2017 Census: Are There Enough Anaesthesiologists in Portugal?

Censos 2017: Existe Número Suficiente de Anestesiologistas em Portugal?

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ABSTRACT

Introduction: The objective of this study is to identify the number of anaesthesiologists working in Portugal and to monitor the national activity of this medical specialty by comparing it with a similar Census performed in 2014.

Material and Methods: Observational cross-sectional study. Data related to the month of May 2017 was collected from Anaesthesiology departments of 53 Portuguese public institutions from a total of 86 hospitals.

Results: The Census registered 615 127 surgical procedures (3.4% more than in 2013), 84.1% of which on a non-emergent basis, and 49.6% day case surgery (6.1% more than in 2013). Moreover, 89 608 procedures were performed outside the operating rooms (19.0% less than in 2013), 282 944 were anaesthetic clinics (1.3% more than in 2013) and 112 183 were chronic pain evaluations (13.1% more than in 2013). In addition, 51 380 labour analgesia were performed for delivery (14.3% more than in 2013) corresponding to 70.5% of all deliveries occurring in the Obstetric department of Portuguese public hospitals in 2016 (5% more than in 2013). A total of 1280 Anaesthesiologists were identified (2.1% more than in May 2014), corresponding to a ratio of 12.4 per 100 000 inhabitants (it was 12.0 in May 2014). Together with the 262 anaesthesiologists that work exclusively in the private system, we found a total sum of 1542 anaesthesiologists indicating a ratio of 15.1 per 100 000 inhabitants (it was 13.9 in 2014).

Discussion: We predict that the identified deficit of 541 anaesthesiologists in the Portuguese National Health Service should be reduced by two thirds until 2023. The reduction of the shortage of anaesthesiologists will allow an increase in human resource capacity in Anaesthesiology.

Conclusion: Even though there was a slight increase in the ratio of Anaesthesiologists per inhabitant in 2017 compared to 2014, Portugal maintains a shortage of Anaesthesiologists.

Keywords: Anesthesiology/manpower; Anesthesiologists; Portugal

RESUMO

Introdução: O objectivo deste estudo é identificar o número de anestesiologistas e monitorizar a actividade da Anestesiologia em Portugal, comparando-a com idêntico Censos realizado em 2014.

Material e Métodos: Estudo observacional transversal. Foram contactados, em maio de 2017, os diretores dos serviços de Anestesiologia das instituições hospitalares com actividade cirúrgica que compõem o Serviço Nacional de Saúde, num total de 53 instituições hospitalares, correspondendo a 86 hospitais.

Resultados: O Censos registou um total de 615 127 intervenções cirúrgicas (mais 3,4% que em 2013), das quais 84,1% foram cirurgias programadas e destas 49,6% em regime de ambulatório (mais 6,1% que em 2013). Constatou-se ainda a realização de 89 608 procedimentos com apoio de anestesia fora do bloco operatório (menos 19,0% que em 2013), 282 944 consultas de anestesia (mais 1,3% que em 2013) e 112 183 consultas de dor crónica (mais 13,1% que em 2013). Identificaram-se 51 380 analgesias de parto (mais 14,3% que em 2013), que corresponderam a 70,5% dos partos ocorridos nos serviços de Obstetrícia dos hospitais do Serviço Nacional de Saúde (mais 5% de partos que em 2013). Foram identificados 1280 Anestesiologistas (mais 2,1% do que em maio de 2014), o que corresponde a um rácio de 12,4 por 100 000 habitantes (este valor era de 12,0 em maio de 2014). Com os 262 Anestesiologistas a trabalhar exclusivamente no sector privado, obtém-se um total nacional de 1542 Anestesiologistas, ou seja, um rácio de 15,1 por 100 000 habitantes (este valor era 13,9 em maio de 2014).

Discussão: Prevê-se que o déficit de 541 Anestesiologistas identificados, possa ser reduzido em cerca de dois terços até 2023. A redução do déficit de Anestesiologistas permitirá aumentar a capacidade de resposta às crescentes solicitações dos serviços de anestesiologia Portugueses.

Conclusão: Apesar de um ligeiro aumento do rácio de anestesiologistas por habitante em 2017 comparativamente a 2014, Portugal continua com um déficit de Anestesiologistas.

Palavras-chave: Anestesiologia/recursos humanos; Anestesiologistas; Portugal

INTRODUCTION

Anaesthesiology is a cross-sectional specialty in modern healthcare systems, due not only to its crucial intervention in hospital medicine, as well as to its increasing support to Family Medicine, in areas such as Pain Medicine and Palliative Medicine.

The presence of Anaesthesiology is mostly required in the hospital setting:

a) In perioperative medicine, with the implementation of adequate conditions for high-quality and safe procedures;
b) In emergency medicine, as well as in pre and hospital emergency, where the integration and leadership of Anaesthesiology within a multidisciplinary team is well recognized;

1. Direção do Colégio de Anestesiologia (2015 - 2017). Ordem dos Médicos. Lisboa. Portugal.
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c) In intensive care medicine in support to the critically ill patient, in postoperative differentiated care to patients having been submitted to highly differentiated surgery as well as to major trauma patients, in whom different integrative knowledge and the acquisition of multiple skills make the presence of an anaesthesiologist crucial;
d) In support to medical tests and diagnostic procedures (MTDP) involving increasingly more complexity and requiring the presence of anaesthesiologists;
e) In pain medicine, in the acute setting as in patients in whom pain has become a chronic issue, or even in labour analgesia providing for help to women going over one the most rewarding moments in their life with no pain.

Increasingly higher safety and quality is required, allowing for improved outcomes regarding patient's functional recovery as well as social, professional and family reintegration.

A regular monitoring and assessment of the organisation of the departments of Anaesthesiology is missing, as well as the need to know their current human resource (HR) status, in order to allow for an adequate strategic planning and the required renovation or increase in medical staff.

