International Journal of Technology Assessment in Health Care, 34:1 (2018), 3–9.

doi:10.1017/S026646231700441X

INTEGRATED CARE PATHWAYS IN LUNG CANCER: A QUALITY IMPROVEMENT PROJECT

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Background: Non small cell lung cancer (NSCLC) diagnosis and treatment is a highly complex process, requiring managerial skills merged with clinical knowledge and experience. Integrated care pathways (ICPs) might be a good strategy to overview and improve patient's management. The aim of this study was to review the ICPs of NSCLC patients in a University Hospital and to identify areas of quality improvement.
Materials and Methods: The electronic medical records of 169 NSCLC patients visited at the University Hospital were retrospectively reviewed. Quality of care (QoC) has been measured trough fifteen indicators, selected according main international Guidelines and approved by the multi-disciplinary team for thoracic malignancies. Results have been compared with those of a similar retrospective study conducted at the same hospital in 2008.
Results: A total of 146 patients were considered eligible. Eight of fifteen indicators were not in line with the benchmarks. We compared the results obtained in the two separate periods. Moreover, we process some proposal to be discussed with the general management of the hospital, aimed to redesign NSCLC care pathways.
Conclusions: ICPs confirm to be feasible and to be an effective tool in real life. The periodic measurement of QoC indicators is necessary to ensure clinical governance of patients pathways.

Keywords: Lung cancer, Integrated pathways, Indicators, Quality of care, Patient's management

Lung cancer is the leading cause of cancer death worldwide and approximately 60 percent of patients are diagnosed in advanced stage with a 5-year survival rate of approximately 5 percent (1). Lung cancer patient's care is highly complex, involving several health professionals and different units. Clinical practice guidelines recommend multidisciplinary teams to be used for managing lung cancer patients (2). Furthermore, growing knowledge about cancer biology and treatment does not always directly translate into the optimal benefit for patients: evidence exists that not all patients benefit equally from innovation (3).

A survey among medical oncology practices in Florida carried out in 2008 identified several areas as target for quality improvement in NSCLC patients; consequently, a successful audit and feedback strategy have been adopted (4;5). In this scenario, integrated care pathways (ICPs) might be an adequate tool for improving patient care management. Currently, ICPs are widely used in hospitals for a structured and detailed planning of care for patients with a specific clinical problem, thus encouraging the enforcement of guidelines into daily clinical practice (6). ICPs adoption could facilitate a systematic and continuous audit of clinical practices through quality indicators that investigate the three dimensions of quality: professional, organizational, and patient-oriented care (7–9). Several studies have been published on ICP in lung cancer, and this appears to be a plausible strategy that addresses both the issue of quality of care and containing the containment of costs (9–15).

We analyzed the ICP for lung cancer patients at the University Hospital of Udine, relying on the results of a previous study published in 2012 (16). We implemented new indicators according to the most recent scientific evidence and we modified some of the previously used indicators on the basis of the former study results.

The aims of the current study were: (i) to reassess the quality of care pathways in lung cancer patients in a university hospital; (ii) to compare the results with those of the 2008 published study (16); (iii) to highlight further room for

Table 1. Study Results of 2008[a] and 2010 Analyses

Indicators	Results		Benchmark
	2008	2010	
Chest physician unit			
No. of diagnostic bronchoscopies		60.7%	80-85% L°
Time between the first visit of the chest physician and diagnosis	16 days	14 days	15-30 days FG^
Time between the first visit of the chest physician and the first oncological visit			
stage I -> IIIA	84 days	84.5 days	56-84 days FG^
stage IIIB -> IV	28 days	29 days	28-42 days FG^
Thoracic surgery			
Patients candidate to surgery that underwent a mediastinoscopy as N2 positive at the PET scan	3%	0%	100% G#
Time between diagnosis and surgery (lobectomy or pneumonectomy)	50 days	58.5 days	21 days FG^
Time between PET and surgery (lobectomy or pneumonectomy)	23 days	53.5 days	14 days FG^
Pathology department			
Time between the diagnostic procedure and diagnosis	5 days	4 days	7 days FG^
Percentage of extemporary cyto/histologic diagnosis during bronchoscopy		0%	100% G#
Concordance between histological diagnosis on the surgical sample and on the bronchoscopy biopsy		61.4%	60-80% L°
% of NSCLC not otherwise specified diagnosis		13%	20% L°
Radiotherapy			
% of concomitant RT treatments for stage III patients		42.8%	80% FG^
Medical oncology			
Time between diagnosis and the first chemotherapy administration (for stage IV only)	26 days	34 days	21 days FG^
% of patients enrolled in clinical trials		2%	5-10% L°
% of patients treated with three or more chemotherapy lines	0%	2.7%	0% G# 10% L°
% of patients dead within 30 days from the last chemotherapy administration	16%	6.18%	20% L°

