(773/1662)**

Appendix

Appendix 1: AIHW Hospital Peer Groups

Principal referral hospitals

Principal referral hospitals are public acute hospitals that provide a very broad range of services, have a range of highly specialised service units, and have very large patient volumes. The term 'referral' recognises that these hospitals have specialist facilities not typically found in smaller hospitals.

Public acute group A hospitals (Group A hospitals)

Public acute group A hospitals are public acute hospitals that provide a wide range of services typically including a 24-hour emergency department, intensive care unit, coronary care unit and oncology unit, but do not provide the breadth of services provided by *Principal referral hospitals.*

Private acute group A hospitals (Group A hospitals)

Private acute group A hospitals are private acute hospitals that have a 24-hour emergency department and an intensive care unit, and provide a number of other specialised services such as coronary care, special care nursery, cardiac surgery and neurosurgery.

Public acute group B hospitals (Group B hospitals)

Public acute group B hospitals are those public acute hospitals that do not have the service profile of the *Principal referral hospitals and Group A hospitals,* but do have 24-hour emergency department; they typically provide elective surgery and have specialised service units such as obstetric, paediatric and psychiatric units.

Private acute group B hospitals (Group B hospitals)

Private acute group B hospitals are private acute hospitals that do not have a 24-hour emergency department, but do have an intensive care unit and a number of other specialised services including coronary care, special care nursery, cardiac surgery and neurosurgery.

Public acute group C hospitals (Other hospitals)

Public acute group C hospitals include those public acute hospitals that provide a more limited range of services than *Principal referral hospitals* or *Public acute group A* and *B hospitals*, but do have an obstetric unit, provide surgical services and/or some form of emergency facility (emergency department, or accident and emergency service).

Private acute group C hospitals (Other hospitals)

Private acute group C hospitals are those private acute hospitals that do not provide emergency department services or have an intensive care unit, but do provide specialised services in a range of clinical specialities.

Public acute group D hospitals (Other hospitals)

Public acute group D hospitals are acute public hospitals that offer a smaller range of services relative to other public acute hospitals, and provide 200 or more separations per year. They are mostly situated in regional and remote areas.

Private acute group D hospitals (Other hospitals)

Private acute group D hospitals are those private acute hospitals that do not provide emergency department services or have an intensive care unit, do not provide specialised services in a range of clinical specialities, but had 200 or more separations

Appendix 2: How the cohorts were defined for lung cancer surgery

2005–2014: PUBLIC & PRIVATE HOSPITAL PATIENTS

Death

Reference Data

QOOL

Queensland Cancer
Registry
Cancer Diagnosed
1982–2014
N = 784,028

Queensland Health
Admitted Patient Data
Collection Records
2000–2017
N = 7,628,192
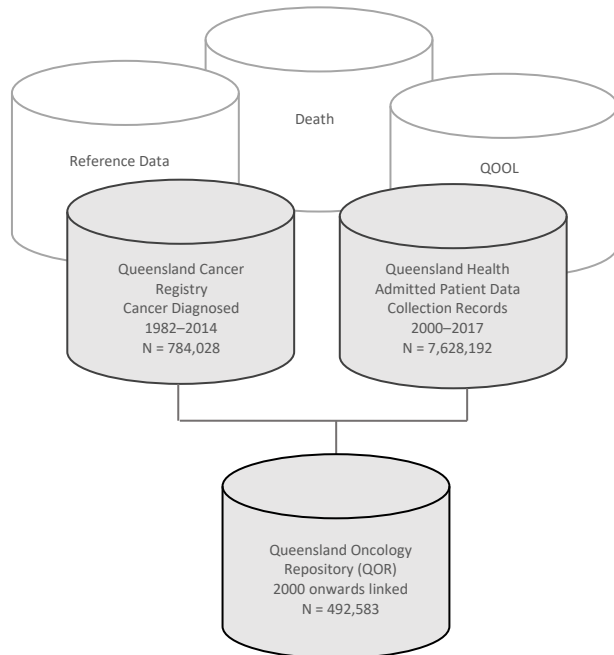
Queensland Oncology Repository

QOR consolidates patient information for Queensland and contains data on invasive, benign and uncertain cancers, patient demographics, surgery, systemic therapy, radiotherapy and death. QOR also contains data collected by clinicians at MDT meetings

Sophisticated matching and linking is performed to identify all persons with cancer who had surgery

