Evaluating lung cancer care in the Netherlands: staging, treatment and surgical quality assurance

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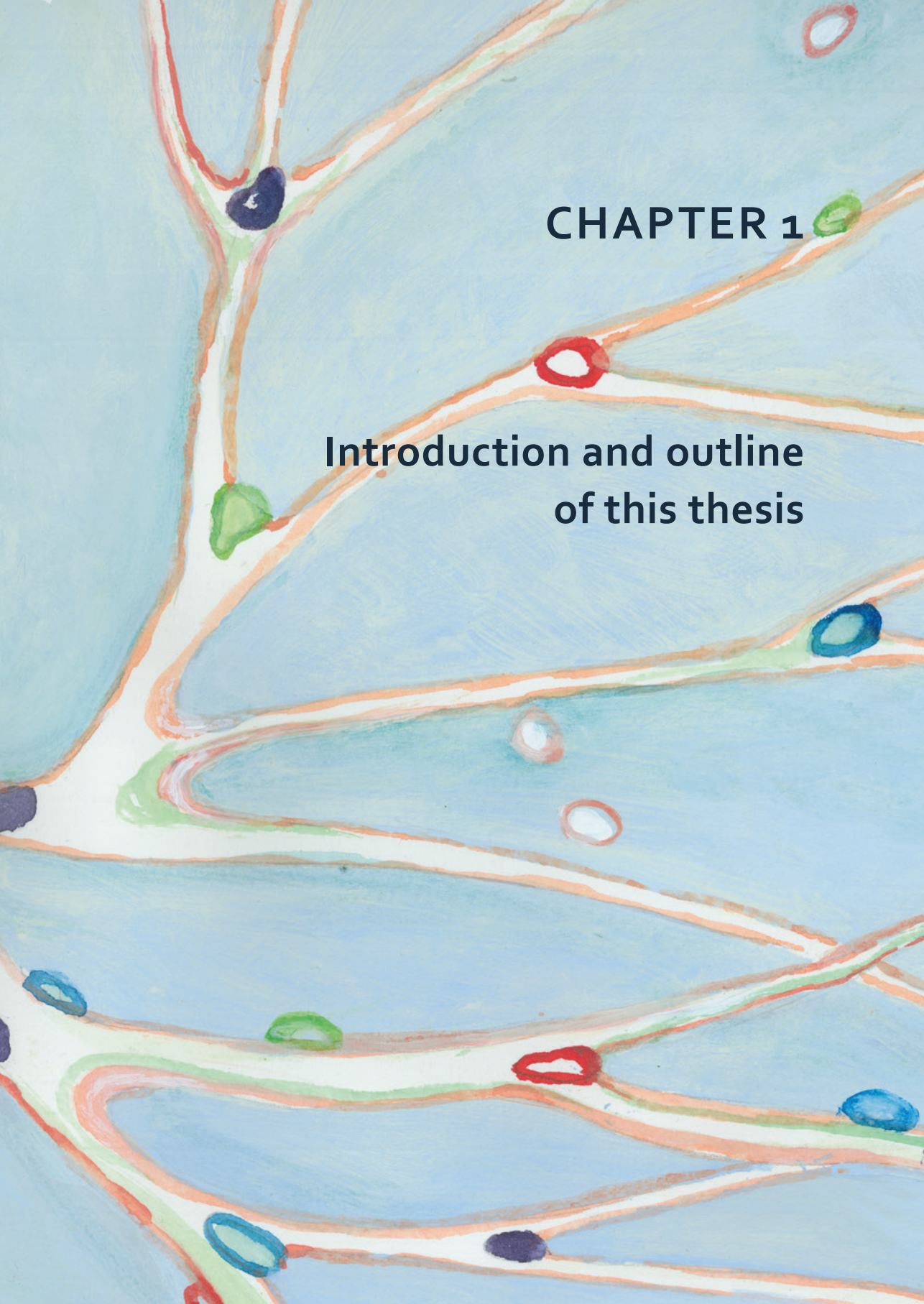

CHAPTER 1

Introduction and outline of this thesis

INTRODUCTION

Lung cancer causes a large burden of morbidity and mortality worldwide with over 2 million new cases annually and is responsible for 18% of cancer-related death. (1) In the Netherlands, this corresponds with 14.000 new cases and 10.000 deaths annually. (2) With 85%, non-small cell lung cancer (NSLCL) is the most common form of lung cancer. Only a small proportion of these patients can be treated curatively. In the Netherlands, 28% of patients have stage I-II NSCLC, and 72% of patients have (locally) advanced disease (21% stage III and 51% stage IV). (2) Patients with stage I-II NSCLC are usually treated with curative intent. For patients with stage III-IV NSCLC, however, curative-intent treatment is only possible in selected cases.

Lung cancer care has evolved considerably in recent years. Minimally invasive staging and -surgery are successfully implemented and the same is ongoing for structured perioperative care. (3-5) Immuno- and targeted therapy are rapidly changing the field, leading to better survival for patients with advanced stages of NSCLC, increased use of multimodality treatment, and a changing role for surgery, which leads to various opportunities and challenges. (6)

During the beginning of this century, multiple developments have driven the demand for reliable, transparent information about our healthcare systems and their outcomes. National quality registries were introduced worldwide, providing outcomes used by healthcare providers, governments, health insurers, patients, and other stakeholders.

