Review Article on Thoracic Surgery Worldwide

Thoracic surgery in Spain

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Abstract: In this manuscript, we briefly report on the Spanish health care system and the current situation of Thoracic Surgery in the country. Our surgical speciality is approached in terms of national spread of thoracic units, education, technological development, and other relevant aspects. Thoracic Surgery national workforce is also reviewed and compared to sister specialities. Prospects and authors' recommendations for development are included. Total cost of public health care expenditure in Spain represents 9% of the gross domestic product (GDP) and the National Health System is included in the top ten more efficient systems in the World. Thoracic Surgery in Spain is an independent medical speciality. The access to training in accredited hospitals is uniformly regulated all around the country and represents the official and only route to certified medical specialization. 0.5 certified specialists in Thoracic Surgery per 100,000 habitants are working in the country, half of them being female in the age subset of 30–39. Currently, more than half of all anatomical resection in the country are performed via VATS. Seven centres are currently accredited by the Ministry of Health for lung transplantation, and the current rate of lung transplants is 7.1 per million of population. To note is the success of the non-heart-beating donors program developed in recent years. Three national professional and scientific societies are gathering most Spanish thoracic surgeons and promoting cooperative multidisciplinary studies on lung cancer and surgical techniques such are video-assisted and robotic lung resection. Implementing a national database of thoracic surgical procedures would be advisable to promote continuous clinical quality improvements.

Keywords: National development; thoracic surgery; lung transplant; robotic surgery

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Introduction

In this article we discuss some of the most relevant features of the current situation, achievements, and future expectations of the speciality of Thoracic Surgery in our country. It also includes some reflections and suggests changes that could improve the future development of our speciality at the national level. The authors have agreed not to consider in the text changes suffered by scheduled thoracic surgical activity during the COVID-19 pandemic estimating that, thanks to the efforts of all health care workers in the World, vaccinations and other measures, this global scourge will soon be overcome.

The kingdom of Spain

Geographic particularities and population

Spain (formally the Kingdom of Spain) is the second-largest country in the European Union, with an area of 505,990 km^2. Most of the Spanish territory is European continental but includes also the Canary and Balearic Islands and other small territories in the North Coast of Morocco.

In mid-2020, the Spanish population was 47,450,795 people (24,195,205 women). According to the National Institute of Statistics (Instituto Nacional de Estadística, INE) 5,434,153 people were immigrants residing permanently in the Spanish territory (1).

Increased life expectancy and decreased birth rates during the last decades (*Figure 1*) is to note. Currently, 26.3% of the Spanish population are 60 or older, compared to 21.5% in 2000 and 15.2% in 1980 (2). As we will see later, these figures must be considered due to its influence on Thoracic Surgery practice, since most lung cancer cases are diagnosed in advanced age patients.

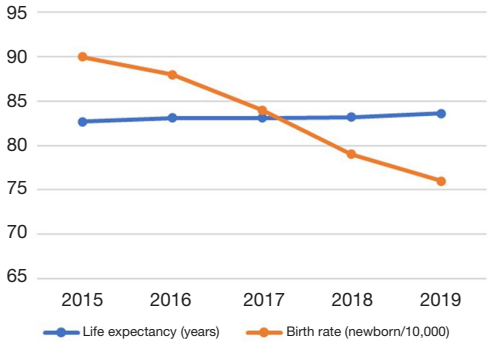

Figure 1 Spanish demography 2015–2019.

Politics, administrative divisions, and economy

The unitary state of Spain is composed by 17 autonomous communities and 2 autonomous cities, with varying degrees of autonomy.

Spain is a member country of the European Union (EU) since January 1, 1986 and became a member of the Eurozone since January 1, 1999. Spain is also a member country of the Schengen Area since March 26, 1995 (3).

With a gross domestic product (GDP) of $1.45 trillion, Spain is 14th in the World rank and 4th in the EU behind Germany, France, and Italy (4). According to the World Data Bank, in 2019 Spain was the 16th larger exporter in the World (5).

The tourism industry is an important economic driver in the country, accounting for about 11% of the nation's annual GDP.

