Improving Timeliness of Lung Cancer Diagnosis and Staging Investigations Through Implementation of Standardized Triage Pathways

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abstract

PURPOSE Timely care for patients with lung cancer (LC) is associated with improved clinical outcomes. In Southeastern Ontario, Canada, we identified delays in the diagnostic process for patients undergoing evaluation for suspected LC through a rapid assessment clinic. We developed improvement initiatives with an aim of reducing the time from referral to diagnosis.

METHODS A Standardized Triage Process (STP) was implemented for patients referred with suspected LC, including routine interdisciplinary triage, standardized pathways with preordered staging tests, and a new Small Nodule Clinic. We retrospectively analyzed all patients referred pre-STP (January to April 2018) and prospectively for improvement (May 2018 to March 2019). Process measures included STP compliance and time to completion of staging investigations (positron emission tomography [PET] and computed tomography/magnetic resonance imaging of brain). Data are reported as means; significance was determined by special-cause variation using Statistical Process Control charts; unpaired *t* tests were compared between groups.

RESULTS We reviewed 833 referrals (207 baseline and 626 post-STP). STP compliance improved monthly to 99.4%. Post-STP, time from referral to PET decreased (from 38.5 to 15.7 days), time from referral to brain imaging decreased (from 33.4 to 13.1 days), and time from referral to diagnosis decreased (from 38.0 to 22.7 days), all demonstrating special-cause variation. Patients completing preordered staging tests experienced significantly faster care than those without preordered tests, including time to PET (23.0 v 35.9 days), computed tomography/magnetic resonance imaging of brain (16.2 v 29.9 days), and diagnosis (39.9 v 28.1 days), all *P* < .001.

CONCLUSION An STP significantly improved timeliness of diagnosis and staging for patients with suspected LC undergoing evaluation in a rapid assessment clinic.

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INTRODUCTION

Lung cancer (LC) is prevalent and associated with high mortality. Relative 5-year LC survival averages 21% in Ontario, Canada, and is lowest (15%) in Southeastern Ontario.¹ While multifactorial, diagnostic and treatment delays contribute.² Timely LC care is critical; delays are associated with patient distress,³ disease progression,^{3,4} altered treatment options,^{2,4-6} and worse clinical outcomes.^{9,10}

Review of clinical pathways in a local rapid assessment clinic, the Lung Diagnostic Assessment Program (LDAP), identified delays in evaluation of new patients with LC. Approximately 500 LC cases are diagnosed yearly in this rural region serving more than 500,000 patients, of whom upward of 60% are evaluated in the LDAP. The provincial target is to diagnose 65% of patients within 28 days of referral, but in 2018, this target was achieved for fewer than 40% of LDAP patients.

Historically, LDAP referrals were triaged by a Nurse Navigator (NN) to respirologists or thoracic surgeons for work-up. Patients were seen in the clinic where diagnostic and staging tests were ordered, including biopsies and imaging, per clinical guidelines.¹¹ Notably, positron emission tomography (PET) is not available in the Southeastern Ontario region; patients travel several hours to obtain this test.

We sought to improve timeliness of care for patients with suspected LC and aimed to decrease mean time from referral to diagnosis to less than 28 days within 1 year through a Standardized Triage Process (STP).

METHODS

Key stakeholders (including LDAP physicians, NNs, managers, and administrators) performed a root-cause analysis to discuss barriers to timely care,

ASSOCIATED CONTENT

Data Supplement

Author affiliations and support information (if applicable) appear at the end of this article.

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including unsupported nurse triage, inappropriate triage (eg, to wrong specialist or patient was accepted despite imaging not suggestive of LC), no prioritization of urgent referrals, and staging test delays. A driver diagram linked root causes to subsequent interventions (Data Supplement).

STP

STP was implemented, including: (1) twice-weekly nurse–physician triage, (2) triage to pathways with pre-ordered staging tests and scheduling according to urgency (Data Supplement), (3) redirection and recommendations for inappropriate referrals, and (4) new Small Nodule Clinic (SNC).

Plan-Do-Study-Act Cycles

The following plan-do-study-act (PDSA) cycles are described in the Data Supplement: (1) April 2018, pilot STP; (2) May 2018, routine STP; (3) July 2018, SNC; (4) September 2018, increase triaging consistency and standardize NN patient calls; (Emergent Factor [October 2018 to January 2019], endobronchial ultrasound [EBUS] broken); and (5) January 2019, standardized referring physician communication form.

