

## Ophthalmology Census 2021: A Demographic Characterisation of Ophthalmologists in Portugal

### Estudo Demográfico da População de Oftalmologistas em Portugal: Censo de Oftalmologia 2021

Paula MARTINS LEITÃO<sup>1,2</sup>, Sandra OLIVEIRA<sup>3,4,5</sup>, Ana MIRANDA<sup>1,6</sup>, Carla VIVAS<sup>7</sup>, João NASCIMENTO<sup>3</sup>, Susana LEAL<sup>3,5</sup>, Joana TAVARES FERREIRA<sup>1,8</sup>, Augusto MAGALHÃES<sup>1,9</sup>

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#### ABSTRACT

**Introduction:** Human resources in ophthalmology have recently received particular attention, and it has been questioned whether there is a sufficient number of workers. The aim of this study was to analyze and characterize Portugal's ophthalmologist population.

**Methods:** In this descriptive, cross-sectional study, an online questionnaire was sent to all ophthalmologists registered with the Portuguese College of Ophthalmology in December 2021. Information on the following variables was collected and analyzed: demographic factors, professional qualifications, professional activity, weekly professional activity and medium-term plans.

**Results:** Among the 910 registered ophthalmologists, a response rate of 64.7% was achieved. There were 0.9 ophthalmologists for every 10 000 inhabitants, 0.45:10 000 working in the public sector (0.35:10 000 full-time equivalent). Among the respondents, 57.6% were over 50 years old (59.6% male), 97.3% were Portuguese, 46.7% completed their residency in the Lisbon region, 27.3% complemented their programme with additional training, 9.5% had a PhD and approximately 58% lived and worked in large urban centres. Regarding professional activity, 58.5% of the respondents worked in the public sector (4.2% exclusively), while 67.9% worked in different economic sectors. The median number of weekly working hours reported was 45 hours, with those in the public sector reporting 35 hours. Private/social sector work and public sector work accounted for 12 926 hours/week and 10 808 hours/week, respectively. It was found that 31.4% of the respondents provided emergency medical services and that 52.8% performed surgical procedures more than once a week. Looking ahead, 38.7% of the ophthalmologists intended to reduce their workload within the next five years due to family reasons, fatigue and demotivation. The projected rate of retirement or cessation of activity in the next five years was estimated to be 1.7%, while an average of 20 new ophthalmologists are expected to enter the profession annually, resulting in a generational balance of 0.8%.

**Conclusion:** While the number of ophthalmologists in Portugal meets the international recommendations, there is a shortage in the public sector and most ophthalmologists work in large urban centres. The number of ophthalmologists in Portugal is expected to be stable for the next five years.

**Keywords:** Ophthalmologists/statistics & numerical data; Ophthalmology; Portugal; Surveys and Questionnaires

#### RESUMO

**Introdução:** Tem sido dada particular atenção aos recursos humanos na oftalmologia, questionando a sua adequação à realidade. O objetivo do estudo foi caracterizar a população de oftalmologistas em Portugal.

**Métodos:** Estudo descritivo e transversal realizado com recurso a um questionário aplicado *online*, à data de dezembro de 2021. O questionário desenhado analisou as seguintes variáveis: demografia, habilitações profissionais, atividade profissional ativa, atividade profissional semanal e planos a médio prazo.

**Resultados:** A taxa de resposta foi de 64,7% (de um total de 910 oftalmologistas inscritos). Existem 0,9 oftalmologistas para 10 000 habitantes; 0,45 colaboram com o sector público (0,35 para equivalente de tempo completo). Há 57,6% de oftalmologistas com mais de 50 anos (59,6% do sexo masculino) e 97,3% têm nacionalidade portuguesa. A formação específica em oftalmologia foi realizada na região de Lisboa em 46,7% dos casos, 27,3% complementaram o internato com formação adicional e 9,5% fizeram um doutoramento. Aproximadamente 58,5% residiam e trabalhavam nos grandes centros urbanos. A colaboração com o sector público acontecia em 58,5% (4,2% em exclusividade) e 67,9% acumulavam funções em diferentes setores económicos. A mediana global do horário de trabalho semanal é de 45 horas, sendo de 35 horas no público. Foram exercidas um total de 12 926 horas/semana e 10 808 horas/semana no setor privado/social e público, respetivamente. A atividade de urgência é desempenhada por 31,4% dos profissionais que responderam. A atividade cirúrgica é realizada mais do que uma vez por semana para 52,8%. No que aos planos a médio prazo (cinco anos) diz respeito, 38,7% dos inquiridos pretende reduzir o seu horário, sendo os principais motivos relacionados com a família, fadiga e/ou desmotivação. Estima-se, a cinco anos, que a taxa de saída por reforma/cessação de atividade seja de 1,7%, a taxa de entrada seja de 20 titulações/ano e o balanço geracional de 0,8%.

