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The Portuguese National Health Service: what motivates physicians to stay?

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THE PORTUGUESE NATIONAL HEALTH SERVICE (NHS): WHAT MOTIVATES PHYSICIANS TO STAY?

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"Uns, com os olhos postos no passado,
Vêem o que não vêem: outros, fitos
Os mesmos olhos no futuro, vêem
O que não pode ver-se.

Por que tão longe ir pôr o que está perto —
A segurança nossa? Este é o dia,
Esta é a hora, este o momento, isto
É quem somos, e é tudo.

Perene flui a interminável hora
Que nos confessa nulos. No mesmo hausto
Em que vivemos, morreremos. Colhe
O dia, porque és ele."

Ricardo Reis, ***Colhe o Dia, porque És Ele in Odes***

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ABSTRACT

Introduction: The standard of care is impacted by availability, accessibility, acceptability, and quality of health workers. Difficulties in training, development, retention and performance are being perceived around the world. Management of these careers must focus on the entire process from education, training and selection, to migration. The downfall of volatile health systems can be fomented by the loss of health workers, resulting in population deaths.

Objectives: The main objectives of the study were to identify factors associated with the retention of doctors in the present, to determine the intention of resident physicians to pursue a future career in the Portuguese National Health Service (NHS), and to describe independent factors associated with the retention of these doctors.

Methodology: The data was collected, between 10th of May and 16th of June of 2022, through structured self-completion questionnaires with samples of specialists physicians that migrated from the Portuguese NHS, and resident doctors. For studying association between variables and relationships between groups, Spearman's rank correlation tests were used. All variables associated with pre-defined outcomes were studied through ordinal logistic regression.

Results: Among the factors studied, 7 had statistically significant correlations with the likelihood of returning to a career in the NHS in specialized physicians that migrated, and 21 had correlations with the likelihood of pursuing a career in the NHS upon completion of the specialty in resident physicians. 38.4% of resident physicians showed an high likelihood of pursuing a career in the NHS. The regression models established 4 predictors for the likelihood of physicians who migrated from the NHS returning, and 6 for the likelihood of resident physicians pursuing a career in the NHS.

Conclusions: It was possible to establish statistical significant relationships between factors and the outcomes of careers in the NHS.

Keywords: human resources management in healthcare; retention of physicians; Portuguese NHS.

RESUMO

Introdução: O padrão de cuidados é influenciado pela disponibilidade, acessibilidade, aceitabilidade e qualidade dos profissionais de saúde. Dificuldades na formação, desenvolvimento, retenção e desempenho estão a ser percebidas em todo o mundo. A gestão destas carreiras deve centrar-se em todo o processo desde a educação, formação e seleção, até à migração. O colapso de sistemas de saúde voláteis pode ser fomentada pela perda de profissionais de saúde, resultando em mortes da população.

Objetivos: Os principais objetivos do estudo foram identificar os fatores associados à permanência de médicos no presente, determinar a intenção dos médicos internos em seguir uma futura carreira no Serviço Nacional de Saúde (SNS) e descrever fatores independentes associados à retenção desses médicos.

Metodologia: Os dados foram recolhidos, entre 10 de maio e 16 de junho de 2022, através de questionários estruturados de autopreenchimento com amostras de médicos especialistas que migraram do SNS português, e médicos internos. Para estudar a associação entre as variáveis e relações entre os grupos, foram utilizados testes de correlação de Spearman. Todas as variáveis associadas aos desfechos pré-definidos foram estudadas através de regressão logística ordinal.

Resultados: Entre os fatores estudados, 7 apresentaram correlações estatisticamente significativas com a probabilidade de regresso à carreira no SNS em médicos especialistas que migraram, e 21 tiveram correlações com a probabilidade de seguir carreira no SNS após a conclusão da especialidade em médicos internos. 38,4% dos médicos internos mostraram alta probabilidade de seguir carreira no SNS. O modelo de regressão logística ordinal estabeleceu 4 preditores para a probabilidade dos médicos que migraram do SNS regressarem, e 6 para a probabilidade dos médicos internos seguirem carreira no SNS.

Conclusões: Foi possível estabelecer relações estatisticamente significativas entre os fatores e os desfechos de carreiras no SNS.

Palavras-chave: gestão de recursos humanos em saúde; retenção de médicos; SNS português.

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ABBREVIATIONS

ACSS	*Administração Central de Serviços de Saúde* (Central Administration of Health Services)
AR	Autonomous Regions
$CI_{95\%}$	95% confidence interval
CMIS	Conceptual Model of Intent to Stay
COVID-19	Coronavirus disease 2019
GHC	Group of Health Centres
GRY	General residency year
GRY*oc*	Occupied positions in the general residency year
HRA	Health Regional Administration
IBM	International Business Machines
IQR	Inter-quartile ranges
LHU	Local Health Units
NHS	National Health Service
OECD	Organisation for Economic Co-operation and Development
OR	Odds ratio
PMA	Portuguese Medical Association
r_s	Spearman's rank correlation coefficient
RHA	Regional Health Administration
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
SR	Specialty residency
SR*vac*	Vacancies in the specialty residency
UK	United Kingdom
USA	United States of America
WHO	World Health Organization
Y	Year

1. INTRODUCTION

Health workers are central elements of health systems. Their distribution and accessibility to population determine the effective fulfilment of the theorical health service coverage (Guilbert, 2006; World Health Organization, 2016). Difficulties in training, development, retention and performance of human resources are being observed in numerous nations, which constrain the realization of public health priorities (World Health Organization, 2016).

Governments and other stakeholders must create policies and strategic programs based on evidence, promoting the planning of future needs, and cooperating internationally to coordinate resources, mobilize knowledge and establish strong health systems. Wealthier countries will be threatened by low fertility and higher numbers of senior people, resulting in high demand of healthcare due to elevated prevalence of chronic diseases.

The strategies in managing healthcare workers careers must address the entire process from education, training and selection, to overseeing migration. Retention issues are usually associated with significant expenses (Guilbert, 2006; Lopes & Delellis, 2013). The loss of health workers can fuel the collapse of unstable health systems, increasing population deaths (Guilbert, 2006).

This study was designed to evaluate the factors related to retention of physicians in the present context and the future perspectives in the Portuguese NHS, identifying associated factors and determining the intention of present resident doctors to pursue a future career in the Portuguese NHS.

The data was collected through structured self-completion questionnaires, between 10th of May and 16th of June of 2022, with convenience and snowball samples of physicians that concluded medical specialty and migrated from the Portuguese NHS, and resident doctors.

According to the literature reviewed, this is the first study assessing factors associated with retention of physicians and evaluating the intention of present resident doctors to follow a career in the Portuguese NHS. It is also the first one studying relationships between the studied factors and the intention to pursue a career in a national public sector, internationally. Therefore, this research should serve as evidence in the construction of better medical human resources management policies in Portugal.

2. LITERATURE REVIEW

2.1. The map of typical medical career in Portugal: from medical school to the NHS

In the last forty years, the *numerus clausus* in Portuguese medical schools increased from 180 to 1800, without forecasting the future needs for physicians in the health system (Simões, Augusto, Fronteira, & Hernandez-Quevedo, 2017). Between 1995 and 2010, it increased more than 250%, resulting in a number of new graduates that enlarged four times between 1996 and 2010 (Santana, Peixoto, & Duarte, 2014).

The number medical graduates in 2019 was 15.8 per 100,000 population, higher than the Organisation for Economic Co-operation and Development-36 (OECD) average of 13.5 per 100,000 population. Between 2000 and 2019, the number of medical graduates strongly increased, due to the creation of new medical schools and the increase in the *numerus clausus*. There is the concern that not all new medical graduates are able to find positions in post-graduate medical training in Portugal (OECD, 2021).

These strict limitations in terms of internship places depend on the reported capacity of NHS healthcare facilities (primary care centres and hospitals) and some private facilities (Simões et al., 2017).

When physicians finish their undergraduate medical education, after 6 years of studies, the general residency year, after which they become autonomous for medical practice, and 4 to 6 years of specialty residency, they become assistant physicians – the lowest step in the NHS graduate physicians' hierarchy (the next steps are graduate assistant physician and senior graduate assistant physician). The hierarchical ascent depends on the number of years and the positions available in the structure (Simões et al., 2017).

2.2. The medical profession in Portugal: career opportunities beyond the NHS

Although the more traditional route is through NHS, there are other options of clinical employability for doctors – private and social sectors (Santana et al., 2014).

The regimens of employment can assume different forms, such as contracts with companies or provision of services by self-employed physicians (Loureiro et al., 2009).

Since the beginning of the last decade, it was observed a growth of early retirements in physicians and of looking for complementary jobs, combining both public and private

sectors (Simões et al., 2017).

In the private sector, there has been, in recent years, the emergence of multiple hospital units and the participation in public-private partnerships. The social sector has been, also, improving their development and impact in the Portuguese health system (Deloitte Consultores, 2011).

2.3. Doctors in the Portuguese NHS: context and evolution

The number of physicians in the Portuguese NHS was, in 2018, 29,291 (21.6% of all health workers), 19,232 of which were in hospitals, 2,538 in Local Health Units (LHU), 7,461 in Regional Health Administrations (RHA) (primary care) and 60 in Central Services. 18,835 were physicians with postgraduate training (specialists) or in equivalent functions, and 8,906 were residents (or junior doctors). 50.8% of all physicians were more than 50 years old in 2018 (Administração Central do Sistema de Saúde, 2019).

According to the recruitment data of 2018, there were 378 vacancies for family medicine specialists, 348 candidates and 293 positions were occupied as result of the recruitment process. A second recruitment process occurred with 113 vacancies, of which 76 were filled (Administração Central do Sistema de Saúde, 2019).

In the field of public health and hospital specialties, in 2018, there were 503 vacancies (20 in public health and 483 in hospital specialties) and 285 of them were occupied. A second recruitment process occurred with 856 vacancies (17 in public health and 839 in hospital specialties), 566 of them were filled. A third process occurred, and was finished in 2019, with 300 vacancies (13 in public health and 287 in hospital specialties), 165 of which were filled (Administração Central do Sistema de Saúde, 2019).

The number of vacancies in the general residency year (GRY) and in the specialty residency (SR) increased (table 1), respectively, from 1,343 (2010) to 2,271 (2018) and from 1,190 (2010) to 1,758 (2018) (Administração Central do Sistema de Saúde, 2019).

There is a crescent deficit of vacancies for physicians to continue their postgraduate training in Portugal, which created a group of doctors which may be disposed to pursuing a medical specialization abroad (Ramos & Alves, 2017).

Y	GRY		SR		SRvac_{y}-GRYoc_{y-1}
	Vacancies	Occupied	Vacancies	Occupied	
2010	1,343	1,241	1,190	1,168	
2011	1,546	1,439	1,391	1,355	150
2012	1,652	1,556	1,496	1,453	57
2013	1,700	1,635	1,541	1,525	-15
2014	1,790	1,785	1,533	1,526	-102
2015	1,950	1,941	1,612	1,602	-173
2016	2,147	2,080	1,569	1,569	-372
2017	2,302	2,197	1,674	1,674	-406
2018	2,271	2,179	1,758	1,758	-439

Table 1. Evolution of positions in the general and specialty residencies. (Y: year; GRY: general residency year; SR: specialty residency; SR*vac*: vacancies in the specialty residency; GRY*oc*: occupied positions in the general residency year; created using data from "*Relatório social do Ministério da Saúde e do Serviço Nacional de Saúde* - 2018" of *Administração Central do Sistema de Saúde (ACSS*)

Relating to the evolution of the number of physicians in the Portuguese NHS, from 2010 to 2018, there was a continuous growth from 23,682 (2010) to 29,291 (2018). Despite this growth, the number of specialist physicians decreased from 17,415 (2010) to 16,530 (2014) and increased then to 18,835 (2018). The number of newly specialized physicians also increased continuously from 798 (2010) to 1,445 (2018) (Administração Central do Sistema de Saúde, 2019).

