



# Using an organizational change model to improve lung cancer surgery services over five years

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**Background:** Lung cancer is the most common cause of cancer death in the UK resulting in 21% of all cancer deaths. In 2016, local lung cancer surgery services required improvement due to under-representation in cancer resections and resource scarcity during the pandemic, which affected critical care bed availability and extended postoperative stays. The aim of this service improvement was to increase the number of lung cancer resection; develop minimally invasive techniques and reduce the use of Critical Care Unit beds by 35% (a subsequent goal).

**Methods:** A five-year plan, guided by Kotter's 8-step change model, was initiated to address these issues. This model promotes sustainable change by setting clear goals, effective communication, and stakeholder involvement. Initial changes included hiring a thoracic surgeon experienced in uniportal video assisted thoracoscopy and enhanced recovery protocols. The team grew to three thoracic surgeons by 2020. The service increased operating theatre days and adopted new postoperative practices to reduce complications and hospital stays. Lung Cancer Multidisciplinary Team Meetings were consistently covered by thoracic surgeons, ensuring comprehensive care. Data on surgical activity were collected from departmental databases and national audits, with internal audits conducted regularly. Statistical significance was tested using chi-square tests with P values <0.05.

**Results:** The number of surgical procedures more than doubled, with primary lung cancer resections increasing nearly three-fold from 12.8% to 29.8% over six years. Postoperative complications and mortality rates remained low. Critical care bed usage dropped significantly during the pandemic, with new protocols enabling safe recovery in general surgical areas.

**Conclusions:** The successful expansion of thoracic surgical services was attributed to the dedicated minimally invasive surgeons, enhanced recovery measures, and skilled staff. The change model facilitated efficient and dynamic progress. With the introduction of lung cancer screening programs, the demand for surgical services is expected to rise. The effective change model will be re-applied to meet this demand. The organizational change model, focused on patients and staff, achieved sustained quality improvement in lung cancer care despite challenging conditions like the coronavirus disease 2019 pandemic.

**Keywords:** Lung cancer; management model; Kotter's change model; implementing change; coronavirus disease 2019 (COVID-19)

Submitted Oct 02, 2023. Accepted for publication Jun 21, 2024. Published online Aug 26, 2024.

doi: 10.21037/jtd-23-1537

View this article at: <https://dx.doi.org/10.21037/jtd-23-1537>

## Introduction

### Background

Lung cancer is the most common cause of cancer death in the UK resulting in 21% of all cancer deaths (2017–2019) (1). Many factors contribute to this level of mortality such as co-morbid state and disseminated disease due to late diagnosis (2).

### Rationale and knowledge gap

In 2016, it was felt a significant change was required locally to improve lung cancer surgery services. The volume of

cancer resections was felt to be under representative of the number of patients diagnosed with lung cancer each year. Furthermore, during the pandemic the scarcity of resources impacted patients due to the low availability of critical care beds and often prolonged post operative length of stay. As such, starting with the appointment of a thoracic lead with experience in management and innovation, a team was created to develop a five-year plan centred around Kotter's change model.

Kotter's 8-step change model is a process that promotes sustained organizational change by identifying goals, communicate effectively and encourage active involvement of stakeholders (3). It is an efficient framework that can be used in extensive projects but also for smaller more specific purposes.

### Objective

This manuscript aims to outline the structure and implementation of this management model, discuss how the model was significantly tested over a period of time, and then successfully adjusted in response to the coronavirus disease 2019 (COVID-19) pandemic.

### Methods

The service of Thoracic Surgery at University Hospital Coventry and Warwickshire NHS Trust is a tertiary referral centre for the surgical management of thoracic diseases with the exception of lung transplantation. The catchment area for the Thoracic Service includes patient from 3 distinct Healthcare Trusts covering an estimated total population of 1.8 million. In 2016, it conducted 69 lung cancer resections (smallest unit in the United Kingdom); with over 96% of all patients undergoing lobectomy and an estimated resection rate of 12.8%. At that time surgical patients were recovered inside the operating theatre and then transferred to the Critical Care Unit for their routine post-operative care for at least for the first night, with the exception of minor procedures. When reviewing the service, it was felt there was capacity to increase the number of surgical procedures and lung cancer resections offered annually. At the same time there was a need to implement the use of minimally invasive thoracic surgery and the application of measures associated with successful enhanced recovery protocols. Subsequently, as resources were diverted to the care of patients suffering from COVID-19 infections, there was a

### Highlight box

#### Key findings

- Thoracic surgical service implemented Kotter's 8-step change model.
- Significant outcomes include a threefold increase in lung cancer resections, a doubling of surgical procedures, and improved outcomes such as reduced mortality and shortened stays.
- Adoption of uniportal surgery became universal.
- Critical care bed use was drastically reduced from 92.4% to 18% with minimal complications.