**Conclusão:** O número de oftalmologistas em Portugal está de acordo com as recomendações internacionais, no entanto, existe uma carência destes profissionais de saúde no setor público. A maioria dos oftalmologistas reside e exerce a sua atividade nos grandes centros urbanos. Prevê-se, a cinco anos, uma população de oftalmologistas estável.

**Palavras-chave:** Inquéritos e Questionários; Oftalmologia; Oftalmologistas/estatísticas e dados numéricos; Portugal

1. College of Ophthalmology, Portuguese Medical Association. Lisbon. Portugal.
2. Department of Ophthalmology, Associação Protectora dos Diabéticos de Portugal. Lisbon. Portugal.
3. Santarém Higher School of Management and Technology. Instituto Politécnico de Santarém. Santarém. Portugal.
4. Life Quality Research Centre. Instituto Politécnico de Santarém. Santarém. Portugal.
5. Center for Innovation in Biomedicine and Biotechnology. Universidade de Coimbra. Coimbra. Portugal.
6. Department of Ophthalmology, Hospital Garcia de Orta. Almada. Portugal.
7. Research Center. Instituto Universitário Militar. Lisbon. Portugal.
8. Department of Ophthalmology, Centro Hospitalar Universitário de Lisboa Norte. Lisbon. Portugal.
9. Department of Ophthalmology, Centro Hospitalar Universitário de São João. Oporto. Portugal.

✉ **Autor correspondente:** Paula Martins Leitão. [paulamartinsleitao@me.com](mailto:paulamartinsleitao@me.com)

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## INTRODUCTION

The sustainability and proper functioning of a healthcare system depend on there being an adequate number of professionals available to meet the population's needs over a given period.<sup>1,2</sup> To successfully manage the differentiated human resources within a healthcare system, it is essential to implement a training and (re)allocation strategy designed to deliver suitable medium- and long-term results. As such, the development of such a strategy requires a thorough understanding and analysis of existing resources and future needs.<sup>3</sup>

Recently released data indicates that Portugal ranks third among all Organization for Economic Co-operation and Development (OECD) countries in terms of doctors *per capita*.<sup>4</sup> However, when we look at the data for ophthalmologists *per capita*, Portugal (0.9:10 000) sits in ninth place in Europe, above Spain (0.89:10 000), France (0.88:10 000) and the United Kingdom (0.22:10 000).<sup>5</sup> Greece (2.8:10 000) and Cyprus (1.4:10 000) occupy the top spots on the list.<sup>5</sup>

In Portugal, the healthcare workforce, particularly in ophthalmology, is poorly characterized. Two studies were published about a decade ago that aimed to anticipate the demand for professionals. The studies were based on data from the Portuguese National Health Service (PNHS) and Statistics Portugal (SP) and primarily focused on the PNHS.<sup>6,7</sup>

In the National Strategy for Eye Care 2018, which was developed under the leadership of the Directorate General of Health, a ratio of 0.5 ophthalmologists per 10 000 inhabitants was recommended, based on current international guidelines.<sup>8</sup> Official data from the Central Administration of the Health System (CAHS) indicates that, in 2017, 471 ophthalmologists were working in the PNHS, and they accounted for 44% of all ophthalmologists registered in the Portuguese Medical Association (PMA). However, according to the National Strategy for Eye Care 2018, a deficit of 114 ophthalmologists in the PNHS was identified, assuming a standard 40-hour work week.<sup>6</sup>

It is important to note that healthcare systems and policies can vary significantly from country to country, as well as the practices of healthcare professionals and their employment models. Additionally, inconsistency in the monitoring and evaluation of human resources and the associated strategies makes it difficult to accurately compare human resources and strategic outcomes across nations.<sup>1,3,9</sup>

To reduce the obstacles preventing country-level comparisons, the World Health Organization has been taking steps to implement internationally standardized classifications.<sup>9</sup> The overall plan for assessing the human resources in healthcare involves obtaining reliable information on the size and composition of the healthcare workforce and iden-

tifying variations across spatial units (e.g., administrative districts, states, provinces or regions), demographic characteristics (e.g., age, sex, migration status) and other socioeconomic factors (e.g., educational attainment, income level, sector of activity).<sup>3,9-15</sup>

Therefore, it is vital to conduct in-depth studies that not only assess the number of ophthalmologists in the public and/or private/social sectors but also thoroughly characterize the existing resources. Hence, the purpose of this study is to fully characterize the existing human resources in terms of productive capacity, age segmentation, geographical distribution and areas of specific differentiation. The goal is to collect rigorous and standardized information, which, in turn, will allow accurate analysis of the current situation and estimation of future needs.<sup>1,3,9,16</sup>

The main goals of this study can be summarized as follows:

1. To characterize the population of Portuguese ophthalmologists in terms of demographics and professional differentiation.
2. To determine the professional activities of Portugal's ophthalmologist population, including the workload and employment status of ophthalmologists, as well as the economic sector(s) in which they work.
3. To gain insight into potential changes in Portuguese ophthalmologists' employment/retirement status and working hours within the next five years.