The number of physicians in Portugal increased, between 2000 and 2019, from 3.1 to 5.3 per 1,000 population, referring to all physician licensed to practice, which may result in over-estimation of around 30% of the number of practising physicians. The OECD-38 average increased from 2.7 to 3.6 per 1,000 population, between the same years (OECD, 2021).

A study by Santana et al. projected the number of doctors in Portugal in 2025, based on models of supply and demand with and without limitations on positions in general and specialty residencies. According to the results, there will be an excess of newly specialized doctors that varies between 3,978 and 8,802 and may not be absorbed by the Portuguese NHS or the remaining health system. It is advised a close monitoring of this reality, allowing the introduction of corrections, which is of greatest importance due to the length of the medical degree and the number of current students, and the length of postgraduate residencies, increasing the time for implementation of changes (Santana et al., 2014).

It was observed that the number of foreign physicians in the Portuguese NHS increased between 2010 (1,696) and 2014 (1,867), becoming stable with a minor decrease in next years (1,834; 2018) (Administração Central do Sistema de Saúde, 2019).

Between 2011 and 2015, the number of physicians leaving Portugal increased from 184 to 475, due to the economic crisis and the deterioration of working conditions in the NHS. Both specialist and junior physicians pursuing their postgraduate medical training abroad emigrated (Simões et al., 2017). However, there is a lack of data about the movement of Portuguese physicians abroad (Leone, Conceicao, & Dussault, 2013; Ramos & Alves, 2017; Russo, Ferrinho, de Sousa, & Conceicao, 2012).

The remuneration, in real terms, decreased between 2010 and 2019 for general practitioners (-2.3%) and specialists (-2.2%) (OECD, 2021).

Between 2016 and 2018, there were contracted 5.76% more hours of external providers to assure medical services (3,422,312 in 2016, 3,631,380 in 2018), 65% of which related to urgent care services (Administração Central do Sistema de Saúde, 2019).

2.4. The health workers and the health systems: a vital relationship

Health workers are key elements of health systems. Availability, accessibility, acceptability, and quality of human resources are factors that influences the standard of care (Gilles, Burnand, & Peytremann-Bridevaux, 2014; Guilbert, 2006; Mohammadiaghdam, Doshmangir, Babaie, Khabiri, & Ponnet, 2020; World Health Organization, 2016). The human resources must be equitably distributed and accessible by population, motivated to deliver the care adapted to the population's expectations, and supported by the health system. This will allow the effective fulfilment of the theorical health service coverage. These workers will be essential to accomplish health and broader development goals in the next decades (Guilbert, 2006; World Health Organization, 2016), and to serve as gatekeepers and pilots for the efficient use of resources (Guilbert, 2006).

The inequity in the dispersion of health workers in countries is an usual severe issue and can generate threats as lack of doctors in disadvantaged regions, which can present restrictions for the population when accessing healthcare services. In most disadvantaged regions, this is an established issue with severe results for the quality, quantity and equity of healthcare services (Mohammadiaghdam et al., 2020).

Health workers are facing growing pressure and uncertainty as they experience a complicated range of forces, involving the health requirements (demographic and epidemiological modifications), the health system (financing plans, technological evolution and user hopes changes) and the context (training, education, labour market and globalization shifts)

(Guilbert, 2006).

Various countries are experiencing complications in the training, development, retention and performance of their human resources, which constrain the achievement of public health priorities (Verma et al., 2016; World Health Organization, 2016). For decades, governments cut costs in health systems, usually by diminishing capacity to the minimum level tolerated, which has openly revelled by the COVID-19 pandemic (McKee, 2021).

In several countries, salaries of health workers are inferior to other professions with comparable qualifications and their projections for career evolution are restricted by strict hierarchies. As a result, many leave their health system for improved offers in other countries, for openings in other areas, or purely to put term to their health careers. This is not only a question of depreciating expert skills and knowledge. There is evidence that health institutions that appeal and retain health workers deliver higher value care (McKee, 2021).

In fact, there is a demand to stimulate political decisions to improve adequately the financing of health systems. The low investment in health human resources is decreasing the sustainability of the health systems, which is maximized by the misalignment between education strategies and population needs. Governments need to make the best achievable use of this limited resources, guaranteeing the application of evidence-based health workforce policies adapted to national contexts (World Health Organization, 2016).

Governments must construct and implement strong human health resources long-term plans and policies to fortify health systems, guaranteeing the alignment between health, education, employment, gender, migration, development collaboration and fiscal policies. They also need to encourage adequate working conditions, ensuring health and safety, reasonable terms to health workers, career progress opportunities based on merit, and an encouraging work environment to empower their practice, retention, and motivation to deliver quality healthcare. The public sector policies must include suitable incentive mechanisms, working settings and career structures, with the necessary heights of flexibility and autonomy (World Health Organization, 2016).

The improvement of working conditions is associated to better job satisfaction, attraction of new candidates and talent, and decreased staff renewal rate by holding qualified experts. Actions to focus on tangible and alleged pay gaps between health workers and corresponding workers in other sectors are required. Promoting working conditions entails a variety of supplementary strategies such as consenting more part-time work, flexibility, transform scheduling schemes and support with childcare arrangements (McKee, 2021).

There is the need to implement transformative policies at the education level. The investment in training at the pre- and post-graduate levels should be consistent to the population and health system necessities (World Health Organization, 2016). Governments and other stakeholders must construct strategic programs based on evidence, allowing the planning of future needs, and cooperating internationally to coordinate resources, mobilize knowledge and establish strong health systems (Verma et al., 2016).

Wealthier nations will be confronted with little fertility and greater numbers of senior people, resulting in high demand of healthcare due to elevated prevalence of chronic and degenerative diseases (Verma et al., 2016).

The strategies in managing health workers careers must address the entire process: at the entry level, education, training, and selection; at the workforce level, promoting better performance through improved management of workers; and at the exit level, overseeing migration to minimize the reckless loss of health workers (Guilbert, 2006; Terregino et al., 2021). Research shows that retention troubles are usually associated with significant expenses (Guilbert, 2006; Lopes & Delellis, 2013).

2.5. The factors associated with retention of physicians: a literature synthesis

The World Health Organization (WHO) advocates that governments must arrange a combination of strategic actions to appeal and retain health workers, incorporating job safety, a controllable workload, helpful and organizational management, continuing training and improvement prospects, improved career growth pathways, family and lifestyle stimulus, adversity pensions, habitation and learning grants, suitable facilities and working equipment, and proposals to enhance work-related health and security (World Health Organization, 2016).

The foundation of contemporary motivational theories divides employee behaviour in five characteristics: needs, reinforcement, cognition, job components, and feelings or emotions (Lopes & Delellis, 2013).

The intention of migration of physicians was described in many European countries. 55% of Portuguese newly medical graduates planned to migrate (Ramos & Alves, 2017), 60% in the United Kingdom (UK) (Lambert, Smith, & Goldacre, 2018), 30% in Germany (Pantenburg, Kitze, Luppa, Konig, & Riedel-Heller, 2018), and 85% of all medical students (between 2013 and 2015) in Romania (Suciu, Popescu, Ciumageanu, & Buzoianu, 2017). The

factors promoting the emigration of doctors included the expense of employing doctors, poor working conditions, and recognition of improved training and career prospects (Glinos, 2015). Poor job fulfilment, concerns of unemployment, and an absence of homogeneous training are factors influencing the emigration in Greece (Filippidis, 2016; Moris, Karachaliou, & Kontos, 2017). 30% of Austrian medical graduates emigrated because of perceptions of poor postgraduate training, reduced basic salaries, heavy bureaucratic work, and extensive working time (Scharer & Freitag, 2015; Seitz, Turk, & Loffler-Stastka, 2017).

The motivators for migration of health workers include worries about absence of promotion scenarios, unsatisfactory management, excess of work, poor equipment, a deteriorating standard of care, poor living conditions and incremented degree of violence and crime. Work-related threats and stress are similarly significant obstacles to retention (Guilbert, 2006).

There is a lack of knowledge from high income countries about migration of physicians. Resident physicians in Ireland showed great dissatisfaction with work condition, training and career prospects. Dissatisfaction with work-life equilibrium, belief that quality of training was poor, and resigning for family or personal motives were predictors of intention to leave. Insufficient supervision, shortage of specified training time and burdens on personal and family life were found in qualitative approaches. Great levels of emigration by physicians have been seen in high-income countries affected by the 2008 global economic crisis. A qualitative study from 2015 stated the pursuit for improved working settings, career advancement and enhanced practice environments as the key reasons for migration of physicians. Insufficient supervision of resident physicians in Ireland is a consequence of growing workloads and workforce deficiencies, aggravated by the effects of economic crisis and reductions of the salaries of new assistant physicians, which has affected on recruitment. (Clarke et al., 2017)

Brugha et al. addressed the factors associated with the migration of doctors in Ireland, which is mainly due to lack of action towards unsatisfactory training and working experiences. In few cases, these factors are associated with the abandonment of medical careers, which has been also connected to burnout and demand for assistance from senior physicians. The loss of physicians is the consequence of inadequate action to improve the factors that promote the resigning of doctors. Even though most Irish medical graduates want to pursue a career in their home country, many will emigrate and not return because of the quality of training, working conditions and career prospects (Brugha, Clarke, Hendrick,

& Sweeney, 2020). Approximately one third of hospital doctors reported burnout and other psychological health issues. Burnout, insensitivity, and negative working experiences were connected to the intention to emigrate and not return among Irish junior doctors (Cronin, Clarke, Hendrick, Conroy, & Brugha, 2019; Hayes, Prihodova, Walsh, Doyle, & Doherty, 2019; World Health Organization, 2016). Unsatisfactory supervision experiences and training expenses are important factors that influence the retention of physicians, which is supported by the intention to remain associated to the perception of improvement of this factors (Brugha et al., 2020). The robust association with poor experience of mentoring indicates that individual relationship or support from supervisors or senior doctors is a significant motivator for the retention of junior doctors (Crowe, Clarke, & Brugha, 2017). Work-related bullying and its connection to poor mentoring are also important distinguishers. Elevated rates of bullying have been described in publications (Clarke et al., 2017; Crowe et al., 2017).

In order to optimize the retention of doctors, in the last years, Ireland increased the number of doctors trained, which mimics the strategy of low and middle income countries to training more and expecting to retain more. The lack of physicians in Ireland was described as not a lack of train human resources, but a refusal of trained physicians to perform their job in the present settings. Quality of care provided, challenging working conditions, stress, overload, demoralization, unappreciation and dissatisfying levels of support at work are main concerns (Humphries, McAleese, Matthews, & Brugha, 2015; McGowan, Humphries, Burke, Conry, & Morgan, 2013). Low morale and burnout are also described (Tasker, Newbery, Burr, & Goddard, 2014). These physicians refuse the premises related to preforming their work in the Irish health system and are prepared to emigrate to escape them. Internationally, comparable realities have been described (Bickel & Brown, 2005; Jovic, Wallace, & Lemaire, 2006). If unsolved, the emigration of physicians will enlarge and aggravate the dependance in the arriving foreign physicians to compensate the shortage (Humphries et al., 2013). The impact of the increment in trained physicians was residual on the Irish medical staff, impacted by the emigration. It is essential to recognize that the issue is not related to a lack of physicians, but a lack of physicians disposed to perform their job in the present circumstances. The resolution of this issue and the accomplishment of health workers self-reliance will entail a broader policy, not restricted to growing the quantity of doctors (through national training or foreign recruitment), but by establishing efficient plans to optimize physicians retention. Physicians will remain to emigrate, looking for training and work in a more caring work setting. Ireland will face medical brain drain, depending on international

physicians, and with a very transitory medical health workers. This reality is not exclusive from Ireland, but the combination of unappealing working settings, intensified by economic austerity and globalization made it more perceptible in this context (Humphries, Crowe, & Brugha, 2018).

