Peer Review File

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Reviewer A:

Comment: This paper reads like an abbreviated report from a national governing body, that has both practical and possibly underlying political implications for the country of origin. How this discussion is relevant to the general community of thoracic surgeons and what would justify publication of the paper in its current form in a thoracic surgery journal in current form is questionable.

It would help if the authors established a clear rationale for their work. Currently, the rationale is not clearly framed. The authors lay out different relevant factors, but not WHY these factors motivate a study. Are there concerns about quality of care? Do these affect thoracic procedures in general, or only some highly complex surgeries? Are there concerns about quality and uniformity of care delivered by different subspecialists? Different hospitals? Different practice volumes? Are there any financial issues underlying the rationale for this study? In North America, there is certainly an ongoing discussion about such issues and there are arguments on both sides of the debate. One may surmise that the authors were motivated in their study by similar questions, and they need to lay them out clearly.

It is only during the course of the paper that the authors address thoracic manpower issues which seem to me to be A, if not THE MAJOR problem, facing thoracic surgery in the Netherlands, and it is toward the end that the authors explicitly address centralization (and only briefly so), although it seems to be an underlying theme throughout the discussion on thoracic workload.

The consequence is that the paper is very descriptive (as opposed to analytical) in nature and in my opinion attempts to tackle too many unrelated topics, that end up being laid out in a very superficial way, which makes them of limited use for the reader.

Any question on the organization of care, and particularly one where any reorganization has real life impact on practicing surgeons, is likely to ignite debate, and possibly some friction as well. In my opinion the best way to address such often sensitive topics is to be as open and forthright as possible. I would therefore encourage the authors to think through their objectives and the structure of their paper.

Reply: The authors thank reviewer A for reading our article carefully and the constructive comments. This was an invited article summarizing the organization and current state of Thoracic Surgery in the Netherlands and hence is not intended to be a scientific manuscript but rather to exchange knowledge. However, we do agree this

study had no clear rationale. Therefore, we have added a rationale in the introduction, accompanied with two sentences as a short introduction.

Regarding the future advances and challenges mentioned in our article, we do agree that it is best to be as open as forthright as possible, however, it is currently still a sensitive topic between all stakeholders in the Netherlands. Because we report this article on behalf of the whole country, we deliberately wrote these sections in a politically correct manner.

Changes: We have altered or added the following text in the **abstract** (see Page 2, lines 27-28): 'The purpose of this article, part of the Thoracic Surgery Worldwide series, is to provide a descriptive review of how thoracic surgery is organized in the Netherlands.

Additionally, we have added the following text in the **introduction** (see Page 3, lines 56-63): 'Since thoracic surgery is rapidly developing in both technical, technological and enhanced recovery areas encompassing minimally invasive approaches, perioperative care and multi-modality treatment of chest diseases, thoracic surgeons are faced with various opportunities and challenges. Due to international healthcare landscape variations, countries and regions may excel in different areas and experience different thoracic surgery-related issues. The aim of the present article is to provide a descriptive review on thoracic surgery in the Netherlands as part of the Thoracic Surgery Worldwide series, elaborating on the organization of thoracic surgery in the Netherlands, touching upon the Dutch healthcare system and regulations, the training and continuing certification of thoracic surgeons, as well as their areas of expertise, research and future challenges and advances.'

Reviewer B:
Comment 1: I have enjoyed reading this manuscript, and I'd like to congratulate the authors not just for the quality of the manuscript, but also for the organization of the specialty and results reported in the text. I have some minor comments, and I thank the authors for reading and considering them.

Reply 1: We thank reviewer B for the kind words and comprehensive review of our manuscript. We would like to thank you for your time and effort, as well as the comments provided. By addressing your comments, we believe these changes will substantially improve the manuscript.

Comment 2: The text of the summary is too succinct. I would suggest at least adding this sentence or similar: "The process of National Quality Surveillance is described in detail and some recently published data on hospital mortality and postoperative adverse events is reported". That could be to increase the readers' interest on reading the full manuscript.

Reply 2: The authors thank you for your comment and suggestion. We agree our summary provided limited information about the content of our study. We have added additional information in our summary, including your suggestion.