Queensland Oncology
Repository (QOR)
2000 onwards linked
N = 492,583

Queensland Cancer Cohort

All cancer QOR
2005-2014 total N = 240,710
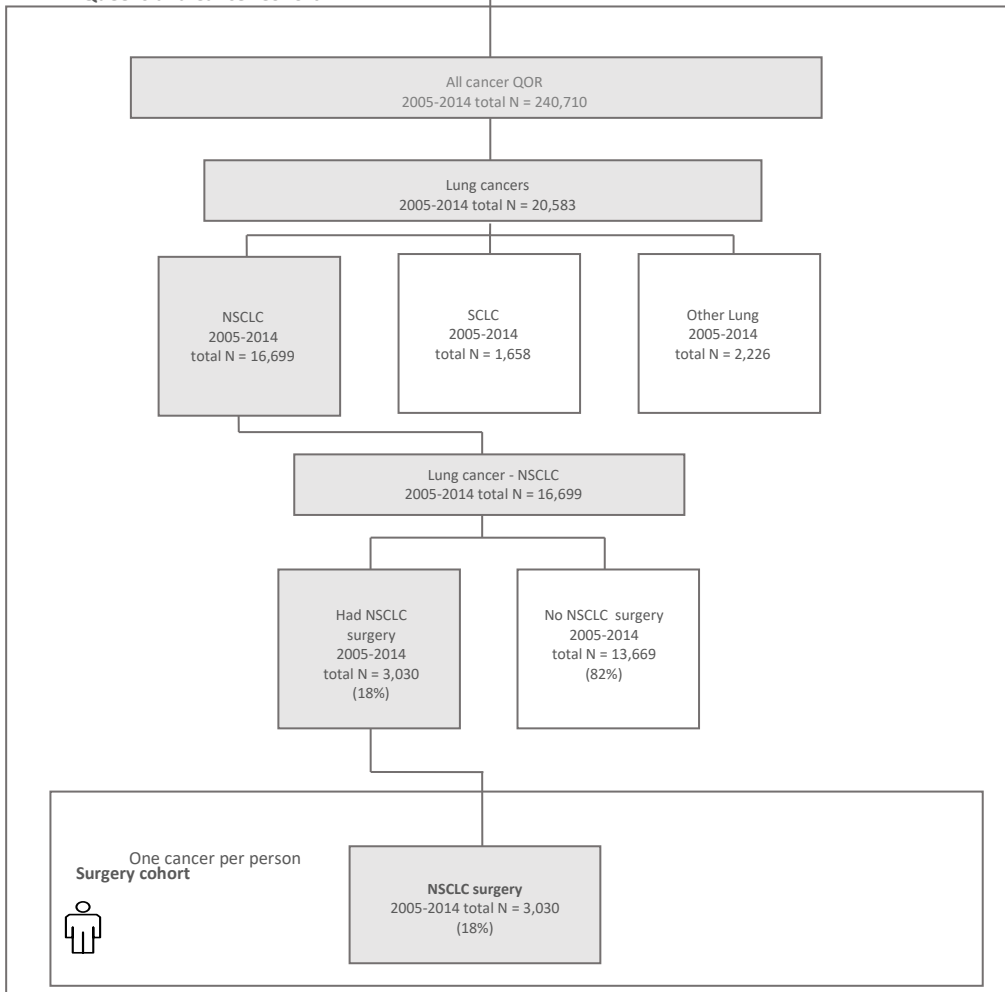
Queensland Cancer Cohort
Includes: Queensland Invasive Cancer incidence
Discharged patients from public or private hospitals
Queensland residents
All ages

Lung cancers
2005-2014 total N = 20,583

Lung Cancer
ICD10-AM C33, C34 – Trachea, Bronchus, Lung
Discharged patients from public or private hospitals
Queensland residents
All ages

| NSCLC 2005-2014 total N = 16,699 | SCLC 2005-2014 total N = 1,658 | Other Lung 2005-2014 total N = 2,226 |

NSCLC Cancer Cohort
Filtered cases
Potential duplicate records removed
NSCLC records retained
If 2 of more diagnosis of NSCLC earliest retained

Lung cancer - NSCLC
2005-2014 total N = 16,699

NSCLC Surgery Cohort
Rules
Surgery included if performed one month prior to diagnosis date or within twelve months after diagnosis date
If person had more than one surgery in different surgery groups then person allocated to the most complex group
If person had more than one surgery in the same surgery group then the most recent surgery counted.