A recent descriptive study promoted by the Portuguese Association of Hospital Administrators, the Portuguese Medical Association (PMA), the National Association of Medical Students, and a private company addressed the decision factors in the medical career among 2005 doctors and medical students. 67% of the participant doctors revealed being low or nothing satisfied in the public sector, indicating base remuneration (74%), lack of human resources and/or equipment (65%) and excess of patients impacting time and quality (50%) as reasons. On the other hand, 16% of the respondent doctors showed dissatisfaction in the private sector, referring little continuous training and teamwork (65%), career progression (43%) and base remuneration (42%) as explanations. 98% of doctors working in the private sector have already worked in the public sector, 20% of these moved 12 months ago or less, because of lack of human resources for the proper functioning of the service, flexibility in managing working hours or schedule, or personal project. In the next 12 months, among the doctors who only work in the public sector, 46% do not intend to change their current clinical practice, 18% intend to have roles in both sectors, 28% are undecided, and 8% intend to stop working in the public sector. 78% of those who are exclusively in the private sector intend to stay. Patient mix or diversity (68%), and training and teamwork (64%) were considered strengths of the public sector. Base remuneration (75%), lack of human resources or equipment (63%), and excess of patients with impact on time and quality (47%) were described as weaknesses. The private sector strengths were flexibility in managing working hours or schedule (74%), base remuneration (72%), and access to technology or innovation (40%). The weaknesses were mix or diversity of patients (45%), less access to clinical research (45%), and training and teamwork (44%). The main reasons described for migration from the public sector were base remuneration (62%), flexibility in managing working hours or schedule (30%), and overtime or pay for overtime (45%). 77% of future doctors intend to work in the public sector after their first year of internship and 43% intend to work in the private sector. (Associação Portuguesa de Administradores Hospitalares, Ordem dos Médicos, Associação Nacional de Estudantes de Medicina, & 2Logical, 2022)

An improved support from co-workers and prospects for career growth are important factors in recruitment and retention of doctors. While, decreased job fulfilment,

professional stress, effective or threatened violence from patients, and managing obstinate patients are connected to increased intentions of resigning (Heponiemi, Hietapakka, Kaihlanen, & Aalto, 2019).

Gilles et al. used the Conceptual Model of Intent to Stay (CMIS) to study the factors associated with the intent to stay of healthcare professionals in the Lausanne University Hospital. The conclusions of this study supported the fundamental impact of job satisfaction on retention of health workers. Burnout was also a significant factor with an indirect impact and association with other variables, such as workload and self-fulfillment, and its adverse influence was only detected among doctors. Institutional identification had a direct and strong impact, observed in all classes of health workers (Gilles et al., 2014).

Globally, research from Ireland, the UK, and the United States of America (USA) indicates unsatisfactory work-life equilibrium, health issues, burnout, and adverse effects of training on junior doctors' private lives (Rich, Viney, Needleman, Griffin, & Woolf, 2016; Shanafelt et al., 2012).

A strong negative association was described between burnout and doctor well-being. There was no association between external motivators (such as salary) and purpose or engagement, neither well-being in most cases. Doctors well-being impacts work efficiency, quality of service provided and patient safety, being of special interest in healthcare systems. Also, poor doctor satisfaction may conduct to deteriorating career engagement. Work setting (such as working hours and salary), doctor self-sufficiency (such as work autonomy, capacity to perform) and modifications in the regional market has the greatest association with doctor well-being. (Tak, Curlin, & Yoon, 2017)

The mental health issues, such as burnout and depression, are consequences of the workforce erosion, and enlighten the importance of permanent and adequate assistance for healthcare workers. The early development of burnout in doctors has an important effect. The elevated frequency of doctors with burnout in the USA conducts to diminished efficiency and augmented occurrence of medical error, which can aggravate burnout itself. The occurrence of major depression in resident physician increased from 4% at baseline to 27% within 3 months of residency. The support of professional accomplishment, well-being and enclosure is required to promote retention of physicians. (Terregino et al., 2021)

Engagement is an essential factor that influences job satisfaction and retention, quality of care, patient safety, efficiency, and reducing costs (Perreira, Perrier, & Prokopy, 2018).

The intention to change jobs had a direct association with real change, making it a

key forecaster of resigning. High doctors' renewal rate may result in reduced productivity, substandard patient care, and an amplified demand on recruiting and training new doctors, which can be expensive and impact on health outcomes (Heponiemi et al., 2019).

There were described different generational profiles within the medical workforce. Baby boomers, born between 1946 and 1964, were characterized as married to medicine, working long hours and being loyal to their employers. The contemporary generation - Gen X & Y -, born between 1965 and 2000, face the medical profession only as a part of their individuality, refusing prolonged working hours, hoping to shift jobs, and appreciating work-life harmony and adaptability (Bickel & Brown, 2005; Connell, 2014; Humphries et al., 2018; Jovic et al., 2006).

The existence of generational disparities within physicians have been debated in diverse platforms, and may indicate a change to the established understanding of medicine, the function of the doctor and the dynamics of medical migration. The contemporary group of physicians have been experiencing different obstacles from those encountered by previous generations. These generational differences were described in many countries, such as Ireland, the UK and the USA. This emphasizes the necessity for governments, health systems and other stakeholders to esteem junior physicians, and advices to not undervalue genuine worries about their work. The medical profession must represent itself for all doctors (Bickel & Brown, 2005; Connell, 2014; Humphries et al., 2018; Jovic et al., 2006).

As considerable amounts of physicians leave their countries, the nations that funded their training fail to achieve the potential benefit of their investment and involuntarily deliver them to wealthier countries, that are destination for these valuable human resources. Nevertheless, the monetary damage is not the most significant consequence. The loss of health workers can stimulate the downfall of unstable health systems, increasing deaths within the population. (Humphries et al., 2018) In this scenario, the impact of migration moves "from brain drain or gain to "fatal flows" (Guilbert, 2006).

As a result of this literature reviewed, it is possible to conclude that is a lack of research about the factors influencing the retention of physicians in health care systems and of instruments validated to address this type of research. There are diverse factors described that can potentially explain the process of retention, but only few studies tried to associate and correlate these factors with the outcome.

In order to build adequate questionnaires for this research, the factors described were

analysed according to frequency and suitability for the Portuguese reality, and grouped in five domains: specialized residency (training quality; national homogeneity of residency; supervision and mentorship by tutor; teaching opportunities; research opportunities; expenses paid by themselves associated with training; and other expenses paid by themselves associated with residency), work characteristics (working hours performed; uncomfortable hours load; occupation with bureaucratic or administrative work; remuneration; supervision and support by specialized doctors; teamwork; equipment, infrastructure, technologies and innovation available; and technical quality of the service provided), feedback and work experiences (personal satisfaction with the work performed; appreciation of the work by the recipient of the service provided; appreciation of the work by peers; appreciation of your work by superiors; interpersonal relationships with other professional classes; good environment at work; participation in the dynamics of the service; and involvement with the institution where you work and work commitment), personal and family impact of work (extreme work-related fatigue; situations causing emotional exhaustion; existence of threats, violence and crime in the workplace; existence of situations of moral harassment in the workplace; existence of situations of discrimination in the workplace; balance between time dedicated to work and personal and family life; and influence of work on your quality of life), perspectives on the (future) career (career progression prospects; existence of employment relationship; possibility of choosing a workplace close to the affective circle; possibility to perform different tasks at work; choice of working hours; possibility of carrying out complementary work; training opportunities; teaching opportunities; research opportunities; access to equipment, infrastructure, technology and innovation; personal identification with the foundational principles and values of the NHS; and evolution of the functioning of the NHS) and satisfaction (satisfaction with the specialty chosen as a future career; satisfaction with the current work; and satisfaction with the current functioning of the NHS).

3. MATERIALS AND METHODS

3.1. Study aims and objectives

This study was designed to assess the factors associated with the retention of physicians in the present context and the future perspectives in the Portuguese NHS.

The main objectives of the study are:

- to identify factors associated with the retention of doctors in the current context;
- to determine the intention of present resident physicians to pursue a future career in the Portuguese NHS;
- to describe independent factors associated with the retention of future specialist doctors in the Portuguese NHS.

3.2. Study design and sample

The first part of this research was defined as a cross-sectional study through a structured self-completion questionnaire with a convenience and snowball sampling of physicians that concluded specialty and migrated from the Portuguese NHS to other typologies of work (private practice, teaching, business consulting and/or others in Portugal or abroad), fulfilling the objective of identifying factors associated with the retention of doctors in the current context.

The second part of this research was defined as a cross-sectional study through a structured self-completion questionnaire with a convenience and snowball sampling of doctors that are pursuing specialty residency, satisfying the objectives of determining the intention of present resident physicians to pursue a future career in the Portuguese NHS and describing independent factors associated with the retention of these future specialists.

3.3. Development of the questionnaires templates

The structured questionnaire for physicians that concluded specialty and migrated from the Portuguese NHS to others typologies of work (annex 1) was constructed to evaluate demographic factors (age, gender, marital status, nationality and existence of dependents), professional characteristics (specialty, year of conclusion of residency and location of

residency), factors potentially associated with the retention of physicians in the NHS related to specialized residency, work characteristics, feedback and work experiences, personal and family impact of work, perspectives on the future and satisfaction, typology of work currently performed, and intention of returning to a career in the Portuguese NHS, to pursue the first main objective.

The structured questionnaire for specialty resident physicians (annex 2) was constructed to evaluate demographic factors (age, gender, marital status, nationality and existence of dependents), professional characteristics (year of residency, specialty of residency and location of residency), factors potentially associated with the retention of physicians in the NHS related to specialized residency, work characteristics, feedback and work experiences, personal and family impact of work, perspectives on the future and satisfaction, and intention to pursue a future career in the Portuguese NHS, to pursue the other two main objectives.

The typologies of questions used included open-ended numerical, multiple choice with one or multiple responses, dichotomic (yes/no), and 5-point Likert-type questions for importance, satisfaction and probability (annexes 1 and 2).

The questionaries were piloted on a group of resident physicians to address its construction and applicability (Boynton & Greenhalgh, 2004; Fox, 1996; Jones, Baxter, & Khanduja, 2013).

3.4. Data collection

The questionnaires were held in an online platform, QuestionPro®, sent through e-mail to resident physicians on behalf of the researcher by the Regional Council of the Center of the PMA, Resident Physicians Associations and Medical Specialties Associations, and their completion were encouraged informally through social media, between 10th of May and 16th of June of 2022.

3.5. Statistical analysis

Data were described with means and standard deviations (SD) for continuous variables or with medians and inter-quartile ranges (IQR) if they show a skewed distribution. Categorical variables were described with absolute frequencies and percentages. For studying

association between variables, and the relationship of variables between groups, Spearman's rank correlation tests were used. The significance level was defined as $p < 0.05$.

All variables associated with pre-defined outcomes were studied through ordered logistic regression. The proportional odds assumption was verified using the Test of Parallel Lines. Those with a clear association in the univariate analysis ($p < 0.10$) were included in the multivariate analysis, which was refined until the best model fitting was achieved. The results of the multivariable models are expressed as odds ratio (OR) with 95% confidence interval ($CI_{95\%}$), p-values, and calculated probabilities from OR with $CI_{95\%}$, according to the following equation:

$$p = \frac{odds\ ratio}{1 + odds\ ratio}$$

Data were analysed using Statistical Package for the Social Sciences (SPSS) (International Business Machines (IBM) Corporation. Released 2020. IBM SPSS Statistics for Macintosh, Version 27.0. Armonk, New York: IBM Corp).

3.6. Ethical issues

All participants were informed about the aim and objectives of the research, and the methodology in place to assure their confidentiality, which were accepted before proceeding with data collection.

4. RESULTS

According to the data of PMA from 2021 (Ordem dos Médicos, 2021), there was 59,545 physicians in Portugal, 14,276 of them with more than 65 years old, which may include retired and deceased professionals. 23,134 non specialist physicians were registered. The information of the Portuguese Central Administration of the Health System described 29,291 physicians working in the Portuguese NHS, 8,906 of them were resident doctors (2,179 in the general residency year).