Changes 2: The following text was added to the **abstract** (see Page 2, lines 27-46):
'The purpose of this article, part of the Thoracic Surgery Worldwide series, is to provide a descriptive review of how thoracic surgery is organized in the Netherlands. General information is provided on the Dutch healthcare system, as well as on how Dutch thoracic surgeons are organized. Additionally, this study provides an overview on the most common thoracic surgeries, information on the national quality surveillance system and academic aspects regarding research and training. Furthermore, we discuss future perspectives.
Approximately 110 general thoracic surgeons and 25 of the 135 cardiothoracic surgeons perform general thoracic surgical procedures in the Netherlands, except for esophageal surgery. Overall, Dutch thoracic surgeons provide minimally invasive lung surgery, chest wall surgery, thymic and mediastinal surgery, and surgical diagnosis and treatment of pleural disorders. Some recently published data on hospital mortality and postoperative adverse events of thoracic surgeries are reported. Furthermore, the structure of the thoracic surgical education and training program is discussed, highlighting the particular structure of two educational programs for thoracic surgery via a general thoracic and cardiothoracic surgery program. To assure high-quality surgical care, the Netherlands has a well-structured national quality surveillance system, involving frequent site visits and mandatory participation in the national lung cancer surgery registry for all hospitals. In terms of academic research, the Netherlands ranked 14th on number of clinical trials conducted across all medical disciplines in 2021. Furthermore, several thoracic-related (inter-)national multicenter

randomized trials which are currently performed and initiated by Dutch hospital research groups are mentioned. Finally, future challenges and advances of Dutch thoracic surgery are addressed, including the implementation of lung cancer screening, imbalanced labor market, and centralization of care.'

Comment 3: The phrase in lines 315 and 316 could be considered by some colleagues as disrespectful to other teachers who have participated in the cited courses. I'm kindly recommending omitting the name of the author in line 316 and just mentioning that the technique of uniportal anatomical VATS resection has been implemented in multiple hospitals (see point 3).

Reply 3: We thank you for your comment. We have deleted the reference to Dr. Gonzalez Rivas.

Changes 3: We have deleted the text "led by Dr. Gonzalez Rivas (50), amongst others," (see Page 13, line 350).

Comment 4: Please consider also if mentioning the uniportal technique adds something to specified in line 314 on the adoption of VATS anatomic lung resection in more than 75% of procedures, which is an extraordinary percentage. In fact, it has never been demonstrated that uniportal lung resection improves relevant patients' outcomes compared to multiportal VATS technique, at least in correctly designed epidemiological studies. Apparently, there are some advantages for the surgeon and that is described in DOI:https://doi.org/10.1016/j.jtcvs.2012.06.006 and others.

Reply 4: Thank you for your comment. We agree that current scientific evidence regarding the advantages of uniportal over multiportal VATS is inconclusive. Since the scope of this study is discussing the current lung practice in the Netherlands in a descriptive and objective manner, we decided not to elaborate on this subject any further.

Changes 4: None

Comment 5: Reference 50 leads to an article that describes in the first personal of the singular the development of an uniportal technique, even though 6 authors sign the text. If you consider necessary including a reference to uniportal anatomical lung resections, maybe this one could be: doi:10.1510/icvts.2010.256222

Reply 5: The authors thank you for your comment. As you suggested in comment 2, we have removed the reference to one of our international colleagues who led our international uniportal VATS course, and concomitantly removed reference 50.

Changes 5: We have deleted the text "led by Dr. Gonzalez Rivas (50), amongst others," (see Page 13, line 350).

Reviewer C

Comment 1: Thank you for the opportunity to review your paper. For me, a Dutch general thoracic surgeon, this overview serves as an interesting snapshot of current general thoracic surgery practice in the Netherlands. The scope is wide and covers many aspects of general thoracic surgery, including labor market and wellbeing of healthcare professionals.

Reply 1: Thank you for the positive comments as well as your thorough review of our article. By addressing your comments, we believe the manuscript will be substantially improved.

Comment 2: My main concern, however, is: why would an international audience want to read this? What do you want to show them? And why?

Reply 2: The authors thank you for your comment. This was an invited article summarizing the organization and current state of Thoracic Surgery in the Netherlands to be published in the Special Series "Thoracic Surgery Worldwide" in *the Journal of Thoracic Disease*, and is not intended to be a scientific manuscript. Hence, we have elaborated the motivation behind the Special Series in the **abstract** and **introduction** of our manuscript.

Changes 2: We have altered or added the following text in the **abstract** (see Page 2, lines 27-28): 'The purpose of this article, part of the Thoracic Surgery Worldwide series, is to provide a descriptive review of how thoracic surgery is organized in the Netherlands.

Additionally, we have added the following text in the **introduction** (see Page 3, lines 56-63): 'Since thoracic surgery is rapidly developing in both technical, technological and enhanced recovery areas encompassing minimally invasive approaches, perioperative care and multi-modality treatment of chest diseases, thoracic surgeons are faced with various opportunities and challenges. Due to international healthcare landscape variations, countries and regions may excel in different areas and experience different thoracic surgery-related issues. The aim of the present article is to provide a descriptive review on thoracic surgery in the Netherlands as part of the Thoracic Surgery Worldwide series, elaborating on the organization of thoracic surgery in the Netherlands, touching upon the Dutch healthcare system and regulations, the training and continuing certification of thoracic surgeons, as well as their areas of expertise, research and future challenges and advances.'

