public health research&practice
A JOURNAL OF THE SAX INSTITUTE

October 2024; Vol. 34(3):e3432423
https://doi.org/10.17061/phrp3432423
www.phrp.com.au

Research

Impact of COVID-19 on lung cancer care in New South Wales, Australia: real-world data from the EnRICH Program

Bea Brown[a,g], Jane Young[b], Kirsty Galpin[c], Michael Boyer[d], Venessa Chin[e,f], Chris Brown[a] and Robert J Simes[a]

[a] NHMRC Clinical Trials Centre, The University of Sydney, NSW, Australia
[b] School of Public Health, The University of Sydney, NSW, Australia
[c] Psycho-oncology Co-operative Research Group (PoCoG), School of Psychology, The University of Sydney, NSW, Australia
[d] Chris O'Brien Lifehouse, Sydney, NSW, Australia
[e] St Vincent's Hospital, Sydney, NSW, Australia
[f] Garvan Institute of Medical Research, Sydney, NSW, Australia
[g] Corresponding author: bea.brown@sydney.edu.au

Article history

Publication date: 23 October 2024
Citation: Brown B, Young J, Galpin K, Boyer M, Chin V, Brown C, Simes RJ. Impact of COVID-19 on lung cancer care in New South Wales, Australia: real-world data from the EnRICH Program. Public Health Res Pract. 2024;34(3):e3432423. https://doi.org/10.17061/phrp3432423

Key points

- Coronavirus disease 2019 (COVID-19) caused major disruptions to healthcare services, leading to predictions of adverse outcomes for patients with a range of serious health conditions, including cancer
- To date, limited real-world data have been published
- This study of 2000 patients diagnosed with lung cancer from 2016–2021 in NSW found quality of care and outcomes were unaffected
- These findings suggest prioritising urgent health services such as cancer care was effective in avoiding the predicted adverse impacts of COVID-19-related disruptions

Abstract

Objectives: The coronavirus disease 2019 (COVID-19) pandemic disrupted healthcare systems worldwide, causing substantial changes to routine healthcare delivery. National and international modelling studies have predicted adverse impacts of this disruption. This study aimed to assess the real-world impact of the COVID-19 pandemic on quality of care and outcomes for patients with lung cancer in New South Wales (NSW).

Study type: Pre-post observational cohort study using data prospectively collected for the Embedding Research (and Evidence) in Cancer Healthcare (EnRICH) Program.

Methods: The study population comprised 2000 patients with lung cancer from six specialist cancer centres in metropolitan and regional NSW. We split this population into two cohorts: the pre-COVID-19 cohort (1143 patients diagnosed from 8 September 2016 to 10 March 2020) and the post-COVID-19 cohort (857 patients diagnosed from 11 March 2020 to 28 October 2021). The main outcome measures were lung cancer clinical quality indicators, 1-year and 2-year overall survival, and patient-reported health-related quality of life and psychological distress.

Results: Patient and disease characteristics (e.g. age, gender, cancer stage) were similar for the pre-and post-COVID-19 cohorts, except for histology (non-small cell lung cancer (NSCLC) 88% in the pre-COVID-19 cohort and 84% in the post-COVID-19 cohort; $p = 0.008$) and region of residence (62% and 55%, respectively, lived in metropolitan areas; $p = 0.002$). Compared to the pre-COVID-19 cohort, fewer patients in the post-COVID-19 cohort received a diagnosis within 28 days of the first investigation of symptoms (clinical diagnosis: 77% compared with 72%; $p = 0.017$, pathological diagnosis: 60% compared with 53%; $p = 0.005$).

Abstract (continued)

However, the median time from the first investigation of symptoms to treatment initiation did not differ. One- and 2-year overall survival, quality of life and psychological distress did not differ between cohorts.

Conclusions: This analysis found that the COVID-19 pandemic did not significantly adversely affect quality of care and outcomes for patients with lung cancer in NSW. Reassuringly, these results suggest that prioritising urgent health services, such as cancer care and implementing protective mitigation measures were effective in avoiding the predicted adverse outcomes of healthcare service disruption.

Introduction

Despite recent advances in treatment, lung cancer remains the leading cause of cancer-related death, morbidity and burden of disease in Australia.[1] To achieve the best possible outcomes, patients must receive optimal evidence-based care, which includes timely and equitable access to diagnostic testing and appropriate treatment modalities.