These data allowed the conservative calculus of 5,686 specialized physicians who migrated from the Portuguese NHS (annex 3), 159 of whom answered the questionnaire, which resulted in a margin of error of the sample size of 7.7% ($CI_{95\%}$).

Among the calculated 6,727 specialty residents (annex 3), 576 completed the questionnaire. The margin of error of the sample size retrieved was 3.9% ($CI_{95\%}$). (Administração Central do Sistema de Saúde, 2019)

	Specialist physicians			Resident physicians		
		r_s	p-value		r_s	p-value
Age, median (IQR)	**40 (34-48)**	**-0.224**	**0.005**	29 (27-30)	-0.053	0.207
Portuguese, n (%)	156 (98.1%)			573 (99.5%)		
Female, n (%)	95 (59.7%)			394 (68.4%)		
Marital status						
Married, n (%)	80 (50.3%)			80 (13.9%)		
Single, n (%)	42 (26.4%)			411 (71.4%)		
Domestic partnership, n (%)	24 (15.1%)			82 (14.2%)		
Dependents		0.048	0.550		0.059	0.160
Yes, n (%)	90 (56.6%)			63 (10.9%)		
No, n (%)	69 (43.4%)			513 (89.1%)		

Table 2. General characteristics of the studied groups – specialist physicians who migrated from the Portuguese NHS, and resident physicians –, and correlations with the outcomes: likelihood of returning to a career in the NHS, and likelihood of pursuing a career in the NHS upon completion of the specialty, respectively. (IQR: inter-quartile range; NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

4.1. Specialized physicians who migrated from the Portuguese NHS

159 specialist physicians responded the questionnaire, with a median of age of 40 (IQR 34-48). Most of the respondents were Portuguese (98.1%), female gender (59.7%), married (50.3%) and with dependents (56.6%) (table 2 and annex 4). The median of the year of conclusion of medical residency was 2013 (IQR 2006-2019). The distribution of the local

of medical residency can be consulted on table 3, and, in more detail, on annex 5.

		r_s	p-value
Year of conclusion of residency, median (IQR)	**2013.50 (2006.75-2019.00)**	**0.265**	**0.001**
Local of medical residency			
North HRA, n (%)	36 (22.64%)		
Centre HRA, n (%)	52 (32.70%)		
Lisbon and Tejo Valley HRA, n (%)	47 (29.56%)		
Alentejo HRA, n (%)	3 (1.89%)		
Algarve HRA, n (%)	12 (7.55%)		
AR of Azores and Madeira Islands, n (%)	5 (3.14%)		
Other, n (%)	4 (2.52%)		

Table 3. Medical residency characteristics of specialist physicians who migrated from the Portuguese NHS, and correlation with the outcome: likelihood of returning to a career in the NHS. (AR: Autonomous Regions; HRA: Health Regional Administration; IQR: inter-quartile range; NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Among the potential factors studied, 7 had correlation with the likelihood of returning to a career in the NHS (tables 2, 3 and 4). The descriptive statistics of the studied factors among the group can be consulted on annex 6.

Age (Spearman's rank correlation coefficient (r_s=-0.224, p=0.005) (table 2) and satisfaction with the current work (r_s=-0.240, p=0.002) (table 4) presented a weak negative relationship with the likelihood of returning to a career in the NHS.

A very weak positive relationship correlated training quality of the specialized medical residency (r_s=0.156, p=0.050); teamwork (r_s=0.183, p=0.021); and existence of employment relationship (r_s=0.171, p=0.031), respectively, with the likelihood of returning to a career in the NHS (table 4).

Variable	r_s	p-value
Specialized Medical Residency		
Training quality	**0.156**	**0.050**
National homogeneity of residency	0.131	0.100
Supervision and mentorship by tutor	0.016	0.845
Teaching opportunities	0.102	0.200
Research opportunities	0.006	0.941
Expenses paid by themselves associated with training	-0.050	0.530
Other expenses paid by themselves associated with residency	0.073	0.358
Work characteristics		
Working hours performed	0.042	0.598
Uncomfortable hours load	-0.046	0.569
Occupation with bureaucratic or administrative work	0.004	0.960

Variable	r_s	p-value
Remuneration	-0.049	0.540
Supervision and support by specialized doctors	0.072	0.370
Teamwork	**0.183**	**0.021**
Equipment, infrastructure, technologies and innovation available	0.010	0.900
Technical quality of the service provided	-0.022	0.786
Feedback and work experiences		
Personal satisfaction with the work performed	-0.067	0.400
Appreciation of the work by the recipient of the service provided	-0.027	0.740
Appreciation of the work by peers	0.023	0.776
Appreciation of your work by superiors	0.029	0.717
Interpersonal relationships with other professional classes	-0.027	0.737
Good environment at work	0.046	0.563
Participation in the dynamics of the service	-0.022	0.781
Involvement with the institution where you work and work commitment	0.002	0.983
Personal and family impact of work		
Extreme work-related fatigue	0.043	0.594
Situations causing emotional exhaustion	0.099	0.215
Existence of threats, violence and crime in the workplace	0.085	0.285
Existence of situations of moral harassment in the workplace	0.050	0.535
Existence of situations of discrimination in the workplace	-0.002	0.984
Balance between time dedicated to work and personal and family life	0.001	0.994
Influence of work on your quality of life	0.004	0.961
Perspectives on the (future) career		
Career progression prospects	0.011	0.895
Existence of employment relationship	**0.171**	**0.031**
Possibility of choosing a workplace close to the affective circle	0.084	0.290
Possibility to perform different tasks at work	0.028	0.725
Choice of working hours	-0.005	0.954
Possibility of carrying out complementary work	0.065	0.415
Training opportunities	0.150	0.060
Teaching opportunities	0.153	0.054
Research opportunities	0.065	0.415
Access to equipment, infrastructure, technology and innovation	0.029	0.718
Personal identification with the foundational principles and values of the NHS	0.113	0.155
Evolution of the functioning of the NHS	-0.042	0.599
Satisfaction and career in the NHS		
Satisfaction with the specialty chosen as a future career	-0.061	0.445
Satisfaction with the current work	**-0.240**	**0.002**
Satisfaction with the current functioning of the NHS	**0.262**	**0.001**

Table 4. Correlations of studied factors for specialist physicians who migrated from the Portuguese NHS with the outcome: likelihood of returning to a career in the NHS. (NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Year of conclusion of medical residency (r_s=0.265, p=0.001) (table 3) and satisfaction with the current functioning of the NHS (r_s=0.262, p=0.001) (table 4) showed a weak positive relationship with the likelihood of returning to a career in the NHS.

Concerning the typology of work currently performed, most of the physicians that answered this questionnaire were clinicians in Portugal (73.0%) and 15.7% were clinicians abroad (annex 6).

The likelihood of returning to a career in the NHS was low (sum of categories 1 and 2) in 83.6%, and high (sum of categories 4 and 5) in 3.8% of the respondents (table 5).

Variable	n (%)
Likelihood of returning to a career in the NHS	
Very low – 1	95 (59.7%)
2	38 (23.9%)
3	20 (12.6%)
4	4 (2.5%)
Very high – 5	2 (1.3%)

Table 5. Likelihood of returning to a career in the NHS – specialist physicians who migrated from the Portuguese NHS. (NHS: National Health Service)

4.1.1. Ordered logistic regression for the likelihood of returning to a career in the Portuguese NHS

Ordered logistic regression was used to analyse the relationship between the studied factors and the likelihood of specialized physicians who migrated from the Portuguese NHS returning to a career in the NHS. After univariate and multivariate analysis, 3 factors were retrieved with statistical significance: teamwork, satisfaction with the current work, and satisfaction with the current functioning of the NHS. The model estimated can be consulted on table 6, and the statistical output can be checked on annex 7. Together, the predictors accounted for a significant amount of variance in the outcome (likelihood ratio chi-square (3) = 18.466, p < 0.001).

Holding other variables constant, the odds of having the higher likelihood of returning to a career in the NHS increased, approximately, 57.5% ($CI_{95\%}$ 50.5%-64.2%) for each point increase in the importance of teamwork compared to the other likelihoods of the outcome.

An increase in the satisfaction with the current work was associated with an 40.9% (33.5%-48.8%) decrease in the odds of having the higher likelihood of returning to a career in the Portuguese NHS upon completion of medical residency, given the other variables

constant.

The odds of having the higher likelihood of returning to a career in the NHS increased, approximately, 62.3% ($CI_{95\%}$ 53.5%-70.4%) for each point increase in the satisfaction with the current functioning of the NHS, holding the other variables constant.

Variable	p-value	OR	$CI_{95\%}$
Teamwork	0.032	1.353	1.020-1.795
Satisfaction with the current work	0.024	0.693	0.503-0.954
Satisfaction with the current functioning of the NHS	0.006	1.655	1.151-2.380

Table 6. Estimated effects of the retrieved predictors for the likelihood of returning to a career in the NHS, using a ordered logistic regression. ($CI_{95\%}$: 95% confidence interval; NHS: National Health Service; OR: odds ratio)

4.2. Resident physicians

576 resident physicians answered the questionnaire, with a median of age of 29 (IQR 27-30). Most of the respondents were Portuguese (99.5%), female gender (68.4%), single (71.4%) and without dependents (89.1%) (table 2 and annex 8). The distributions of year and local of medical residency can be consulted on table 7, and, in more detail, on annex 9.

Variable	n (%)	r_s	p-value
Year of medical residency		0.004	0.918
1st	104 (18,1%)		
2nd	128 (22,2%)		
3rd	150 (26,0%)		
4th	111 (19,3%)		
5th	72 (12,5%)		
6th	11 (1,9%)		
Local of medical residency			
North HRA	178 (30.90%)		
Centre HRA	163 (28.30%)		
Lisbon and Tejo Valley HRA	162 (28.13%)		
Alentejo HRA	22 (3.82%)		
Algarve HRA	34 (5.90%)		
AR of Azores and Madeira Islands	13 (2.26%)		
Others	4 (0.69%)		

Table 7. Medical residency characteristics of resident physicians, and correlation with the outcome: likelihood of pursuing a career in the NHS upon completion of the specialty. (AR: Autonomous Regions; HRA: Health Regional Administration; IQR: inter-quartile range; NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Within the potential factors studied, 21 had statistically significant correlations with the likelihood of pursuing a career in the NHS upon completion of the specialty (table 8). The descriptive statistics of the studied factors among the group can be consulted on annex 10.

The importance given to expenses paid by themselves associated with training in the specialized residency (r_s=-0.102, p=0.014); working hours performed (r_s=-0.154, p<0.001); uncomfortable hours load (r_s=-0.094, p=0.025); occupation with bureaucratic or administrative work (r_s=-0.162, p<0.001); equipment, infrastructure, technologies and innovation available (r_s=-0.095, p=0.022); extreme work-related fatigue (r_s=-0.122, p=0.003); situations causing emotional exhaustion (r_s=-0.138, p<0.001); career progression prospects (r_s=-0.094, p=0.024); choice of working hours (r_s=-0.150, p<0.001); and possibility of carrying out complementary work (r_s=-0.165, p<0.001) showed a very weak negative relationship with the likelihood of pursuing a career in the NHS upon completion of the specialty (table 8).

A weak negative relationship correlated remuneration (r_s=-0.203, p<0.001) and the likelihood of pursuing a career in the NHS upon completion of the specialty (table 8).

