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ORIGINAL ARTICLE

Improving the timeliness of care for regional lung cancer patients through the implementation of a web-based lung cancer referral pathway

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Key words
health pathway, timeliness, lung cancer, health service research, regional cancer service.

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Abstract

Background: Lung cancer remains a significant public health problem and a leading cause of cancer-related mortality worldwide. The delays in the diagnosis of lung cancer are more pronounced for rural and regional Australians compared to their urban counterparts. Implementing an online HealthPathway is one way to reduce delays in the diagnosis of lung cancer.

Aim: The Townsville Lung Cancer Referral Pathway (TLCRP) was implemented to guide local general practitioners (GPs) in the referral process of people with suspected lung cancer. The aim of the study was to compare the time interval from initial GP consultation of the person with suspected lung cancer to the first specialist referral and from the first specialist referral to the initial specialist appointment, before and after implementation of TLCRP. Other lung cancer service outcomes were also compared between the pre- and post-implementation groups.

Methods: A retrospective cohort study of 316 participants was conducted, and descriptive statistical analysis of the data was used to discern any difference in timelines and other clinical outcomes in the pre-pathway implementation group compared to the post-pathway implementation group.

Results: The time interval from initial GP presentation to initial referral to specialist appointment was significantly reduced in the post-pathway group (15 days) compared to the pre-pathway group (8 days, $P = 0.03$). However, the time interval from GP referral to initial appointment with a specialist increased in the post-pathway group (15 and 20 days, $P = 0.03$). Many of the Cancer Australia lung cancer optimal care pathway referral guidelines were not met. Only 40% of the pre-pathway group and 34% of the post-pathway group were seen in the specialist clinic within 2 weeks of GP referral. Significant proportions of patients in both groups did not have chest x-rays ordered by the GP, and the proportion of participants who were appropriately referred to the respiratory clinic did not improve after implementation of TLCRP (76% and 72%). Nearly 30% of participants in both groups were diagnosed after emergency presentation.

Conclusions: TLCRP improved the time interval from initial GP consultation to specialist referral, thus meeting its primary objective. However, better strategies are required to improve other timelines and meet Cancer Australia's lung cancer optimal care pathway guidelines.

Introduction

Lung cancer remains a major public health problem and a "leading cause of cancer-related mortality worldwide.[1] Around 80% of patients with lung cancer are already at an advanced stage at presentation, therefore excluding them from potentially curative surgical resection and radiation therapy.[2] There is concern that delays in diagnosis may be a contributing factor in the high frequency of advanced disease at presentation.[3] Studies suggest that timeliness may be particularly important for early-stage lung cancer that

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could potentially be cured surgically.[4,5] Timeliness of care improves patient satisfaction and may also improve lung cancer survival.[6–9]

In Australia, initial recognition by a general practitioner (GP) in primary healthcare settings and appropriate specialist referrals for definitive diagnosis and staging are critical steps in the care of people suspected of having lung cancer,[10] and many studies have shown delays in these steps.[11–14] Inappropriate specialist referrals can also lead to duplication of investigations, inappropriate management and increased healthcare costs.[15] These delays are more pronounced for rural and regional Australians compared to their urban counterparts.[16–18] For example, a north Queensland study found that lung cancer patients who lived in rural areas experienced delays in the time from onset of symptoms to treatment and the time from GP consultation to seeing a specialist.[14] Novel solutions such as web-based care pathways are needed to reduce these delays.[19]

HealthPathways is an international web-based information portal that provides health providers with more than 550 condition-specific guidelines and referral pathways to specialists and services.[20] HealthPathways was developed by New Zealand's Canterbury District Health Board and was subsequently adopted by health services throughout New Zealand, Australia and the United Kingdom. Each local pathway becomes an agreement between primary and specialist services on how patients with particular health conditions are managed in their region. There is emerging evidence that use of HealthPathways is associated with improved referral quality from primary care, more timely access to secondary care and standardisation of clinical management decisions by GPs and improved survival.[21–24] Several authors have investigated the time taken to initiate the diagnosis and treatment of patients with lung cancer.[11–14] Published studies on other HealthPathways have evaluated their usage, acceptance, satisfaction and economic benefits.[22,25–30] However, there is limited information on the impact of implementing HealthPathways on referral patterns of people with suspected lung cancer, particularly in rural and regional areas.