In March 2020, the World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) a global pandemic. The COVID-19 pandemic and associated public health policy responses impacted healthcare systems worldwide, causing substantial changes to routine healthcare delivery.[2-4] Alongside this, patients changed their healthcare-seeking behaviours.[5] In New South Wales (NSW), Australia's most populous state, several COVID-19-related public health restrictions were enacted. These included mask-wearing mandates, capacity restrictions, physical distancing requirements, venue check-in requirements, testing and quarantine requirements, and two periods of stay-at-home orders ('lockdowns') from March to June 2020 and from June to October 2021.[6] During the first lockdown period, there were sizeable declines in healthcare activities in NSW, compared with the same period in 2019 before COVID-19 was declared a global pandemic. Among these were marked decreases in face-to-face primary care consultations, emergency department visits and public hospital inpatient episodes, as well as a one-third decrease in planned surgical activity in public hospitals.[7]

Similar COVID-19-related disruptions have been observed globally across healthcare for patients with a variety of diseases, including all types of cancer and lung cancer specifically due to overlapping symptoms with COVID-19. Several international population- and registry-based studies have shown substantial decreases in new and existing lung cancer–related patient encounters; delays in the detection, diagnosis and treatment of lung cancer; and significant increases in the number of patients presenting with late-stage disease and poor performance status[8-13], all of which are associated with poorer outcomes. Multiple modelling studies exploring the longer-term effects of such disruptions have predicted even modest diagnostic delays of 1 to 6 months will decrease survival and result in more cancer deaths. The impact has been predicted to be most severe for aggressive cancers such as lung cancer.[14,15]

Given the concerning findings and predictions reported elsewhere, there is a need to understand how COVID-19-related changes in healthcare delivery affected quality of care and outcomes for patients with lung cancer in Australia. A Cancer Australia analysis of Medicare Benefits Schedule (MBS) claims data for 2020 revealed a 9% nationwide decrease in diagnostic procedures for lung cancer compared with historical trends. The decrease across states and territories ranged from 2% to 12%, with the greatest reduction in NSW/Australian Capital Territory (ACT).[16] Perhaps surprisingly, given data reported elsewhere, the number of lung cancer–related surgical therapeutic procedures was similar to that expected, but this varied widely between jurisdictions (from 25% less than expected to 22% more than expected). A major limitation of these data, however, is the lack of principal diagnosis codes in the MBS claims datasets, which meant the allocation of procedures to cancer types was based on the judgement of specialist clinicians.

While modelling studies predicting the impacts of COVID-19 on cancer diagnoses and mortality in Australia have been published[17,18], to our knowledge, no real-world Australian data specific to lung cancer have been reported. The Embedding Research (and Evidence) in Cancer Healthcare (EnRICH) Program[19] is a prospective clinical cohort of patients newly diagnosed with lung cancer between 2016 and 2021 at six metropolitan and regional specialist cancer centres across three Local Health Districts in NSW. The dataset includes comprehensive patient, demographic, diagnostic, referral, treatment and outcome data (including patient-reported outcomes for a subset of patients), collected in close-to-real time and mapped against evidence-based clinical quality indicators.[20] This makes the EnRICH dataset ideal for examining the real-world impact of COVID-19 on quality of care and outcomes for patients with lung cancer in NSW.

This study aimed to assess the impact of COVID-19 on quality of care and outcomes for patients with lung cancer in NSW by comparing patients enrolled in the EnRICH

Program who were diagnosed before the pandemic was declared with those diagnosed after.

Methods

Sample

The study population comprised 2000 consecutive patients aged over 18 years who were newly diagnosed with primary lung cancer between 8 September 2016 and 28 October 2021 at the following specialist cancer centres: Chris O'Brien Lifehouse, Coffs Harbour Health Campus, Concord Repatriation General Hospital, Orange Health Service (including Bathurst and Dubbo Base Hospitals), Royal Prince Alfred Hospital and St Vincent's Hospital Sydney (including The Kinghorn Cancer Centre).

For this study, we divided the sample into two cohorts. The pre-COVID-19 cohort comprised patients diagnosed from 8 September 2016 to 10 March 2020. The post-COVID-19 cohort comprised patients diagnosed from 11 March 2020 (the date WHO declared COVID-19 a global pandemic) to 28 October 2021.

Data collection and measures

We extracted patient, demographic, clinical and patient-reported outcome data from the EnRICH REDCap database, including:

- Quality of care – under a waiver of consent, trained EnRICH research staff collected clinical data for all patients from electronic hospital medical records. Data were collected at defined time points from diagnosis to 5 years after diagnosis, or date of death if earlier
- Survival – we obtained dates of death from medical records and monthly linkage with death notifications recorded in the NSW Registry of Births, Deaths and Marriages (up to 25 August 2023)
- Patient-reported outcomes – we collected patient-reported outcomes from a subset of patients (who had provided consent) at diagnosis, 3, 6, and 12 months after diagnosis, and annually thereafter up to 5 years after diagnosis or to the date of death if earlier. Outcomes were collected using two previously validated measures: the European Organisation for Research and Treatment of Cancer Quality of Life Group Core Questionnaire (EORTC QLQ-C30) and the National Comprehensive Cancer Network (NCCN) Distress Thermometer

This study reports data collected to 2 years after diagnosis.