Health care

The Spanish National Health System (SNS) is based in the principles of universality, free access, equity, and fairness of financing, and is mainly funded by taxes. Health competences are transferred to the 17 Autonomous Communities after 1986. At the national level, the Inter-territory Council for the SNS, is responsible for certain strategic areas (such are organ transplantation) as well as for the coordination and evaluation of the performance of the health system. The private sector provides voluntary health insurance schemes to individuals (6).

The public health expenditure was in 2019 was over €75,025 million (€1,593 per habitant) (7); in 2019, an estimated 9% of the GDP corresponded to health care expenses (8).

Recently, the World Health Organization classified the Spanish SNS as the 7th more efficient in the World (9).

Thoracic surgery, an independent medical speciality

Legislation and competences

Since 1978, Thoracic Surgery in Spain is an independent medical speciality with clearly identified competences. Access to training after licensing as general practitioner in Medicine, registering as specialist and professional competences are established by legislation at a national level.

Since health care is transferred to autonomic

communities, regional authorities are responsible for the administration, planning and management of institutions, services, and health programs to guarantee the right to health to all citizens. Portfolio services in Thoracic Surgery are defined, published, and controlled by competent authorities at regional level. In those documents, competences of individual Thoracic Surgery services are specified (10).

Diagnosis and management of congenital or acquired diseases of the chest, including disease of chest wall, pleura, lungs, airways, mediastinum, and diaphragm are competences of thoracic surgeons. Oesophageal diseases, except for emergencies such as oesophageal perforation, are included among General Surgery competences in most regional health care services.

Training aspects

Access to training programs

To become a specialist doctor in Spain, it is necessary to obtain a trainee position through the MIR (médico interno residente in Spanish). It was established as a uniform national requirement in the early 80s and consists of a period in which the specialist applicant works in an accredited for training hospital (in the case of clinical specialities) for a period ranging from 3 to 5 years, the largest ones for surgical specialities. During this period, the trainee receives a salary and is obliged to provide care to patients, with progressively increasing responsibilities, according to his abilities and the level of training in which he is located and participates in educational and research programs.

Some basic principles of the MIR system are (11): (I) the hospital training system is endorsed as the official and only route to certified medical specialization; (II) the National Council of Medical Specialities (NCMS) and one National Speciality Commission (NSC) for each speciality is settled; and (III) a competitive and merit-based access to MIR training is established. Before the selection process, the number of financed training posts is approved on a yearly basis according to the existing accredited training units, the estimated national need of specialists and the healthcare budgeting of the autonomic communities.

A national competitive exam takes place yearly since 1979 and its normative has been updated several times, the last one in 2014. Candidates are ranked according to their academic performance at medical school (10% of final score) and their scores at 225 multiple-choice questionnaires on basic and clinical aspects of medical science (90% of final score). Candidates are classified in the first positions have preference selecting the speciality and institution of their choice out of all national training posts available. In the last five years, the mean number of applicants to the MIR exam has been 13,390 competing for a mean of 6,400 positions. The number of Thoracic Surgery positions have increased slightly in recent years, from 14 in 2016 to 23 in 2020.

The training program

Requirements for the training of specialists are regulated by the Ministry of Health at the national level. The hospital must be evaluated for accreditation as a teaching center and the Thoracic Surgery service must meet several requirements including a minimum of three specialists, at least 250 major thoracic procedures per year and several organizational and quality of care characteristics. The degree of excellence of the educational process is evaluated periodically and, depending on that, teaching accreditation may be revoked.

The content of the educational program in the speciality is currently under review by the National Commission. The current one details the objectives of knowledge and abilities to be acquired for each year of residence. Currently, the thoracic surgery trainee starts his experience as a full-time junior surgical doctor in general surgery for at least 10 months to one year and participates in general surgery on-calls for at least two years.

The program also includes rotations by other units such as cardiovascular surgery, intensive care medicine, and pulmonology.

Currently, external rotations in reference Thoracic Surgery units of different hospitals, cities or countries are recommended but not mandatory.