Variable	r_s	p-value
Specialized residency		
Training quality	0.015	0.711
National homogeneity of residency	-0.060	0.150
Supervision and mentorship by tutor	-0.036	0.389
Teaching opportunities	0.032	0.450
Research opportunities	0.050	0.232
Expenses paid by themselves associated with training	**-0.102**	**0.014**
Other expenses paid by themselves associated with residency	-0.064	0.127
Work characteristics		
Working hours performed	**-0.154**	**<0.001**
Uncomfortable hours load	**-0.094**	**0.025**
Occupation with bureaucratic or administrative work	**-0.162**	**<0.001**
Remuneration	**-0.203**	**<0.001**
Supervision and support by specialized doctors	**0.085**	**0.042**
Teamwork	**0.108**	**0.010**
Equipment, infrastructure, technologies and innovation available	**-0.095**	**0.022**
Technical quality of the service provided	**0.085**	**0.040**
Feedback and work experiences		
Personal satisfaction with the work performed	0.036	0.395
Appreciation of the work by the recipient of the service provided	0.010	0.805
Appreciation of the work by peers	0.070	0.093
Appreciation of your work by superiors	-0.013	0.759

Variable	r_s	p-value
Interpersonal relationships with other professional classes	0.005	0.905
Good environment at work	0.052	0.216
Participation in the dynamics of the service	**0.111**	**0.008**
Involvement with the institution where you work and work commitment	0.057	0.175
Personal and family impact of work		
Extreme work-related fatigue	**-0.122**	**0.003**
Situations causing emotional exhaustion	**-0.138**	**<0.001**
Existence of threats, violence and crime in the workplace	-0.017	0.676
Existence of situations of moral harassment in the workplace	-0.009	0.835
Existence of situations of discrimination in the workplace	0.035	0.403
Balance between time dedicated to work and personal and family life	0.023	0.580
Influence of work on your quality of life	0.024	0.572
Perspectives on the (future) career		
Career progression prospects	**-0.094**	**0.024**
Existence of employment relationship	**0.103**	**0.014**
Possibility of choosing a workplace close to the affective circle	0.022	0.594
Possibility to perform different tasks at work	0.077	0.066
Choice of working hours	**-0.150**	**<0.001**
Possibility of carrying out complementary work	**-0.165**	**<0.001**
Training opportunities	0.077	0.065
Teaching opportunities	0.069	0.100
Research opportunities	0.073	0.078
Access to equipment, infrastructure, technology and innovation	0.006	0.894
Personal identification with the foundational principles and values of the NHS	**0.150**	**<0.001**
Evolution of the functioning of the NHS	**0.107**	**0.010**
Satisfaction and career in the NHS		
Satisfaction with the specialty chosen as a future career	**0.209**	**<0.001**
Satisfaction with the current work	**0.366**	**<0.001**
Satisfaction with the current functioning of the NHS	**0.462**	**<0.001**

Table 8. Correlations of studied factors for resident physicians with the outcome: likelihood of pursuing a career in the NHS. (NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Supervision and support by specialized doctors (r_s=0.085, p=0.042); teamwork (r_s=0.108, p=0.010); technical quality of the service provided (r_s=0.085, p=0.040); participation in the dynamics of the service (r_s=0.111, p=0.008); existence of employment relationship (r_s=0.103, p=0.014); personal identification with the foundational principles and values of the NHS (r_s=0.150, p<0.001); and evolution of the functioning of the NHS (r_s=0.107, p=0.010) presented very weak positive relationships with the likelihood of pursuing a career in the NHS upon completion of the specialty (table 8).

Satisfaction with the specialty chosen as a future career (r_s=0.209, p<0.001) showed a weak positive relationship, satisfaction with the current work (r_s=0.366, p<0.001) a

moderate positive relationship, and satisfaction with the current functioning of the NHS (r_s=0.462, p<0.001) a strong positive relationship with the likelihood of pursuing a career in the NHS upon completion of the specialty (table 8).

In relation to the likelihood of pursuing a career in the NHS upon completion of the specialty, it was low (sum of categories 1 and 2) in 130 (22.6%) and high (sum of categories 4 and 5) in 221 (38.4%) of resident physicians (table 9).

Variable	n (%)
Likelihood of pursuing a career in the NHS upon completion of the specialty	
Very low - 1	54 (9.4%)
2	76 (13.2%)
3	225 (39.1%)
4	164 (28.5%)
Very high – 5	57 (9.9%)

Table 9. Likelihood of pursuing a career in the NHS – resident physicians. (NHS: National Health Service)

4.2.1. Ordered logistic regression for the likelihood of pursuing a career in the Portuguese NHS

Ordered logistic regression was used to analyse the relationship between the studied factors and the likelihood of resident physicians pursuing a career in the Portuguese NHS upon conclusion of medical residency. After univariate and multivariate analysis, 6 factors were retrieved with statistical significance: working hours performed, teamwork, existence of employment relationship, possibility of carrying out complementary work, satisfaction with the current work, and satisfaction with the current functioning of the NHS. The model estimated can be consulted on table 10, and the statistical output can be checked on annex 11. Together, the predictors accounted for a significant amount of variance in the outcome (likelihood ratio chi-square (6) = 232.121, p < 0.001).

Holding other variables constant, the odds of having the higher likelihood of pursuing a career in the NHS decreased, approximately, 39.8% ($CI_{95\%}$ 33.1%-47.1%) for each point increase in the importance of working hours performed compared to the other likelihoods of the outcome.

An increase in the importance given to teamwork was associated with an 58.2% (52.5%-63.6%) increase in the odds of having the higher likelihood of pursuing a career in the Portuguese NHS upon completion of medical residency, given the other variables

constant.

The odds of having the higher likelihood of pursuing a career in the NHS increased, approximately, 56.2% ($CI_{95\%}$ 51.1%-61.2%) for each point increase in the importance of existence of employment relationship compared to the other likelihoods of the outcome, holding the other variables constant.

For each point increase in the importance of the possibility of carrying out complementary work, there was a 40.7% ($CI_{95\%}$ 36.5%-45.1%) decrease in the odds of having the higher likelihood of pursuing a career in the NHS increased compared to the other likelihoods of the outcome, given the other variables constant.

Holding the other variables constant, there was a 65.0% ($CI_{95\%}$ 36.3%-68.7%) increase in the odds of having the higher likelihood of pursuing a career in the NHS increased compared to the other likelihoods of the outcome for each point increase on the satisfaction with the current work.

The odds of having the higher likelihood of pursuing a career in the NHS compared to the other likelihoods of the outcome had an increase of 71.7% ($CI_{95\%}$ 67.3%-75.8%) for each point increase in the satisfaction with the current functioning of the NHS, given the other variables constant.

Variable	p-value	OR	$CI_{95\%}$
Working hours performed	0.006	0.662	0.494-0.889
Teamwork	0.005	1.391	1.107-1.748
Existence of employment relationship	0.018	1.282	1.043-1.576
Possibility of carrying out complementary work	<0.001	0.687	0.575-0.821
Satisfaction with the current work	<0.001	1.856	1.570-2.193
Satisfaction with the current functioning of the NHS	<0.001	2.538	2.062-3.125

Table 10. Estimated effects of the retrieved predictors for the likelihood of pursuing a career in the NHS upon completion of medical residency, using a ordered logistic regression. ($CI_{95\%}$: 95% confidence interval; NHS: National Health Service; OR: odds ratio)

4.3. Relationships of studied factors between groups – specialized physicians who migrated from the Portuguese NHS, and specialty resident doctors

The correlations of the distributions of potentially associated factors between groups – specialized physicians who migrated from the Portuguese NHS and specialty residents – showed statistical significance in the great majority (table 11).

Satisfaction with the current work (r_s=-0.288, p<0.001) showed a negative weak

correlation between groups (table 11).

Positive very weak correlations were found between groups in the following factors: research opportunities in the specialized residency (r_s=0.171, p<0.001); working hours performed (r_s=0.131, p<0.001); uncomfortable hours load (r_s=0.142, p<0.001); occupation with bureaucratic or administrative work (r_s=0.103, p=0.005); remuneration (r_s=0.136, p<0.001); technical quality of the service provided (r_s=0.124, p<0.001); personal satisfaction with the work performed (r_s=0.084, p=0.022); good environment at work (r_s=0.193, p<0.001); participation in the dynamics of the service (r_s=0.148, p<0.001); situations causing emotional exhaustion (r_s=0.199, p<0.001); balance between time dedicated to work, and personal and family life (r_s=0.163, p<0.001); influence of work on your quality of life (r_s=0.143, p<0.001); possibility to perform different tasks at work (r_s=0.149, p<0.001); possibility of carrying out complementary work (r_s=0.159, p<0.001); research opportunities in a future career (r_s=0.128, p<0.001); access to equipment, infrastructure, technology and innovation (r_s=0.084, p=0.022); evolution of the functioning of the NHS (r_s=0.109, p=0.003); and satisfaction with the current functioning of the NHS (r_s=0.112, p=0.002) (table 11).

Training quality of the specialized residency (r_s=0.282, p<0.001); national homogeneity of residency (r_s=0.242, p<0.001); supervision and mentorship by tutor (r_s=0.278, p<0.001); teaching opportunities in the specialized residency (r_s=0.296, p<0.001); expenses paid by themselves associated with training (r_s=0.227, p<0.001); other expenses paid by themselves associated with residency (r_s=0.248, p<0.001); interpersonal relationships with other professional classes (r_s=0.220, p<0.001); extreme work-related fatigue (r_s=0.257, p<0.001); possibility of choosing a workplace close to the affective circle (r_s=0.245, p<0.001); training opportunities in a future career (r_s=0.221, p<0.001); teaching opportunities in a future career (r_s=0.241, p<0.001); and personal identification with the foundational principles and values of the NHS (r_s=0.223, p<0.001) showed a positive weak relationship between groups (table 11).

Positive moderate relationships were discovered between groups in supervision and support by specialized doctors (r_s=0.337; p<0.001); teamwork (r_s=0.305; p<0.001); existence of situations of moral harassment in the workplace (r_s=0.395; p<0.001); existence of situations of discrimination in the workplace (r_s=0.383; p<0.001); and existence of employment relationship (r_s=0.359; p<0.001) (table 11).

Existence of threats, violence and crime in the workplace (r_s=0.422; p<0.001) showed a positive strong correlation between groups (table 11).

Variable	r_s	p-value
Specialized Medical Residency		
Training quality	**0.282**	**<0.001**
National homogeneity of residency	**0.242**	**<0.001**
Supervision and mentorship by tutor	**0.278**	**<0.001**
Teaching opportunities	**0.296**	**<0.001**
Research opportunities	**0.171**	**<0.001**
Expenses paid by themselves associated with training	**0.227**	**<0.001**
Other expenses paid by themselves associated with residency	**0.248**	**<0.001**
Work characteristics		
Working hours performed	**0.131**	**<0.001**
Uncomfortable hours load	**0.142**	**<0.001**
Occupation with bureaucratic or administrative work	**0.103**	**0.005**
Remuneration	**0.136**	**<0.001**
Supervision and support by specialized doctors	**0.337**	**<0.001**
Teamwork	**0.305**	**<0.001**
Equipment, infrastructure, technologies and innovation available	0.022	0.560
Technical quality of the service provided	**0.124**	**<0.001**
Feedback and work experiences		
Personal satisfaction with the work performed	**0.084**	**0.022**
Appreciation of the work by the recipient of the service provided	-0.008	0.827
Appreciation of the work by peers	0.067	0.071
Appreciation of your work by superiors	0.030	0.422
Interpersonal relationships with other professional classes	**0.220**	**<0.001**
Good environment at work	**0.193**	**<0.001**
Participation in the dynamics of the service	**0.148**	**<0.001**
Involvement with the institution where you work and work commitment	0.030	0.413
Personal and family impact of work		
Extreme work-related fatigue	**0.257**	**<0.001**
Situations causing emotional exhaustion	**0.199**	**<0.001**
Existence of threats, violence and crime in the workplace	**0.422**	**<0.001**
Existence of situations of moral harassment in the workplace	**0.395**	**<0.001**
Existence of situations of discrimination in the workplace	**0.383**	**<0.001**
Balance between time dedicated to work, and personal and family life	**0.163**	**<0.001**
Influence of work on your quality of life	**0.143**	**<0.001**
Perspectives on the (future) career		
Career progression prospects	**0.354**	**<0.001**
Existence of employment relationship	**0.359**	**<0.001**
Possibility of choosing a workplace close to the affective circle	**0.245**	**<0.001**
Possibility to perform different tasks at work	**0.149**	**<0.001**
Choice of working hours	-0.043	0.248
Possibility of carrying out complementary work	**0.159**	**<0.001**
Training opportunities	**0.221**	**<0.001**
Teaching opportunities	**0.241**	**<0.001**

Variable	r_s	p-value
Research opportunities	**0.128**	**<0.001**
Access to equipment, infrastructure, technology and innovation	**0.084**	**0.022**
Personal identification with the foundational principles and values of the NHS	**0.223**	**<0.001**
Evolution of the functioning of the NHS	**0.109**	**0.003**
Satisfaction and career in the NHS		
Satisfaction with the specialty chosen as a future career	0.069	0.060
Satisfaction with the current work	**-0.288**	**<0.001**
Satisfaction with the current functioning of the NHS	**0.112**	**0.002**

Table 11. Correlations of the studied factors between groups: specialist physicians who migrated from the Portuguese NHS, and resident physicians. (NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

5. DISCUSSION

As presented in the literature review, physician retention is an important and global issue that conditions resource planning and populations' access to quality health care. The improving knowledge about factors associated with physician retention allows for better planning of policies and strategies that promote more robust health systems.