This assessment was started in 2014[1] and is now followed by the repetition of the *Censos Anestesiologia*, aimed at providing for an update of the knowledge regarding HR in Anaesthesiology currently existing in Portugal, as well as the activity in public hospitals within the Portuguese National Health System [*Serviço Nacional de Saúde (SNS)*].

MATERIAL AND METHODS

Data were based on a survey that was sent over by e-mail (Appendix 01: https://www.actamedicaportuguesa.com/revista/index.php/amp/editor/proofGalley/10094/5430) to all the Heads of Department of Anaesthesiology of the public hospitals with surgical activity (with corporate or private management, in mainland Portugal and in the Autonomous Regions of the Azores and Madeira, including the three regional centres of the *Instituto Português de Oncologia Dr. Francisco Gentil (IPOFG)* and the two units of the Portuguese Military Hospitals *(HFA)* in Lisbon and Porto, involving 53 hospital institutions (HI) and corresponding to 86 hospitals. Data corresponding to week 14-21 May 2017 regarding the organization, human resources and logistics and to year 2016 regarding output data were requested in the survey.

Logistic characteristics were requested, based on data regarding the hospital type, current surgical specialties, presence and characteristics of the outpatient surgery program, MTDP with the support of Anaesthesiology and presence and characteristics of the Emergency Department (Accident & Emergency Department). Demographic data on the total number of specialists, their professional ranking and current contract and conditions of service were requested, as well as data regarding registrars undergoing training. The identification of any current staff shortage was also requested to the heads of department, including methods that were used for data collection. Data on daily task characteristics were requested and time spent should be counted in six-hour working units. Finally, annual output data have been requested, regarding anaesthesia in elective surgery (considering conventional vs. outpatient surgery), in emergency surgery, in anaesthesia outside of the operating room (including labour analgesia) and in pre-anaesthesia and Pain Medicine consultations.

A simplified version of the survey (only including the identification of current hospital logistics and the nominative identification of anaesthesiologists) was sent by mail to the clinical directors of private hospitals with surgical activity, aimed at the identification of all the anaesthesiologists working full-time at these hospitals. In order to increase the accuracy of the Census, an email has been sent to all the physicians registered at the College of Anaesthesiology of the Portuguese Medical Association - *Ordem dos Médicos (OM)* and specifically asking those working full-time at the private sector to return their response including their medical license name, number and duration of clinical activity as at May 2017.

RESULTS

A total of 53 HI with surgical activity were included in the study, including 47 in mainland Portugal, three in the Autonomous Region of the Azores (*Hospital do Divino Espírito Santo* in Ponta Delgada, *Hospital do Santo Espírito* in Angra do Heroísmo and the *Hospital da Horta*), one in the Autonomous Region of Madeira (*Hospital Central Dr. Nélio Mendonça* in Funchal) and two military hospitals (in Lisbon and in Porto). A total of 20 hospitals, 19 hospital centres and eight institutions integrated into local health units – *Unidades Locais de Saúde - ULS* (*Alto Minho, Matosinhos, Nordeste, Guarda, Castelo Branco, Norte Alentejano, Baixo Alentejo* and *Litoral Alentejano*) were included into the 47 HI in mainland Portugal, geographically distributed by the Regional Health Administration [*Administração Regional de Saúde* (ARS)] of *North* (15), *Centre* (11), *Lisbon* (15), *Alentejo* (4) and *Algarve* (2).

The only differences to the 2014 Census were:

- The split of the Department of Anaesthesiology at the *Centro Hospitalar de Setúbal* into one at the *Hospital de Setúbal* and the second one at the *Hospital de Outão*;

- A call for more comprehensive data regarding the area of Obstetrics.

Characteristics of the public hospital institutions

Significant differences were found between the hospital institutions that were included in this analysis, regarding their dimension, surgical specialties and surgical complexity. Elective surgery is increasingly performed in an outpatient care facility and is organised as an autonomous model in 40 of the HI that were analysed (75.5%), i.e. with an independent circuit and facility from inpatient surgery (operating room and recovery room).

Anaesthesia involvement outside of the operating room

is increasingly more frequent and we may currently find anaesthesiologists in support to Gastroenterology (90.6% of the HI), Interventional Cardiology and Pulmonology (75.5%), Neuroradiology (71.7%), Radiology (54.7%) and Ear, Nose & Throat (ENT) (47.2%). The support to Psychiatry (22.6%) and to Reproductive Medicine (18.9%) was less significant.

An emergency room was available in 49 HI, involving different healthcare facilities, including *Vias Verdes* (Stroke and Coronary Unit) in 75.5% and special facilities (Neurosurgery, Vascular and Cardiothoracic Surgery) in 34.0%; this was not available in four HI (*IPOFG Centro Regional de Coimbra, Hospital de Cantanhede, Hospital do Outão* and *Instituto de Oftalmologia Dr. Gama Pinto*, in Lisbon). The presence of departments of obstetrics (79.2%) and paediatric surgery (39.6%) emergency facilities in a high percentage of HI is also worth mentioning.

Anaesthesiology is not restricted to the operating room or to the support to MTDP. In fact, and according to their expertise within perioperative medicine, pain medicine, intensive care and emergency medicine, anaesthesiologists are very much involved in different healthcare programs and demanding tasks apart from their presence in perioperative medicine, in post-anaesthesia care units and in labour analgesia (within the Department of Obstetrics). On the other hand, their support to chronic pain units in 84.9% of the HI, in hospital emergency in 73.6%, in acute pain programs in 71.7% and in Intensive Medicine in 58.1% is also worth mentioning.

Characteristics of the departments of Anaesthesiology and their activity

Thirty seven departments reported directly to the Clinical Director (69.8%) and six are integrated into departments such as Intensive Medicine (11.3%) and eight in Surgery departments (15.1%). In one HI, Anaesthesiology became a functional unit and in another HI, given the absence of an independent department, anaesthesia is carried out by an external provider.

The different functions of the anaesthesiologists and their response to the different demands were obtained based on weekly six-hour work shifts. According to the results, a 7.8 operating room (OR) national average turnover of elective surgery per working day and per HI has been found and ¾ of the OR were occupied in the morning and ¼ in the afternoon.