Each accredited for training unit is in charge of supervising their trainees, being responsible for their continued evaluation and knowledge review. If after these five years the unit considers the trainee has successfully met the requirements, his speciality will be certified. Not a final exam at the end of training to demonstrate capability is mandatory at a national basis.

Mutual recognition of medical qualifications in the European Union

The annual quota for admission of foreign medical graduates into MIR program is only 4%. Nevertheless,

Table 1 Thoracic Surgery and related specialities workforces in Spain (updated 2018)

Speciality	Number of specialists*	Per 100,000 habitants	Aged 60 or older (%)	Female (%)
Thoracic	244	0.5	13.7	32.8
Vascular	463	1	8	42.5
Cardiac	502	1.07	23.8	25.9

*, Working in the Public Health System.

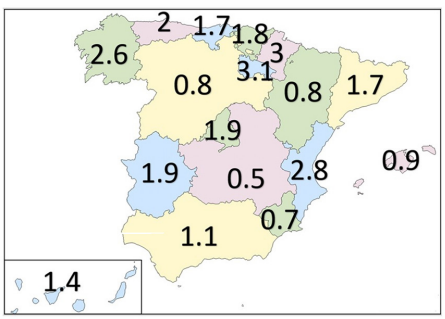

Figure 2 Geographical distribution of Thoracic Surgery services in Spain (units per million of population).

fully trained specialists can settle down in the Country. To facilitate professional mobility, the recognition of qualifications laid down in Directive 2005/36/EC (12) enables the free movement of general practitioners and specialists and other professionals within the EU. If a substantial difference in the education process or contents is detected, the applicant can be obliged to take an aptitude test or complete an adaptation period. Also, the host country can carry out language checks on the benefit of patient safety. Officially, a "Paid Fellowship Program" is not established in Spanish Public Health as an opportunity of temporary job experience for foreign doctors.

The current status of clinical practice

Thoracic Surgery workforce and services around the Country

According to data published in 2018 (13), 244 certified thoracic surgeons were working in the Spanish network of public hospitals, representing 0.5 specialists per 100,000 habitants. At that time, almost one third were female. Gender differences almost disappear in the subset of specialists aged 30 to 39, where half of them were female. On *Table 1* we are comparing demographic data of three related specialities: Thoracic, Vascular and Cardiac Surgery.

In a recently published review by the SECT (14), the total number of Thoracic Surgery units in the Country is 77, including 23 in private institutions run by diverse health insurance companies. Geographical distribution is represented as the number of thoracic units per million habitants in *Figure 2*.

From the total number of units, only 38, just one among private providers, have been accredited for the MIR program in the whole country.

Technological development

Thanks to huge investment in public health care, the availability of the last diagnostic equipment indispensable for thoracic surgery practice all along the Country is reasonably good. As an example, the Public Health System has 1.6 PET scan and 15.9 equipments of magnetic resonance image (MRI) per million of habitants. An increase in the number of radiotherapy units in the next years (currently 0.22/million) would be desirable.

Major video-assisted thoracic surgery (VATS) is fully developed in Spain, Currently, more than half of all anatomical resection in the country are performed via VATS (15).

Robotic-assisted surgery is not available for most Thoracic Surgery services, but the clinical and economic advantages of such technology are still under evaluation (16).

Lung transplant

Spain occupies a privileged position in the domain of solid organ transplantation, with one of the highest deceased donation rates ever (17) (*Figure 3*). The success of the Spanish model resulted from the implementation of a set of measures adopted since The Spanish National Transplant Organisation (ONT), a technical agency of the Ministry of Health, was created in 1989. The core principle of the Spanish Model is a systematic and organizational approach to the process of deceased donation structured and coordinated at three interlinked levels: national, regional, and hospital. In the case