Townsville Cancer Centre (TCC), a regional cancer centre in north Queensland, Australia (within Townsville Hospital and Health Service (THHS)) serves a large rural and remote population.[31] To improve care of lung cancer patients in the region, TCC has started implementing the Cancer Australia optimal care pathway (OCP) for people with lung cancer,[7] the initial phase being the implementation of a HealthPathways to guide GPs on the referral process of people with suspected lung cancer. This HealthPathways, titled the Townsville Lung Cancer Referral Pathway (TLCRP) outlines the recommended investigations and referrals for a person with suspected lung cancer in THHS. The TLCRP was developed in consultation with local GPs and lung cancer specialists and was added to the https://townsville.communityhealthpathways.org/ portal in August 2019 (Fig. 1). The TLCRP was publicised to all GPs in the THHS by the local primary health network (PHN) through newsletters and flyers. The Townsville hospital GP liaison officer also organised in-person information sessions about TLCRP for selected GP clinics in the area.

Aim

The study aimed to compare the time interval from initial GP consultation of the person with suspected lung cancer to the first specialist referral and from the first specialist referral to the initial specialist appointment, before and after implementation of TLCRP. Other service outcomes that were compared were the proportion of participants seen in lung cancer specialist clinics within 2 weeks of GP referral, the proportion whose first GP referral was to a respiratory clinic, the proportion

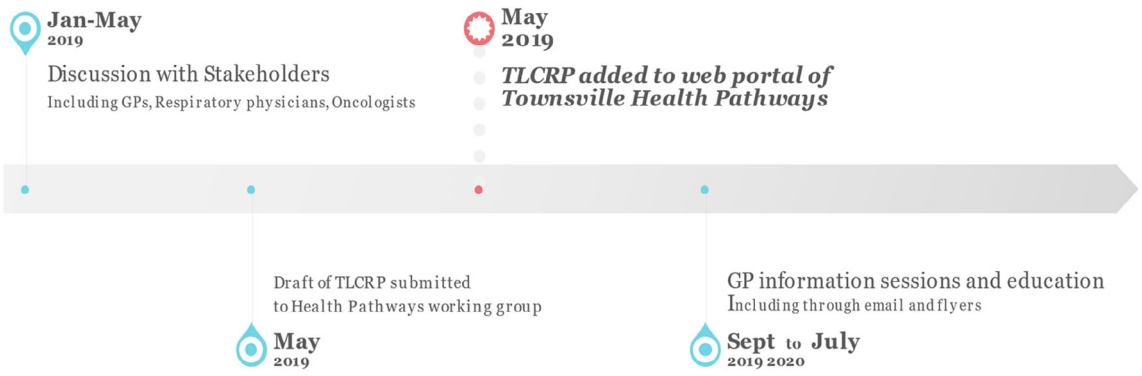

Figure 1 Timelines for the Townsville Lung Cancer Referral Pathway (TLCRP) implementation. GP, general practioner.

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diagnosed via emergency admission route, the proportion who had recommended imaging organised by the GP and the median time interval from GP referral to the first specialist clinic appointment for rural participants compared to those living in regional areas. It is part of a broader project exploring the implementation of the TLCRP and its impact on lung cancer patient outcomes.

Methods

Design and setting

A retrospective cohort study was conducted of lung cancer patients seen at the TCC between 2016 and 2023. Lung cancer services at TCC (within the Townsville University Hospital) are part of the government-funded public healthcare system and consist of respiratory medicine, cardio-thoracic surgery, radiation and medical oncology, palliative care, pathology, radiology, nursing and allied health. At the time of the study, there were four respiratory physicians, two bronchoscopic interventionists, three cardio-thoracic surgeons, five radiation oncologists, five medical oncologists and three palliative care physicians. Patients with suspected lung cancer are referred to TCC by the GPs, other specialists or the emergency department. TCC also accepts referrals of patients outside the THHS as it is the tertiary referral centre for the whole of north Queensland. After initial evaluation and diagnosis by the respiratory physician, the patient cases are discussed at the lung cancer multidisciplinary meeting (MDT). The lung cancer MDT at TCC occurs weekly and includes respiratory physicians, medical oncologists, radiation oncologists, thoracic surgeons, radiologists, nuclear medicine physicians, pathologists and the MDT coordinator.