In the Netherlands, the establishment of the Dutch Institute for Clinical Auditing (DICA) by multiple healthcare professionals facilitated the start of 'clinical audits'. (7) These audits were based on the model of clinical auditing introduced by Ernest Amory Codman in the early twentieth century, building on the belief that 'The systematic critical analysis of the quality of medical care, including the procedures used for diagnosis and treatment, and the resulting outcome for the patient, should be carried out by those personally engaged in the activity concerned.' (8)

Results from these audits show variation in processes and outcomes between hospitals. Feedback to healthcare professionals triggers them to improve their outcomes, reveals ambiguities in guidelines, and shows variation in clinical practice. This was first demonstrated in the Netherlands by the Dutch Surgical Colorectal Audit (DSCA), initiated in 2009. Within three years of implementing the audit guideline adherence for

diagnostics, preoperative multidisciplinary team meetings, and standardized reporting increased. Complication-, re-intervention and postoperative mortality rates significantly decreased. (9) This was consistent with results from previous quality improvement research conducted in other countries. (10) For lung cancer, Denmark was an early adopter of clinical auditing, implementing their Danish Lung Cancer Registry in 2000. (11)

Other instruments used in the Netherlands to monitor and improve the quality of (lung) cancer care are the SONCOS quality standards and the Dutch Guideline Database. (12,13) Furthermore, concentration of care has been an ongoing topic of debate. Encouraged by several stakeholders, centralization and closer collaboration between hospitals are expected to be implemented for lung cancer surgery.

In 2012 the nationwide Dutch Lung Surgery Audit (DLSA) started, which later became the Dutch Lung Cancer Audit (DLCA): a registry containing a surgical audit (DLCA-S), a pulmonological audit (DLCA-L), and a radiotherapeutic audit (DLCA-R). (14,15) In the first 4 years 19,557 patients undergoing lung surgery were registered in the DLCA-S, of which almost half comprised lung cancer patients. Overall postoperative mortality after NSCLC surgery was 2.0% and varied between hospitals from 1.5 to 2.9%. (14) A postoperative complicated course – defined as a complication leading to a prolonged hospital stay (>14 days), unplanned reintervention, or death – was present in 13.6% and the overall complication rate was 34.4% in surgically treated NSCLC patients. (16) Already, improvements in outcomes were measured in these first years, for example, the percentage of patients being discussed in a preoperative multidisciplinary team (MDT) meeting increased from 81.5% to 96.5% ($p < 0.001$). Also, an increasing number of patients got surgery within 21 days after the last MDT meeting (40.8% in 2012 to 64.1% in 2015). (14)

Since the beginning of the DLCA-S, the accuracy between the clinical TNM (cTNM) and pathological TNM (pTNM) has profoundly been analyzed. Only 54.6% of the patients was staged accurately. Understaging was present in 30.3%, and 15.1% of the patients was clinically overstaged. Both discrepancies in T and N stage were responsible for this. Accuracy for each clinical stage ranged from 40.2% for stage IIA to 66.7% for stage IA. (17)

The first audit results gave insight into national practice and allowed Dutch lung surgeons for the first time to compare their outcomes with colleagues and learn from them. Furthermore, clinical questions arose which formed the basis of this thesis.

OUTLINE OF THIS THESIS

Part I: National quality registries

Most countries use nationwide registries to collect data and give feedback to their clinicians. (18-20) Comparing different national registries offers opportunities to compare outcomes, learn from differences, and possibly improve the quality of care, the audit, and the collected variables. In **Chapter 2** we compare the Dutch data with Denmark, a Western European country with a high standard of health care and a high-quality national registry for lung cancer surgery. However, Denmark's healthcare system is organized differently, resulting in highly centralized lung surgery. This study aimed to analyze the impact of different financial coverage, governance, and level of centralization on outcomes such as mortality, morbidity, and accuracy of clinical staging.

Comparing data and benchmarking on an international level comes with challenges. Definitions that minimally differ from each other can lead to relevant differences in outcomes, making data incomparable. Also, the quality and comparability of data can be influenced by the protocols used for data registration and collection. Reliable data and knowledge of how these are collected, are therefore imperative. In **Chapter 3** we describe the methods for quality assurance of data by DICA and we present the outcomes of the data verification of the DLCA-S.

Part II: Variation in staging and its consequences

Adequate clinical staging is important in NSCLC. The multidisciplinary team (MDT) chooses an optimal, patient-tailored treatment regimen for a patient based on the clinical TNM and other factors, such as pulmonary function and operability. Early study results from our research group showed a low concordance between clinical and pathological TNM stage, this was a major reason to dive deeper into clinical staging in this thesis.