Younger specialist physicians and the ones that concluded medical residency more recently had more likelihood of returning to a career in the NHS, that might be explained by the career length and stability achieved by older specialist physicians. These findings are not described in the literature reviewed.

The training quality of the specialized residency is discussed on literature as a reason of migration of physicians, mainly, to other countries (Brugha et al., 2020; Clarke et al., 2017; Glinos, 2015; Scharer & Freitag, 2015; Seitz et al., 2017). In this research, specialist physicians who gave more importance to training quality in the residency were more likely to return to a career in the NHS, which is supported by the literature (Associação Portuguesa de Administradores Hospitalares et al., 2022) and might be explained by the organization of medical training centred on public services in Portugal (Simões et al., 2017).

Specialist physicians who revealed teamwork as an important factor had more likelihood of returning to career in the NHS, which might be caused by the perception of physicians about the organization based on teams of the Portuguese NHS in contrast to the traditional private practice based on individual direct providers. The literature shows teamwork as a positive characteristic of public sector in Portugal (Associação Portuguesa de Administradores Hospitalares et al., 2022), but also as a motivator of migration (Humphries et al., 2015; McGowan et al., 2013).

The greater importance expressed towards the existence of employment relationship was correlated to an higher likelihood of returning to a career in the NHS. This finding might be explained by the greater stability of work in the Portuguese public sector compared to the private practice, which traditionally relies on the provision of services by self-employed doctors (Loureiro et al., 2009). The fear of unemployment and existence of employment relationship are described in literature as causes of migration (Filippidis, 2016; Moris et al., 2017).

The specialist physicians, who migrated from the Portuguese NHS, that showed more satisfaction with their current work were less likely to return to a career in the NHS. Even

though, there was not found research about the likelihood of returning to national health services, the relationship between unsatisfaction and migration exists (Brugha et al., 2020; Cronin et al., 2019; Filippidis, 2016; Gilles et al., 2014; Hayes et al., 2019; Heponiemi et al., 2019; Moris et al., 2017; Perreira et al., 2018; Terregino et al., 2021; World Health Organization, 2016).

There is described in literature the connection between satisfaction with management and retention of physicians (Guilbert, 2006), which supports the increase likelihood of returning to a career in the NHS in physicians who were more satisfied with the current functioning of the NHS.

83.6% of the specialist physicians that participated in the study had an aggregated low intention to return to a career in the Portuguese NHS, which was concordant to the 85.5% of them who had an aggregated low satisfaction with the current functioning of the NHS and, hypothetically, might be the main cause of this outcome. There were no studies found related to the likelihood of specialist physicians returning to national health services, but there is described a direct association between intention to change jobs and real change (Heponiemi et al., 2019).

The obtained ordered logistic regression model established significant relationships between the likelihood of specialized physicians who migrated from the Portuguese NHS returning to a career in the NHS and 3 predictive factors: teamwork, satisfaction with the current work, and satisfaction with the current functioning of the NHS.

Holding other variables constant, the odds of having the higher likelihood of returning to a career in the NHS enlarged with the increase in each of the following predictors: importance given to teamwork and satisfaction with the current functioning of the NHS, compared to the other likelihoods of the outcome.

In contrast, an increase in the satisfaction with the current work was associated with decrease in the odds of having the higher likelihood of pursuing a career in the Portuguese NHS upon completion of medical residency, given the other variables constant.

Since there are no known studies on predictive models in the retention of physicians, this model should serve to reflect on the importance of these factors for physicians who migrated from the NHS and how the system should be improved, as far as concerns its inefficiencies and existing policies with a view to reversing this exodus.

Expenses paid by themselves associated with training in the specialized residency is a motivator of migration found in literature (Brugha et al., 2020), which was concordant to

the findings of this study. There was an association between higher importance given to expenses paid by themselves associated with training in the specialized residency and lower likelihood of pursuing a career in the NHS.

Resident physicians who declared greater importance to working hours performed and uncomfortable hours load had less likelihood to pursue a career in the NHS. The literature shows similar data, associating higher working hours loads to migration (Associação Portuguesa de Administradores Hospitalares et al., 2022; Clarke et al., 2017; Gilles et al., 2014; Guilbert, 2006; Scharer & Freitag, 2015; Seitz et al., 2017).

Occupation with bureaucratic or administrative work is described in literature as motivator of resigning (Scharer & Freitag, 2015; Seitz et al., 2017). This study found an association between the greater importance given to occupation with bureaucratic or administrative work and the lower likelihood of pursuing a career in the NHS.

There was a relationship between the importance of equipment, infrastructure, technologies and innovation available, and the likelihood of pursuing a career in the NHS. As suggested by the literature reviewed, resident physicians who attributed high importance to working physical setting had higher likelihood of migration from the health service (Associação Portuguesa de Administradores Hospitalares et al., 2022; Clarke et al., 2017; Guilbert, 2006; Humphries et al., 2015; McGowan et al., 2013).

Extreme work-related fatigue (Clarke et al., 2017; Cronin et al., 2019; Gilles et al., 2014; Guilbert, 2006; Hayes et al., 2019; Humphries et al., 2015; McGowan et al., 2013; Rich et al., 2016; Tak et al., 2017; Tasker et al., 2014; Terregino et al., 2021; World Health Organization, 2016) and situations causing emotional exhaustion (Clarke et al., 2017; Crowe et al., 2017; Guilbert, 2006; Rich et al., 2016; Shanafelt et al., 2012; Terregino et al., 2021) are established in literature as causes of migration of resident physicians. In this study, resident physicians who indicated a great importance in these factors showed a lower likelihood of pursuing a career in the NHS.

Junior physicians who gave more importance to career progression prospects were less likely to pursue a career in the NHS. As in literature, career progression prospects is identified as a motivator of migration (Clarke et al., 2017; Glinos, 2015; Guilbert, 2006), but it is also described as a reason of dissatisfaction in the private sector (Associação Portuguesa de Administradores Hospitalares et al., 2022).

Choice of working hours (Humphries et al., 2015; McGowan et al., 2013; Tak et al., 2017) and possibility of carrying out complementary work (Tak et al., 2017) are established

as causes of migration in the literature revised. The data of this study showed an association between high levels of importance of these factors related to physician autonomy and low likelihood of pursuing a career in the NHS.

The resident physician who gave more importance to remuneration had less likelihood of pursuing a career in the NHS. This finding is supported by the literature, which describes remuneration as motivator of migration (Clarke et al., 2017; Scharer & Freitag, 2015; Seitz et al., 2017) and as a weakness of the public sector (Associação Portuguesa de Administradores Hospitalares et al., 2022).

Supervision and support by specialized doctors is defined by the studies reviewed as a cause of physician migration (Boynton & Greenhalgh, 2004; Brugha et al., 2020; Clarke et al., 2017; Crowe et al., 2017; Heponiemi et al., 2019; Humphries et al., 2015; McGowan et al., 2013). In this study, the more importance given to supervision and support by specialist physicians was associated to higher likelihood of pursuing a career in the NHS, which might be explained by the perception of resident physicians about the differences of work organization between public and private sectors.

Resident physicians who revealed teamwork as an important factor had more likelihood of pursuing a career in the NHS, which might be explained by the perception about the team-based organization of the Portuguese NHS in contrast to the traditional private practice based on individual direct providers (Associação Portuguesa de Administradores Hospitalares et al., 2022). In contrast, other literature reviewed presents teamwork as a motivator of migration (Humphries et al., 2015; McGowan et al., 2013).

The technical quality of the service provided was also identified as a motivator of medical migration (Guilbert, 2006; Humphries et al., 2015; McGowan et al., 2013). The junior physicians respondents of this study who classified this factor as more important had an associated higher likelihood of pursuing a career in the NHS. This connection might be caused by the perception of resident physician about an higher standard of care in the public sector.

The importance given to the participation in the dynamics of the service was associated to a greater likelihood of pursuing a career in the NHS among resident physicians. Although the participation in the dynamics of the service is a promoter of medical migration in the literature review (Clarke et al., 2017), this result might be explained by their perception of greater possibility of participating in the decision in the public services, possibly influenced by a working experience centred in the NHS.

The fear of unemployment and existence of employment relationship is reported in literature as reasons of migration (Filippidis, 2016; Moris et al., 2017). The great importance declared towards the existence of employment relationship was associated with an higher likelihood of pursuing a career in the NHS. This finding might be enlightened by the greater stability of employment in the Portuguese public sector in contrast to the private practice, which usually relies on the provision of services by self-employed doctors (Loureiro et al., 2009).

Resident physicians who gave more importance to the personal identification with the foundational principles and values and the evolution of the functioning of the NHS had more likelihood of pursuing a career in the NHS, which is supported by literature that describes institutional identification as an important factor for retaining medical professionals (Gilles et al., 2014).

Job satisfaction is described as an important promoter of retention of medical staff in literature (Brugha et al., 2020; Cronin et al., 2019; Filippidis, 2016; Hayes et al., 2019; Heponiemi et al., 2019; Moris et al., 2017; Perreira et al., 2018; Tak et al., 2017; Terregino et al., 2021; World Health Organization, 2016), which is in accordance to the relationships between higher satisfaction with the specialty chosen as a future career and greater likelihood of pursuing a career in the NHS, and higher satisfaction with the current work and greater likelihood of the same outcome.

There is stated in literature an association between satisfaction with management and retention of doctors (Guilbert, 2006), which supports the increase likelihood of returning to a career in the NHS in physicians who were more satisfied with the current functioning of the NHS.

The likelihood of pursuing a career in the Portuguese NHS upon completion of medical residency was low in 22.6%, intermediate in 39.1% and high in 38.4% among the resident physicians who participated in the study. Although there is research on the migration intention among recently graduated doctors (Lambert et al., 2018; Pantenburg et al., 2018; Ramos & Alves, 2017; Suciu et al., 2017), no studies were found on resident physicians with comparing information. However, literature shows that intention to change jobs had a direct association with real change, making it a key forecaster of resigning (Heponiemi et al., 2019).

The obtained ordered logistic regression model established significant relationships between the likelihood of resident physicians pursuing a career in the Portuguese NHS and 6 predictive factors: working hours performed, teamwork, existence of employment

relationship, possibility of carrying out complementary work, satisfaction with the current work, and satisfaction with the current functioning of the NHS.

Holding other variables constant, the odds of having the higher likelihood of pursuing a career in the NHS decreased with the increase in each of the following predictors: importance given to working hours performed and possibility of carrying out complementary work, compared to the other likelihoods of the outcome.