Statistical methods

We used Wilcoxon rank sum and Pearson's chi-square tests to compare patient characteristics and performance against clinical quality indicators between the pre- and post-COVID-19 cohorts. We used Kaplan–Meier estimates to compare 1-year and 2-year survival between the cohorts. Wilcoxon rank sum tests were used to compare subscales of the QLQ-C30, reflecting overall quality of life and physical functioning, role functioning, emotional functioning, cognitive functioning and social functioning and scores on the NCCN Distress Thermometer. Estimates of key times were reported as the median and interquartile range (IQR). A Poisson exact test was used to compare the diagnosis rates in the 12 months before and the 12 months after COVID-19 was declared a global pandemic.

Ethics approval

The Sydney Local Health District Lead Human Research Ethics Committee (RPA Zone) provided ethics approval for this project under protocol number X16-0447.

Results

Descriptive statistics

The pre-COVID-19 cohort comprised 1143 patients, and the post-COVID-19 cohort comprised 857 patients. The number of new diagnoses was slightly lower in the 12 months before COVID-19 was declared a global pandemic (n = 493) than in the 12 months after (n = 537) (rate ratio 1.09; p = 0.18).

Patient and disease characteristics were generally similar between the two cohorts (Table 1): pre- and post-COVID-19 median age 70 years at diagnosis (p = 0.2); pre-COVID-19 55% male v post-COVID-19 53% male (p = 0.5); pre-COVID-19 42% stage IV v post-COVID-19 41% stage IV (p = 0.4). However, there were differences in histology (p = 0.008). Compared to the pre-COVID-19 cohort, a lower proportion of patients in the post-COVID-19 cohort were diagnosed with non-small cell lung cancer (NSCLC) (84% compared with 88%). A higher proportion of patients in the post-COVID-19 cohort had no pathology studies (5% compared with 3% in the pre-COVID-19 cohort) and, therefore, had a clinical diagnosis based only on imaging. There were also differences in the region of residence (based on postcode); the post-COVID-19 cohort had a higher proportion of regional patients than the pre-COVID-19 cohort (45% compared with 38%, p = 0.002).

Table 1. Patient characteristics

Characteristic	Overall cohort (*N* = 2 000)	Pre-COVID-19 cohort (*n* = 1 143)	Post-COVID-19 cohort (*n* = 857)
Gender (*p* = 0.5)			
Female, *n* (%)	920 (46)	518 (45)	402 (47)
Male, *n* (%)	1 080 (54)	625 (55)	455 (53)
Age at diagnosis, median (IQR), years (*p* = 0.2)	70 (63, 76)	70 (62, 76)	70 (63, 77)
ECOG Performance Status Scale score (*p* = 0.9)			
0, *n* (%)	1 045 (53)	597 (53)	448 (53)
1, *n* (%)	652 (33)	373 (33)	279 (33)
2, *n* (%)	190 (10)	102 (9)	88 (10)
3, *n* (%)	81 (4)	48 (4)	33 (4)
4, *n* (%)	9 (<1)	6 (<1)	3 (<1)
Unknown[a], *n*	23	17	6
Histology (*p* = 0.008)			
NSCLC, *n* (%)	1 729 (86)	1 010 (88)	719 (84)
SCLC, *n* (%)	196 (10)	101 (9)	95 (11)
Undefined, *n* (%)	1 (<1)	0 (0)	1 (<1)
No pathology, *n* (%)	74 (4)	32 (3)	42 (5)
Clinical stage (*p* = 0.4)			
I or II, *n* (%)	736 (37)	422 (37)	314 (37)
IIIa, *n* (%)	220 (11)	126 (11)	94 (11)
IIIb or IIIc, *n* (%)	199 (10)	107 (9)	92 (11)
IV, *n* (%)	827 (41)	476 (42)	351 (41)
Indeterminate, *n* (%)	14 (1)	11 (1)	3 (<1)
Unknown[a], *n* (%)	4 (<1)	1 (<1)	3 (<1)
Smoking status (*p* = 0.4)			
Never, *n* (%)	365 (18)	204 (18)	161 (19)
Ex, *n* (%)	1 173 (59)	676 (59)	497 (58)
Passive, *n* (%)	21 (1)	16 (1)	5 (1)
Unknown[a], *n* (%)	23 (1)	13 (1)	10 (1)
Language spoken (*p* = 0.5)			
English, *n* (%)	1 601 (80)	909 (80)	692 (81)
Non-English, *n* (%)	398 (20)	234 (20)	164 (19)
Unknown[a], *n*	1	0	1
Region of residence[b] (*p* = 0.002)			
Metropolitan, *n* (%)	1 179 (59)	710 (62)	469 (55)
Regional, *n* (%)	815 (41)	433 (38)	382 (45)
Unknown[a], *n*	6	0	6

ECOG = Eastern Cooperative Oncology Group; IQR = interquartile range; NSCLC = non-small cell lung cancer; SCLC = small cell lung cancer
Note: The p-values were calculated using the Wilcoxon rank sum test for age and Pearson's chi-square test for all other variables.
[a] Excluded from analyses.
[b] Based on patient postcode.