## METHODS

The Portuguese College of Ophthalmologists (PCO) conducted a census in partnership with the Santarém Higher School of Management and Technology (SHSMT) to gather information about all the ophthalmologists working in Portugal.

### Study design

A descriptive, cross-sectional study was conducted.

### Study population

The study population consisted of all ophthalmologists who were registered with the PCO (N = 910) and whose fee payments were up to date at the time the questionnaire was administered (November 30, 2021).

### Data collection instrument

The data collection instrument consisted of a well-structured questionnaire that could be self-completed by the respondents. The questionnaire was generated using the Survey Monkey tool [available through the Life Quality Research Center (CIEQV)], funded by the Foundation for Science and Technology, project no. UID/CED/04748/2020.

## Variables

The questionnaire items were designed to collect information on the following variables:

- Demographics: age, sex, place of residence (Nomenclature of Territorial Units for Statistics 3), nationality.
- Professional qualifications: academic training, residency, differentiated training within the specialty, hospital medical career degree.
- Active professional activity: workplaces (Nomenclature of Territorial Units for Statistics 3), sectors in which professional activity is carried out (public, private/for-profit or social/non-profit), weekly workload, practice of emergency services, contractual regime.
- Weekly professional activity: schedule, clinical/surgical/non-clinical activity, areas of differentiation within the specialty (medical and surgical).
- Medium-term plans: intention to leave the public sector, retirement or cessation of activity.

## Data protection and formal procedures

All formal procedures inherent to research of this nature were followed, with meticulous respect for data protection principles. The PMA's National Council approved the study protocol. The data were appropriately anonymized, and informed consent was obtained before data collection. The data will be stored for five years and then destroyed. Only those designated by the PCO's Board of Directors and SHSMT team will have access to the data.

## Pre-test and data collection procedures

a) Pre-test: A pre-test was conducted with eight PCO members to assess the questionnaire's effectiveness. Subsequently, a focus group of six ophthalmologists (with similar characteristics to the subjects under study) provided feedback. Overall, the participants found the questions to be pertinent, the questionnaire concise and the number of items suitable. However, two questions required adjustment: 1) the options for training obtained after residency were clarified to mitigate different interpretations of the term fellowship and 2) redundancies in the questions about plans for the future were addressed.

b) Dissemination of the questionnaire: Various measures were taken to disseminate the questionnaire and encourage participation in the study. An initial email, sent in advance to all ophthalmologists on the PMA mailing list, explained the study's purpose and emphasized the importance of participation. The study was further promoted through emails from the PMA and the newsletter of the Portuguese Society of Ophthalmology (PSO). Additionally, the project was presented at the 64<sup>th</sup> Portuguese Congress of Ophthalmology in December 2021.

c) Application procedures: The questionnaire was made available on December 1<sup>st</sup>, 2021, through the Survey Monkey platform, and the link was sent via email from the PMA to all ophthalmologists on the PMA mailing list. To maximize reach, the link was also included on printed cards handed out at the aforementioned congress. To encourage a high response rate, reminders were sent via the PMA, PSO and PSO newsletter on three separate occasions. Furthermore, a text message was sent by the PMA close to the questionnaire submission deadline (February 14<sup>th</sup>, 2022).

## Data treatment and analysis

Only fully completed questionnaires were considered eligible for analysis. Exploratory analysis was performed using descriptive analysis techniques (absolute and relative frequencies, means and standard deviations). SPSS software (version 21.0) was used for this purpose. The following pre-defined parameters were used in the analysis: age at the beginning of the activity = 27 years, age of retirement = 70 years and medium-term = five years. The SP 2021, PORTDATA 2021, OECD 2021 and Statista 2021 databases were consulted to complement and contextualize the obtained information.<sup>4,5,17,18</sup>

## RESULTS

From the 910 ophthalmologists who were registered with the PCO, we received 856 responses; hence, the response rate was 94.1%. However, only completed questionnaires were considered for analysis; this led to 29.2% being rejected, as per the pre-defined criteria. The final sample was composed of 589 individuals, resulting in a response rate of 64.7% and a maximum margin of error of  $\pm 2.4\%$  for a 95% confidence level.