In contrast, increased importance given to teamwork and to existence of employment relationship, increased satisfaction with the current work and with the current functioning of the NHS were individually associated with increased odds of having the higher likelihood of pursuing a career in the Portuguese NHS upon completion of medical residency, given the other variables constant.

According to the literature consulted, there is no studies known using regression models to study association between predictors and outcomes of retention of physicians. Therefore, the predictors of the regression model obtained should serve as the main focus and evidence in the construction of public policies for the management of medical human resources in the NHS, as well as in the formulation of management guidelines for the various units that comprise it.

Regarding the relationships of potentially associated factors between groups – specialized physicians who migrated from the Portuguese NHS and specialty residents –, there was a negative correlation of the satisfaction with the current work between groups, which represented the distinct work experiences of physicians in the public and private sectors. In the literature reviewed, there was not found data comparing satisfaction of doctors according to the type of health service in which physicians perform their job.

Furthermore, the intensity of correlations showed the intergenerational similarities given by physicians to factors related to their work experience and perspectives. These results supported the increased importance of factors such as threats, violence and crime in the workplace as it is described in literature, consequence of the increment of threats and different degrees of violence by patients (Guilbert, 2006; Heponiemi et al., 2019).

By contrast, the absence of relationships in some studied factors and the low intensity relationships in others, might be explained by the different contexts experienced by the physicians of distinct groups. The different generational profiles among physicians and the existence of generational disparities emphasize the importance to promote change in the organization of health services in order to respond to the worries of an health workforce in

transformation (Bickel & Brown, 2005; Connell, 2014; Humphries et al., 2018; Jovic et al., 2006). There were no studies found in literature, comparing factors associated with migration or retention between groups of doctors of different generations or performing their work in public versus private sectors.

6. CONCLUSIONS

Health workforce is a key element of health systems. Their distribution and accessibility to population determine the health service coverage. Difficulties in training, development, retention and performance of human resources are being observed in diverse countries, restricting the realization of public health priorities.

The management strategies of health workers careers must focus on all stages from entry and workforce level, to exit level, and the supervision of this process should optimize retention and save significant expenses. Although the monetary damage is present, the loss of health workers can result in the collapse of unbalanced health systems, increasing deaths within the population.

This study was planned to assess the factors associated with the retention of physicians in the present context and the future perspectives in the Portuguese NHS. The main objectives of the study were to identify factors associated with the retention of doctors in the present context, to determine the intention of present resident physicians to pursue a future career in the Portuguese NHS, and to describe independent factors associated with the retention of these doctors.

The data was collected, between 10th of May and 16th of June of 2022, through structured self-completion questionnaires with convenience and snowball samples of physicians that concluded medical residency and migrated from the Portuguese NHS, and resident doctors.

159 specialist physicians responded the questionnaire. There were found correlations between the likelihood of returning to a career in the NHS and each one of the following factors: age, satisfaction with the current work, training quality of the specialized medical residency, teamwork, existence of employment relationship, year of conclusion of medical residency and satisfaction with the current functioning of the NHS.

83.6% of the respondents expressed a low likelihood of returning to a career in the NHS.

The ordered logistic regression model retrieved teamwork, satisfaction with the current work, and satisfaction with the current functioning of the NHS as predictors for the likelihood of specialized physicians who migrated from the Portuguese NHS returning to a career in the NHS.

576 resident physicians participated in the study. 21 of the factors studied presented

statistically significant correlations with the likelihood of pursuing a career in the NHS upon completion of the specialty. They were expenses paid by themselves associated with training in the specialized residency; working hours performed; uncomfortable hours load; occupation with bureaucratic or administrative work; equipment, infrastructure, technologies and innovation available; extreme work-related fatigue; situations causing emotional exhaustion; career progression prospects; choice of working hours; possibility of carrying out complementary work; remuneration; supervision and support by specialized doctors; teamwork; technical quality of the service provided; participation in the dynamics of the service; existence of employment relationship; personal identification with the foundational principles and values of the NHS; evolution of the functioning of the NHS; satisfaction with the specialty chosen as a future career showed; satisfaction with the current work; and satisfaction with the current functioning of the NHS.

Concerning the likelihood of pursuing a career in the NHS upon completion of the specialty, it was low in 22.6%, medium in 39.1% and high in 38.4% of the resident physicians.

The ordered logistic regression model retrieved working hours performed, teamwork, existence of employment relationship, possibility of carrying out complementary work, satisfaction with the current work, and satisfaction with the current functioning of the NHS as predictors for the likelihood of resident physicians pursuing a career in the NHS upon completion of the medical specialty.

In relation to the relationships of potentially associated factors between groups – specialized physicians who migrated from the Portuguese NHS and specialty residents –, the variance of relationships in the studied factors might be explained by the distinctive generational profiles among physicians and the existence of generational gaps.

As a result of the literature review, it was concluded that is a lack of research about the factors influencing the retention of physicians in health care systems and of instruments validated to address this type of research. Multiple factors are indicated as potential motivators of retention or migration of physicians, but only limited studies tried to associate and correlate these factors with the outcome. This is the first study of its kind in Portugal and the only known, internationally, that studied relationships between the studied factors and the intention to pursue a career in a national health service, compared resident and specialized doctors, and developed predictive models for the respective outcomes.

Thus, the results obtained in this research, in particular the predictive factors resulting from the regression models, should be considered in the process of reflection, discussion

and construction of strong and transformative policies and plans for the management of medical human resources in the Portuguese NHS, following the recommendations of the WHO.

Ideally, sampling strategy would include randomization, which is conditioned by the access to the population. Even though some entities collaborated with the distribution of questionnaires (one Regional Council of the PMA, regional or national Resident Physicians Associations and Medical Specialties Associations), no institution with national coverage of all physicians accepted to cooperate with this study. This was a great obstacle and represents a limitation of this study.

Concerning the research instruments design, there were no previous questionnaires found in literature addressing this subject, which represented a complex process of construction of research instruments.

In relation to the participants of this study, there is the possibility that unsatisfied people might respond these type of questionaries more frequently, and this must be taken in consideration when interpreting the results.

The objectives of these study were to describe factors and associations between factors and outcomes. Therefore, the results cannot be interpreted as cause-effect relationships.

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ANNEXES

Annex 1. Questionnaire for specialized physicians who migrated from the Portuguese NHS.

Variable	Type of question
General Information	
Age	Open-ended numerical
Nationality	Multiple choice – single response [1]
Gender	Multiple choice – single response [2]
Marital status	Multiple choice – single response [3]
Dependents	Dichotomic – yes or no
Residency Information	
Year of conclusion of residency	Open-ended numerical
Specialty of residency	Multiple choice – single response [4]
Local of residency	Multiple choice – single response [5]

[1] Spain, Portugal, or other.

[2] Female, male, or non-binary.

[3] Married, divorced, single, domestic partnership, or widowed.

[4] Anaesthesiology, Angiology/vascular surgery, Cardiac surgery, Cardiology, Child and adolescent psychiatry, Clinical haematology, Clinical pathology, Clinical pharmacology, Dermatology, Endocrinology/nutrition, Gastroenterology, General and family medicine, General surgery, Gynaecology/obstetrics, Immuno-allergology, Immuno-hemotherapy, Infectious diseases, Intensive medicine, Internal medicine, Legal medicine, Maxillofacial surgery, Medical genetics, Medical oncology, Nephrology, Neurology, Neuroradiology, Neurosurgery, Nuclear medicine, Occupational medicine, Ophthalmology, Orthopaedics, Otorhinolaryngology, Paediatric cardiology, Paediatric surgery, Paediatrics, Pathological anatomy, Physical and rehabilitation medicine, Plastic surgery, Psychiatry, Public health, Pulmonology, Radiology, Radio-oncology, Rheumatology, Sports medicine, Stomatology, Thoracic surgery, or Urology.

[5] Alcoitão Rehabilitation Medical Centre, Algarve Hospital Centre, Alto Ave Hospital Centre, Alto Minho LHU, Armed Forces Hospital – Lisboa, Arouca Mercy Hospital, Arrábida Hospital, Baixo Alentejo LHU, Baixo Vouga Hospital Centre, Barreiro Montijo Hospital Centre, Beatriz Ângelo Hospital, Braga Hospital, Cascais Hospital, Castelo Branco LHU, Champalimaud Foundation, Coimbra Hospital and University Centre, Cova da Beira Hospital Centre, CUF Descobertas Hospital, CUF Infante Santo Hospital, CUF Porto Hospital, Divino Espírito Santo of Ponta Delgada Hospital, Entre-Douro and Vouga Hospital Centre, Espírito Santo of Évora Hospital, Figueira da Foz District Hospital, Funchal Central Hospital, Garcia de Orta Hospital, Guarda LHU, Horta Hospital, Institute of Ophthalmology Dr. Gama Pinto, Leiria Hospital Centre, Lisboa Central Hospital Centre, Lisboa Norte Hospital Centre, Lisboa Ocidental Hospital Centre, Litoral Alentejano LHU, Lusíadas Hospital, Luz Hospital, Magalhães Lemos Hospital, Matosinhos LHU, Médio Ave Hospital Centre, Médio Tejo Hospital Centre, National Centre of Sports Medicine of Lisbon, National Centre of Sports Medicine of Porto,

Variable	Type of question
Specialized Medical Residency	
Training quality	5-point Likert-type for importance
National homogeneity of residency	5-point Likert-type for importance
Supervision and mentorship by tutor	5-point Likert-type for importance
Teaching opportunities	5-point Likert-type for importance
Research opportunities	5-point Likert-type for importance
Expenses paid by themselves associated with training	5-point Likert-type for importance
Other expenses paid by themselves associated with residency	5-point Likert-type for importance
Work characteristics	
Working hours performed	5-point Likert-type for importance
Uncomfortable hours load	5-point Likert-type for importance
Occupation with bureaucratic or administrative work	5-point Likert-type for importance
Remuneration	5-point Likert-type for importance
Supervision and support by specialized doctors	5-point Likert-type for importance

Nordeste LHU, Norte Alentejano LHU, Norte Rehabilitation Centre, Oeste Hospital Centre, Porto Hospital Centre, Portuguese Oncology Institute of Coimbra Francisco Gentil, Portuguese Oncology Institute of Lisboa Francisco Gentil, Portuguese Oncology Institute of Porto Francisco Gentil, Portuguese Rheumatology Institute, Póvoa/Vila do Conde Hospital Centre, Prelada Hospital, Prof. Dr. Fernando Fonseca Hospital, Psychiatric Hospital Centre of Lisbon, Rehabilitation Medicine Centre of the Centre Region Rovisco Pais, Santa Ana Orthopaedic Hospital – Parede, Santa Maria Maior Hospital – Barcelos, Santarém District Hospital, Santo Espirito of Terceira Island Hospital, São João Hospital Centre, Senhora da Oliveira Hospital – Guimarães, Setúbal Hospital Centre, Tâmega e Sousa Hospital Centre, Tondela-Viseu Hospital Centre, Trás-os-Montes and Alto Douro Hospital Centre, Vila Franca de Xira Hospital, Vila Nova de Gaia/Espinho Hospital Centre, Alentejo Central GHC, Algarve I GHC, Algarve II GHC, Algarve III GHC, Almada/Seixal GHC, Alto Ave GHC, Alto Trás-os-Montes GHC, Amadora GHC, Arco Ribeirinho GHC, Arrábida GHC, Ave GHC, Baixo Mondego GHC, Baixo Vouga GHC, Bom Jesús Health Centre, Camacha Health Centre, Canhas Health Centre, Caniço Health Centre, Cascais GHC, Cávado I GHC, Cávado II GHC, Cávado III GHC, Cova da Beira GHC, Dão Lafões GHC, Douro I GHC, Douro II GHC, Entre Douro e Vouga I GHC, Entre Douro e Vouga II GHC, Estreito de Câmara de Lobos Health Centre, Estuário do Tejo GHC, Faial Island Health Unit, Funchal Zona I GHC, Funchal Zona II GHC, Graciosa Island Health Unit, Grande Porto I GHC, Grande Porto II GHC, Grande Porto III GHC, Grande Porto IV GHC, Grande Porto V GHC, Grande Porto VI GHC, Grande Porto VII GHC, Grande Porto VIII GHC, Lezíria GHC, Lisboa Central GHC, Lisboa Norte GHC, Lisboa Ocidental e Oeiras GHC, Loures/Odivelas GHC, Médio Tejo GHC, Monte Health Centre, Oeste Norte GHC, Oeste Sul GHC, Pico Island Health Unit, Pinhal Interior Norte GHC, Pinhal Interior Sul GHC, Pinhal Litoral GHC, Porto da Cruz Health Centre, Santo António Serra Health Centre, São Jorge Island Health Unit, São Miguel Island Health Unit, Sintra GHC, Tâmega I GHC, Tâmega II GHC, Tâmega III GHC, Terceira Island Health Unit, Trás-os-Montes GHC, Zona Câmara de Lobos GHC, Zona Leste GHC, Zona Oeste GHC, Legal Medicine National Institute – North Delegation, Legal Medicine National Institute – Centre Delegation, Legal Medicine National Institute – South Delegation, Public Health National School, abroad, or other.