Around 32% of the whole anaesthesia activity was carried out in the Emergency room, while an increasing percentage of this is carried out outside of the operating room (perioperative medicine, support to MTDP, chronic pain unit, Intensive Care, Emergency, training, etc.), corresponding to more than 35% of the total.

Some data regarding the 2016 hospital output are shown in Table 1. A total of 615,127 surgical procedures have been

Table 1 – Annual output (2016 and 2013) of the public hospital institutions that were analysed, regarding anaesthesia activity

Annual output	2016 (n = 53)		2013 (n = 52)	
	No. (%)	Mean ± SD	No. (%)	Mean ± SD
Elective surgery (total)	517,058 (84.06%)	9,755.8 ± 8,717.3	492,784 (82.80%)	9,476.6 ± 7,968.6
Inpatient surgery (total)	260,693 (50.42%)	4,918.7 ± 4,824.2	278,358 (56.49%)	5,353.0 ± 4,776.9
Outpatient surgery (total)	256,365 (49.58%)	4,837.1 ± 4,455.1	214,426 (43.51%)	4,123.6 ± 3,772.1
Emergency surgery (total)	98,069 (15.94%)	1,850.4 ± 1,550.2	102,401 (17.20%)	2,007.9 ± 1,765.5
Surgeries (total)	**615,127**	**11,606.2 ± 10,013.0**	**595,185**	**11,445.9 ± 9,509.7**
Outside of the operating room	89,608	1,792.2 ± 4,565.3	110,668	2,258.5 ± 6,259.6
Deliveries (total)	72,902	1,375.5 ± 1,115.0		
C-section rate (%)	27.73%			
Hospitals with < 27% C-section rate	14			
Labour analgesia (total)	51,380 (70.48%)	969.4 ± 856.6	44,956	881.5 ± 789.0
Perioperative medicine consultations (total)*	282,944 (54.36%)	5,338.6 ± 4,620.6	279,205 (56.66%)	5,474.6 ± 4,835.2
Chronic pain consultations (total)	112,183	2,116.7 ± 2,056.7	99,153	1,983.1 ± 1,841.1
Acute pain consultations (total)	65,562	1,260.8 ± 1,771.8	68,858	1,350.2 ± 1,924.7

* o This percentage corresponds to the number of consultations compared to the total number of elective surgeries
SD: standard deviation

recorded by the Census in the 53 HI that were analysed, from which 84.1% were elective surgeries and, from these, 49.6% were outpatient surgeries. A 3.4% increase in total surgical production has been found, when compared to 2013, in addition to a reduction in emergency surgery, which was now found in 15.9% of the cases. An increase in outpatient surgeries has been found, now in the region of 50%. From the 86,254 deliveries that were recorded in Portugal in 2016,[2] 72,902 (84.5%) took place at departments of Obstetrics in public hospitals, 70.5% under analgesia. However, as a 15% percentage of elective C-section delivery was found in public HI, we may consider that more than 85% of pregnant mothers with onset of labour in public hospitals underwent labour analgesia throughout 2016 (a 80% percentage was found in 2013). It is worth mentioning that a 27.73% national C-section rate has been found in public HI and that a C-section rate below 27% was only found in one third of these hospitals. Therefore, mean values had a less significant relevance, due to the large dispersion that was found in the different hospitals.

Characteristics of the Human Resources in Anaesthesiology

A) As part of the staff of the departments of Anaesthesiology in public HI, regardless of the management model

A total of 1,158 anaesthesiologists (3.3% more than in 2014) were found as part of the staff of the departments of Anaesthesiology in the 53 HI, as at week 14-21 May 2017, 847 of which are female (73.1% *vs.* 73.8% found in 2014, showing a minor reversal in the trend over the past few years).

The distribution of the 1,157 anaesthesiologists per year of birth is shown in Fig. 1 and a 48.6-year mean age has been obtained, showing a mild ageing of the population (47.9 years in 2014).

B) Anaesthesiologists working in the public sector and not part of the staff of any department of Anaesthesiology, regardless of the management model

A total of 76 self-employed anaesthesiologists and mainly working at intensive-care units or at chronic pain units were found in public HI [mostly female (69.7%)].

C) Other anaesthesiologists working in the public sector, without a binding employment contract

Apart from the 1,234 anaesthesiologists already described, a total of 46 anaesthesiologists (consultants) waiting for placement into the public sector (84.8% female) were found.

D) Specialty registrars

With the entry into force of the Ordinance no. 49/2011 in 26 Jan, the structure and organisation of the training program in Anaesthesiology has been updated and five-year duration has been established onwards. Additionally, updated legislation of the training program was published through the Ordinance no. 92-A/2016 in 15 Apr with which the annual national training capacity was increased to around 80 registrars. Therefore, the Census allowed for the identification of 363 registrars (67.2% female). In addition, training credits in Anaesthesiology have been extended to three public hospitals (*Hospital Faro* (HF), *Hospital Vila Franca de Xira* (HVFX) and *Hospital Beatriz Ângelo* (HBA)) and to a private hospital (*Hospital da Luz*, in Lisbon) over the past three years.

E) Anaesthesiologists working full-time in private hospitals

A total of 262 physicians were working full-time in private hospitals, from retired physicians to young consultants.

F) Ratio of Anaesthesiologists per 100,000 population and per Regional Health Administration

A ratio of 12.4 per 100,000 population has been obtained based on the results of the study (1,280 anaesthesiologists with a binding employment contract to a public HI) (Table 2), rising to 15.1 when a total of 262 anaesthesiologists working full-time at the private sector are included. A positive trend has therefore been found in almost all the Regional Health Administrations. It must be borne in mind that an improvement regarding this indicator may also have been related to the decline in the Portuguese resident population found over the past two years.

Shortage in staff anaesthesiologists in public HI has grown worse, from 41.7% in 2014 to 46.7% in 2017 (Table 3), when the different heads of department in public HI were asked to inform on any HR shortage that they seek to address in different ways through overtime hours, hiring of temporary work or even by workplace closure.