TLCRP contains information for GPs to organise appropriate investigations and referrals for people with suspected lung cancer. The TLCRP is available on the Townsville HealthPathways website, http://townsville.communityhealthpathways.org/, and can be accessed by all clinicians in the THHS area. Information about the implementation of TLCRP was disseminated to all of the GPs in the THHS region through the local PHN network and the Townsville Hospital GP liaison officer (GPLO). GPs were informed about TLCRP through emails, flyers and updates on the Townsville HealthPathways website. Engagement with the GPLO and advertising through North Queensland PHN publications, particularly regular email newsletters, was performed to inform GPs about the pathway. We anticipated that 12 months post-implementation of TLCRP would have provided enough time for all the GPs to be aware of the TLCRP and have started using it; thus, this was the start date for the post-implementation audit.

Data collection

Data were collected from patients' hospital-based electronic health records, PowerChart (Cerner Corporation, Kansas City, MO, USA) and MOSAIQ (Elekta Inc., Sunnyvale, CA, USA), by the first author and two medical registrars. Cerner PowerChart is an enterprise-wide, multifacility, multientity, longitudinal electronic medical record. MOSAIQ is a certified health information system that manages the treatment of cancer patients in both medical oncology and radiation oncology healthcare settings. All data for patients referred to hospital specialists were entered into electronic medical records as part of standard practice, including the date of GP referral to a hospital specialist. If the date of initial consultation with a GP was not available in the medical record or GP letters, we called the GP practice to obtain the relevant dates.

Inclusion and exclusion criteria

All patients with lung cancer seen in the TCC during the following periods were included:

1 Pre-pathway implementation group from August 2016 to July 2019, and
2 Post-pathway implementation group from August 2020 to July 2023.

Records were excluded if:

1 Patients were referred by GPs outside the THHS, as these GPs would not have access to TLCRP.
2 Patients referred to private specialists, as we are not able to access their data.
3 Patients without a histological confirmation of lung cancer.
4 Patients under treatment or follow-up for other cancers in the oncology department (these patients did not require a new referral to the oncology department).

Primary outcome

Time interval 1 (T1) from the date of initial presentation to GP to the date when the GP sent the referral to a lung cancer specialist (respiratory physician, oncologist or thoracic surgeon, as per the definition in Cancer Australia OCP for people with lung cancer) (Fig. 2).

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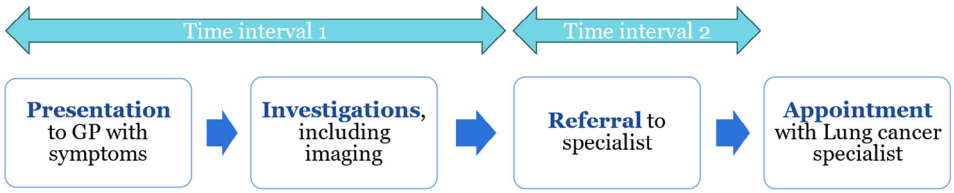

Figure 2 Time intervals. GP, general practioner.

Secondary outcomes

- Time interval 2 (T2) from the date of receipt of GP referral to the outpatient department to the date of initial appointment with a lung cancer specialist (Fig. 2).
- Median time interval from GP referral to first specialist clinic appointment for rural and remote patients compared to regional patients. Rurality was measured using the modified Monash method 2019 version.[32]
- Proportion of patients seen in the specialist clinic within 2 weeks of referral from the GP.[7]
- Proportion of patients with suspected lung cancer referred by the GP directly to respiratory clinic.
- Proportion of patients who had chest x-ray and computed tomography (CT) scan of the chest organised by the GP.
- Proportion of lung cancer patients diagnosed via emergency admission rather than in the outpatient clinic.

Sample size and statistical power

Hypothesising an improvement of 20% in the time from initial GP consultation to specialist referral post-implementation of TLCRP, 182 cases in total were needed to determine the difference between the two groups with a power of 90% and type 1 error of 0.05 (two-tailed test). The sample size was calculated using the OpenEpi version 3 software.[33]

Data analysis

Simple univariate descriptive statistics were used to compare outcomes pre- and post-pathway implementation. Chi-square tests with the calculations of odds ratios and 95% confidence intervals were used to compare proportions pre- and post-implementation. Fischer exact tests were used to compare times pre- and post-pathway implementation, and *t* tests or chi-square tests to compare demographics and characteristics. Only patients diagnosed via the GP referral pathway were included in time interval analyses.