## Demographic factors

The number of ophthalmologists has increased by 161% over the 30 years prior to the time of the data collection; our results indicated that there were 0.9 per 10 000 inhabitants at the time of the data collection (Table 1). The average age of the ophthalmologists was 53.4 years (range = 27 - 86 years; aged over 50 years: 37.3% in the public healthcare system), and most were male (Table 1). The retirement/cessation of activity rate was estimated to be 1.7% over the next five years, and an average of 20 new professionals are expected to begin working per year. Therefore, the generational balance was calculated to be 0.8%. The majority (97.3%) of the ophthalmologists were Portuguese, and the geographical distribution of the respondents is shown in Fig. 1.

Table 1 – Demographic data

a) Portugal <sup>1</sup>	1991			2021			Increase 1991 - 2021 (%)
	N	N/10 000 inhab	M:F	N	N/10 000 inhab	M:F	
Doctors	28,326	56.7	1.5:1	58,735	113.7	0.8:1	107
Ophthalmologists	446	0.4	-	1140	1.1	-	161
b) Ophthalmologists (2021)	Statistics Portugal <sup>2</sup>	PCO <sup>3</sup>		PNHS <sup>4</sup>		PNHS FTE 40h <sup>4</sup>	
N	1140	910		471		390	
N/10,000 hab	1.1	0.9		0.45		0.35	
c) Age (years range) <sup>5</sup>	≤ 30	31 ≤ 40	41 ≤ 50	51 ≤ 60	60 ≤ 70	> 70	Total
N	15	138	97	123	156	60	589
%	2.5	23.4	16.5	20.9	26.5	10.2	-
M:F	0.5:1	0.8:1	1.1:1	1.6:1	2.5:1	3.6:1	1.5:1
M:F (2027)	0.9:1	0.9:1	1:1	1:1	1.7:1	3:1	1.5:1
d) Nationality	Portuguese	Spanish	Italian	Brasilian	French	American	Total
N	573 (97.30%)	7 (1.20%)	3 (0.51%)	3 (0.51%)	2 (0.34%)	1 (0.17%)	589
e) Residents <sup>5</sup>	Total	Average/year (2011 - 2021)		In 5 years		% of the ophthalmologists	
N	83	23		80		2.5	
f) Five-year projection for generational balance	New professionals		Retirement/cessation		Balance		
	2.5%		1.7%		0.8%		

a) Evolution of the number of doctors and ophthalmologists in Portugal (1991-2021), evolution per 10,000 inhabitants and the male:female ratio; b) Number of ophthalmologists in Portugal (2021) and number per 10,000 inhabitants according to National Statistics and the PCO records; the number of ophthalmologists working with the PNHS and corresponding FTE 40 hours; c) Distribution of the population by age and sex; d) Distribution of the population by nationality; e) Residents: absolute number; average of graduation per year over a 10 year; 5 years estimated predicted number; f) 5-year ophthalmologists balance projection [CI0.95 (0.37%, 1.23%)].

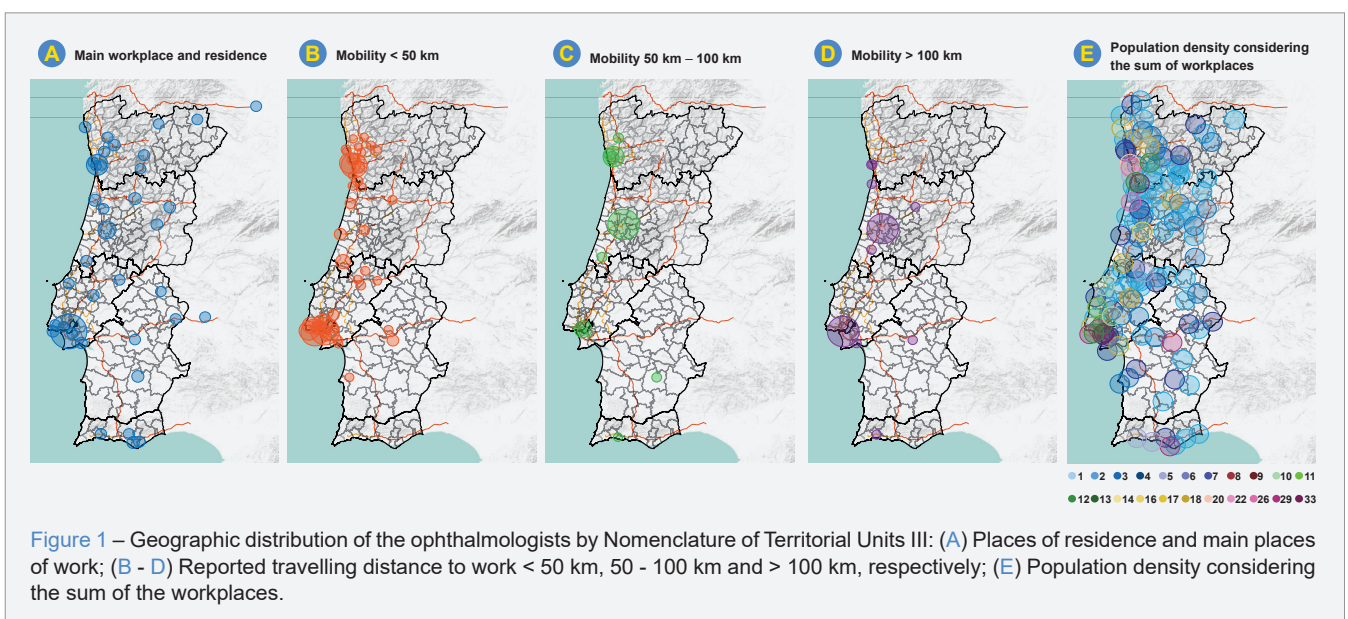
<sup>1</sup>: PORTATA 2021; <sup>2</sup>: Statistics Portugal, 2021; <sup>3</sup>: Portuguese College of Ophthalmologist 2021; <sup>4</sup>: Central Administration of the Health System 2021; <sup>5</sup>: Census 2021;