Study of the Interventions

Data were collected at baseline (January to April 2018) and prospectively across PDSA cycles (May 2018 to March 2019) for all LDAP-referred patients, including dates of referral, triage, appointment, and diagnosis. Patient completion of preordered staging tests and pathologic diagnoses were collected. Exclusion criteria included patient not assessed in LDAP (pathway 1/2), nonmalignant diagnosis (eg, pneumonia), patient lost to follow-up, or patient declined assessment. All patients were included in balancing measure analysis.

Measures

Through standardization, we anticipated reduced variability and therefore report mean values. The outcome measure was time from referral to diagnosis (defined as date of pathology report or decision to treat on the basis of clinical diagnosis). Process measures were compliance with STP and time from both referral to assessment and referral to staging tests. Balancing measures included patients triaged as inappropriate for LDAP with eventual LC diagnosis and unnecessary staging tests.

Analysis

We used QI Macros 2017 (<https://www.qimacros.com/>) for Microsoft Excel to create Statistical Process Control (SPC) charts and assess for special cause. Descriptive data are reported as number (%). Unpaired *t* tests assess continuous variables, and χ^2 tests assess categorical variables. SQUIRE 2.0 guidelines informed reporting.¹²

Local ethics approval was obtained.

RESULTS

LDAP Characteristics

We reviewed 833 referrals: 207 at baseline (January to April 2018) and 626 post-STP (May 2018 to March 2019). Compared with baseline, more referrals were redirected post-STP (23 [11.1%] baseline *v* 171 [27.3%] post-STP, *P* = .0001, the latter including 120 [19.2%] inappropriate and 51 [8.1%] SNC). LDAP patients with an ultimate LC diagnosis remained unchanged (57.1% *v* 59.1%, *P* = .37).

Impact of Preordered Tests

Patients who underwent preordered testing (category 3/4) had faster time to staging imaging than those who were first seen in the clinic (category 3/4 patients who declined preordered tests and category 5; PET 35.9 *v* 23.0 days,

FIG 1. Impact of preordered staging tests on process and outcome measures. LDAP, Lung Diagnostic Assessment Program; PET, position emission tomography. (*) *P* = .0001

FIG 2. Effect of STPs on process and outcome measures. (A) Process measure: mean time from LDAP referral to brain imaging (SPC X-barS chart, 3 sigma). (B) Process measure: mean time from LDAP referral to positron emission tomography (SPC X-barS chart, 3 sigma), (continued on following page)

FIG 2. (Continued). (C) outcome measure: mean time from LDAP referral to diagnosis (SPC X-barS chart, 3 sigma). Red diamonds and lines represent special-cause variation, ie, indicate instability in data and represent statistically significant differences²³; teal squares and lines represent in-control points and trends (common-cause variation). Red diamonds without fill depict ghosted points and represent out-of-control data points in the baseline that were excluded from calculation of the baseline mean and control limits. The baseline mean is represented by a dashed light blue line, which was fixed and used to identify special-cause variation in the process moving forward. Means and control limits were recalculated when special-cause variation was demonstrated, depicted by a solid light blue line. Special-cause variation and preparation of SPC charts were in keeping with The Health Care Data Guide.²⁴ CL, control limit; EBUS, endobronchial ultrasound; LDAP, Lung Diagnostic Assessment Program; NN, Nurse Navigator; PDSA, Plan-Do-Study-Act; SNC, Small Nodule Clinic; SPC, Statistical Process Control; STP, Standardized Triage Pathway.

$P = .0001$; computed tomography/magnetic resonance imaging of brain 29.9 v 16.2 days, $P = .0001$) and faster diagnosis (39.9 v 28.1 days, $P = .0001$), despite no difference in time to first assessment (14.0 v 13.9 days, $P = .91$; Fig 1).

Process Measures

STP use at triage averaged 99.4% from June 2018 to March 2019. Following STP, mean time from referral to first clinic visit for all LDAP patients decreased (16.3 to 13.2 days, $P = .0001$). Of 301 patients eligible for preordered tests (category 3/4), 260 (86.3%) had tests preordered; 207 (79.6%) completed these tests. Barriers to preordered testing included patient preference for consultation before testing (14 [26%]) and travel/cost concerns (12 [22.6%]). This informed PDSA cycles four and five, leading to increased completion of preordered tests (PDSA cycles one to three, 62.5%; PDSA cycle four, 77.7%; PDSA cycle five, 88.0%).