Ethics approval was obtained for the study from the local Hospital and Health Service Human Research Ethics Committee (HREC/2020/QTHS/58635). All collected data were de-identified and stored in a secure computer and managed according to the Australian Code for Responsible Conduct of Research.

Patient and public involvement statement

Patients or the public were not involved in the design or conduct or reporting or dissemination plans for our research.

Results

Out of 316 participants included, 164 were in the pre-pathway group and 152 were in the post-pathway group. Participant demographics are summarised in Table 1. The median age was 68 years, and there was an equal proportion of male and female patients in both groups. Rurality, indigenous status, type of lung cancer, stage of lung cancer and treatment intent in both groups were statistically comparable. There was no significant difference in the diagnostic pathways between the groups. A total of 29.8% of the pre-pathway (49 participants) and 32.9% of the post-pathway (50 participants) group were diagnosed after being admitted through the emergency department.

The time interval from initial GP presentation to initial specialist referral (T1) was significantly reduced in the post-pathway group, 8 days compared to 15 days ($P = 0.03$) (Table 2). However, the time interval from GP referral to initial appointment with a lung cancer specialist (T2) was increased from 15 days in the pre-pathway group to 20 days in the post-pathway group (Table 2). The median duration from initial presentation to GP to initial appointment with a lung cancer specialist was 35 days in the pre-pathway group and 30 days in the post-pathway group (Table 2).

Both rural/remote and regional patients had apparent improvements in T1, although not sufficiently powered for statistical significance (Table 3). T2 also showed a non-significant reduction for rural patients after implementation of TLCRP, although it significantly increased in regional patients.

Only 40% of the pre-pathway group and 34% of the post-pathway group were seen in the specialist clinic within 2 weeks of referral from the GP, as recommended by Australian OCP guidelines (Table 4).[7] Although the majority

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Table 1 Patient demographics

	Pre-pathway, $n = 164$, *n* (%)	Post-pathway, $n = 152$, *n* (%)	*P*-value
Median age (years)	68	68	0.96
Sex			
Male	96 (58.5)	89 (58.5)	1.0
Female	68 (41.5)	63 (41.5)	
Indigenous status			
Non-indigenous	148 (90)	131 (86)	0.44
Aboriginal and/or Torres Strait Islander	16 (10)	21 (14)	
Type of lung cancer			
Non-small cell lung cancer	139 (84.7)	128 (84.2)	0.93
Small cell lung cancer	23 (14)	23 (15)	
Others	2 (1)	1 (0.6)	
Stage of lung cancer			
1	6	4	0.93
2	14	5	
3	37	35	
4	107	108	
Treatment intent			
Curative	42 (25.6)	38 (25)	0.95
Palliative	122 (74.4)	114 (75)	
Diagnostic pathway			
GP	95 (57.9)	88 (57.9)	0.56
Emergency	49 (29.8)	50 (32.9)	
Other specialists	20 (12.2)	14 (9.2)	
Locality			
MMM 2 (regional)	115	112	0.75
MMM 3–7 (rural and remote)	46	40	

GP, general practitioner; MMM, modified Monash model.

Table 2 Changes in time intervals for pre-pathway and post-pathway groups

Time interval	Pre-pathway median (range) in days, $n = 95$	Post-pathway median (range) in days, $n = 88$	*P*-value
Initial presentation to the GP to initial referral to specialist (T1)	15 (1–160)	8 (1–70)	0.03
Initial referral from the GP to lung cancer specialist appointment (T2)	15 (1–90)	20 (1–76)	0.03
Initial presentation to GP to lung cancer specialist appointment (T1 + T2)	35 (2–183)	30 (6–90)	0.10

Only the participants who were referred by a GP to a lung cancer specialist were included in the analysis.GP, general practitioner; T1, time interval 1; T2, time interval 2.