N: number; inhab: inhabitants; M: male; F: female; PCO: Portuguese College of Ophthalmology; PNHS: Portuguese National Health Service; FTE; Full Time Equivalent.

## Academic background and specific training in ophthalmology

Most (82.3%) of the ophthalmologists had a degree in

medicine and/or an integrated master's degree, and 9.5% had a doctoral degree. In terms of where they completed their ophthalmology residency, 95% of the respondents



completed their residency in Portugal, with 46.69% undertaking their training at the Central Lisbon University Hospital Center (formerly Lisbon Civil Hospitals) (Appendix 1: <https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/20321/15334>). After their residency, 27.3% pursued further training, primarily in clinical areas. More than half (51%) had attended clinical internships for over three months. Since 2015, there has been a trend towards taking the European Board of Ophthalmology examination (13%/year).

### Professional activity

The Appendix 1 (Appendix 1: <https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/20321/15334>) summarizes the information collected from the respondents on their medical career degrees, professional activity, sectors of work and contractual regimes. Among the respondents, 76.3% were professionally active, 20.2% were retired but continued to practice and 3.6% had ceased professional activity. Table 2 outlines the workload distribution of the respondents according to economic sector. It was found that 39.1% of the ophthalmologists pro-

vided emergency services and that 21% were working more than 12 hours/week. Within the PNHS subgroup, 61.8% of the respondents were providing emergency services (Table 2). This activity was mainly located in the Lisbon, Oporto and Coimbra regions. Information on the respondents' age, sex and medical career grade according to activity type is shown in Table 3.

### Distribution of weekly activity

Clinical activity was found to dominate the respondents' weekly activity, accounting for 84.4% of their workload. Around 50% of the ophthalmologists had been working in differentiated clinics for more than 10 years, except for those who specialized in neuro-ophthalmology, ergo-ophthalmology and oncology and oculoplastics. The reported surgical activity did not vary with age. The most frequently performed surgery was cataract surgery (80%), followed by intravitreal injections (48%). The remaining areas of differentiated surgical practice were performed by approximately 15% of the ophthalmologists. The distribution of the respondents' weekly hours of work is shown in Table 2.

Table 2 – Workload and weekly professional activity

a) Professional Status (N/%)				
In the exercise of the professional activity	Retired and working	Retired and not working		
449 (76.2)	119 (20.2)	21 (5.6)		
b) Hours assigned to each Activity Sector (hours/week)				
Statistics	Sum	Mean	Median	Std. Deviation
Public	10 809	32.2	35	9.4
Private	12 926	24.0	20	13.5
Social	786	14.3	12	10.2
c) Emergency Service assigned to each Activity Sector (hours/month)				
Statistics	N Sum	Mean	Median	Std. Deviation
Public	209 10 136	48	40	42
Private	198 9 897	50	40	44
Social	18 930	52	35	55
d) Weekly Clinical Activity - average hours dedicated to:		e) Population distribution by regularity of surgical activity (%)		
General Ophthalmology	16.8	1x/month		4.4
Retina, Glaucoma and Pediatric Ophthalmology	9.4 - 1.4	2x/month		12.3
Immunopathology, Cornea, RI, Oculoplastic and Ergophthalmology	6.2 - 8.0	1x/week		30.5
Contactology, Neuroophthalmology and Oncology	3.9 - 5.3	≥ 2x/week		52.8

Distribution of the population according to: a) Exercise of professional activity; b) Working hours assigned to each activity sector; c) Emergency service workload; d) and e) Clinical and Surgical activity.