Note. *, Significance of the difference between 2010 results and the benchmark values. °, Literature reference. ^, Focus group values as reference. #, Guidelines value as reference.

[a]Fasola G et al. Adopting integrated care pathways in non small cell lung cancer: from theory to practice. *J Thorac Oncol.* 2012;8:1283-1290.

improvement in clinical practice for lung cancer patients; (iv) to make the use of quality indicators a "standard practice" in the management of lung cancer patients.

MATERIALS AND METHODS

We retrospectively reviewed the electronic medical records of 169 consecutive NSCLC patients who had their first consultation at the Oncology Department of the University Hospital Santa Maria della Misericordia (Udine, Italy) during 2010.

As in our previous study (16), two working groups, were established: (i) a steering committee, consisting of professionals and healthcare researchers from the University Hospital Santa Maria della Misericordia and from Bocconi University (Milan, Italy), involved in study planning; (ii) a professional focus group of specialists involved in the management of NSCLC patients (i.e., medical oncologists, pulmonologists, radiologists, thoracic surgeons, pathologists, nuclear medicine physicians, and radiation oncologists). The flow chart of the ICP drawn in 2008 was reassessed, but no further change was implemented.

Selection of quality-of-care indicators: A total of fifteen indicators (Table 1) (6 more than in 2008) were selected according RAND-modified Delphi metho and taking into account their availability, reproducibility, significance, and measurability (8).

Indicators were developed using group-facilitation techniques designed to explore the level of consensus among a group of experts (including patients representatives) and to aggregate judgments into refined agreed opinions.

These indicators were chosen as well relying on the availability of corresponding benchmark, which was derived from: (i) literature evidence, and (ii) international guidelines, published by the National Comprehensive Cancer Network

https://doi.org/10.1017/S026646231700441X Published online by Cambridge University Press

(www.nccn.org), the European Society for Medical Oncology (ESMO; www.esmo.org), and the American Society of Clinical Oncology (www.asco.org); and expert opinion of the hospital's multidisciplinary lung cancer team ($n = 10$), which comprised medical oncologists, pulmonologists, radiologists, thoracic surgeons, pathologists, nuclear medicine physicians, and radiotherapists).

These clinicians did not participate in the Delphi survey focus group.

The total number of patients evaluated for each indicator (i.e., the denominator) can vary depending on the indicator's content. All data concern the period of 5 months ahead to 9 months after diagnosis.

Indicators related to the time elapsed were measured as median values and were compared with the median benchmark value. To compare the value of the indicators of the study population with the benchmark *t*-tests, proportion tests and linear regressions were used. A p-value <0.05 was considered statistically significant.

The study was approved by the local ethic committee and was supported by the hospital administration.

RESULTS

Among the 169 selected patients, 146 were considered eligible; reasons for ineligibility are highlighted in (Supplementary Figure 1). Median age was 67 years (range, 41–87 years). The majority of patients were males (65 percent) and presented with adenocarcinoma histology and advanced disease at diagnosis (52.7 percent). The stage distribution and the tumor histology in study population resembled epidemiological and literature data (18). Detailed patients' characteristics are summarized in Table 2.

Table 2. Patient's Characteristics

Patients ($n = 146$)	*n*	Range/%
Age (average)	66.9	41-87
Gender		
Males	93	65%
Females	53	35%
Stage at diagnosis		
0	1	0.7%
I	13	8.9%
IA	6	4.1%
IB	7	4.8%
II	20	13.7%
IIA	11	7.5%
IIB	9	6.2%
III	35	24%
IIIA	15	10.3%
IIIB	20	13.7%
IV	77	52.7%
Hystotype		
Adenocarcinoma	88	60.3%
Squamous carcinoma	35	24%
Carcinoma NOS	19	13%
Adenosquamous carcinoma	2	1.3%
Large cell carcinoma	1	0.7%
Atypical adenomatous hyperplasia	1	0.7%

Note. NOS, not otherwise specified.