Quality of care

Quality of care did not differ significantly between the cohorts across the majority of clinical quality indicators (Table 2). However, lower proportions of patients received a clinical or pathological diagnosis within 28 days of the first investigation of symptoms that were suspicious for lung cancer in the post-COVID-19 cohort (clinical diagnosis 77% compared with 72%; $p = 0.017$, pathological diagnosis 60% compared with 53%; $p = 0.005$).

Table 2. Performance against quality indicators for each cohort

Quality indicator	Overall cohort	Pre-COVID-19 cohort (n = 1 143)	Post-COVID-19 cohort (n = 857)	p-value[a]
Diagnostic quality indicators				
Proportion diagnosed within 28 days of first presentation[b], n (%)	1 524 (76) (N = 2 000)	900 (79)	624 (73)	0.002
Proportion with a pathological diagnosis within 28 days of first presentation[b], n (%)	1 099 (57) (N = 1 927)	664 (60)	435 (53)	0.005
Proportion of Stage III patients reviewed by MDT prior to potentially curative treatment, n (%)	242 (78) (N = 310)	129 (79)	113 (77)	0.8
Proportion of Stage IV NSCLC with molecular testing (excludes squamous cell and carcinoid tumours), n (%)	577 (97) (N = 595)	341 (96)	236 (98)	0.3
Treatment quality indicators				
Proportion of Stage I–III commencing curative treatment within 28 days of diagnosis, n (%)	234 (24) (N = 976)	126 (23)	108 (25)	0.5
Proportion of Stage IV commencing systemic treatment within 28 days of diagnosis, n (%)	360 (50) (N = 718)	208 (51)	152 (49)	0.6
Proportion of Stage IV patients referred to palliative care within 8 weeks of diagnosis, n (%)	259 (53) (N = 493)	148 (49)	111 (58)	0.061
Outcome quality indicators				
1-year survival[c,d], % (95% CI)	71 (69, 73) (N = 2 000)	70 (67, 73)	72 (69, 75)	0.2
2-year survival[c,d], % (95% CI)	57 (55, 59) (N = 2 000)	57 (54, 60)	57 (54, 61)	0.2

CI = confidence interval; MDT = multidisciplinary team; NSCLC = non-small cell lung cancer

[a] The p-value was calculated using Pearson's chi-square test.

[b] The date of the first investigation of symptoms that were suspicious for lung cancer (e.g. imaging, cytology, biopsy) could be before the date of the first presentation at a site included in this study, as it could include general practitioner–ordered or specialist-ordered investigations, and emergency department presentations. The clinical diagnosis date was defined as the date of the first imaging that had the outcome of 'probable lung cancer'. The pathological diagnosis date was defined as the date of sample collection for the earliest conclusive cytology, biopsy or resection.

[c] Kaplan–Meier estimates (95% CI)

[d] Median follow-up: pre-COVID-19 cohort 4.6 years; post COVID-19 cohort 2.7 years

The median number of days from the first investigation of symptoms to diagnosis for patients with stages I–III disease was higher for the post-COVID-19 cohort (median 11, IQR 0–52) than for the pre-COVID-19 cohort (median 8, IQR 0–32; $p = 0.02$) (Table 3). However, the median number of days from diagnosis to treatment was lower for the post-COVID-19 cohort (median 50, IQR 28–72) than for the pre-COVID-19 cohort (median 54, IQR 32–87; $p = 0.006$). This was largely driven by reduced surgical wait times for the post-COVID-19 cohort (median 47 days, IQR 24–67) compared with the pre-COVID-19 cohort (median 51 days, IQR 28–82; $p = 0.011$). Because of

the shorter time from diagnosis to treatment in the post-COVID-19 cohort, the total interval between presentation and treatment did not significantly differ between the two cohorts (pre-COVID-19 cohort: median 74 days, IQR 44–129; post-COVID-19 cohort: median 75 days, IQR 48–125; $p = 0.5$). No significant differences in time from diagnosis to treatment were observed for patients with advanced-stage disease or for patients who received non-surgical treatment. Further, no differences in time to treatment were observed between cohorts when broken down by region of residence or location of the hospital.