Table 3 – Activity sector analysis

	Public		Private		Social	
	N	%	N	%	N	%
<b>a) Sex</b>						
Female	168	49.7%	191	42.3%	9	33.3%
Male	170	50.3%	261	57.7%	18	66.7%
Total	338	100.0%	452	100.0%	27	100.0%
<b>b) Age range</b>						
31 - 40	144	42.6%	138	30.5%	11	40.7%
41 - 50	68	20.1%	80	17.7%	7	25.9%
51 - 60	73	21.6%	95	21.0%	4	14.8%
61 - 70	49	14.5%	103	22.8%	4	14.8%
> 70 years	4	1.2%	36	8.0%	1	3.7%
Total	338	100.0%	452	100.0%	27	100.0%
<b>c) Hospital Medical Career Grade</b>						
Hospital Assistant	141	43.9%	159	38.6%	13	48.1%
Graduated Hospital Assistant	153	47.7%	194	47.1%	13	48.1%
Senior Hospital Assistant	27	8.4%	59	14.3%	1	3.7%
Total	321	100.0%	412	100.0%	27	100.0%

Distribution of the population according by Activity Sector according to age, sex and Medical Career Degree.

Table 4 – Future scenarios

<b>a) Changes in working hours in the next 5 years (N/%)</b>									
Reduce			Maintain				Increase		
220 (38.7)			335 (59.0)				13 (2.3)		
<b>b) Reason to reduce working hours (N/%) (Total = 220)</b>									
Family	Fatigue	Lack of motivation	Health	Burnout	Lack of recognition	Another professional orientation	Search for better salary	Carreer progression	Another reason
74 (33.8)	48 (21.8)	21 (9.5)	13 (6.0)	12 (5.4)	5 (2.3)	7 (3.2)	4 (1.8)	2 (0.9)	31 (14.0)
<b>c) Highlight (N)</b>									
Sectors	Exclusivity 1 private institution	Exclusivity 1 social institution	Exclusivity 1 public institution	Work in the Public Sector	Not working in the Public Sector				
Intend to work exclusively in the private sector	83	0	2	13	5				
Intend to work in various private sector institutions	27	0	0	76	50				
Abandon/Reduce Public	0	0	0	7	0				

Distribution of the population according to: **a)** Plans for changes in working hours in 5 years; **b)** Reasons for working hours reduction; **c)** Intention to change the professional activity profile concerning the activity sector.

### Future plans

Among the respondents, 59% intended to maintain their current workload without any changes and 38.7% intended

to reduce their workload. The main reasons the respondents gave for intending to reduce their workload were family and fatigue (Table 4).

## DISCUSSION

To the best of our knowledge, this is the first comprehensive characterization of Portugal's ophthalmologist population, whose members work across the public, private and social sectors. By conducting a census, we were able to gather precise, detailed and standardized information and produce a comprehensive overview of the ophthalmologists working in Portugal.<sup>19,20</sup> The methodology we applied in this study allowed us to surpass the limitations typically encountered in survey-based studies; namely, that sample sizes are often too small to allow precise estimations. To promote cross-national comparisons in the future, we have diligently used internationally standardized variables to generate this comprehensive overview of the human resources in ophthalmology. It is important to note that the list of studied variables is not exhaustive and may be used in other human resource assessments.

The response rate of this census was 64.7%, which is higher than the 54% usually obtained in this type of study.<sup>19,21-23</sup>

When we compared the data on the respondents who were working in the PNHS with the data provided by CAHS,<sup>6</sup> we found that our results aligned. The two data sets showed a similar percentage of ophthalmologists working in the PNHS (CAHS, 51.8% vs CENSUS 2021, 58.5%), as well as an equivalent age distribution (aged over 50 years: CAHS, 39.4% vs CENSUS 2021, 37.3%). Ophthalmologists working in the PNHS and younger ophthalmologists were found to have participated in the Ophthalmology Census 2021 at a slightly higher rate.

The number of ophthalmologists, in Portugal, has increased over the past few years, following an increase in the number of doctors.<sup>4,5</sup> Between 1991 and 2021, the number of doctors increased by 107% and the number of ophthalmologists by 161%.<sup>18</sup> The number of ophthalmologists per 10 000 inhabitants went from 0.4 to 1.1 in the same period.<sup>18</sup> Currently, Portugal has the ninth highest number of ophthalmologists in Europe,<sup>5</sup> with 0.9 PCO-enrolled ophthalmologists per 10 000 inhabitants. This figure drops to 0.6 if we only consider the ophthalmologists under 70 years old. The figure in the PNHS is 0.45, and it drops to 0.35 when only full-time equivalent (FTE) workers, who work 40 hours/week, are considered. Therefore, considering the international recommendation (1:10 000)<sup>8</sup> and the current Portuguese population (10 344 066), it can be concluded that the number of ophthalmologists in Portugal is in line with the recommendations. However, if we focus on the number working in the PNHS, there is a deficit of 127 professionals.<sup>8</sup> These findings reflect the problem of retaining qualified professionals in the PNHS.