Until recently, mediastinoscopy was the gold standard in surgical staging of mediastinal lymph nodes. However, the diagnostic value of this procedure is dependent on the surgical quality of the procedure. The data of the DLCA-S allowed us to analyze guideline adherence for (video)mediastinoscopy, which is presented in **Chapter 4**. The proportion of unsuspected mediastinal lymph node metastases (unforeseen N2) after mediastinoscopy is an indicator of the surgical quality of the mediastinoscopy. Therefore, we compared the rate of unforeseen N2 between patients staged according to guidelines and patients who were not.

Eventually, all results of clinical staging methods are discussed in a final, pre-treatment MDT discussion, which is nowadays the standard of care for all oncological diseases.

We hypothesized that low staging concordance combined with increasing treatment options could lead to inter-hospital differences in both staging and treatment of NSCLC patients, despite the pursuit of uniform treatment nationwide. This is particularly relevant in stage IIIA patients, because it may influence their chances of curative-intent treatment. **Chapter 5** comprises a unique study set-up, financed and facilitated by KWF Dutch Cancer Society, in which multiple MDT's participated to 1) clinically stage ten study patients with locally advanced NSCLC and 2) give treatment advice. Staging and treatment proposals were compared to gain insight into MDT decision-making.

The TNM staging system is guiding the treatment decisions of our MDT's, but at several points discussion is possible and evidence for the best treatment regimen is still lacking for certain stages. Besides the anatomic extent of disease described by the TNM, tumor biology plays an increasingly important role in guiding treatment decisions. **Chapter 6** is an opinionated article discussing current pitfalls and practical problems in focusing primarily on the TNM staging system in the treatment of NSCLC.

Part III: Variation in perioperative care

The last part of this thesis is about perioperative care and focuses on perioperative care routines and one of the most common complications after lung surgery: persistent air leakage (PAL).

Perioperative care for lung cancer patients was not standardized in the Netherlands. Good results of enhanced recovery after surgery (ERAS) in colorectal surgery, led to an enhanced recovery after thoracic surgery (ERATS) protocol, to optimize and standardize perioperative care for lung surgery patients, thereby aiming for better health care by reducing complications and length of hospital stay (LOS). (21,22) Before implementation, we were interested in differences in perioperative care routines in the Netherlands, which, if present, would support the importance of implementing an ERATS protocol. LOS has been used as a quality measure of perioperative care. (23,24) In **Chapter 7** we investigate variation in median LOS between Dutch hospitals and whether LOS could be an adequate indicator for perioperative care routine.

Persistent air leak is one of the most common complications after lung surgery. It greatly influences the LOS. However, unambiguous evidence is lacking in the adequate management of PAL. **Chapter 8** combines data on persistent air leak from the DLCA-S with data from a complementary survey we performed under Dutch thoracic surgeons. Combining these sources allowed us to analyze hospital-level associations between management strategies and the incidence of PAL.

Objective

The primary objective of this thesis is to enhance lung cancer care by evaluating current practice and providing insight into care processes. Imperative for evaluating quality of care is the consensus among professionals in the field regarding which data are meaningful and useful, and to collect these data in a well-defined and structured way. **Part I** of this thesis focuses on methods for ensuring the quality of data used by DICA, aiming to provide guidance for other starting registries and promote data comparability. Furthermore, we compare DLCA-S data with the Danish Lung Cancer Registry to assess surgical outcomes and in particular accuracy of clinical staging, to possibly find an explanation for the low concordance in the Netherlands, and subsequently learn from Danish practice and find possible directions for improvement.

Clinical staging guides treatment decisions for NSCLC and, therefore, adequate staging is of utmost importance. In **part II** of this thesis, we critically evaluate clinical staging. We assess quality of surgical staging by mediastinoscopy to determine adherence to guidelines and, to evaluate whether there is room to improve staging concordance. We hypothesize that despite guideline adherence and discussions in MDT meetings, variation in clinical staging, and subsequently treatment recommendation, would exist. By analyzing MDT decision making, we aimed to quantify this variation, raise awareness, and encourage regional collaborations. Additionally, we aimed to create awareness about the shortcomings of the TNM system to guide treatment decisions.

Feeding back reliable data on processes and outcomes and corresponding inter-hospital variation provides insight into a hospital's care process, leads to clues for in-depth research, and reveals improvement potential. This leads to better care for the individual patient and simultaneously has an impact on the efficiency of care, costs, and the sustainable deployment of people and resources. In **part III** of this thesis, we analyze LOS and PAL as measures of quality of perioperative care to reveal improvement potential and to understand whether both outcomes would qualify as a quality indicator within the DCLA-S. By analyzing LOS, we aimed to demonstrate the need for a standardized perioperative care protocol for patients undergoing lung resection and establish a baseline for comparison following the implementation of an ERATS protocol. The analysis of PAL aimed to identify strategies for its prevention.

By answering the questions in this thesis, we demonstrate how data from nationwide outcome registries can be used to evaluate lung cancer care and generate leads to optimize lung cancer care. They might also be seen as exemplary for how real-world data can be used to identify aspects of care that are open for improvement, induce practice-changing adjustments and might generate hypotheses for further research.

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