#### What is known and what is new?

- Lung cancer is a leading cause of cancer death.
- Minimally invasive surgery and enhanced recovery protocols can improve surgical outcomes.
- Kotter's 8-step change model is a framework for achieving organizational change.
- Application of Kotter's model in a thoracic surgery context led to a significant increase in surgical volume and improved outcomes.
- During the coronavirus disease 2019 pandemic, the service adapted to reduce critical care bed usage, maintaining high levels of surgical care with reduced resources.
- The successful implementation led to the development of protocols that are now being used in other areas of the hospital.

#### What is the implication, and what should change now?

- The study demonstrates that structured change models can lead to improvements in services and outcomes, even during a global crisis.
- The reduction in critical care bed usage without compromising patient care highlights the potential for resource optimization.
- Other healthcare services should consider adopting Kotter's 8-step change model to drive improvements and adapt to evolving challenges.
- Emphasize the implementation of minimally invasive surgery and enhanced recovery to improve outcomes and optimize resources.
- Continue fostering a culture of continuous improvement and stakeholder involvement to sustain high-quality care.

need to reduce routine admission to critical care and this became another target in the strategy.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the department's quality improvement lead of University Hospital Coventry and Warwickshire (Approval ID: 3381), and individual consent for this retrospective analysis was waived.

### *Main goals*

- (I) Increase the number of surgical procedures and lung cancer resection rates by 25%.
- (II) Development of minimally invasive techniques towards universal use of uniportal video-assisted thoracic surgery (VATS).
- (III) Decrease the use of Critical Care Unit beds by 35% (later goal).

These goals were determined by reviewing the theatre utilization time, national reports of lung cancer resections, and later on in time the reduction of available beds for elective surgical cases following the worldwide pandemic.

### *Progressive changes in the service*

The initial change was the appointment at the end of 2016 of a dedicated Thoracic Surgeon with established experience on uniportal VATS surgery and a background in the implementation of measures associated with successful enhanced recovery protocols.

The workforce then comprised of 1 Consultant Thoracic Surgeon (appointed) and 1 existing Cardio-Thoracic Surgeon with a mixed practice. In late 2018 an additional Thoracic Surgeon was employed (and trained in uniportal VATS approach), and in 2020 the third Consultant Thoracic Surgeon substituted the previous Cardio-Thoracic Surgeon (with large experience in uniportal VATS).

Over the whole process, the service shared a dedicated ward, staff and resources with cardiac surgery. The dedicated operating theatre lists gradually increased from 3.25 to 4 days per week since June 2020.

Immediate changes implemented were an initial loan and then purchase of dedicated VATS surgical instruments thus offering uniportal VATS to the vast majority of the patients; the use of a single intercostal drain after surgery; insertion of paravertebral catheters for postoperative analgesia and the routine avoidance of epidural catheters (and their side effects), urinary catheters and central venous lines.

Postoperative early ambulation and physiotherapy were considered key steps in recovery and the consultants reviewed all patients at least once daily during their stay in hospital. All efforts were directed to prevent complications and delayed hospital discharges.

During the course of this review (since 2020) all Lung Cancer Multidisciplinary Team Meetings (MDT) were routinely covered by two dedicated Thoracic Surgeons to ensure universal presence of Thoracic Surgeons and the benefit of multiple views. Thoracic Surgeons also become involved in existing Infectious Diseases MDT, Interstitial Lung Diseases MDT, Major Trauma MDT and newly created Central Airways MDT, Pleural diseases MDT, Lung Volume Reduction MDT and Intermediate/Nodules MDT.

The service's catchment area has not expanded over the years which helps the benchmarking of the results and the reflection process of the improved results. In terms of lung cancer resections the lung health project started as a pilot in some of our high-risk areas in 2021 and will be expected to become universal in 2025.