The current number of ophthalmologists is expected to remain stable for the next five years, as shown by the gen-

erational pyramid (balance of 0.8%). However, it is essential to undertake an in-depth analysis of the future needs of the ageing and growing population to determine whether having 20 - 21 new ophthalmology residents per year will be sufficient.

In 2011, Correia *et al*<sup>7</sup> analyzed the population of ophthalmologists and concluded that 65.5% were over 50 years old and that 32% were female. Our results showed that 57.6% were over 50 years old and that 40.4% were female, indicating that the average age decreased by 10 years and that the number of female ophthalmologists increased. Detailed examination of the age distribution data showed that there was a stable pyramid with a slight predominance of doctors over 60 years old and a slight deficit of professionals in their forties. This variation is in line with the fluctuation in the total number of physicians and can be explained by the variance in both medical school and residency admissions. The observed increase in the number of females in ophthalmology follows the general trend in medicine. Although female (56.1%) outnumbered male in the 40 - 50-year age group, men remained the majority across all age groups. This may need to be taken into account when predicting the need for professionals since women tend to work fewer hours in the earlier stages of their careers and may take maternity leave.<sup>24-26</sup>

The proportion of ophthalmologists who are foreign nationals was found to be low (2.7%), as was the proportion of ophthalmologists who completed their residency abroad (4.9%). The former was a consequence of working in Portugal and of our healthcare services not being attractive, possibly due to low salaries and poor working conditions.

The geographical distribution of the respondents was asymmetrical. Most of the respondents (58.1%) lived and worked in the Lisbon, Oporto and Coimbra regions. The respondents tended to live and work in the regions where they graduated until they entered the job market as specialists. Few respondents reported travelling more than 50 km to work (3%), and this low workforce mobility accentuates the gaps in the healthcare services experienced in Portugal, especially for primary healthcare services. Our analysis measured only mobility, not the hours spent in each location. This means that the national coverage may be even less than what a brief analysis of the data presented in Fig. 1 may indicate.

The distribution according to graduation and residency training regions reflects the country's situation prior to the 1960s and 1970s when there was no *numerus clausus* and most medical graduates in Portugal studied at the University of Lisbon. Focusing on the ophthalmology residency data, it can be seen that 49.7% of the respondents completed their training program in the Lisbon region; this cohort included most doctors over 50 years old and reflects the fact that

training was offered at the former Lisbon Civilian Hospitals (now the CHULC). As new generations enter the job market, we will continue to witness a decentralization of the training programs. Currently, there are programs available outside the leading hospitals in Lisbon, Oporto and Coimbra.

Regarding the development of professional skills, the respondents favored training and differentiation: 17.6% had a master's degree (pre-Bologna) or PhD, and 27.3% complemented their training in ophthalmology. Among the younger cohorts (under 40 years old), there was a demand for international certification, presumably to create opportunities to work abroad. Analyzing the postgraduate training data was a complex task because there was significant heterogeneity and a lack of standardization in the reported training. This was one of the variables that we had difficulty analyzing and that needs to be reviewed in the future.

Our analysis did, however, reveal that some of the ophthalmologists continued to practice even after retiring: 20.2% were retired but still working (10% were over 70 years old).

The respondents reported working in three economic sectors: the public, private and social sectors. A wide variety of employment contracts were also used. This heterogeneity made it difficult to draw conclusions. Nevertheless, the results showed that the respondents' work was distributed between the public and private sectors, with a residual collaboration with the social sector. More ophthalmologists were found to work exclusively in a single institution in the private sector (25%) than in the public sector (4.2%). Just over half (58.5%) collaborated with the public sector, regardless of the contractual relationship. According to Correia *et al*, the percentage was lower in 2011, at 45.1%.<sup>1</sup> The large number of retired doctors at the time may help explain these numbers.<sup>1</sup> In comparison to the 30 - 40-year age group, the 40 - 50-year age group showed a significant reduction in the percentage of ophthalmologists working in the public sector; the 40 - 50-year age group had fewer ophthalmologists. A premature withdrawal from the public system could explain this finding.

As mentioned above, there was considerable variation found in the types of employment contracts that governed the labor activities of the ophthalmologists: 20% were under a public service contract (25% in the subgroup of professionals collaborating with the public sector). The most frequent type of contract used in the public sector was the individual employment contract, but there were also individual and corporate service contracts in use. In the private and social sectors, most of the contracts were freelance contracts. The variation in the types of contractual agreements that were found to be in place in the public sector amplifies the instability observed in the delivery of healthcare services and training capacities.