Comment 3: While it, presumably, was your intention to write a strictly observational paper, in my opinion, the paper would benefit from more international context. The European scientific societies have put forward guidelines for training of general thoracic surgeons, which are far stricter than the Dutch requirements (European Journal of Cardio-Thoracic Surgery 57 (2020) 418–421); According to European certification standards for general thoracic surgery units, The Netherlands does not have a single center that qualifies. (European Journal of Cardio-Thoracic Surgery 45 (2014) 779–786).

Reply 3: We thank you for your suggestions. We have compared our thoracic surgery training, education and national recertification requirements to the European guidelines, and reported it in multiple paragraphs in our manuscript.

Changes 3: We have added the following text in paragraph **Training and education of (cardio)thoracic surgeons** – *Training and education of a general thoracic surgeon* (see Page 7, lines 163-172): 'Compared to the European Guidelines provided by European scientific societies, the Dutch training program for thoracic surgery is less strict. According to the European Guidelines, for example, a minimum of three years of exposure to thoracic surgery is prerequired within a minimum of five years of surgical training (27), while the Dutch sub-specialty training period requires only one year. (26) Additionally, a minimal number of operations required to perform during the training period is not yet defined in the Netherlands, whereas the European Board of Thoracic Surgery mandates a minimum of 100 surgeries during the training period. (27) Even though there is no volume-based threshold for training, a Dutch thoracic surgical trainee can only be certified as a thoracic surgeon if they achieve the minimum level of expertise per thoracic procedure after formal proficiency assessments by their supervisors. For example, a surgical trainee has to be able to perform an anatomical resection without assistance at the end of their surgical training (proficiency level D). (26)

We additionally added the stricter volume of thoracic procedures in the paragraph *Centralization of care* (see Page 15, lines 397-409): 'In the last few years, concentration of care has been an ongoing topic of debate among the stakeholders involved. Disregarding the drive and specific interest of the primary initiator, centralizing care, particularly complex care, has many clear benefits. Aside from improving patient outcomes, it also realizes increased experience and efficiency as well as it maintains proficiency and reduces clinical variability. The European Thoracic Surgery guidelines therefore propose a minimum volume of major thoracic procedures of more than 150 (±50) and 300 (±50) for standard and higher specialized general thoracic surgery units, respectively. Based on a large data repository analysis including 124,293 patients, hospitals with a volume of more than 150 surgical resections each year showed increased perioperative and long-term (1-year or more) survival compared to hospitals performing less than 70 procedures per year. (66) Even though centralization is also associated with potential detriments, it is encouraged by

several stakeholders and is expected to be implemented in different degrees and areas of (cardio)thoracic surgery. Its effect on the Dutch thoracic surgical landscape will become visible in the coming years.'

Comment 4: While it, presumably, was your intention to write a strictly observational paper, in my opinion, the paper would benefit from more international context. Discussing the Dutch situation (with 2 separate scientific societies, with 2 separate sets of training and quality rules!!!) in comparison to the European (and/or other international) standards might add more relevance to your paper for an international audience.

Reply 4: We thank you for your comment. We described our differences in the training curriculum, education and national recertification requirements compared to the European guidelines in a new section called **Current challenges in thoracic surgery**.

Changes 4: We have added the following paragraph called *Homogenization of training and education* in a new section called **Current challenges in thoracic surgery,** (see Pages 14-15, lines 383-395): 'The Netherlands has a particular training curriculum program for thoracic surgery, as cardiothoracic surgeons and general thoracic surgeons have a separate training curriculum, as well as separate quality rules and professional associations. Other countries have organized thoracic surgical education in a different manner. For example, the United Kingdom provides a general thoracic surgery training program for independent cardiac, thoracic, or cardiothoracic consultants, (62) whereas in Australia only cardiothoracic surgeons with a small sub-specialty of thoracic (non-cardiac) surgery are employed. (63) Furthermore, in the United States there are three different pathways to become a cardiothoracic surgeon or general surgeon performing thoracic surgery, (64) and in Spain thoracic and cardiac surgery are monospecialties. (65) Even though comparison data is lacking on performance results in thoracic surgery performed by general thoracic surgeons versus cardiothoracic surgeons in the Netherlands, the Dutch Society for Lung Surgery and the Dutch Association for Cardiothoracic Surgery are currently collaborating to integrate general thoracic surgery training and provide the same set of recertification requirements for non-cardiac thoracic surgeons in order to improve patient care.'

Comment 5 The same applies for the outcomes; While describing the infrastructure of the national audit, it would be interesting to know whether the outcomes of the Dutch situation are comparable to other countries.

Reply 5: The author's thank reviewer C for the suggestions regarding the comparison with other countries. We have added a comparison in national audits compared to other countries.