Many different reasons may exist to explain for this worsening of the situation, even though the most relevant would certainly include:

- An outflow (which was not offset) of many anaesthesiologists to the private sector and abroad, due to a higher competitiveness;
- The application of employment legislation that has been in force for many years to physicians working in the public sector, by establishing compensatory rests for those working in night shifts or in rest days;
- Hiring of new anaesthesiologists with working time including 18-hour shift rotation in emergency, instead of the previous 12-hour shift rotation (corresponding to 21.2% of the staff anaesthesiologists in 2017, compared to 7.9% in 2014), leading to an effective 30% reduction in the available working time spent in elective work;

All these changes correspond to a significant medical HR shortage in response to everyday demand.

It is worth mentioning that these data are of the sole and exclusive responsibility of the heads of department, most of whom were not available to explain how these were obtained.

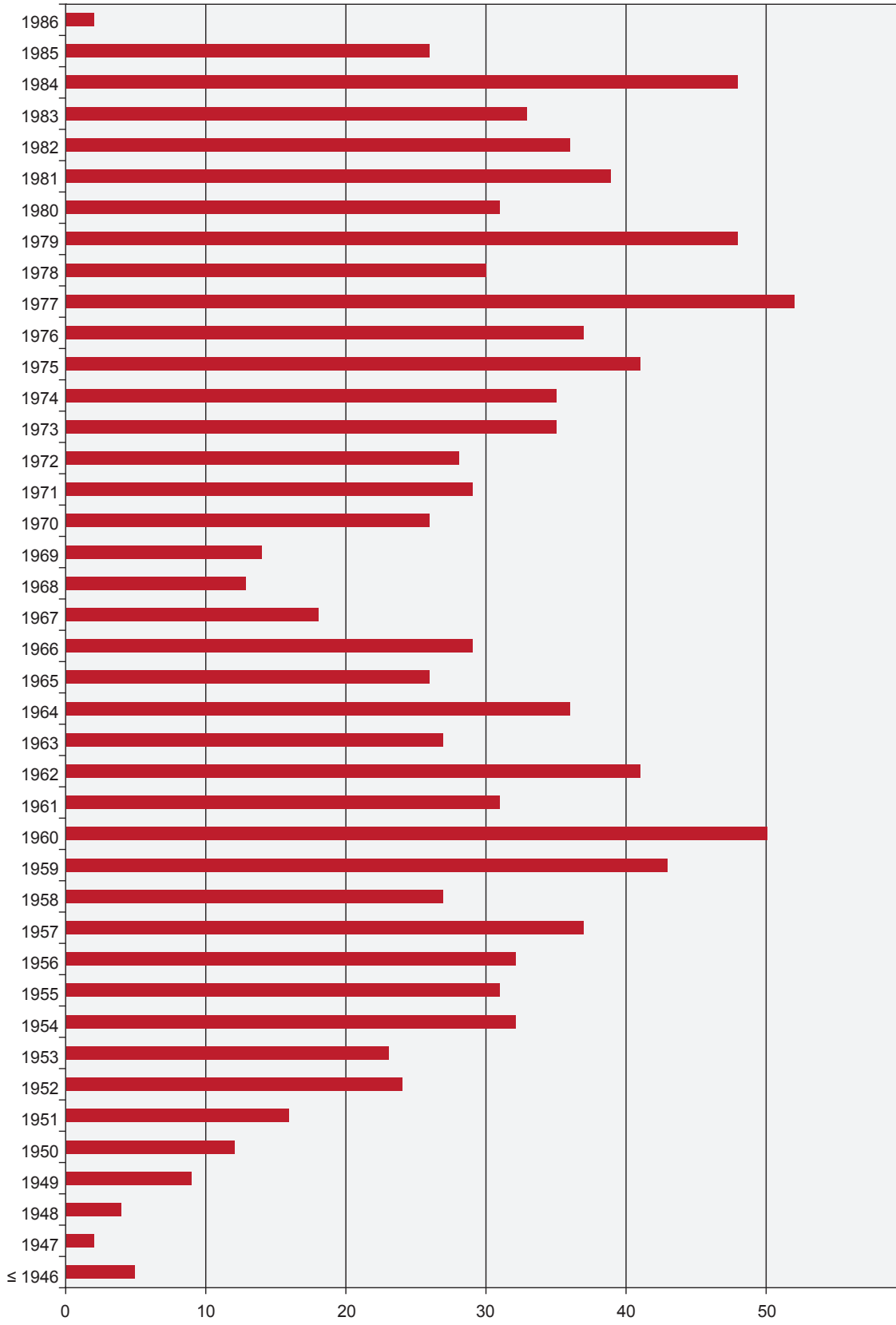

Figure 1 – Anaesthesiologists as part of the staff of the departments of Anaesthesiology in the hospital institutions that were analysed in the study (n = 53) per year of birth

Indicators related to the activity of Anaesthesiology

The proposed cluster monitoring model defined by the Portuguese *Administração Central do Sistema de Saúde (ACSS)* for the Portuguese National Health System (SNS), through the inclusion of different benchmark dimensions, including economic and financial, access, production or quality indicators, was used in the study.[3]

Only Group C, D and E public HI were included in the analysis, as results could easily have been biased by the remaining hospitals, due to their own characteristics or mainly due to the low number of anaesthesiologists in many Group A and B HI.