Had NSCLC
surgery
2005-2014
total N = 3,030
(18%)

No NSCLC surgery
2005-2014
total N = 13,669
(82%)

No Surgery Cohort
Includes Qld residents of all ages diagnosed with NSCLC who did not undergo surgery in the cohort time period

One cancer per person
Surgery cohort

NSCLC surgery
2005-2014 total N = 3,030
(18%)

In-hospital mortality crude rate (%)
(% of patients who die in hospital after lung surgery)

	Diagnosis year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Principal referral hospitals	Hospital 281			- (0/5)	7.7% (1/13)	- (0/14)	- (0/14)	- (0/17)	- (0/14)	- (0/19)	- (0/25)	**0.8%** **(1/121)**
	Hospital 92	- (0/23)	- (0/29)	- (0/22)	3.7% (1/27)	- (0/28)	- (0/41)	- (0/35)	- (0/44)	- (0/46)	- (0/37)	**0.3%** **(1/332)**
	Hospital 4	- (0/18)	4.8% (1/21)	- (0/24)	- (0/18)	- (0/25)	- (0/32)	2.6% (1/38)	- (0/24)	- (0/33)	- (0/24)	**0.8%** **(2/257)**
	Hospital 18	1.4% (1/74)	- (0/85)	- (0/78)	1.6% (1/61)	- (0/70)	- (0/63)	- (0/51)	1.8% (1/57)	- (0/77)	1.2% (1/84)	**0.6%** **(4/700)**
	Hospital 12	- (0/19)	6.3% (1/16)	6.3% (1/16)	10% (1/10)	- (0/32)	- (0/18)	- (0/27)	- (0/21)	- (0/27)	- (0/30)	**1.4%** **(3/216)**
Group A hospitals	Hospital 96	- (0/28)	- (0/29)	- (0/20)	8% (2/25)	12% (3/25)	- (0/23)	- (0/16)	- (0/26)	- (0/27)	- (0/32)	**2%** **(5/251)**
	Hospital 143	- (0/37)	- (0/28)	- (0/35)	- (0/53)	- (0/48)	- (0/53)	- (0/39)	- (0/48)	- (0/47)	- (0/31)	**-** **(0/419)**
	Hospital 149	- (0/7)	- (0/6)	- (0/3)	- (0/4)	- (0/6)	- (0/6)	5.3% (1/19)	5.6% (1/18)	- (0/15)	9.1% (1/11)	**3.2%** **(3/95)**
	Hospital 111										- (0/6)	**-** **(0/6)**
	Hospital 85	- (0/6)	- (0/8)	- (0/6)	- (0/6)		- (0/1)	- (0/1)		- (0/6)	- (0/4)	**-** **(0/38)**
	Hospital 90	- (0/2)		- (0/1)	- (0/1)					- (0/1)		**-** **(0/5)**
	Hospital 57	- (0/1)		16.7% (1/6)	- (0/6)	- (0/6)	20% (1/5)	- (0/4)	- (0/4)	- (0/8)	- (0/7)	**4.3%** **(2/47)**
	Hospital 51	7.1% (2/28)	8.3% (2/24)	- (0/23)	- (0/25)	8.7% (2/23)	- (0/27)	- (0/30)	3% (1/33)	- (0/39)	- (0/40)	**2.4%** **(7/292)**
Group B hospitals	Hospital 125	- (0/10)	- (0/13)	- (0/17)	- (0/10)	- (0/15)	6.7% (1/15)	5.6% (1/18)	- (0/16)	- (0/26)	3.4% (1/29)	**1.8%** **(3/169)**
Other hospitals	Hospital 2904	- (0/6)	- (0/11)	- (0/9)	- (0/14)	- (0/9)	25% (2/8)	- (0/1)	- (0/7)	- (0/9)	- (0/8)	**2.4%** **(2/82)**
Queensland		**1.2%** **(3/259)**	**1.5%** **(4/270)**	**0.8%** **(2/265)**	**2.2%** **(6/273)**	**1.7%** **(5/301)**	**1.3%** **(4/306)**	**1%** **(3/296)**	**1%** **(3/312)**	**-** **(0/380)**	**0.8%** **(3/368)**	**1.1%** **(33/3030)**

Blank spaces indicate that no surgery occurred.
A dash (-) indicates 0% mortality.

Appendix 4: 30 day mortality rates 2005-2014

30 day mortality crude rate (%)
(% of patients who die ≤30 days after lung surgery)