Table 3. Median time to diagnosis and treatment for each cohort

Time interval	Pre-COVID-19 cohort (*n* = 1 143)	Post-COVID-19 cohort (*n* = 857)	p-value[a]
Number of days from the first investigation of symptoms to diagnosis, by stage			
Stages I–III, median (IQR)	8 (0–32)	11 (0–52)	0.02
Stage IV, median (IQR)	2 (0–13)	2 (0–15)	0.2
Number of days from diagnosis to treatment, by stage[b]			
Stages I–III, median (IQR)	54 (32–87)	50 (28–72)	0.006
Stage IV, median (IQR)	28 (17–45)	29 (20–43)	0.4
Number of days from diagnosis to treatment, by treatment type[b]			
Surgery, median (IQR)	51 (28–82)	47 (24–67)	0.011
Non-surgery, median (IQR)	35 (20–56)	36 (23–54)	0.6
Number of days from diagnosis to treatment, by region of residence[b]			
Metropolitan, median (IQR)	37 (22–63)	37 (22–56)	0.3
Regional, median (IQR)	43 (23–73)	41 (24–64)	0.3
Number of days from diagnosis to treatment, by region of hospital[b]			
Metropolitan, median (IQR)	40 (22–68)	39 (22–61)	0.3
Regional, median (IQR)	41 (24–63)	40 (25–56)	0.4

IQR = interquartile range
[a] The p-values were calculated using the Wilcoxon rank sum test.
[b] Excludes 91 patients in the pre-COVID-19 cohort and 61 patients in the post-COVID-19 cohort who had no active anti-cancer treatment.

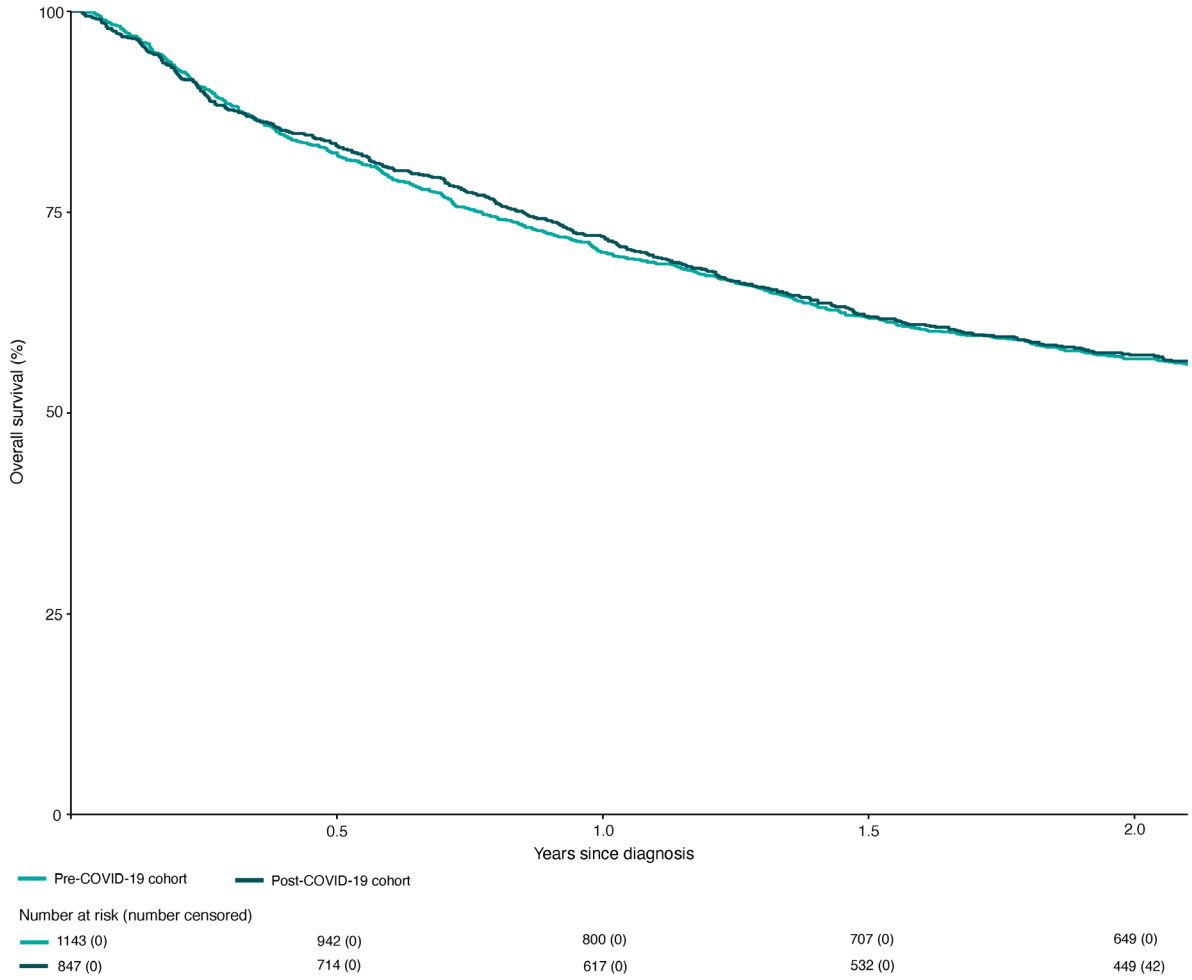
Survival

There were no significant differences between the two cohorts in 1-year survival (70% in the pre-COVID-19 cohort compared with 73% in the post-COVID-19 cohort; $p = 0.2$) and 2-year survival (57% in both cohorts) (Figure 1).