From the different indicators that were analysed and shown in Table 4, one aimed at showing HR in Anaesthesiology through the ratio between the number of hours of the different physicians in the weekly workload (including overtime and part-time working hours) compared to the estimated number of hours to respond to the different demands of the departments of Anaesthesiology (including Emergency, although not considering any additional surgical workload). These were assessed based on six-hour working periods, in order to allow for an easier estimate of the number of hours allocated to the activity in the operating room, in which a value of 1 corresponded to the perfect match between the available workload and the different demands to which the departments had to respond. A value > 1 means there is some waist regarding HR management and when < 1 it would mean that, in order to respond, the department either is working very efficiently or some contracted hours failed to be included in order to effectively respond to demand ('HR hours / periods ratio' column). Different indicators of the activity in which anaesthesiologists are involved are also shown in Table 4 as, for instance, the percentage of perioperative medicine consultations to patients referred for elective surgery (vs. non-elective) in the different HI, the percentage of outpatient surgeries compared to the total number of elective surgeries, the number of perioperative medicine consultations per six-hour working period, the number of outpatient consultations in chronic pain units per six-hour working period, the number of surgeries per operative time in elective surgery in the different public HI, the number of anaesthesia procedures out of the operating room per six-hour working period and the number of anaesthesia procedures per operating room in Emergency. Some data are worth mentioning due to their unlikelihood, as for instance the number of 35.2 consultations per six-hour working period or 22.9 anaesthesia procedures out of the operating room per six-hour working period, which would correspond to one consultation or anaesthesia procedure each 10 and 15 min, respectively! These may also have occurred due to data incorrect recording.

Attention is drawn to the declining trend in (i) the rate of perioperative consultation per elective surgery (from 57.1 to 39.1%), (ii) the rate of outpatient surgery (from 53.5% to 42.7%), (iii) the number of consultations per six-hour working period (from 12.1 to 10.8) and (iv) the number of elective surgeries per six-hour working period (from 4.1 to 2.7) in the different hospital groups, as complexity and diversity of healthcare services increase in the hospital (from Group C to E hospitals). In the other hand, it is worth mentioning the reverse trend in the number of emergency surgeries per operating room allocated to the emergency department (from 3.2 to 3.7).

The different HI have been coded and each code is known by each head of department, who can therefore compare the indicators of each department to the hospital group average in which the department belongs to.

DISCUSSION

The presence of autonomous hospital departments is a major element in keeping high quality standards in clinical practice, not only due to the fact that these allow for two-way learning and continuous training throughout the professional life, as to the fact that these allow for the implementation of assessment and clinical improvement programs based on a peer-to-peer cooperation and trust.

Therefore and due to the cross-sectional nature of the intervention in Anaesthesiology within the hospital organisation, it has been recommended that departments of Anaesthesiology should be autonomous, independent and unique per HI, as it actually happens. Whenever this is not the option of the executive board, its independence should always remain and it is desirable that activity in anaesthesiology should be included into structures with an intermediate management and departments with an output not directly dependent from the availability of anaesthesiologists

Table 2 – Ratio of anaesthesiologists per 100,000, according to the Regional Healthcare Administrations (ARS) in 2017 and in 2014

Regional Healthcare Administration	Anaesthesiologists	Population*	per 100,000 2017	2014
North	525	3,603,778	14.6	13.5
Centre	225	2,256,364	10.0	9.7
Lisboa and Tagus Valley	429	2,812,678	15.3	15.7
Alentejo	28	724,391	3.9	3.8
Algarve	20	441,929	4.5	5.7
Autonomic Region of the Azores	30	245,766	12.2	9.7
Autonomic Region of Madeira	23	256,424	9.0	8.0
Total	1,280	10,341,330	12.4	12.0

* Living in Portugal by 31 Dec 2015, according to the Instituto Nacional de Estatística (INE)

Table 3 – Shortage of anaesthesiologists in 2017 per hospital, according to the Head of Department

ARS	Hospital	Staff	Shortage	
			no.	%
ARS North	CH Alto Minho	16	6	37.5%
	H Braga	43	8	18.6%
	H Barcelos	5	1	20.0%
	CH Alto Ave	18	5	27.8%
	CH Médio Ave	14	6	42.9%
	CH Póvoa - Vila do Conde	11	5	45.5%
	CH Tâmega - Sousa	26	9	34.6%
	CHTMAD	15	10	66.7%
	CH Nordeste	10	9	90.0%
	ULS Matosinhos	36	8	22.2%
	CH S João	71	15	21.1%
	IPO Porto	24	6	25.0%
	CH Porto	77	15	19.5%
	CH Gaia - Espinho	57	10	17.5%
	CH Entre Douro e Vouga	24	8	33.3%
ARS Centre	CH Baixo Vouga	19	12	63.2%
	CH Tondela - Viseu	33	16	48.5%
	H Cantanhede	0	2	
	H Figueira da Foz	8	12	150.0%
	CH Universitário Coimbra	92	38	41.3%
	IPO Coimbra	11	2	18.2%
	ULS Guarda	6	3	50.0%
	CH Cova da Beira	8	8	100.0%
	ULS Castelo Branco	9	3	33.3%
	CH Leiria - Pombal	18	6	33.3%
	CH Médio Tejo	10	17	170.0%
ARS Lisbon and Tagus Valley	CH Oeste	15	6	40.0%
	H Santarém	9	11	122.2%
	H V F Xira	19	3	15.8%
	H Beatriz Ângelo	29	3	10.3%
	H Fernando Fonseca	26	8	30.8%
	CH Cascais	19	3	15.8%
	CH Lisboa Ocidental	57	16	28.1%
	CH Lisboa Central	94	44	46.8%
	CH Lisboa Norte	49	49	100.0%
	Instituto Oftalmologia Gama Pinto	4	2	50.0%
	IPO Lisboa	20	4	20.0%
	CH Barreiro - Montijo	10	7	70.0%
	H Garcia de Orta	20	21	105.0%
	CH Setúbal	13	8	61.5%
	H Outão	3	2	66.7%
ARS Alentejo	H Évora	13	7	53.8%
	ULS Norte Alentejano	5	11	220.0%
	ULS Baixo Alentejo	4	8	200.0%
	H Litoral Alentejano	5	14	280.0%
ARS Algarve	H Faro	12	18	150.0%
	H Barlavento Algarvio	6	8	133.3%
RA Madeira	HC Funchal	21	28	133.3%
RA Azores	H Ponta Delgada	16	8	50.0%
	H Terceira	8	4	50.0%
	H Horta	4	1	25.0%
Military Hospitals	Polo Lisbon	10	4	40.0%
	Polo Porto	6	3	50.0%
	Total	**1158**	**541**	**46.7%**