The limited career progression of the respondents was reflected in the reduced number of Senior Hospital Attending, particularly among those working in the PNHS and in the 50 - 60-year age group (1.9%). The progression of this group of professionals is vital to the functioning of specialized services and the provision of training capacities.

We next analyzed the weekly activity data of the respondents and found that the median number of reported work hours was 45 hours, with 35 hours dedicated to the public sector. In the subgroup of respondents who collaborated with the public sector, the median number of hours dedicated to the private/social economic sector was still considerable at 20 hours. There were 471 ophthalmologists working in the public sector, and this figure was reduced to 390 when only FTE workers (working 40 hours/week) were considered. These findings reflect the work done in different economic sectors and the existence of reduced hours in the public sector, which allows an additional 20 hours/week of work in other economic sectors.

The total number of hours assigned to the private/social sector (12 926 hours) was higher than those assigned to the public sector (10 809 hours). Analysis of this data must take into account the differentiated clinical care provided in each economic sector. Nevertheless, this finding revealed that the provision of ophthalmological healthcare outside the scope of the public sector is significant and should be acknowledged.

When we examined the weekly activity data in greater depth, we found that the respondents mainly undertook clinical work (> 80%) and surgical activity (52.8% reported undertaking this activity more than twice a week). We also noticed that general ophthalmology was practiced twice as much (average 16.8 hours) as differentiated care (average 7.6 hours). Of those who practiced differentiated care, 50% had done so for over 10 years. Almost all of the ophthalmologists performed surgeries (91.7%): 80% performed cataract surgeries and 48% performed intravitreal injections. Further analysis of this data must include productivity data from the different departments to identify where the training capacity lies.

Regarding the respondents' future plans, 59% intended to maintain their level of activity as it is, 38.7% wanted to reduce their level of activity and 2.3% wanted to cease their activity. The main reasons for reducing activity were personal, family-related issues, fatigue and demotivation or other health issues.

The issue of healthcare worker retention is critical and demands immediate attention. It is a concern that extends beyond Europe and affects countries worldwide. Factors that influence the retention of healthcare workers include professional and career growth, organizational aspects, and personal considerations. Developing effective human



resource strategies requires the leadership of established institutions and collaboration with educational institutions and professional associations.

This study is limited due to self-reported questionnaires, with greater participation by younger ophthalmologists and those working in the PNHS. Some responses on training after specialization were complex to analyze and should be reviewed in future studies. Moreover, we have not performed a comparative analysis to examine our findings in the European or international context or addressed Portugal's specific needs in visual healthcare. Both are complex tasks that we cannot handle at this time.

The dynamics of human resources in healthcare are complex and depend on multiple variables, including politics. However, characterizing the human resources in healthcare is the first step in the process of designing, planning, and implementing successful interventions. In the next step in our project, we will study the existing capacity, predict the population's needs and repeat the process every five years. The collected data will be used to plan training needs, and it is also vital to take into account that the number of specialized professionals must meet the population's needs for a given period and that the quality of the provided services is affected by the excess or lack of professionals.

By projecting the future needs, it is possible to create training strategies and to prioritize and recommend sustainable policies for the health programs of the successive Constitutional Governments that ensure access, equity and proximity, as stated in the Constitution of the Portuguese Republic, the Basic Health Law, the National Health Plan and the National Strategy for Eye Care 2018.

## CONCLUSION

In Portugal, the ratio of ophthalmologists to inhabitants is higher than the European average and in line with the OECD's recommendations. However, the ratio drops when the public sector is considered alone, and even further when an FTE workload of 40 hours/week is considered. This highlights the disparity between the public and private/social sectors in terms of the distribution and workload of ophthalmologists. Geographically, the ophthalmologists in our study were concentrated in the urban areas of Lisbon, Oporto and Coimbra, indicating an asymmetry in the distribution of resources across the country. Furthermore, our findings revealed that the workload in the private/social sector was more significant than in the public sector, emphasizing the role of private practice in the provision of ophthalmological healthcare. Looking forward, the generational balance for the ophthalmologist workforce is expected to remain stable, with an annual increase of 0.8% ophthalmologists per year. The valuable knowledge generated in this study will be used to develop effective strategies for training

new specialists and address the challenges in ensuring the sustainability of the ophthalmological healthcare system in Portugal.

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## PREVIOUS AWARDS AND PRESENTATIONS

The study results were formally presented at the 65<sup>th</sup> Portuguese Congress of Ophthalmology in 2022.

## AUTHOR CONTRIBUTIONS

PML, SO, AM: Study design, data collection, analysis and interpretation, writing and critical review of the manuscript, supervision.

AM, CV, JTF: Study design, data collection, analysis and interpretation, writing and critical review of the manuscript.

JN, SL: Study design, data collection, analysis and interpretation.

## PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

## DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

## COMPETING INTERESTS

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