Mean time to computed tomography/magnetic resonance imaging of brain decreased from 33.4 to 13.1 days; time to

PET scan decreased from 38.5 days at baseline to 15.7 days, both demonstrating special-cause variation (Fig 2A and Fig 2B). Significant decrease in variability and reduction in common-cause variation was demonstrated in SPC charts.

Outcome Measure

Time from referral to diagnosis decreased from 38.0 days at baseline to 22.7 days, demonstrating special-cause variation in PDSA cycles two, three, and five (Fig 2C). Although special-cause variation was not seen in PDSA cycle four, this was confounded by EBUS downtime. The percentage of patients who met the 28-day referral to diagnosis target increased (39.3% to 48.1%, $P = .001$). Substantial decrease in variability was observed in the control limits of the SPC charts.

Balancing Measures

Over 1 year of follow-up, only two patients (0.01% of category 1/2 patients) redirected from LDAP were

diagnosed with LC; both cases were identified on surveillance imaging for nodules.

There was no change in the percentage of patients with a non-LC diagnosis undergoing staging tests (24% baseline v 27.5% post-STP, $P = .12$). The percentage of patients with stage I LC who underwent brain imaging increased (59.3% baseline v 71.6% post-STP, $P = .024$).

Increased time spent by physicians during the triage process was offset by reduced time in clinic visits discussing need for staging tests, a task which is now completed by the NN.

DISCUSSION

Timely LC care is critical because delays are associated with disease progression and altered treatment options.^{2-6,13} Standardized triage has improved timeliness of care in other LC clinics,¹⁴ while other Canadian centers have benefitted from NN-led triaging and preordered staging tests, despite lack of standard algorithms.¹⁵

Our study adds further evidence that an STP with early completion of staging tests improves timeliness of LC management in a rapid assessment clinic. Standardized triage led to appropriate diversion of more patients to alternative pathways. Joint physician/NN triage facilitated referral prioritization on the basis of urgency. Preordered testing for patients with high LC suspicion led to faster completion of staging investigations and diagnosis. Identifying barriers to preordered testing and implementing improved communication tools facilitated compliance.¹⁶

This initiative led to a 15-day mean reduction from referral to diagnosis. Albeit challenging to assess clinical significance, when combined with improvement efforts in other phases of the diagnostic pathway, incremental improvements become additive and more likely to have an impact on clinical outcomes. In fact, this improvement project complements our recently published initiative of a multidisciplinary clinic leading to a 25-day reduction in time from LC diagnosis to treatment.¹⁷ Combined, these improvement efforts lead to an average 6-week improvement in timeliness of care. Notwithstanding clinical impact, timely care reduces patient anxiety and improves quality of life.¹⁸⁻²¹

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PRIOR PRESENTATION

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Given that patients with LC report the highest distress levels of all cancer types, these patients are especially in need of timely care.^{18,19}

An important balancing measure included unnecessary staging tests. Although there was no difference in completion of staging tests in patients with nonmalignant diagnoses, there was an increase in brain imaging for patients with stage I LC. Future PDSA cycles will include preordering brain imaging only in patients with clinically suspected stage II or higher disease.

A strength of our intervention is that no additional resources were required. Physician clinic time spent preparing patients for staging imaging was shifted to the NN during initial telephone conversation. Another strength was the ability to use improvement science to tackle challenges encountered during the change process, leading to ongoing improvement despite uncontrollable process delays (eg, broken EBUS).

Limitations include the negative impact of EBUS downtime on timeliness of diagnosis. We collected sufficient data to show sustained improvement despite this emergent factor. Another limitation was no initial tracking of patients' reasons for declining preordered testing. We identified this barrier, implemented a tracking mechanism, and were able to enhance patient receptiveness toward preordered testing through improved NN scripting and better communication with referring physicians.

Finally, our initiative is sustainable, accomplished through a relentless focus on continuous improvement, celebration of successes, and staff engagement. This initiative benefits from its simplicity and could be an applicable framework to apply to other diagnostic programs, because across Canada, time to LC diagnosis and treatment is presently longer than recommended.¹³

In conclusion, STPs improved the efficiency of a rapid LC assessment clinic and timeliness of staging investigations and diagnosis. Further improvement cycles will focus on the use of staging tests and understanding patient perceptions of the diagnostic process, which will be key to informing strategies to support this patient population.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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