Table 4 – Human resource management and anaesthesia output indicators of Group C, D and E hospitals in 2016

Hospital Group	Hospital	HR Hours / Periods Ratio	Consultations / Elect Surg	Outpatient / Elect Surg	Perioperative Cons / 6-h Period	Chronic Pain Cons / 6-h Period	Elect Surg / 6-hour Period	Emerg Surg / Emerg OR	Outside OR / 6-hour Period
C	1	1.26	85.5%	40.4%	10.4	19.3	3.4	2.1	
	2	0.91	32.1%	61.6%	8.9	3.3	4.6	3.2	
	3	0.77	28.9%	33.4%	12.7		2.7	1.0	
	4	0.79	54.3%	36.6%	12.3	6.2	4.1	4.5	2.8
	5	0.93	41.1%	57.6%	6.7	15.2	3.7	1.6	5.3
	6	1.06	102.7%	54.5%	11.6	5.0	1.9	2.8	4.7
	7	0.25	104.8%	44.4%	11.4	6.9	3.6	7.0	3.9
	8	1.14	9.7%	23.3%		14.8	4.2	4.7	1.9
	9	0.54	72.5%	64.6%	8.9	7.4	4.1	2.1	1.6
	10	0.70	57.1%	39.1%	12.5	12.8	5.2	2.4	2.8
	11	1.05	101.3%	22.5%	14.3	7.9	3.1	1.0	2.7
	12	1.01	74.6%	39.4%	11.9	16.8	3.0	4.2	
	13	0.88	95.5%	59.9%	15.8	5.9	2.8	3.2	1.9
	14	0.95	32.9%	68.8%	8.1	6.0	5.3	5.0	2.7
	15	0.85	56.6%	67.3%	15.1	8.4	5.5	6.9	10.4
	16	0.95	98.8%	54.9%	18.4	13.1	4.1	2.9	4.3
	17	1.23	23.1%	53.5%	15.3	2.9	7.3	5.7	3.0
Group C HI - Median		**0.93**	**57.1%**	**53.5%**	**12.1**	**7.7**	**4.1**	**3.2**	**2.8**
(IQR; 25% - 75%)		**(0.79 - 1.05)**	**(32.9% - 95.5%)**	**(39.1% - 59.9%)**	**(10.0 - 14.5)**	**(5.9 - 13.5)**	**(3.1 - 4.6)**	**(2.1 - 4.7)**	**(2.7 - 4.3)**
D	1	1.32	24.1%	57.7%	4.4	9.7	2.8	3.2	0.5
	2	0.71	46.9%	55.8%	20.2	9.7	3.8	3.2	11.7
	3	0.73	53.9%	49.2%	11.2		3.2	2.9	3.3
	4	0.67	27.1%	42.6%	9.7	21.4	4.8	1.9	3.1
	5	1.04	50.5%	51.4%	6.5	11.9	3.3	3.5	2.2
	6	1.02	49.8%	61.9%	35.2	7.6	3.3	3.9	22.9
	7	0.70	41.4%	69.9%	11.3	7.4	3.8	6.0	8.0
	8	1.22	90.5%	53.0%	19.7	6.7	2.8	4.0	6.4
Group D HI – Median		**0.88**	**48.4%**	**54.4%**	**11.3**	**9.7**	**3.3**	**3.4**	**4.8**
(IQR; 25% - 75%)		**(0.71 - 1.09)**	**(37.8% - 51.4%)**	**(50.9% - 58.8%)**	**(8.9 - 19.8)**	**(7.5 - 10.8)**	**(3.1 - 3.8)**	**(3.1 - 3.9)**	**(2.9 - 8.9)**
E	1	0.70	50.6%	35.2%	20.0	15.9	10.8	4.8	4.1
	2	0.73	131.4%	27.6%	17.1	6.7	1.9	2.4	
	3	0.38	85.2%	49.1%	10.3	6.1	2.1	3.9	
	4	1.12	23.6%	55.1%	8.2	7.4	3.1	3.2	3.4
	5	0.98	27.6%	50.9%	11.4	6.7	3.8	3.5	2.4
	6	0.63	17.1%	36.2%	8.5	8.4	2.3	6.2	2.5
Group E HI – Median		**0.72**	**39.1%**	**42.7%**	**10.8**	**7.1**	**2.7**	**3.7**	**2.9**
(IQR; 25% - 75%)		**(0.65 - 0.92)**	**(24.6% - 76.5%)**	**(35.5% - 50.5%)**	**(8.9 - 15.7)**	**(6.9 - 8.2)**	**(2.2 - 3.6)**	**(3.3 - 4.6)**	**(2.5 - 3.6)**

Group C: CH Alto Minho, CH Alto Ave, CH Tâmega-Sousa, ULS Matosinhos, CH Entre Douro e Vouga, CH Cova da Beira, CH Leiria-Pombal, CH Médio Tejo. H Santarém, CH Cascais PPP, H Beatriz Ângelo, CH Barreiro-Montijo, CH Setúbal, ULS Norte Alentejano, ULS Baixo Alentejo and H Barlavento Algarvio
Group D: H Braga, CH Trás-os-Montes e Alto Douro, CH Gaia-Espinho, CH Tondela-Viseu, H Fernando da Fonseca, H Garcia de Orta, H Évora and H Faro
Grupo E: CH S João, CH Porto, CH Universitário de Coimbra, CH Lisboa Ocidental, CH Lisboa Central and CH Lisboa Norte
IQR: interquartile range; OR: operating room

(such as Intensive Medicine, for instance).