	Diagnosis year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Principal referral hospitals	Hospital 281			- (0/5)	- (0/13)	- (0/14)	- (0/14)	- (0/17)	- (0/14)	- (0/19)	- (0/25)	**-** **(0/121)**
	Hospital 92	- (0/23)	- (0/29)	- (0/22)	7.4% (2/27)	- (0/28)	- (0/41)	- (0/35)	2.3% (1/44)	- (0/46)	- (0/37)	**0.9%** **(3/332)**
	Hospital 4	- (0/18)	4.8% (1/21)	- (0/24)	- (0/18)	- (0/25)	- (0/32)	2.6% (1/38)	- (0/24)	- (0/33)	- (0/24)	**0.8%** **(2/257)**
	Hospital 18	1.4% (1/74)	- (0/85)	- (0/78)	1.6% (1/61)	1.4% (1/70)	1.6% (1/63)	- (0/51)	- (0/57)	- (0/77)	- (0/84)	**0.6%** **(4/700)**
	Hospital 12	5.3% (1/19)	6.3% (1/16)	6.3% (1/16)	- (0/10)	- (0/32)	- (0/18)	- (0/27)	4.8% (1/21)	3.7% (1/27)	- (0/30)	**2.3%** **(5/216)**
Group A hospitals	Hospital 96	- (0/28)	- (0/29)	- (0/20)	8% (2/25)	12% (3/25)	4.3% (1/23)	- (0/16)	- (0/26)	- (0/27)	- (0/32)	**2.4%** **(6/251)**
	Hospital 143	2.7% (1/37)	- (0/28)	- (0/35)	1.9% (1/53)	- (0/48)	- (0/53)	- (0/39)	- (0/48)	- (0/47)	- (0/31)	**0.5%** **(2/419)**
	Hospital 149	- (0/7)	- (0/6)	- (0/3)	- (0/4)	- (0/6)	- (0/6)	5.3% (1/19)	5.6% (1/18)	6.7% (1/15)	9.1% (1/11)	**4.2%** **(4/95)**
	Hospital 111									- (0/6)		**-** **(0/6)**
	Hospital 85	- (0/6)	- (0/8)	- (0/6)	- (0/6)		- (0/1)	- (0/1)		- (0/6)	- (0/4)	**-** **(0/38)**
	Hospital 90	- (0/2)		- (0/1)	- (0/1)					- (0/1)		**-** **(0/5)**
	Hospital 57	- (0/1)		- (0/6)	- (0/6)	- (0/6)	20% (1/5)	- (0/4)	- (0/4)	- (0/8)	- (0/7)	**2.1%** **(1/47)**
	Hospital 51	7.1% (2/28)	8.3% (2/24)	- (0/23)	- (0/25)	8.7% (2/23)	- (0/27)	- (0/30)	3% (1/33)	- (0/39)	- (0/40)	**2.4%** **(7/292)**
Group B hospitals	Hospital 125	- (0/10)	- (0/13)	- (0/17)	- (0/10)	- (0/15)	6.7% (1/15)	5.6% (1/18)	- (0/16)	- (0/26)	3.4% (1/29)	**1.8%** **(3/169)**
Other hospitals	Hospital 2904	- (0/6)	9.1% (1/11)	- (0/9)	- (0/14)	- (0/9)	- (0/8)	- (0/1)	- (0/7)	- (0/9)	- (0/8)	**1.2%** **(1/82)**
Queensland		**1.9%** **(5/259)**	**1.9%** **(5/270)**	**0.4%** **(1/265)**	**2.2%** **(6/273)**	**2.0%** **(6/301)**	**1.3%** **(4/306)**	**1%** **(3/296)**	**1%** **(4/312)**	**0.5%** **(2/380)**	**0.5%** **(2/368)**	**1.3%** **(38/3030)**

Blank spaces indicate that no surgery occurred.
A dash (-) indicates 0% mortality.

Appendix 5: 90 day mortality rates 2005-2014

90 day mortality crude rate (%)
(% of patients who die ≤90 days after lung surgery)