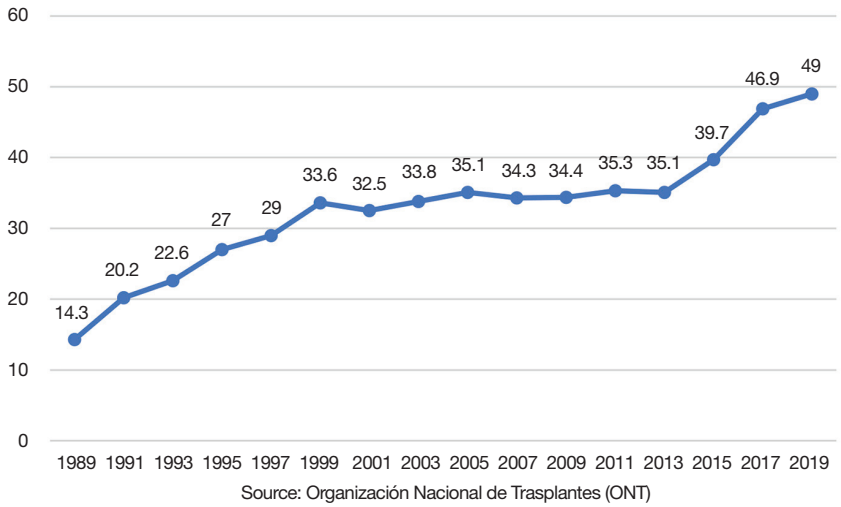

Figure 3 Evolution of the rate of deceased donors per million of population in Spain (Source ONT, 2020).

of lung transplant, 7 centres are currently accredited by the Ministry of Health for lung transplantation. Their activity has been increasing since the first procedure in 1990 (18). Until January 2020, more than 5,200 single and double lung transplantations have been performed in the whole country with a yearly historical maximum in 2019 with 419 cases (318 double, 99 single, 2 combined); in December 2020, the rate of lung transplantations in the country was 7.1 per million of population.

To decrease death rate while waiting for suitable lung donors, Spanish lung transplant groups have developed programs for lobar transplantation and non–heart-beating donors (19,20). The last published Spanish report on lung transplantation with lungs obtained after circulatory death describes in detail a simple and effective preservation method using only topical lung cooling, associated with an excellent 5-year survival rate of 87.5%. The authors attribute their results to effective cardio-pulmonary resuscitation using external compression devices and to shorter warm ischaemic times gained (19).

Professional societies and associations

The Spanish Society of Thoracic Surgeons

Most Spanish thoracic surgeons are members of the Spanish Society of Thoracic Surgeons (Sociedad Española de Cirujanos Torácicos, SECT), founded in 2007. Besides, other specialists and health care professionals (nurses and physiotherapists mainly) related to thoracic patients and procedures can be admitted as associate members. An annual meeting and several other educational activities organized under the patronage of the SECT are aimed to promote the advancement of patient care, medical knowledge, and research and to lead multicentric and multidisciplinary cooperation on issues related to the speciality. The SECT is also publishing consensus documents and clinical practice guidelines on thoracic topics.

The Society's official journal is Cirugía Española (see below).

The Spanish Association of Surgeons (Asociación Española de Cirujanos, AEC, founded 1935)

AEC is the largest surgical professional organisation. Twenty sections representing several surgical specialities, Thoracic Surgery one of them, and areas of interest of the members are included in the AEC. The activity of the society is directed at the organisation of conferences and meetings and the maintenance of its journal, Cirugía Española. The Journal, published by Elsevier, is indexed in the largest bibliographic databases (SCIE/JCR and Index Medicus/Medline).

The Spanish Society of Pulmonology and Thoracic Surgery (SEPAR)

Founded in 1967, the Spanish Society of Pulmonology and Thoracic Surgery (known as SEPAR by its former name Sociedad Española de Patología Respiratoria) includes in its organisation chart a thoracic surgeon as Vice-president and

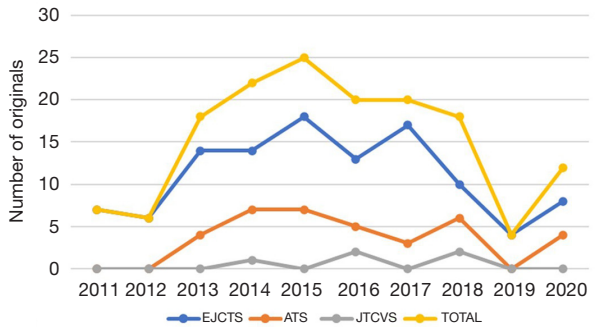

Figure 4 Published originals in three top journals along the last ten years (Source PubMed).