Table 3 Changes in time intervals for rural and remote patients compared to regional patients

	Rural patients†			Regional patients‡		
	Pre-pathway median in days, $n = 46$	Post-pathway median in days, $n = 40$	*P*-value	Pre-pathway median in days, $n = 115$	Post-pathway median in days, $n = 112$	*P*-value
Initial presentation to initial referral (T1)	15	7	0.12	16	11	0.12
Initial referral to lung specialist appointment (T2)	20	17	0.38	16	21	0.04

†Rural/Remote defined as MMM of 3–7.‡Regional defined as MMM of 2.GP, general practitioner; MMM, modified Monash model; T1, time interval 1; T2, time interval 2.

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Table 4 Proportion of GP referrals meeting the OPC guidelines

	Pre-pathway, *n* (%), *n* = 95	Post-pathway, *n* (%), *n* = 88	*P*-value
Proportion of patients seen by a lung cancer specialist within 14 days of initial GP referral	38 (40)	30 (34)	0.43
Proportion of patients whose initial referral was to a respiratory clinic by a GP	76 (83)	72 (81)	0.20
Proportion of patients who had a chest x-ray organised by the GP	57 (62.6)	51 (57.3)	0.54
Proportion of patients who had CT chest organised by the GP	85 (93.4)	83 (93.2)	0.98

CT, computed tomography; GP, general practitioner; OPC, optimal care pathway.

of patients had a CT chest organised by their GPs, only 62.6% of participants in the pre-pathway group and 57.3% of participants in the post-pathway group had a chest x-ray. The proportion of patients whose initial specialist referral was to the respiratory clinic did not improve after the implementation of TLCRP (81% vs. 83%) (Table 4).

Discussion

The time interval from initial GP consultation to the date when the GP sent the initial referral to the lung cancer specialist (T1) was significantly reduced after the implementation of TLCRP. Since the aim of TLCRP was to help GPs in the diagnosis and referral of people with suspected lung cancer, the study met its primary objective. To our knowledge, this is the first study to show that a web-based referral pathway such as TLCRP can help to optimise the timeliness of GP referral to specialists for people with suspected lung cancer. Both regional and rural cohorts had improvements in T1 after implementation of TLCRP. Web-based referral pathways may help to improve referral times from GPs in other cancers as well, although this needs to be empirically tested.

Despite meeting the primary goal, however, the time interval from GP referral to specialist appointment (T2) was increased in the post-implementation group. Furthermore, this study identified several gaps in adherence to the Australian lung cancer OCP guidelines.[7] For example, only 30%–40% of participants in this study were seen by a specialist within 2 weeks, although the OCP recommends that all patients with suspected lung cancer should be seen by a specialist within 2 weeks of referral.[7,34–36] There could be several potential reasons for these findings, and it should be an area of future research. Some of the time delays during the post-TLCRP implementation period could be at least partially explained by the confounding impact of the COVID-19 pandemic and local workforce shortage during this period.[37–40] However, it is equally possible that these factors did not influence the findings. There was also a local shortage of respiratory physicians during this period, as two of the consultants were on leave, and there were restrictions on diagnostic procedures such as bronchoscopy due to the COVID-19 pandemic.[41] This might indicate the sensitivity of patient flow and timeliness of care to workforce interruptions. Another possible reason for achieving the secondary outcomes of the study could be the lack of a lung cancer nurse in the TCC. When a lung cancer nurse is added to the team, the timelines can be re-audited to evaluate improvements. The factors causing delay in specialist appointments need to be addressed in the next phase of the implementation of the lung cancer OCP in the TCC.

The Cancer Australia Lung Cancer OCP also recommends that GPs organise a chest x-ray for all patients with suspected lung cancer before specialist referral and a CT chest if the chest x-ray result is abnormal.[7] There was no significant improvement in the percentage of patients having either a chest x-ray or CT chest after implementation of TLCRP. The proportion of participants in both time periods having a CT chest was considerably higher than that of those having a chest x-ray; the reasons for this should be further investigated, and TLCRP will be revised accordingly.