	Diagnosis year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Principal referral hospitals	Hospital 281			- (0/5)	7.7% (1/13)	- (0/14)	- (0/14)	- (0/17)	- (0/14)	- (0/19)	- (0/25)	**0.8%** **(1/121)**
	Hospital 92	- (0/23)	- (0/29)	- (0/22)	7.4% (2/27)	3.6% (1/28)	- (0/41)	- (0/35)	4.5% (2/44)	4.3% (2/46)	- (0/37)	**2.1%** **(7/332)**
	Hospital 4	- (0/18)	4.8% (1/21)	- (0/24)	- (0/18)	- (0/25)	- (0/32)	5.3% (2/38)	- (0/24)	- (0/33)	- (0/24)	**1.2%** **(3/257)**
	Hospital 18	5.4% (4/74)	- (0/85)	1.3% (1/78)	3.3% (2/61)	1.4% (1/70)	1.6% (1/63)	- (0/51)	1.8% (1/57)	- (0/77)	2.4% (2/84)	**1.7%** **(12/700)**
	Hospital 12	5.3% (1/19)	12.5% (2/16)	6.3% (1/16)	10% (1/10)	- (0/32)	- (0/18)	3.7% (1/27)	9.5% (2/21)	3.7% (1/27)	3.3% (1/30)	**4.6%** **(10/216)**
Group A hospitals	Hospital 96	3.6% (1/28)	- (0/29)	- (0/20)	12% (3/25)	12% (3/25)	13% (3/23)	- (0/16)	3.8% (1/26)	- (0/27)	- (0/32)	**4.4%** **(11/251)**
	Hospital 143	2.7% (1/37)	- (0/28)	- (0/35)	1.9% (1/53)	- (0/48)	- (0/53)	- (0/39)	- (0/48)	2.1% (1/47)	6.5% (2/31)	**1.2%** **(5/419)**
	Hospital 149	29% (2/7)	16.7% (1/6)	- (0/3)	25% (1/4)	- (0/6)	- (0/6)	5.3% (1/19)	5.6% (1/18)	6.7% (1/15)	9.1% (1/11)	**8.4%** **(8/95)**
	Hospital 111									- (0/6)		**-** **(0/6)**
	Hospital 85	- (0/6)	- (0/8)	- (0/6)	- (0/6)		- (0/1)	- (0/1)		- (0/6)	- (0/4)	**-** **(0/38)**
	Hospital 90	50% (1/2)		- (0/1)	- (0/1)					- (0/1)		**20.0%** **(1/5)**
	Hospital 57	- (0/1)		17% (1/6)	17% (1/6)	- (0/6)	20% (1/5)	- (0/4)	- (0/4)	- (0/8)	- (0/7)	**6.4%** **(3/47)**
	Hospital 51	7.1% (2/28)	8.3% (2/24)	- (0/23)	4% (1/25)	13% (3/23)	3.7% (1/27)	- (0/30)	12.1% (4/33)	- (0/39)	- (0/40)	**4.5%** **(13/292)**
Group B hospitals	Hospital 125	- (0/10)	- (0/13)	5.9% (1/17)	- (0/10)	6.7% (1/15)	13.3% (2/15)	5.6% (1/18)	- (0/16)	3.8% (1/26)	3.4% (1/29)	**4.1%** **(7/169)**
Other hospitals	Hospital 2904	- (0/6)	9.1% (1/11)	- (0/9)	14.3% (2/14)	- (0/9)	25% (2/8)	- (0/1)	- (0/7)	- (0/9)	- (0/8)	**6.1%** **(5/82)**
Queensland		**4.6%** **(12/259)**	**2.6%** **(7/270)**	**1.5%** **(4/265)**	**5.5%** **(15/273)**	**3%** **(9/301)**	**3.3%** **(10/306)**	**1.7%** **(5/296)**	**3.5%** **(11/312)**	**1.6%** **(6/380)**	**1.9%** **(7/368)**	**2.8%** **(86/3030)**

Blank spaces indicate that no surgery occurred.
A dash (-) indicates 0% mortality.

Appendix 6: Lung cancer surgery between 2005-2014

Number of lung cancer surgeries *(Count of lung cancer surgeries performed each year)*		2005-2009			2010-2014			
Peer Group	Hospital	Lobectomy	Partial resection	Pneumone ctomy	Lobectomy	Partial resection	Pneumone ctomy	Total
Principal referral hospitals	Hospital 281	17	13	2	45	38	6	121
	Hospital 92	74	46	9	148	40	15	332
	Hospital 4	67	39		107	44		257
	Hospital 18	231	89	48	226	85	21	700
	Hospital 12	55	32	6	90	31	2	216
Group A hospitals	Hospital 96	81	36	10	95	26	3	251
	Hospital 143	130	52	19	151	55	12	419
	Hospital 149	8	16	2	37	26	6	95
	Hospital 111				1	5		6
	Hospital 85	8	16	2	5	7		38
	Hospital 90	2	2			1		5
	Hospital 57	12	7		21	7		47
	Hospital 51	37	80	6	79	86	4	292
Group B hospitals	Hospital 125	42	10	13	69	23	12	169
Other hospitals	Hospital 2904	16	30	3	16	15	2	82
Queensland		780	468	120	1090	489	83	3030

Appendix 7: Survival by lung cancer surgery

1 year surgical survival

Diagnosis year 2005-2009

1 year surgical survival *(% patients alive 1 year after lung cancer surgery)*		**All** Crude rates	**Lobectomy** Crude rates	**2005-2009 | Diagnosis year** **Partial Resection** Crude rates	**Pneumonect-omy** Crude rates
Principal referral hospitals	Hospital 281	84%	91%	97%	97%
	Hospital 92	90%	95%	95%	99%
	Hospital 4	92%	95%	97%	100%
	Hospital 18	88%	93%	97%	97%
	Hospital 12	85%	94%	92%	99%
Group A hospitals	Hospital 96	84%	88%	98%	98%
	Hospital 143	92%	96%	97%	99%
	Hospital 149	77%	96%	88%	92%
	Hospital 111				
	Hospital 85	100%	100%	100%	100%
	Hospital 90	75%	75%	100%	100%
	Hospital 57	68%	84%	84%	100%
	Hospital 51	84%	98%	90%	96%
Group B hospitals	Hospital 125	83%	94%	95%	94%
Other hospitals	Hospital 2904	73%	94%	80%	100%
Queensland		**87%**	**94%**	**95%**	**98%**

Blank spaces indicate that no surgery occurred.