Patient-reported outcomes

At the time of diagnosis, there were no significant differences between the two cohorts in global health-related quality of life, physical functioning, role functioning, emotional functioning, cognitive functioning or social functioning (See Supplementary File A, Table A1; available at: https://figshare.com/articles/journal_contribution/Supplementary_File_A_pdf/26920351?file=48965797). Similarly, self-reported distress at diagnosis did not significantly differ between cohorts (mean distress score of 3.73 in the pre-COVID-19 cohort and 3.62 in the post-COVID-19 cohort; $p = 0.7$) (See Supplementary File A, Figure A1; available at: https://figshare.com/articles/journal_contribution/Supplementary_File_A_pdf/26920351?file=48965797).

Figure 1. Kaplan–Meier estimated 1-year and 2-year survival for each cohort



Discussion

We analysed real-world data from 2000 patients who were newly diagnosed with lung cancer at six specialist cancer centres across metropolitan and regional NSW between September 2016 and October 2021. We found minimal differences in patient and disease characteristics, quality of care and outcomes for patients diagnosed with lung cancer before or after COVID-19 was declared a global pandemic.

Contrary to data reported elsewhere[8,12,13], we found that after COVID-19 was declared a global pandemic there was no increase in the proportions of patients presenting with advanced-stage disease or poor performance status, both of which are associated with poorer prognoses.

The distribution of patients' regions of residence varied between the cohorts. Compared to the pre-COVID-19 cohort, the post-COVID-19 cohort had a higher proportion of patients who resided in regional postcodes. The reasons for this difference require further investigation. However, it may have been due to decreased presentations of metropolitan-based patients during the COVID-19 pandemic resulting from the stricter and lengthier lockdowns experienced in metropolitan areas of NSW compared to regional areas.

The main impact of the COVID-19 pandemic on quality of care was on the timeliness of diagnosis following investigative procedures (radiology and/or pathology). Compared with the pre-COVID-19 cohort, a significantly lower proportion of patients in the post-COVID-19 cohort received a clinical or pathological diagnosis within the recommended 28 days. However, although there was a 4-day increase in the median diagnostic interval for patients with early-stage disease, this was negated by a 4-day reduction in the treatment interval, which was largely driven by reduced surgical wait times. As such, the overall time from the first investigation of symptoms to the commencement of treatment was the same. These findings suggest that, rather than the treatment being ceased or postponed, urgent health services such as cancer care, including Category 1 elective surgery, were prioritised in NSW, in line with guidance.[21] The shorter time to treatment seen during the COVID-19 pandemic is consistent with the findings of a recent study of over 7000 patients newly diagnosed with stage IV NSCLC in the United States of America.[22] That study found that, after adjusting for treatment type, Eastern Cooperative

Oncology Group Performance Status Scale score (ECOG), age, gender, race and histology type, the time to treatment during the COVID-19 period was 4.6 days less than it was before COVID-19 (p = 0.0004).

One- and 2-year overall survival rates were similar among patients diagnosed before or after COVID-19 was declared a global pandemic. These findings are contrary to the adverse impacts of the COVID-19 pandemic predicted by several modelling studies.[14,15,18] These predictions were, however, for longer-term survival and were based on estimated diagnostic delays of between 1 and 6 months. For patients presenting to EnRICH clinical sites, the increase in median time from the first investigation of symptoms suspicious for lung cancer (imaging or cytology/histology) to diagnosis was less than 1 week. Further, for patients with stages I–III operable lung cancer – the group with the greatest predicted reduction in 5-year net survival resulting from treatment delays[23] – the time to treatment was shorter for patients in the post-COVID-19 cohort compared to the pre-COVID-19 cohort. This suggests that the worst predicted outcomes for reduced net survival may not eventuate in this cohort.

There were no significant differences between the pre- and post-COVID-19 cohorts for patient-reported outcomes related to global health-related quality of life, physical functioning, role functioning, emotional functioning, cognitive functioning, social functioning or psychological distress. These findings contrast with an analysis of 688 interactions with Cancer Council NSW support services between 1 December 2019 and 31 May 2020. That analysis found that patients had higher levels of distress during the first 6 months of the COVID-19 pandemic than they did during the same period in the preceding year (median distress thermometer scores of 7/10 and 6/10, respectively).[24] However, the statistical significance of the change was not reported. Median distress levels in that study were also higher than those reported by EnRICH patients in the pre- and post-COVID-19 cohorts. This suggests potential selection bias in the sample of individuals accessing support services, of whom only 58% had cancer themselves. Planned further analyses will examine patient-reported outcomes for the EnRICH cohort over time, with up to 5 years of follow-up.