Changes 5: We have added the following text in **National quality surveillance for thoracic surgery care** – *Nationwide lung cancer registry* (see Page 10, lines 253-256): 'Across Europe, at least thirty countries collect national cancer data in 2018, with most of the data collected in a national registry for all cancers. Registries based on data collection for lung cancer specifically, and databases specific for thoracic surgery, are only performed in several countries such as Denmark, France and the Netherlands. (37)'

Comment 6: In the discussion section, you might adopt more of a helicopter view and try to show the upsides and the down sides of the Dutch situation and current developments in concentration of care, collaborations in care networks, homogenization of training between the different societies, nationwide participation in trials, etc. Maybe even describe a future direction, based on your overview of the Dutch general thoracic landscape.

Reply 6: Thank you for your suggestions. To provide a more helicopter view, we distinguished the current issues from the future perspectives, and therefore added a new section called **Current challenges in thoracic surgery**, wherein we discuss the current state of centralization and challenges including the upsides of *centralization*, the *homogenization of training and education* as suggested in comment 3, and we replaced the paragraph about the *imbalanced labor market*. In the section called **Future perspectives and opportunities**, we have described a future direction for thoracic surgical care such as national registrations for other thoracic diseases.

Changes 6: We have added an additional section called **Current challenges in thoracic surgery**. We replaced the paragraph *an imbalanced labor market* and *centralization of care* to this section.

We have added the following paragraph called *Homogenization of training and education* in a new section called **Current challenges in thoracic surgery,** (see Pages 14-15, lines 383-395): 'The Netherlands has a particular training curriculum program for thoracic surgery, as cardiothoracic surgeons and general thoracic surgeons have a separate training curriculum, as well as separate quality rules and professional associations. Other countries have organized thoracic surgical education in a different manner. For example, the United Kingdom provides a general thoracic surgery training program for independent cardiac, thoracic, or cardiothoracic consultants, (62) whereas in Australia only cardiothoracic surgeons with a small sub-specialty of thoracic (non-cardiac) surgery are employed. (63) Furthermore, in the United States there are three different pathways to become a cardiothoracic surgeon or general surgeon performing thoracic surgery, (64) and in Spain thoracic and

cardiac surgery are monospecialties. (65) Even though comparison data is lacking on performance results in thoracic surgery performed by general thoracic surgeons versus cardiothoracic surgeons in the Netherlands, the Dutch Society for Lung Surgery and the Dutch Association for Cardiothoracic Surgery are currently collaborating to integrate general thoracic surgery training and provide the same set of recertification requirements for non-cardiac thoracic surgeons in order to improve patient care.'

We additionally added the stricter volume of thoracic procedures in the paragraph *Centralization of care* (see Page 15, lines 397-409): 'In the last few years, concentration of care has been an ongoing topic of debate among the stakeholders involved. Disregarding the drive and specific interest of the primary initiator, centralizing care, particularly complex care, has many clear benefits. Aside from improving patient outcomes, it also realizes increased experience and efficiency as well as it maintains proficiency and reduces clinical variability. The European Thoracic Surgery guidelines therefore propose a minimum volume of major thoracic procedures of more than 150 (±50) and 300 (±50) for standard and higher specialized general thoracic surgery units, respectively. Based on a large data repository analysis including 124,293 patients, hospitals with a volume of more than 150 surgical resections each year showed increased perioperative and long-term (1-year or more) survival compared to hospitals performing less than 70 procedures per year. (66) Even though centralization is also associated with potential detriments, it is encouraged by several stakeholders and is expected to be implemented in different degrees and areas of (cardio)thoracic surgery. Its effect on the Dutch thoracic surgical landscape will become visible in the coming years.'

Comment 7

The conclusions, drawn from your observations, might change if you choose to follow my suggestion of using more international context. In its current form I have the following issues with the conclusion: You state that thoracic surgery in the Netherlands is well structured. On the basis of the information you provide, you could also argue that having >50 hospitals with surgeons affiliated to 2 societies, with different sets of rules regarding quality and training in a small country is too diverse, too scattered and overly complicated. In the conclusion you also state that general thoracic surgery is of high quality, but no quality outcomes were provided, only the presence of well-organized audit systems.

Reply 7: Thank you for your comment, we have adjusted our conclusion.

Changes 7: We have adjusted our conclusion (see Page 17, lines 453-463): 'In general, thoracic surgery in the Netherlands has a well-organized quality structure, since thoracic-related professional associations and the government monitor surgery centers every (five) year(s), and thoracic surgeons must be recertified per five years.

Furthermore, Dutch thoracic surgery is transparent due to nationwide obligated registries providing open-access annual reports. Training and education of thoracic surgery is particularly structured with separate training programs, professional associations and quality requirements for cardiothoracic surgery and general thoracic surgery. Current challenges such as the unbalanced labor market, centralization of surgical care, and the lack of mandatory data registration for non-oncological thoracic surgical care have to be addressed.'