1 year surgical survival

Diagnosis year 2010-2014

1 year surgical survival *(% patients alive 1 year after lung cancer surgery)*		All	Lobectomy	2010-2014 | Diagnosis year Partial Resection	Pneumonect- omy
		Crude rates	Crude rates	Crude rates	Crude rates
Principal referral hospitals	Hospital 281	94%	96%	99%	100%
	Hospital 92	93%	94%	99%	100%
	Hospital 4	96%	98%	98%	100%
	Hospital 18	93%	96%	98%	99%
	Hospital 12	88%	91%	98%	99%
Group A hospitals	Hospital 96	90%	93%	98%	100%
	Hospital 143	93%	95%	99%	99%
	Hospital 149	88%	93%	100%	96%
	Hospital 111	100%	100%	100%	100%
	Hospital 85	100%	100%	100%	100%
	Hospital 90	100%	100%	100%	100%
	Hospital 57	89%	93%	96%	100%
	Hospital 51	87%	95%	93%	99%
Group B hospitals	Hospital 125	84%	91%	96%	96%
Other hospitals	Hospital 2904	88%	97%	94%	97%
Queensland		**91%**	**95%**	**97%**	**99%**

Blank spaces indicate that no surgery occurred.

1 year surgical survival

2 year surgical survival

Diagnosis year 2005-2009

2 year surgical survival (% patients alive 2 year after lung cancer surgery)		All	Lobectomy	2005-2009 | Diagnosis year Partial Resection	Pneumonect- omy
		Crude rates	Crude rates	Crude rates	Crude rates
Principal referral hospitals	Hospital 281	72%	81%	94%	97%
	Hospital 92	80%	89%	93%	98%
	Hospital 4	78%	85%	93%	100%
	Hospital 18	74%	84%	95%	95%
	Hospital 12	75%	86%	90%	99%
Group A hospitals	Hospital 96	70%	79%	94%	97%
	Hospital 143	80%	89%	93%	98%
	Hospital 149	73%	96%	85%	92%
	Hospital 111				
	Hospital 85	81%	96%	88%	96%
	Hospital 90	50%	50%	100%	100%
	Hospital 57	47%	74%	74%	100%
	Hospital 51	67%	93%	79%	96%
Group B hospitals	Hospital 125	63%	82%	94%	88%
Other hospitals	Hospital 2904	61%	92%	71%	98%
Queensland		**74%**	**86%**	**91%**	**96%**

Blank spaces indicate that no surgery occurred.

2 year surgical survival

Diagnosis year 2010-2014

2 year surgical survival *(% patients alive 2 year after lung cancer surgery)*		2010-2014 | Diagnosis year			
		All Crude rates	**Lobectomy** Crude rates	**Partial Resection** Crude rates	**Pneumonect-omy** Crude rates
Principal referral hospitals	Hospital 281	90%	93%	97%	100%
	Hospital 92	85%	90%	98%	98%
	Hospital 4	89%	95%	95%	100%
	Hospital 18	86%	91%	98%	98%
	Hospital 12	78%	81%	98%	99%
Group A hospitals	Hospital 96	80%	85%	94%	100%
	Hospital 143	83%	88%	96%	99%
	Hospital 149	83%	87%	100%	96%
	Hospital 111	86%	100%	86%	100%
	Hospital 85	92%	100%	92%	100%
	Hospital 90	100%	100%	100%	100%
	Hospital 57	82%	86%	96%	100%
	Hospital 51	76%	91%	86%	99%
Group B hospitals	Hospital 125	66%	81%	92%	93%
Other hospitals	Hospital 2904	70%	88%	85%	97%
Queensland		**82%**	**89%**	**95%**	**98%**

Blank spaces indicate that no surgery occurred.

Appendix 8: International rates

Country	Time period	In-hospital mortality rate	30 day mortality rate	90 day mortality rate	1 year surgical survival
USA[1]	1998 - 2007				84%
USA[2]	2003 - 2013				85%
USA[3]	1996 - 2012				94%
USA[4]	2006 - 2011	3%	7%	4%	
Canada[5]	2007 - 2011		3%	5%	
Italy[6]	2004 - 2009				86%
France[7]	2000 - 2008	5%			
Finland[8]	2000 - 2010			5%	
Queensland	**2005-2009**	**1.5%**	**1.7%**	**3.4%**	**87%**
Queensland	**2010-2014**	**0.8%**	**0.9%**	**2.3%**	**91%**

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Method

Adjusted rates

The following indicators report both crude and adjusted rates. Adjusting is used to remove the effect of differences in composition of the various populations.