Overall, seven of fifteen indicators were aligned with the benchmarks (Table 3). The observed median time between the first visit with the pulmonologist and the diagnosis (14 days; range, 0–202) was not statistically different from the 15- to 30-day benchmark value (13;17). Linear regression analysis highlighted that stage IIIB and IV patients had a statistically significant shorter time between the first visit with the pulmonologist and the diagnosis ($p = 0.003$).

The observed median time between the first visit with the pulmonologist and the first oncological referral was just within limits in patients with early stages I–IIIA, 84.5 versus 56–84 days (benchmark), whereas it is perfectly aligned for advanced stages, IIIB and IV: 29 (range = 0–261) versus 28–42 days (benchmark) (12).

Three of four indicators assessing the performance of the pathology department (Table 3) were in line with the benchmark values (18–23). The percentage of patients dead within 30 days from the last chemotherapy administration was 6 percent (benchmark 20 percent), and the observed percentage of patients that received more than three lines of chemotherapy for advanced disease, 2.7 percent versus 10 percent (benchmark), were in line with literature data (18,20,24–31).

The remaining eight indicators values were statistically different from benchmark, as you can see below. The percentage of diagnostic bronchoscopic procedures was 60.7 percent (observed) versus 80–85 percent (benchmark) (see also Table 4) (32–34). No extemporary cytology was performed during bronchoscopy, dramatically far below the 100 percent benchmark value (34). Three indicators focusing on the surgical area were also misaligned: N2 positron emission tomography (PET) surgical candidates undergoing mediastinoscopy (0 percent observed versus 100 percent benchmark value), median time from diagnosis to surgery (58.5 observed days, range = 9–191, versus 21 days expected), and median time from PET to surgery (53.5 observed days, range = 10–171 versus 14 days benchmark value) (12;17;19).

Only 42.8 percent of the patients received concomitant chemo-radiotherapy for stage III disease compared with the expected 80 percent value of benchmark ($p = 0.007$) and only 2 percent of the patients in this series were enrolled in clinical trials (benchmark 5–10 percent) (35–39). Finally, in stage IV

https://doi.org/10.1017/S026646231700441X Published online by Cambridge University Press

Table 3. Study Results of 2010 Analyses

Indicators	2010	Benchmark	*p*-Value*
Chest physician unit			
Number of diagnostic bronchoscopies	60.7%	80-85% L°	.002
Time between the first visit of the chest physician and diagnosis	14 days	15-30 days FG^	.07
Time between the first visit of the chest physician and the first oncological visit			
stage I -> IIIA	84.5 days	56-84 days FG^	.08
stage IIIB -> IV	29 days	28-42 days FG^	.09
Thoracic surgery			
Patients candidate to surgery that underwent a mediastinoscopy as N2 positive at the PET scan	0%	100% G#	.03
Time between diagnosis and surgery (lobectomy or pneumonectomy)	58.5 days	21 days FG^	.02
Time between PET and surgery (lobectomy or pneumonectomy)	53.5 days	14 days FG^	.001
Pathology department			
Time between the diagnostic procedure and diagnosis	4 days	7 days FG^	.09
Percentage of extemporary cyto/histologic diagnosis during bronchoscopy	0%	100% G#	.002
Concordance between histological diagnosis on the surgical sample and on the bronchoscopy biopsy	61.4%	60-80% L°	.07
Percentage of NSCLC not otherwise specified diagnosis	13%	20% L°	.08
Radiotherapy			
% of concomitant RT treatments for stage III patients	42.8%	80% FG^	.007
Medical oncology			
Time between diagnosis and the first chemotherapy administration (for stage IV only)	34 days	21 days FG^	.0001
% of patients enrolled in clinical trials	2%	5-10% L°	.04
% of patients treated with three or more chemotherapy lines	2.7%	0% G# 10% L°	.07
% of patients dead within 30 days from the last chemotherapy administration	6.18%	20% L°	.08

Note. *, Significance of the difference between 2010 results and the benchmark values. °, Literature reference. ^, Focus group values as reference. #, Guidelines value as reference.

PET, positron emission tomography; NSCLC, non small cell lung cancer; RT, radiotherapy.