a section of Thoracic surgery mainly focused on medical quality, clinical management, and teaching, promoting the more complete development of our youngest doctors and the culture of teamwork. The area's coordinator team is specifically interested in the promotion of multidisciplinary working groups and recently have made available to its associates an electronic platform for reflexive self-assessment to detect areas for professional improvement; the process, in cooperation with the General Council of Colleges of Physicians, is aimed to obtain recertification. The official journal of SEPAR is Archivos de Bronconeumología, with a 2020 impact factor of 4.957.

Current research in thoracic surgery

Multi-institutional projects under development

Multi-institutional projects on different aspects of Thoracic Surgery are mainly promoted by the SECT and coordinated by the Scientific Committee. Currently, the Society is leading and financing multi-institutional studies on survival after pulmonary resection alone or combined with other therapies, different aspects of VATS (15) and robotic-assisted lung resection, thymic diseases, predictive value of pleural lavage cytology in non-small cell lung carcinoma and preoperative identification of peripheral pulmonary nodules. A simple, valid, and reliable risk prediction model has been obtained from the multi-institutional VATS database, resulting in a useful tool for establishing the risk of a patient undergoing anatomic lung resection (21).

Besides projects leaded and financed by the SECT, the SEPAR Spanish cooperative group for the study of pulmonary metastasis, has published a prospectively collected large series of cases showing an association between VATS resection and good postoperative outcomes (22).

Multi-disciplinary projects

We are briefly commenting on the Lung Cancer Spanish Group (Grupo Español de Cáncer de Pulmón, GECP) and the Spanish branch of the Lung Ambition Alliance, both representing highly active initiatives in the Country mainly focused on the diagnosis and therapy of non-small cell lung cancer (NSCLC).

The GECP (established 1991) is an independent, non-profit cooperative group aimed to promote the study and research in lung cancer. More than 400 specialists (oncologists, thoracic surgeons, radiotherapists, and basic researchers) and 150 hospitals throughout Spain participate in the activities. The GECP, currently leading lung cancer clinical research in Spain, is aimed to promote and support translational and cooperative research in different aspects of lung cancer; also provides support to young investigators granting scholarships to new projects. Among GECP projects we want to highlight the Phase III Clinical Trial, prospective, randomized, double-blind, adjuvant chemotherapy with MEDI4736 versus placebo in PD-L1 NSCLC patients after complete resection. The study, having completed patient recruitment, is expected to offer relevant information in the next few years.

The Lung Ambition Alliance is an international project that brings together the main scientific and social organizations involved in the treatment of lung cancer. In Spain, the Alliance, with cooperation from the GECP, SECT and SEPAR, is working since 2020, to promote recommendations for improvement in three areas related to the approach of this cancer: early detection, access to innovative medicine, and quality of patient care. Currently, the Alliance is working on the promotion of pilot screening programs in Autonomous Communities, with the aim of generating local evidence and getting this practice generalized in the coming years throughout the Spanish healthcare system, through a national plan. To note is that evidence in our Country exists on excellent surgical outcomes and 5- and 10-year survival rates for patients participating in a lung cancer screening program with low-dose CT (23).

Manuscripts in the three top journals of the Speciality

The scientific production of Spanish thoracic surgeons published in the 3 major journals of the speciality (*The Journal of Thoracic and Cardiovascular Surgery*, *The Annals of Thoracic Surgery* and *The European Journal of Thoracic and Cardiovascular Surgery*) in the last 10 years have been