### *Data collection*

Data regarding surgical activity were obtained from a prospective departmental database (part of a continuous audit within the Local Audit Committee) and surgical log-books/patients' clinical records. This was supplemented by data involving Lung Cancer diagnostic and surgical activity from the National Lung Cancer Audit in the UK. Several internal audits and clinical evaluations were conducted over this time period under the Local Audit Committee and regularly reported to the local Quality Improvement and Patient Safety (QIPS) and Patients Safety Committee as well as at least once a year in a Trust-wide Grand Round presentation.

When used, qualitative data were tested with a Chi-squared test and P values less than 0.05 were considered significant throughout.

### *Change of model*

Kotter's 8-step change model was implemented in *Figure 1*.

#### **Step 1—create urgency**

As a predominately cardiac surgery centre, staff can often overlook the burden of disease thoracic malignancies can have. At the outset of the initiative, information regarding the prevalence and outcomes for lung cancer were

presented across the department at regular staff meetings. Furthermore, successful patient stories were used to highlight the impact of positive outcomes with an aim to motivate staff.

As the pandemic developed, the focus for all staff changed to the immediate emerging threat. In this circumstance it was important to again highlight how lung cancer was still a pathology which, if left untreated, would cause significant harm to patients. Appreciating this, lung cancer services needed to continue as close to normal as possible.

### Step 2—form a powerful coalition

Increasing operative numbers results in a significant increase in work for many staff groups, including administration, nursing and theatre staff. When trying to create change, representation and input from all stakeholders is important in order to provide a sense of ownership by all staff across the patient’s journey.

An Ishikawa chart (Figure 2) was created to identify

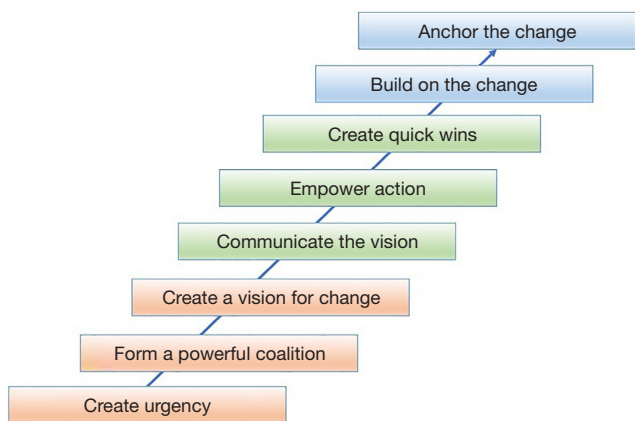


Figure 1 Eight-step change model (3).

barriers to change and the staff groups which would be best placed to help overcome them (4).

### Step 3—create a vision for change

The thoracic surgery team, at its inception, highlighted the vision for increased lung cancer resections. This objective was the centre of the vision for change. This vision had to be adjusted to account for the pressures from COVID-19.

This adjustment meant lung cancer patients were offered surgery if it was felt the prognostic benefit of surgery outweighed the risk of contracting COVID-19 in hospital. Furthermore, the additional goal of resource reduction was created to maximise the possibility of planned care to proceed. These goals were retained even with the eventual reduction of COVID-19 cases, as it was felt these new goals conferred an overall benefit to the service.

### Step 4—communicate the vision

Poor communication is the biggest cause of complaints in the NHS (5) and is a fundamental cause of poor staff morale and poorer outcomes for patients (6). This need for good communication was further compounded by the difficulties of the ever-changing state of the pandemic. At the inception of the project, a multisystem communication approach was decided upon and was maintained throughout this service development.