Table 4. Distribution of the Diagnostic Bronchoscopies

		Positivity	
Diagnostic bronchoscopies	*n*	*n*	%
First procedure	116	76	65.5
Second procedure	11	3	27.3
Third procedure	2	0	0
Fourth procedure	1	0	0
Total procedures	130	79	60.7

disease patients, the length of the interval between the date of the diagnosis and the first day of chemotherapy administration was statistically longer than the benchmark's value (34 days observed versus 21 days expected; $p < 0.0001$) (12;19).

DISCUSSION

The quality of care is high on the political agenda in most Western countries. However, little is known about how quality-related information translates into actual changes in the clinical care and outcomes (40;41).

In this scenario, the management of especially complex patients amplifies the risk of suboptimal care. To improve the quality of care, different activities have to be assessed in a reliable way so to become common practice. The efficacy of ICP strategy in lung cancer patients has been tested and validated both in single institutions and in multicenter groups (9;10;12–16).

Moreover, treating patients according to evidence-based guidelines has been shown to be a cost-effective strategy for delivering care to NSCLC patients (11). The present study underlines the role of ICP as an essential tool to ensure clinical governance and continuous audit of quality of care. As a matter of fact, our results highlight several areas of good alignment with international guidelines as well as some areas that show room of improvement.

https://doi.org/10.1017/S026646231700441X Published online by Cambridge University Press

Overall, the Pathology Department exhibited a strong adherence to the ideal ICP given the alignment of the selected indicators to the benchmark values. In fact, despite the well-known intra-tumor heterogeneity, a good consistency between histological diagnosis of the surgical sample and the one of the bronchoscopy biopsy remains valuable for treatment decisions (42). Moreover, the reassignment of not otherwise specified to the squamous and nonsquamous histotype is key in the treatment strategy.

Both the time interval between the first visit with the pulmonologist and diagnosis and that the one between the bronchoscopy procedure and diagnosis joined well with benchmarks; indeed, for patients with advanced stage (IIIB and IV) the median time was significantly shorter than expected (Table 4). Possible explanations could be the higher easiness in performing tissue biopsies and the priority due to the advanced stage and/or clinical symptoms. Moreover, fewer diagnostic and staging procedures are often required in this setting. The same may be true for the timing between the first visit with the pulmonologist and the first oncology consultation.

The percentage of patients dead within 30 days from the last chemotherapy administration (6 percent) was within the expected values, showing an appreciable 10 percent reduction in comparison with 2008 results (Table 1). This evidence suggests that a palliative care approach was adequately considered. Related benchmarks value are somewhat variable in literature, ranging from 11 percent to 20 percent (25;43;44).

In our series, the decision to administer a third line therapy was made on a case-by-case basis after considering patient characteristics (age, Performance Status, benefit from previous treatments and high motivation) that could suggest a potential role for an additional treatment. International guidelines indeed do not recommend further treatment after progressing to third line treatment; however, literature data report around 10 percent of patients were treated beyond progression to third line and our performance is well within these limits (24;28;29).

Despite a good performance for several indicators, in our hospital there is still large room for improvement, first of all regarding the presurgical procedures and timing for surgery. In our series successfully diagnostic bronchoscopies (a newly introduced indicator) were 20 percent less than the international benchmarks (32–34). This difference might be explained both by procedural constraints, partly operator related, and by the lack, at the time of the analysis, of endo-bronchoscopy ultrasound (EBUS) which allows a better accuracy.

Despite the widespread recognition of the added value of extemporary diagnosis, no guideline clearly states this requirement. Therefore, due to a temporary resource shortage in the Pathology Unit, none of these procedures was performed.

None of the twelve patients undergoing surgery with a positive or doubtful presurgical PET for N2 disease underwent mediastinoscopy, compared with 3 percent in the 2008 analysis (Table 1). Although mediastinoscopy is recommended in these cases, the shortage of thoracic surgical sessions and the fact that just one surgeon was confident with this approach, could explain this result. As a result of these findings, some measures have been proposed and adopted to obtain an improvement in diagnosis and staging. The provision of an EBUS to the Pneumology Department, recognized by the ESMO guidelines as a reliable alternative to mediastinoscopy, improved performance in this setting (45).