There was no reduction in the percentage of patients diagnosed via emergency admission after implementation of TLCRP. Published literature shows that patients diagnosed with lung cancer after presenting to the emergency department with severe symptoms have worse outcomes than patients diagnosed by the GP.[42] TLCRP sought to increase early detection of lung cancer by GPs, so that patients do not present to the emergency department with advanced cancer. Also, the proportion of patients referred directly to the respiratory clinic by GPs did not change in the post-implementation group. When the GPs refer suspected lung cancer patients to the oncologist or thoracic surgeon without histological diagnosis and staging, their diagnosis and treatment are often delayed.[14]

Relatively few studies have evaluated the effect of referral pathways on the care of rural lung cancer patients.[28,30]

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It was interesting to note in this study that T2 was reduced in the rural cohort while it increased in the regional cohort. Although somewhat underpowered, perhaps this could be explained by tele-health consultations not experiencing as much disruption as face-to-face consultations during the COVID-19 pandemic.[43] More rural and remote patients were seen by tele-health rather than face-to-face consultations with specialists during the COVID-19 pandemic.[41]

TLCRP addresses the initial part of the lung cancer pathway. THHS is planning to implement the rest of the Lung Cancer OCP, including treatment and survivorship. Implementing the whole of the lung cancer OCP aim will help to further improve the outcomes for people with lung cancer in THHS and increase compliance with Cancer Australia lung cancer OCP guidelines. Lessons learned in implementing the TLCRP, including the need for better coordination of services, can be used in improving the referral pathways for other common cancers in THHS. Many national guidelines have been published to improve the care of people with lung cancer,[7,36,44] but adherence to these guidelines is variable.[45–47] Many centres in Australia and a small number of developed countries have implemented referral pathways for common cancers.[28,44,48,49] Novel strategies have been successfully trialled in other health services to reduce the waiting time for specialist clinics, including rapid-access clinics,[50,51] increasing use of telemedicine[52] or a timed lung cancer diagnostic pathway.[44]

Strengths and limitations

The study included an adequate number of patients to calculate a statistically significant difference in timelines. Since THHS had implemented electronic medical records, all the referrals to specialist clinics were captured. There was good support from the local primary care network in educating all the GPs about TLCRP. The data collected by registrars were cross-checked by the principal investigator.

The current study also has several limitations. The date of initial consultation with the GP could not be accurately captured for some patients. It was difficult to define the exact time when some patients initially presented to their GP with symptoms of possible lung cancer, as they also had symptoms from other chronic respiratory illnesses such as chronic obstructive pulmonary disease. So, the study may have underestimated or overestimated the time interval from initial presentation to GP with symptoms to specialist referral (T1). Underestimation of T1 is more likely, according to evidence for health-seeking behaviours. Before their diagnosis, patients with cancer present in primary care more frequently than do matched controls with a symptom-lead time <3 months.[53] If we assume GPs act on the most recent presentation and refer, T1 may be shorter than the actual.

The study was performed in a single health service, and responses may have been affected by a range of local, contextual factors. The COVID-19 epidemic started in Queensland in early 2020 and could have affected the timelines of care of lung cancer patients in the post-pathway period.[39] About 15% of patients in both groups had small cell lung cancer, which progresses rapidly compared to non-small cell lung cancer. These patients often present with acute symptoms, and TLCRP may be relatively less useful in managing these patients. Different stages of lung cancer can vary in their clinical presentations, and we did not separate different stages of lung cancer while evaluating time to care. The actual proportion of patients referred to a lung cancer specialist did not differ significantly in the two groups.

Implications for future research

More research is needed to identify the degree of awareness about the TLCRP of GPs in the region and other possible barriers to the uptake of TLCRP and find solutions for these barriers. Work is underway in these areas. The initiative described in this manuscript is largely the effort of clinical champions, and adoption at a system level is crucial for sustainability through adequate resourcing, monitoring and quality improvement. Sustainability of TLCRP and other care pathways requires adoption at the whole of health service level for adequate resourcing, monitoring and quality improvement. Even if people with suspected lung cancer are referred early to specialist clinics, there can be delays in specialist appointments and investigations, which can adversely affect their outcome. Strategies to reduce waiting times for respiratory clinic appointments and specialist investigations also need to be investigated.

Conclusions

Implementation of the TLCRP improved the time interval from initial GP consultation to specialist referral for people with suspected lung cancer in north Queensland. However, better strategies are required to address delays in specialist clinic appointments and meet national OCP guidelines. Refining TLCRP and implementing the rest of the lung cancer OCP may help to improve outcomes for people with lung cancer in the region.

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