This system involved the following rules:

- (I) All communication comes from a single point of access (lead thoracic surgeon).
- (II) All senior members of each stakeholder department (such as theatres, nursing, critical care) are individually briefed about pathway changes and plans.
- (III) Foster a culture of open questioning and encourage raising concerns.
- (IV) All verbal communication should have a written

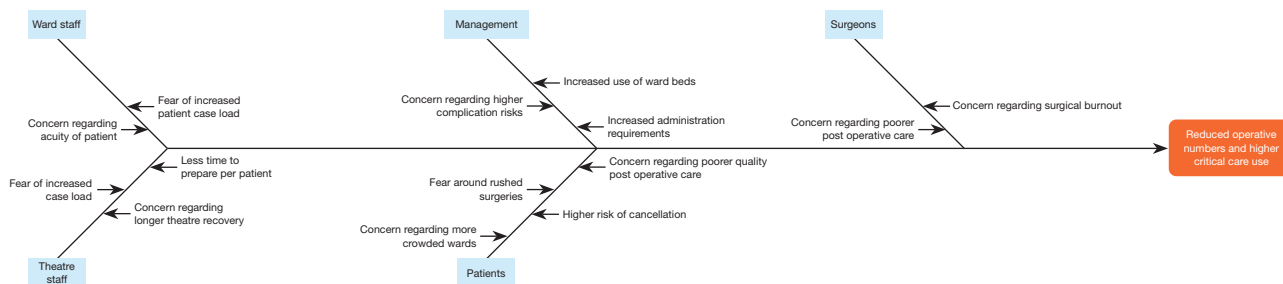
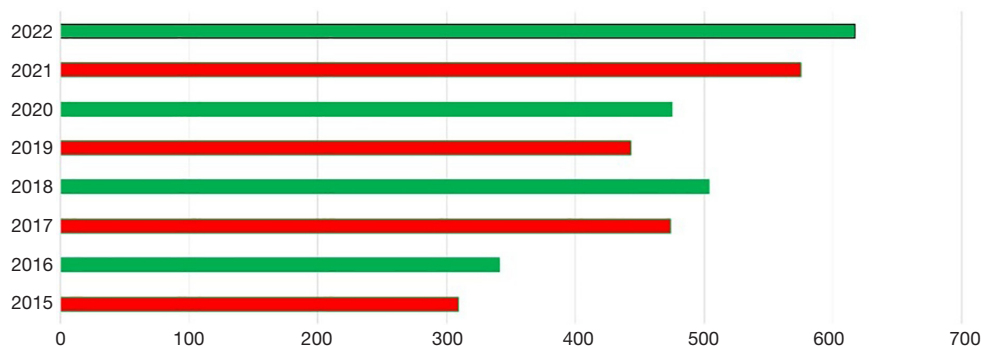


Figure 2 An Ishikawa chart highlighting stakeholders in thoracic surgery (4).



**Figure 3** Thoracic surgical activity 2015–2022.

follow up.

- (V) Our global vision of still providing good quality lung cancer care should be emphasised in every interaction.

#### Step 5—empower action

Through the stakeholder identification used in step 2, it was possible to identify where each staff group interacted with a patient along their lung cancer journey. Through effective communication it was possible to highlight to staff the impact their input has on a patient's outcome; empowering them to take ownership of that stage.

Staff were encouraged to proactively provide suggestions for change; with their successes celebrated. As the pandemic progressed, this empowerment gave staff a sense of control in a wider situation whereby they may have felt helpless.

#### Step 6—create quick wins

At the inception of the project, it was known that early and quick wins provide encouragement to staff. In this case, the increased volume of surgeries and the associated success stories were emphasised to all. These early patients were used as “proof of concept” to demonstrate how this organisational change has benefited patients.

During the pandemic, short terms wins became even more critical as staff morale and confidence was at its lowest. As such, all patients who underwent successful surgery were highlighted as a persistent reminder that the service was still continuing. Moreover, patients who were directly transferred from theatre recovery to the ward, avoiding critical care admission, were actively highlighted to staff as successful implementation of change.

#### Step 7—build on the change

As the use of critical care beds decreased and the volume of operations increased, it was important to ensure stagnation did not occur. After meeting the targets initially envisioned, the focus of the project changed to stakeholder suggested improvements. On reviewing staff feedback, a nursing led pre-operative screening protocol was introduced. This allowed for patients to attend clinic and have their pre-operative assessment conducted on the same day.

Furthermore, the move to more minimally invasive surgery and the use of regional post operative analgesia resulted in faster theatre recovery time and step down to a ward-based area.

#### Step 8—anchor the changes in corporate culture

As the new system progressed and improved results were noted, the departments success was recognition trust wide. The team were nominated for local trust awards, with the service changes and its outcomes presented at conferences. These awards and presentations were made visible to the whole department to prove, in spite of adversity as great as the pandemic, successful and positive change occurred. The use of this change model is now being implemented in other areas of the department and hospital trust.