A limitation of our study is a lack of data on the pre-diagnostic interval between symptom onset and the first investigation of symptoms in primary care. Given the widespread disruption to healthcare services during the pandemic, including a reduction in face-to-face primary care consultations[7] and stringent COVID-19 testing requirements for patients with respiratory symptoms[3], it is conceivable that patients experienced delays in primary care before they were referred for diagnostic testing. However, if such delays did occur, they have not translated into later-stage presentations. It is also conceivable that, as predicted elsewhere, some lung cancers went undiagnosed. However, despite a reported decrease in diagnostic procedures for lung cancer in NSW in 2020[16], the total rate of new lung cancer presentations to EnRICH clinical sites did not significantly differ in the 12-month periods immediately before and after COVID-19 was declared a global pandemic. Planned analyses of routinely collected NSW statewide population health datasets will identify if there was an increase in retrospective post-mortem lung cancer diagnoses during the post-COVID-19 period outside of the specialist cancer centres included in this study. Another potential limitation of this study is that loss to follow-up was unknown if patient movement out of NSW was not documented in their medical record. Survival analyses assumed patients were alive unless a date of death was recorded in their electronic medical record or a death notification had been received by the NSW Registry of Births, Deaths and Marriages. However, the most recent Australian population statistics indicate that less than 1% of the NSW population migrated out of the state in 2023[25], and it is arguable that patients with lung cancer, who experience high levels of morbidity and burden of disease, would be less likely to migrate than the general population. Further, state and national border restrictions during the COVID-19 pandemic would have limited patient movement.

Conclusion

Continued follow-up is necessary to determine the ongoing impacts of the COVID-19 pandemic on longer-term lung cancer incidence and mortality. However, our analysis of a prospective clinical cohort of 2000 patients found quality of care and outcomes, including 1-year and 2-year survival and patient-reported quality of life and distress, were not significantly affected by the pandemic. Reassuringly, these results suggest that prioritising urgent health services, such as cancer care, and implementing protective mitigation measures were effective in avoiding the predicted adverse outcomes of healthcare service disruption.

Acknowledgements

We would like to acknowledge and thank the patients and clinicians who have supported the EnRICH Program. We would also like to thank the EnRICH project team and clinical site teams for their significant data collection efforts.

EnRICH Steering Committee members: Dr Teresa Anderson, Professor David Barnes, Professor Michael Boyer, Dr Karen Briscoe, Associate Professor Venessa Chin, Professor Wendy Cooper, Professor Phil Hogg, Dr Ruth Jones, Professor Anthony Joshua, Dr Anthony Linton, Dr Diane McPhail (consumer representative), Professor John Simes, Adjunct Associate Professor Vicki Taylor, Professor Emeritus Jane Young.

Peer review and provenance

Externally peer reviewed, not commissioned.

Competing interests

None declared.

Author contributions

BB contributed to the study conceptualisation, methodology and writing of the manuscript. KG contributed to the writing of the manuscript. JY, MB, VC and JS contributed to the study conceptualisation and methodology and reviewed the manuscript. CB provided biostatistics support and reviewed the manuscript.