- Inpatient mortality rate
- 30 day mortality rate
- 90 day mortality rate
- 1-yr surgical survival
- 2-yr surgical survival
- Time from diagnosis to surgery ≤ 30 days, 31-90 days and > 90 days

The indicators have been adjusted by age, sex, socioeconomic status (disadvantaged Y/N), rurality* (urban/rural), comorbidity (Y/N), ASA, emergency status (Y/N) and Aboriginal and Torres Strait Islander status (Y/N).

Results highlighted with * and ** are deemed to be statistically significantly different to the whole of Queensland result. The likelihood the observed difference is due to chance alone is less than 1 for those marked ** and less than 5 for those marked *.

Statistical significance is determined from the results of Poisson regression. The displayed confidence intervals are intended to show the level of precision of the adjusted rate estimate and on occasion may not accurately reflect significance.

Assigning a surgery record to a person

To assign a surgery record to a person with cancer, the earliest diagnosis in the cancer group is used. For example, if a person was diagnosed with NSCLC in 2005 and 2008, the surgery record linked to the NSCLC cancer diagnosed in 2005 where the surgery occurred within 30days prior to diagnosis date and up to 365 days after diagnosis date will be counted.

Diagnosis year

This report is structured around diagnosis years as reported by the Queensland Cancer Registry, the latest incident year being 2014. Only patients diagnosed between 2005 and 2014 will be included in this report. Patients that had surgery in 2005 but were diagnosed in an earlier year are excluded from the report.

Definitions

ASA score

American Society of Anaesthetic (ASA) physical status classification system for assessing the fitness of a patient prior to surgery.

Hierarchies by ASA Group

Normal/Mild Disease: ASA 1-2

Severe Disease: ASA 3-6

When two or more different ASA scores are coded on the same date in the admissions data, only one ASA score is chosen. The choice of the ASA score is based on the type of anaesthesia in the following order of selection: General > Sedation > Neuraxial > Regional > Intravenous Regional > Infiltration > Local. For example, if General Anaesthesia ASA 2 and Sedation ASA 3, are coded on the same date, the General Anaesthesia score of 2 is chosen.

Comorbidity

A clinical condition that has the potential to significantly affect a cancer patient's prognosis.

Comorbidity is derived from hospital admissions data following the Quan algorithm for classifying ICD-10 coded conditions, modified to exclude metastasis, which is represented by a separate and distinct metastasis dimension.

Comorbidity is limited to conditions coded in any admission episode between 12 months before and 12 months after the date of cancer diagnosis.

For any given cancer diagnosis, comorbidity is restricted to conditions other than the primary cancer. E.g. A rectum cancer can be a comorbidity to a colon cancer diagnosis and vice versa, if they are diagnosed within 12 months of each other.

Benign tumours are not considered comorbidities.

Co-morbidity list:

AIDS	Acute myocardial	Cancer
Cerebrovascular disease	Congestive heart failure	Chronic obstructive pulmonary disease
Dementia	Diabetes	Diabetes + complications
Hemiplegia or Paraplegia	Mild liver disease	Moderate/severe liver disease
Peptic ulcer	Peripheral vascular disease	Renal disease
Rheumatoid disease		

Confidence interval (CI)

The confidence interval represents the probability that a population parameter will fall between two set values. A very wide interval may indicate that more data should be collected before anything very definite can be said about the parameter.

Flows

In-flows

In-flows show the distribution of residence for the total group of patients who were operated on by a hospital, group of hospitals or HHS.

Out-flows

Out-flows shows the proportion of patients residing in a given HHS who receive their surgery in a different HHS.

Forest plots

The forest plot is a graphical display of the results from a regression model, illustrating the hazard ratios for each covariate included in the regression model. The dot represents the estimate of the hazard ratio with the confidence interval of the estimate represented by a horizontal line. A central vertical line representing no effect is also plotted, and if the confidence intervals for an estimate cross this line then the effect is considered not to be statistically significant.

Funnel plots

Funnel plots have been created by plotting the observed result for each hospital result against the surgical volume of the hospital. Confidence limit intervals of 95% (~2 standard deviations) and 99% (~3 standard deviations) have been superimposed around the overall Queensland result.

Hazard Ratio

Describes the ratio of the hazard rates corresponding to post-operative mortality for the different hospital volume groups, where medium volume hospitals are the control group.