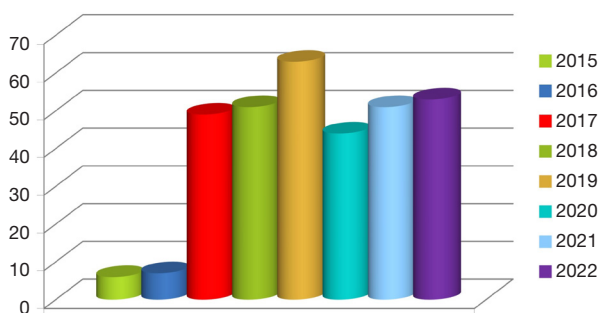
## Results

There was a significant increase in the total number of surgical procedures undertaken in the Department more than doubling hospital events within 3 years (*Figure 3*). This effect was immediate and maintained year by year in all areas of thoracic surgical activity. This included an

**Table 1** Primary lung cancer resections (2016–2022)

Year	Total lung cancer diagnoses	Primary lung cancer resections	Surgical resection rate*
2016	540	69	12.8%
2017	599	125	20.8%
2018	613	143	23.3%
2019	635	145	22.8%
2020	641	171	26.7%
2021	692	194	28.0%
2022	711	212	29.8%

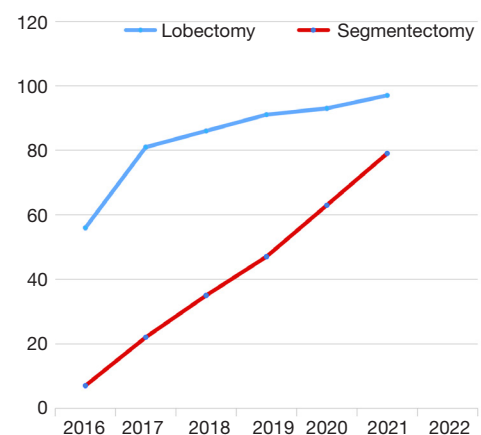
Total new lung cancer diagnoses included from the three lung multidisciplinary teams of the catchment area covered by our thoracic surgical service. \*, Chi Square test P value <0.001.

**Figure 4** Thoracic trauma procedures in thoracic surgery 2015–2022.

increase in the number of resections for primary lung cancer and mediastinal tumours. Operations for thoracic trauma (*Figure 4*) and the increase in minimally invasive surgery since 2017.

To justify any change in service it is important to evaluate the change based on the initial intended outcomes. Surgical resection for confirmed primary lung cancers has increased nearly 3-fold over this 5-year model period from 12.8% to 29.8% in 6 years ( $P < 0.001$ ). This has been calculated adding the total numbers of new diagnoses of primary lung cancers from the three Lung MDTs that are covered by our thoracic surgical service (*Table 1*).

This increase in activity has been evaluated locally every year in terms of outcomes such as mortality, severe complications and postoperative length of stay in hospital as part of our internal clinical governance, with improving outcomes year by year. Our hospital mortality for lung cancer resections is consistently below 1% every year; conversions to open surgery below 2% and median hospital stay below 4 days for anatomical lung resections.

**Figure 5** Use of uniportal video assisted thoracoscopic lobectomies and anatomical segmentectomies 2016–2022.

We have introduced and expanded the use of anatomical segmentectomies which is now overtaking in numbers traditional lobectomies (*Figure 5*).

With the changes adopted in our practise involving every step in the patients' journey: universal use of single-port VATS surgery, virtual avoidance of intraoperative events and conversions to open surgery, early ambulation after surgery, and other enhanced recovery strategies (single intercostal drain, avoidance of epidural analgesia and central venous lines) we were in a position to change the postoperative pathway of patients.

With the COVID-19 pandemic, hospital resources were redirected to the care of the critically ill and it was not different in our service. We were fortunate to continue a limited thoracic surgical service even at the more demanding times concentrating in lung cancer treatments

**Table 2** Results evaluation of avoidance admissions to critical care after thoracic surgery

Admissions	2019 (8 weeks)	2020 (8 weeks)	2023 (12 months)
Numbers	47	58	438
Critical care admissions	44 (94%)	16 (28%)	79 (18%)
Ward admissions	3 (6%)	42 (72%)	359* (82%)
Chi square		P<0.001	P<0.001

\*, in 2023 only 1 patient initially admitted to the ward required readmission to critical care for postoperative complications (0.2%).