Two other indicators, time between diagnosis and surgery and between the positron tomography, and surgical intervention, significantly worsened in comparison to the 2008 results and fell below benchmark values. These outcomes highlight a persistent difficulty, at the time, in the management of patient flow in the Thoracic Surgery Unit, due both to shortage of operating session and to the length of the preoperative assessment for patients undergoing surgery.

With the purpose of assessing the performance of the Radiotherapy Unit, in this study we introduced and evaluated a new indicator (the percentage of concomitant chemo-radiation in stage III pts) but it was far from the benchmark. Relying on previous literature and international guidelines a benchmark of 80 percent was used; however, a recent study reported a more realistic 40 percent value, considering a better patient selection based on clinical features (46). This confirms that these tools should always be considered a work in progress, that requires a continuous updating of references.

Among the activities of the Medical Oncology Department two QoC indicators did not reach the benchmark, highlighting gaps and potential rooms for improvements. The number of patients enrolled in clinical trials, lower than benchmark value, could be due to the fact that this analysis was performed during a particular time range: indeed, some clinical trials on lung cancer had just been completed while new trials were not yet open to recruitment. On another side, the substantial increase of time interval between diagnosis and first chemotherapy administration in advanced stages, (Table 3), might be explained by the need for repeat CT scan before starting treatment, due to the aging of the previous scan.

Overall, the NSCLC ICP in this university hospital is somewhat in line with guidelines and literature-based evidence. It is remarkable to observe that, as in 2008, the most critical area was the early stage disease; this underlines the need for these ICP to be reshaped as patients with early stage disease have a better prognosis and can be radically cured.

Moreover, some previously reported unsuitableness were again confirmed, demonstrating that working with these tools does not automatically translate into improved clinical activities, as could also be derived from other experience (5;6). This confirms that tools themselves are not the guarantee of change and will not achieve maximum success without an actual engagement of the hospital management and an actionable plan (5;6).

https://doi.org/10.1017/S026646231700441X Published online by Cambridge University Press

There may be some barriers to change that would be interesting to investigate in the next future, including: the compliance of professionals, the difficulties in negotiating with general management, and financial or organizational constraints. To address the main shortcomings identified in the study, it is necessary to share the results with general management of the hospital and gain strong commitment by general management itself to identify specific solutions.

Following this experience, some additional proposal were shared and successfully introduced: (i) the presence of pathologists during the bronchoscopic procedures for extemporary diagnosis of the biopsy sample adequacy; (ii) a net increase in the thoracic surgery session number to reduce delays in management and treatment; (iii) a predefined sequence of cardiologic consultation during preoperative assessment of elderly people or patients with heart disease to speed up the presurgical path. The institution of ERAS would probably also help improve patient outcomes.

This study has, of course, strengths and limitations (Supplementary Table 1). One of the main strength is, in our opinion, the full hospital computerization which allowed us to overcome the commonly identified issues in retrieving required information to measure the quality indicators. An ehealth system has been proven successful in supporting integrated care in healthcare pathways and sharing information among centers (47–49). A further strength can be considered the experience gained from the previous study, published in 2012.

Among the weakness should be recognized that this is a retrospective, single-center review with a limited sample size. Second, some indicators of the quality of care are lacking, such as perioperative mortality, postoperative length of stay, or the proportion of adjuvant treatment among stage II–III surgical patients, an issue well recorded in literature (8). Lastly, this analysis does not include patient's perceived quality of care and prehospital evaluation, which, however, has been included in the following study.

While the data compared two different time periods, we did not think there were any other changes that occurred to affect the outcome of the data. Also the 5-year survivals were not recorded and we have no data on whether the delays led to upstaging or worse survival rates.

CONCLUSIONS

Our study demonstrated that the adoption of ICP methodology in a teaching hospital is feasible and enables the assessment of the quality level in healthcare delivery to a specific patient group/population. Relying on the knowledge of this work, the same research team has designed a new prospective study, the third in this series, which has just stopped recruiting cases. Finally, our experience has been shared with the general management and executive staff of the hospital, with the aim of re-engineering the delivery of care focusing on processes, people, and technology.

SUPPLEMENTARY MATERIAL

Supplementary Table 1:
https://doi.org/10.1017/S026646231700441X
Supplementary Figure 1:
https://doi.org/10.1017/S026646231700441X

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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https://doi.org/10.1017/S026646231700441X Published online by Cambridge University Press