From the results that were obtained, we may reach the conclusion that:

a) An increasing elective surgical activity has been found, especially involving outpatient surgery;
b) Less procedures with the support of anaesthesiologists outside of the operating room have been found, possibly due to a shortage in registrars and to a strategy mainly focused in surgical activity that has been followed by hospitals, economically more profitable and with a higher impact on public expectations and pressure;
c) A larger number of pregnant mothers were treated by anaesthesiologists, aimed at increasing safety, quality and comfort of future mothers in delivery and considering that Portugal is currently one of the European countries with labour analgesia rates highly above the European mean;[4]
d) A lower percentage of patients having attended perioperative medicine has been found, which is clearly negative when considering that the chance is lost for clinical optimisation (whenever necessary), for the assessment of perioperative risk, for patient clarification and information as well as for the early planning of perioperative approach aimed at best postoperative outcomes.
e) The staff shortage in Anaesthesiology that was described by the heads of department of the public HI got worse, also due to the implementation of working rules aimed at the promotion of occupational safety, such as the application of compensatory rests, even though having reduced the effective working time.

Anaesthesiology has become a speciality in wide expansion over the past two decades, with new skills and facing new challenges, in step with the advances in medical sciences in general. Therefore, the increasing demand for these specialists, especially in public HI, seems obvious.

A total of 1,192 anaesthesiologists have been identified by the 2014 Census as part of the staff of public HI and 145 more consultants have meanwhile been graduated over the past three years, from which 99 (68.3%) were found as part of the staff of public HI, i.e. one third of the young consultants chose not to enter into a contract with any public HI. Attention was already been drawn in the 2014 Census for the relevance of an increase in the training capacity in Anaesthesiology. The reorganisation of the training residency in Anaesthesiology, established in 2016 through the Ordinance no. 92-A/2016 from 15 Apr, has allowed for an increase in training capacity of anaesthesiologists to 80 registrars instead of the 64 that were possible with the previous legislation. However, as we reach the conclusion that only two thirds of the new consultants really entered into contract with public HI, a total of 300 anaesthesiologists would hardly be achieved throughout the estimated three-year period, as it was estimated by the 2014 Census. With the estimate shown by the Fig. 2, in which a scenery of an outflow of anaesthesiologists at the age of 66 entering retirement is expected, in addition to the estimated inflow of registrars, we may reach conclusion that only 200 anaesthesiologists could be added to the current total of 1,234 by 2020, a distance away from the 1,554 expected by the 2014 Census for that year.

However, a different scenario may occur from that date onwards, as the estimated curve will get closer to the *Overview II* shown in Fig. 2, allowing for a 66%-67% decline in the shortage that was described by the heads of department of the public HI up to 2023 (at the expense of the current 363 registrars in training).

It is interesting to see that a shortage in 541 anaesthesiologists in the public HI, which was described by the different heads of department, is in line with the estimated demand obtained according to the methodology that was used in the *Rede Nacional de Especialidade Hospitalar e de Referenciação da Anestesiologia* (a document that was approved by the Health ministry in June 2017), by the allocation to hospitals, according to their typology (I, II and III) a number of 20, 48 and 99 anaesthesiologists, respectively.[5]

This study allowed for the conclusion that an improvement in the ratio of anaesthesiologists per 100,000 population from 13.9 in May 2014 to 15.1 in 2017 has occurred, even though away from the 17.9 that were estimated by the World Federation of Societies of Anaesthesiologists (WFSA) for Portugal (Fig. 3).[6]

There is no international reference value in this matter, even though in fact a ratio around 20 anaesthesiologists per 100,000 exist in most of the developed countries (North America, Australia, Europe), Austria and Germany being the European countries with the highest ratio of anaesthesiologists per 100,000 population, with 39.3 and 31.0, respectively.[6]

The ongoing shortage of anaesthesiologists in Portugal seems evident and requiring a correction over the next few years in order to provide for enough anaesthesiologists for a timely and universal delivery of high-quality anaesthetic care. It seems also clear that, with the declining mortality directly related to Anaesthesiology over the past few decades (1:200,000 anaesthesia deliveries)[7] and with the increasing safety and quality of anaesthesia delivery, the assessment of the importance of an widening in the area of intervention of Anaesthesiology in healthcare procedures outside of the operating room seems crucial, especially as regards anaesthesia support to MTDP, to pain medicine, emergency and intensive medicine and also particularly regarding postoperative care within perioperative medicine. Postoperative mortality is in fact still a major concern in Public Health, despite the technical advances in modern medicine, mainly when we realize, from different studies, that 30 to 50% of these would be avoidable.[8] Therefore, not only an expected decline in postoperative morbidity and mortality would occur, as well as a more rapid functional recovery of patients, with higher levels of patient comfort and satisfaction.

The critical relevance of the immediate implementation of alternative measures aimed to reduce this shortage in the short-term is also easy to understand, including:

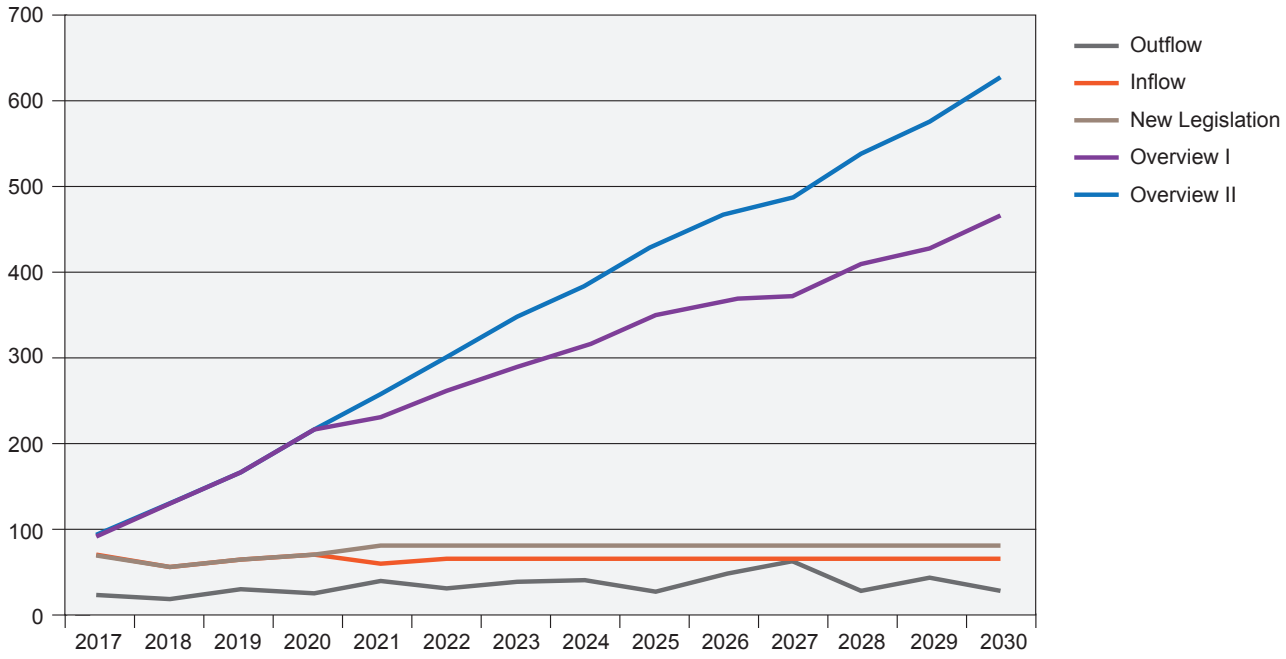

Figure 2 – Pattern of the growth of HR in Anaesthesiology up to 2030 in public hospital institutions that were analysed in the study, taking into account the outflow at the age of 66 entering for retirement and annual fixed inflow of 64 and 80 registrars, Overview I and Overview II, respectively

a) New individual employment contracts [*Contratos Individuais de Trabalho (CIT)*] for anaesthesiologists not covered by the current legislation under which a 18-hour weekly working shift in Emergency is assigned, allowing, when necessary, for the assignment of a 12-hour shift in Emergency or even less. It is worth noting that current CIT contracts correspond to an estimated 30% workload reduction;
b) Development of competitive working conditions for anaesthesiologists aimed at keeping these at the public hospitals, when compared to the private sector or to public hospitals with private management.

We believe that, with the different recommendations, shortage would be solved as soon as possible and mainly a reversal of the current situation would occur in 2020. It is worth mentioning that the ratio that was obtained would be biased should part-time consultants were not employed by the departments of the public HI. The inability to identify all the anaesthesiologists working full-time in the private sector was another limitation of the study.

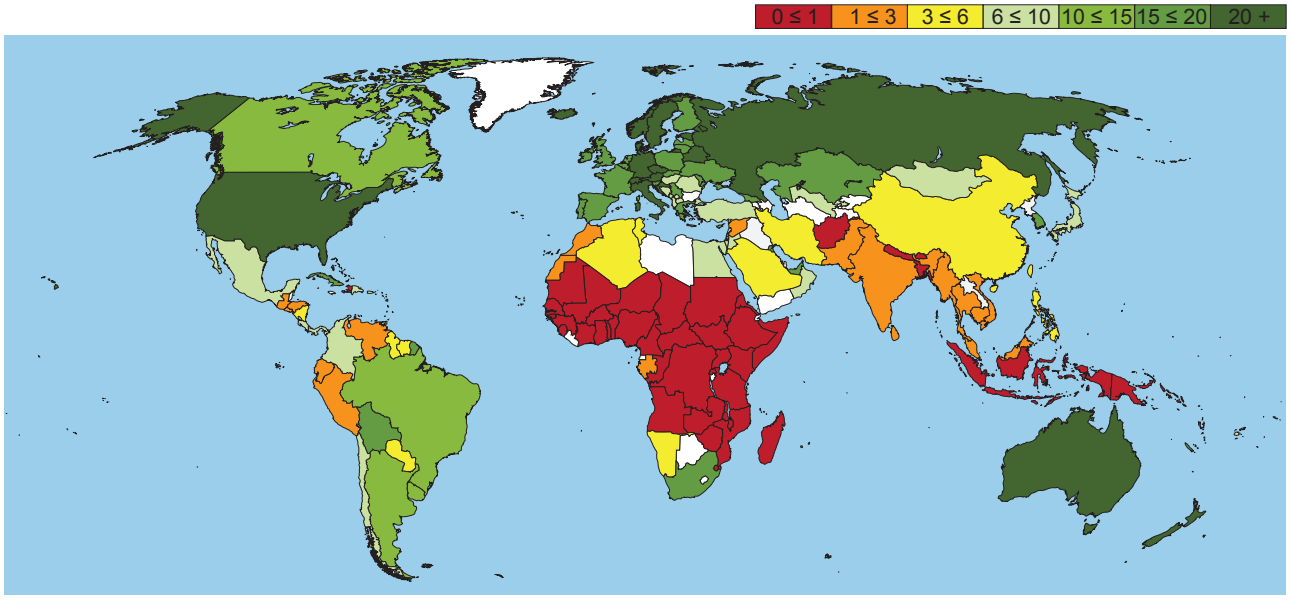

Figure 3 – World distribution of anaesthesiologists per 100,000 (no available information for the countries left blank)

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CONCLUSION

A total of 615,127 surgeries has been recorded by the Census carried out at the 53 HI that were analysed, 84.1% of which were elective surgeries and 49.6% of these were outpatient surgeries. A total of 89,608 medical procedures with the support of Anaesthesiology outside of the operating room have also been found, in addition to 282,944 perioperative medicine consultations and 112,183 consultations in chronic pain outpatient units. A total of 51,380 delivery analgesia procedures have been found, corresponding to more than 85% of the deliveries that have occurred at the Departments of Obstetrics in public hospital institutions.

A total of 1,280 anaesthesiologists working in public hospital institutions have been identified, corresponding to a ratio of 12.4 per 100,000, rising to a ratio of 15.1 per 100,000 if the 262 anaesthesiologists working full-time at the private sector are taken into account.

Despite the limitations of the methodology that was used for the identification of HR shortage in the hospital institutions that were analysed, a shortage of 541 anaesthesiologists has been described by the different heads of department in public hospital institutions for the demands in anaesthetic care.

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