(and maintaining the activity). A mini-model of change was then planned and implemented to minimise the use of critical care resources in our service. Several protocols were introduced that required training of staff in order to enable safe postoperative recovery of thoracic surgical patients in a general surgical recovery area (between one and four hours) and then transferring the patients directly to the Cardio-Thoracic ward without the use of critical care beds with the exception of complex procedures or in patients with significant co-morbidities where invasive monitoring was required. This change was reviewed by an internal audit reviewing the resource use after implementation of the pandemic adjusted model (2019–2021), the use of critical care bed reduced from 94% to 28% (Table 2). A more recent internal audit in 2023 has confirmed the use of critical care bed was of 18% over the whole year, with a minimal (under 1%) readmissions to critical care due to complications.

## Discussion

As can be seen by the results over the last five years, the use of this recognised change model has profoundly streamlined thoracic surgical services offered to patients, including lung cancer. It can be noted that despite the effect of the pandemic, local lung cancer resections continued to increase through 2020 and 2021.

As the initial model was designed from the outset to be dynamic and robust, for example with the detailed communication system, despite significant disruption such as the pandemic, very little change was required to ensure services are maintained.

When we try to reflect on the main causes for the successful expansion of the thoracic surgical service we must take into account the appointment of dedicated minimally invasive surgeons, the progressive adoption of enhanced recovery measures and the clinical skills of theatre and ward staff teams that led to a low-complications practice. The protocol for change by itself cannot be responsible for the

success as it is merely an effective and dynamic framework to ensure progress and efficient change.

## Future challenges

In 2010, the United State National Lung Cancer Screening Trial (NLST) demonstrated a 20% relative reduction in lung cancer mortality using computed tomography (CT) scan screening (7). Based on this work, the UK Lung Cancer Screening (UKLS trial) pilot trial (2011–2013) was organised to aid early lung cancer diagnosis and in turn improve mortality outcomes (8). The UKLS trial was a randomised control trial which compared CT screening in the UK to usual care in patients deemed as high risk for lung cancer based on age and smoking history.

The UKLS received over 75,000 positive responding patients which were reviewed, with 4,055 of these patients deemed high risk for lung cancer and therefore randomised evenly into each arm. In the CT screening arm, 2.1% of patients were diagnosed with cancer and over 90% of these were seen as early stage with potentially curative treatment. Based on this trial and subsequent meta-analysis of eight other international trials, unequivocal support for lung cancer screening was demonstrated (9). As the national lung cancer screening program is adopted, the subsequent increase in the demand on surgical services as early cancers are more amenable to surgical resection for curative intent (10).

To meet this new expected demand, the steps of this Kotter's change model are again being constructed and implemented as it has already proven to be effective in our thoracic surgical service.

## Conclusions

Lung cancer is a burdensome disease and timely intervention is often required. Though the above model may seem overly business minded, throughout its

implementation a patient and staff centered focus has been taken. Using this established organisational change model, with a patient centered focus, sustained quality improvement can be achieved for patients even in the most trying and rapidly changing conditions.

### Acknowledgments

The authors would like to acknowledge the help and commitment of the Thoracic Surgery and Medical Education departments at University Hospitals Coventry and Warwickshire NHS Trust.

*Funding:* None.

### Footnote

*Data Sharing Statement:* Available at <https://jtd.amegroups.com/article/view/10.21037/jtd-23-1537/dss>

*Peer Review File:* Available at <https://jtd.amegroups.com/article/view/10.21037/jtd-23-1537/prf>

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <https://jtd.amegroups.com/article/view/10.21037/jtd-23-1537/coif>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the department's quality improvement lead of University Hospital Coventry and Warwickshire (Approval ID: 3381), and individual consent for this retrospective analysis was waived.

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**Cite this article as:** Walji HD, Martin E, Brookes T, Ellis SA, Kolokotroni M, Hernandez L, Martin-Ucar A. Using an organizational change model to improve lung cancer surgery services over five years. *J Thorac Dis* 2024;16(8):5042-5049. doi: 10.21037/jtd-23-1537