Hospital peer groups

The Australian Institute of Health and Welfare (AIHW) have published The Australian hospital peer groups report that groups public and private hospitals that share similar characteristics, providing a basis for meaningful comparisons. There are thirty peer groups, nine of which are relevant to this report. Peer group definitions and groupings used in this report are defined in Appendix 1.

Aboriginal and Torres Strait Islander status

A measure of whether a person identifies as being of Aboriginal or Torres Strait Islander origin.

Interquartile range (IQR)

The interquartile range is a measure of variability, based on dividing a data set into quartiles. Quartiles divide a rank-ordered data set into four equal parts. The values that separate these parts are called the first, second, and third quartiles; and they are denoted by Q_1, Q_2 (median), and Q_3, respectively. The IQR is the distance between the 75th and 25th percentiles, $IQR = Q_3 - Q_1$.

Lung Surgery procedures

ICD-10-AM	Procedure/Grouping
	Partial Resection
90169-00	Endoscopic wedge resection of lung
38440-01	Radical wedge resection of lung
38438-00	Segmental wedge resection of lung
38440-00	Wedge resection of lung
	Lobectomy of lung
38438-01	Lobectomy of lung
38441-00	Radical lobectomy
	Pneumonectomy
38438-02	Pneumonectomy
38441-01	Radical pneumonectomy

Median age (yrs)

The age that divides a population into two halves: one older than the median, the other younger than the median.

Mortality

Inpatient mortality

The percentage of patients that die in hospital following their surgery.

30 day mortality

The percentage of patients that die within 30 days following their surgery.

90 day mortality

The percentage of patients that die within 90 days following their surgery.

Number of surgeries

Includes Queensland residents of all ages diagnosed with invasive cancer in the surgical cohort time period who underwent lung cancer surgery.

Private hospital

All hospitals that are not Queensland Health hospitals.

Public hospital

Queensland Health hospitals.

Relative survival (5 year)

Relative survival is a net survival measure representing cancer survival in the absence of other causes of death. Relative survival is defined as the ratio of the proportion of observed survivors in a

cohort of cancer patients to the proportion of expected survivors in a comparable set of cancer free individuals.

Relative survival is calculated by dividing observed survival by expected survival, where the numerator and denominator have been matched for age, sex and calendar year.

Observed survival refers to the proportion of people alive for a given amount of time after a diagnosis of cancer; it is calculated from population-based cancer data. Expected survival refers to the proportion of people in the general population alive for a given amount of time and is calculated from life tables of the entire Australian population, assumed to be cancer free.

Changes to cancer incidence rates and the underlying life tables to may lead to fluctuations in relative survival estimates. Accordingly, caution should be used when making comparisons to historically reported rates of relative survival.

Remoteness

The relative remoteness of residence at time of diagnosis, derived from the Australian Standard Geographical Classification (ASGC). In this report, remoteness is classified into three groups based on the original ASGC grouping.

ASGC classifications	Modified ASGC classification	Rurality classification
Major City	Metropolitan	Urban
Inner Regional	Regional	Rural
Outer Regional	Regional	Rural
Remote	Rural and Remote	Rural
Very Remote	Rural and Remote	Rural

An exception to this grouping is the metropolitan area of Townsville (originally classified as Rural). Townsville has been classified as Metropolitan because of the availability of tertiary level cancer services.

Sex

Refers to the biological and physiological characteristics that define men and women.

Socioeconomic status

Socioeconomic status is based on the Socio-Economic Indexes for Areas (SEIFA), a census-based measure of social and economic well-being developed by the Australian Bureau of Statistics (ABS) and aggregated at the level of Statistical Local Areas (SLA).

The ABS uses SEIFA scores to rank regions into ten groups or deciles numbered one to ten, with one being the most disadvantaged and ten being the most affluent group. This ranking is useful at the national level, but the number of people in each decile often becomes too small for meaningful comparisons when applied to a subset of the population. For this reason, this document further aggregates SEIFA deciles into 3 socioeconomic groups.

SEIFA Group	Decile	Percentage of population (approximate)
Disadvantaged	1-2	20%
Middle	3-8	60%
Affluent	9-10	20%

Surgical survival

One Year Surgical Survival

All-cause crude survival: the percentage of cases still alive one year after surgery.

Two Year Surgical Survival

All-cause crude survival: the percentage of cases still alive two years after surgery.

Time to surgery from histological diagnosis

Time from histological diagnosis to surgery was measured for patients whose first treatment was lung cancer surgery (no neo-adjuvant therapy). Time periods were reported as being ≤ 45 days, 46-90 days or >90 days.

FOR MORE INFORMATION

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