References

1. Australian Institute of Health and Welfare (AIHW). Cancer in Australia 2021. Canberra; 2021. Report No: CAN 144. [cited 2024 Jan 20]. Available from: www.aihw.gov.au/reports/cancer/cancer-in-australia-2021/summary
2. Jazieh A, Akbulut H, Curigliano G, Rogado A, Alsharm A, Razis E, et al. Impact of the COVID-19 pandemic on cancer care: a global collaborative study. JCO Glob Oncol. 2020;6:1428–38.
3. Weinkove R MZ, Adler J, Agar MR, Blyth E, Cheng AC, et al. Managing haematology and oncology patients during the COVID-19 pandemic: interim consensus guidance. Med J Aust. 2020;212(10):418–9.
4. Edge R, Meyers J, Tiernan G, Li Z, Schiavuzzi A CP, Vassallo A, et al. Cancer care disruption and reorganisation during the COVID-19 pandemic in Australia: a patient, carer and healthcare worker perspective. PLoS One. 2021;16(9):e0257420.
5. Schirmer C, Ringer A, Arthur A, Binning M, Fox C, James R, et al. Delayed presentation of acute ischemic strokes during the COVID-19 crisis. J Neuro Interv Surg. 2020;12(7):639–42.
6. NSW Ministry of Health. Public Health – NSW COVID-19 Response. Sydney. 2023. [cited 2024 March 8]. Available from www.health.nsw.gov.au/Infectious/covid-19/evidence-hub/Publications/phr-report.pdf
7. Sutherland K, Chessmana J, Zhaob J, Sarac G, Shetty A, Smith S, et al. Impact of COVID-19 on healthcare activity in NSW, Australia. Public Health Res Pract. 2020;30(4):3042030.
8. Cancer Research UK. Health Professional COVID-19 and Cancer Hub; 2021 [cited 2024 Jan 20]. Available from: www.cancerresearchuk.org/health-professional/diagnosis/hp-covid-19-and-cancerhub#HP_COVID-191
9. Mitchell H, Alford B, O'Hare S, O'Callaghan E, Fox C, Gavin A. Impact of the COVID-19 pandemic on emergency hospital cancer admissions in a UK region. BMC Cancer. 2022;22(1):850.
10. London J, Fazio-Eynullayeva E, Palchuk M, Sankey P, McNair C. Effects of the COVID-19 pandemic on cancer-related patient encounters. JCO Clin Cancer Inform. 2020;4:657–65.
11. Patt D, Gordan L, Diaz D, Okon T, Grady L, Harmison M, et al. Impact of COVID-19 on Cancer Care: how the pandemic is delaying cancer diagnosis and treatment for American seniors. JCO Clin Cancer Inform. 2020;4:1059–71.
12. van Breeschotena J, Ismaila R, Smitd H, Schuurbierse O, Schramelf F, on behalf of the Dutch Lung Cancer Audit Scientific Committee. An invisible group of COVID-19 victims; impact on Dutch lung cancer care. Lung Cancer. 2021;159:177–8.
13. Gourd E. Lung cancer control in the UK hit badly by COVID-19 pandemic. Lancet Oncol. 2020;21(12):1559.
14. Sud A, Torr B, Jones M, Broggio J, Scott S, Loveday C, et al. Effect of delays in the 2-week-wait cancer referral pathway during the COVID-19 pandemic on cancer survival in the UK: a modelling study. Lancet Oncol. 2020;21(8):1035–44.
15. Malagón T, Yong J, Tope P, Miller W, Franco E, McGill Task Force on the Impact of COVID-19 on Cancer Control and Care. Predicted long-term impact of COVID-19 pandemic-related care delays on cancer mortality in Canada. Int J Cancer. 2022;150(8):1244–54.
16. Cancer Australia. The impact of COVID-19 on cancer-related medical services and procedures in Australia in 2020. Examination of MBS claims data for 2020, nationally and by jurisdiction. Surry Hills, NSW; 2021 [cited 2024 Jan 20]. Available from: www.canceraustralia.gov.au/sites/default/files/publications/impact-covid-19-cancer-related-medical-services-and-procedures-australia-2020-examination-mbs-claims/pdf/the-impact-of-covid-19-on-cancer-services-in-australia-in-2020.pdf
17. Te Marvelde L, Wolfe R, McArthur G, Blake L, Evans S. Decline in cancer pathology notifications during the 2020 COVID-19-related restrictions in Victoria. Med J Aust. 2021;214(6):281–3.
18. Actuaries Australia COVID-19 Working Group. COVID-19: Excess mortality for May 2022 at similarly high levels to earlier in 2022; 2022 [cited 2024 Jan 20]. Available from www.actuaries.digital/2022/08/31/covid-19-excess-mortality-for-may-2022-at-similarly-high-levels-to-earlier-in-2022/
19. Brown B, Boyer M., Young J, Chin V, Brown C, Simes RJ, et al. Patterns of care and outcomes for a clinical cohort of patients with lung cancer (2016-2021). Report on the Embedding Research (and Evidence) in Cancer Healthcare - EnRICH Program. Sydney, Australia: NHMRC Clinical Trials Centre, University of Sydney; 2023 [cited 2024 Jan 20]. Available from: //hdl.handle.net/2123/31787

20. Brown B, Galpin K, Simes RJ, Boyer M, Brown C, Chin V, et al. Development of clinically meaningful quality indicators for contemporary lung cancer care; experiences of the Embedding Research (and Evidence) in Cancer Healthcare (EnRICH) Program. BMJ Open. 2024;14(2):e074399.

21. NSW Agency for Clinical Innovation. Key principles for management of surgery during COVID-19 pandemic. Advice for NSW health services. NSW; 2020 [cited 2024 Jan 20]. Available from: www.health.nsw.gov.au/Performance/Documents/covid-surgery-principles.pdf

22. Zhai Y CP, Kang D, Robert NJ, Zhang W. Impact of COVID-19 pandemic on non-small cell lung cancer care. Curr Oncol. 2023;30(1):769–85.

23. Sud A, Jones M, Broggio J, Loveday C, Torr B, Garrett A, et al. Collateral damage: the impact on outcomes from cancer surgery of the COVID-19 pandemic. Ann Oncol. 2020;31(8):1065–74.

24. Edge R, Mazariego C, Li Z, Canfell K, Miller A, Koczwara B, et al. Psychosocial impact of COVID-19 on cancer patients, survivors, and carers in Australia: a real-time assessment of cancer support services. Support Care Cancer. 2021;29(9):5463–73.

25. Australian Bureau of Statistics. National, state and territory population. Canberra: ABS; 2023 [cited 2024 March 8]. Available from: www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release