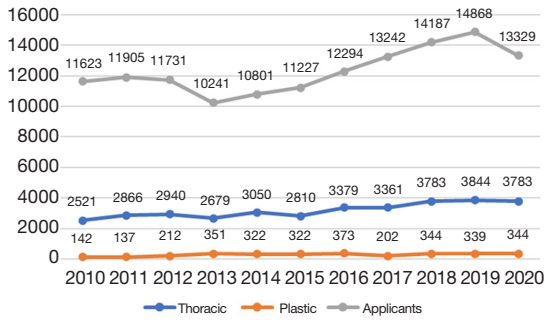

Figure 5 Median rank of candidates to start training in thoracic and plastic surgery and total number of graduates in Medicine applying to MIR selection process (Data from the Spanish Ministry of Health, https://fse.mscbs.gob.es).

reviewed in PubMed. We have selected originals, case series and editorials obtaining 140 citations. As presented in *Figure 4*, a decline in the number of papers along the last years can be observed. This review is obviously biased since truly relevant journals specialized in transplant, lung cancer and other thoracic topics have not been included but deserves consideration and discussion.

Comments

Education

Although the beginnings of thoracic surgery are based on the development of the treatment of tuberculosis complications and war wounds, and not on cardiac diseases, in many countries training in thoracic and cardiovascular surgery are linked. Matching similar knowledge and surgical training with other European and North American countries could become an increase in job opportunities for Spanish thoracic surgeons outside our borders.

Job opportunities in the Spanish public health system are offered only to certified specialists by MIR system or European trainees after a rather long process for recognizing the equivalence of their specialist license. For non-European specialists, there is a never-ending bureaucratic process until granting a valid national license. It should be taken in consideration the advantages of admitting doctors on fellowship programs, which introduces to the National Health Care System an international perspective, and it supposes an obvious source of workforce if needed.

To note is that the position in the final rank of applicants to thoracic training in Spain inside the MIR system has impoverished with time. Compared to other surgical specialities, being more appealing to junior colleagues maybe because of better economic perspectives or social prestige, the median rank for applicants selecting Thoracic Surgery in 2020 was 3,783 out of 13,329 applicants admitted to the exam (*Figure 5*). An effort is needed to make our speciality a more appealing one to young doctors.

Finally on training aspects, unifying evaluation criteria in all national territory at the end of the training should be prosecuted to evaluate all trainees under the same requirements.

National Health System requirements and prospects

As we have presented above, birth rate in Spain is decreasing and mean age of population is expected to increase rapidly in the coming years. Although, thanks to early detection programs, changes in smoking habits, and therapeutic progresses, lung cancer mortality in the Country is expected to decrease in the forthcoming years and, in fact, it is already decreasing in males (24), the number of thoracic procedures for diagnosis and treatment of lung neoplasms is expected to increase due to new surgical indications and better postoperative outcomes. For that, the workforce of thoracic surgeons in the Country should remain at least as is nowadays, maybe with a better distribution of thoracic units to avoid inequalities between regions. Currently, one third of thoracic surgeons in Spain are women and just three of them are head of her departments versus 57 males. The gap between genders could be partly justified with a historic low inclusion of women in Medicine and mainly in surgical specialities. In 2020, the female applicants to training in Thoracic Surgery was just 42%, very low compared to other surgery branches as Gynaecology or Paediatric Surgery (85% and 62%, respectively) (25). However, this situation is expected to change soon. Increasingly, most medical students are women and in 2020 the percentage of females in medical schools reached 72.5. Therefore, this new trending will imply changes in the presence of women in our speciality and consequently, a likely higher participation in the management of thoracic units.

Surgical practice

The advent of new diagnostic and therapeutic endoscopic technologies both in the bronchial tree, the pleural space and the oesophagus has opened an interesting field of cooperation between different specialists. Our Country has a long tradition in multidisciplinary cooperation between

medical and surgical units and scientific societies, as described above, and that represents a real advantage for patients and health care system efficiency.

Also, development of multi-institutional projects for risk assessment and clinical management guidelines, briefly mentioned above, guarantee a promising future for our speciality in fundamental aspects of our profession, such as the best possible care for patients and the control of public health spending. These kinds of projects would be very much facilitated by the implementation of a national database of surgical thoracic procedures sponsored by related professional and scientific societies.

We have tried to make all the statements contained in this article based on published and accessible to reader evidence, but some contents remain arguable, and we are open to further discussion and improvement.

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Footnote

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