Variable	Type of question
Teamwork	5-point Likert-type for importance
Equipment, infrastructure, technologies, and innovation available	5-point Likert-type for importance
Technical quality of the service provided	5-point Likert-type for importance
Feedback and work experiences	
Personal satisfaction with the work performed	5-point Likert-type for importance
Appreciation of the work by the recipient of the service provided	5-point Likert-type for importance
Appreciation of the work by peers	5-point Likert-type for importance
Appreciation of your work by superiors	5-point Likert-type for importance
Interpersonal relationships with other professional classes	5-point Likert-type for importance
Good environment at work	5-point Likert-type for importance
Participation in the dynamics of the service	5-point Likert-type for importance
Involvement with the institution where you work and work commitment	5-point Likert-type for importance
Personal and family impact of work	
Extreme work-related fatigue	5-point Likert-type for importance
Situations causing emotional exhaustion	5-point Likert-type for importance
Existence of threats, violence, and crime in the workplace	5-point Likert-type for importance
Existence of situations of moral harassment in the workplace	5-point Likert-type for importance
Existence of situations of discrimination in the workplace	5-point Likert-type for importance
Balance between time dedicated to work and personal and family life	5-point Likert-type for importance
Influence of work on your quality of life	5-point Likert-type for importance
Perspectives on the career	
Career progression prospects	5-point Likert-type for importance
Existence of employment relationship	5-point Likert-type for importance
Possibility of choosing a workplace close to the affective circle	5-point Likert-type for importance
Possibility to perform different tasks at work	5-point Likert-type for importance
Choice of working hours	5-point Likert-type for importance
Possibility of carrying out complementary work	5-point Likert-type for importance
Training opportunities	5-point Likert-type for importance
Teaching opportunities	5-point Likert-type for importance
Research opportunities	5-point Likert-type for importance
Access to equipment, infrastructure, technology, and innovation	5-point Likert-type for importance
Personal identification with the foundational principles and values of the NHS	5-point Likert-type for importance
Evolution of the functioning of the NHS	5-point Likert-type for importance
Satisfaction and career in the National Health Service	
Satisfaction with the specialty chosen as a future career	5-point Likert-type for satisfaction
Satisfaction with the current work	5-point Likert-type for satisfaction
Satisfaction with the current functioning of the NHS	5-point Likert-type for satisfaction
Typology of work currently performed	Multiple choice - many answers [6]
Likelihood of returning to a career in the NHS	5-point Likert-type for probability

[6] Clinic in Portugal, clinic abroad, teacher in Portugal, teacher abroad, consultant in Portugal, consultant abroad, and/or other.

Annex 2. Questionnaire for specialty resident physicians.

Variable	Type of question
General Information	
Age	Open-ended numerical
Nationality	Multiple choice – single response [7]
Gender	Multiple choice – single response [8]
Marital status	Multiple choice – single response [9]
Dependents	Dichotomic – yes or no
Residency Information	
Year of residency	Multiple choice – single response [10]
Specialty of residency	Multiple choice – single response [11]
Local of residency	Multiple choice – single response [12]

[7] Spain, Portugal, or other.

[8] Female, male, or non-binary.

[9] Married, divorced, single, domestic partnership or widowed.

[10] 1st, 2nd, 3rd, 4th, 5th, or 6th.

[11] Anaesthesiology, Angiology/vascular surgery, Cardiac surgery, Cardiology, Child and adolescent psychiatry, Clinical haematology, Clinical pathology, Clinical pharmacology, Dermatology, Endocrinology/nutrition, Gastroenterology, General and family medicine, General surgery, Gynaecology/obstetrics, Immuno-allergology, Immuno-hemotherapy, Infectious diseases, Intensive medicine, Internal medicine, Legal medicine, Maxillofacial surgery, Medical genetics, Medical oncology, Nephrology, Neurology, Neuroradiology, Neurosurgery, Nuclear medicine, Occupational medicine, Ophthalmology, Orthopaedics, Otorhinolaryngology, Paediatric cardiology, Paediatric surgery, Paediatrics, Pathological anatomy, Physical and rehabilitation medicine, Plastic surgery, Psychiatry, Public health, Pulmonology, Radiology, Radio-oncology, Rheumatology, Sports medicine, Stomatology, Thoracic surgery, or Urology.

[12] Alcoitão Rehabilitation Medical Centre, Algarve Hospital Centre, Alto Ave Hospital Centre, Alto Minho LHU, Armed Forces Hospital – Lisboa, Arouca Mercy Hospital, Arrábida Hospital, Baixo Alentejo LHU, Baixo Vouga Hospital Centre, Barreiro Montijo Hospital Centre, Beatriz Ângelo Hospital, Braga Hospital, Cascais Hospital, Castelo Branco LHU, Champalimaud Foundation, Coimbra Hospital and University Centre, Cova da Beira Hospital Centre, CUF Descobertas Hospital, CUF Infante Santo Hospital, CUF Porto Hospital, Divino Espírito Santo of Ponta Delgada Hospital, Entre-Douro and Vouga Hospital Centre, Espírito Santo of Évora Hospital, Figueira da Foz District Hospital, Funchal Central Hospital, Garcia de Orta Hospital, Guarda LHU, Horta Hospital, Institute of Ophthalmology Dr. Gama Pinto, Leiria Hospital Centre, Lisboa Central Hospital Centre, Lisboa Norte Hospital Centre, Lisboa Ocidental Hospital Centre, Litoral Alentejano LHU, Lusíadas Hospital, Luz Hospital, Magalhães Lemos Hospital, Matosinhos LHU, Médio Ave Hospital Centre, Médio Tejo Hospital Centre, National Centre of Sports Medicine of Lisbon, National Centre of Sports Medicine of Porto, Nordeste LHU, Norte Alentejano LHU, Norte Rehabilitation Centre, Oeste Hospital Centre, Porto Hospital Centre, Portuguese Oncology Institute of Coimbra Francisco Gentil, Portuguese Oncology Institute of Lisboa

Variable	Type of question
Specialized Medical Residency	
Training quality	5-point Likert-type for importance
National homogeneity of residency	5-point Likert-type for importance
Supervision and mentorship by tutor	5-point Likert-type for importance
Teaching opportunities	5-point Likert-type for importance
Research opportunities	5-point Likert-type for importance
Expenses paid by themselves associated with training	5-point Likert-type for importance
Other expenses paid by themselves associated with residency	5-point Likert-type for importance
Work characteristics	
Working hours performed	5-point Likert-type for importance
Uncomfortable hours load	5-point Likert-type for importance
Occupation with bureaucratic or administrative work	5-point Likert-type for importance
Remuneration	5-point Likert-type for importance
Supervision and support by specialized doctors	5-point Likert-type for importance
Teamwork	5-point Likert-type for importance
Equipment, infrastructure, technologies, and innovation available	5-point Likert-type for importance

Francisco Gentil, Portuguese Oncology Institute of Porto Francisco Gentil, Portuguese Rheumatology Institute, Póvoa/Vila do Conde Hospital Centre, Prelada Hospital, Prof. Dr. Fernando Fonseca Hospital, Psychiatric Hospital Centre of Lisbon, Rehabilitation Medicine Centre of the Centre Region Rovisco Pais, Santa Ana Orthopaedic Hospital – Parede, Santa Maria Maior Hospital – Barcelos, Santarém District Hospital, Santo Espirito of Terceira Island Hospital, São João Hospital Centre, Senhora da Oliveira Hospital – Guimarães, Setúbal Hospital Centre, Tâmega e Sousa Hospital Centre, Tondela-Viseu Hospital Centre, Trás-os-Montes and Alto Douro Hospital Centre, Vila Franca de Xira Hospital, Vila Nova de Gaia/Espinho Hospital Centre, Alentejo Central GHC, Algarve I GHC, Algarve II GHC, Algarve III GHC, Almada/Seixal GHC, Alto Ave GHC, Alto Trás-os-Montes GHC, Amadora GHC, Arco Ribeirinho GHC, Arrábida GHC, Ave GHC, Baixo Mondego GHC, Baixo Vouga GHC, Bom Jesús Health Centre, Camacha Health Centre, Canhas Health Centre, Caniço Health Centre, Cascais GHC, Cávado I GHC, Cávado II GHC, Cávado III GHC, Cova da Beira GHC, Dão Lafões GHC, Douro I GHC, Douro II GHC, Entre Douro e Vouga I GHC, Entre Douro e Vouga II GHC, Estreito de Câmara de Lobos Health Centre, Estuário do Tejo GHC, Faial Island Health Unit, Funchal Zona I GHC, Funchal Zona II GHC, Graciosa Island Health Unit, Grande Porto I GHC, Grande Porto II GHC, Grande Porto III GHC, Grande Porto IV GHC, Grande Porto V GHC, Grande Porto VI GHC, Grande Porto VII GHC, Grande Porto VIII GHC, Lezíria GHC, Lisboa Central GHC, Lisboa Norte GHC, Lisboa Ocidental e Oeiras GHC, Loures/Odivelas GHC, Médio Tejo GHC, Monte Health Centre, Oeste Norte GHC, Oeste Sul GHC, Pico Island Health Unit, Pinhal Interior Norte GHC, Pinhal Interior Sul GHC, Pinhal Litoral GHC, Porto da Cruz Health Centre, Santo António Serra Health Centre, São Jorge Island Health Unit, São Miguel Island Health Unit, Sintra GHC, Tâmega I GHC, Tâmega II GHC, Tâmega III GHC, Terceira Island Health Unit, Trás-os-Montes GHC, Zona Câmara de Lobos GHC, Zona Leste GHC, Zona Oeste GHC, Legal Medicine National Institute – North Delegation, Legal Medicine National Institute – Centre Delegation, Legal Medicine National Institute – South Delegation, Public Health National School, abroad, or other.

Variable	Type of question
Technical quality of the service provided	5-point Likert-type for importance
Feedback and work experiences	
Personal satisfaction with the work performed	5-point Likert-type for importance
Appreciation of the work by the recipient of the service provided	5-point Likert-type for importance
Appreciation of the work by peers	5-point Likert-type for importance
Appreciation of your work by superiors	5-point Likert-type for importance
Interpersonal relationships with other professional classes	5-point Likert-type for importance
Good environment at work	5-point Likert-type for importance
Participation in the dynamics of the service	5-point Likert-type for importance
Involvement with the institution where you work and work commitment	5-point Likert-type for importance
Personal and family impact of work	
Extreme work-related fatigue	5-point Likert-type for importance
Situations causing emotional exhaustion	5-point Likert-type for importance
Existence of threats, violence, and crime in the workplace	5-point Likert-type for importance
Existence of situations of moral harassment in the workplace	5-point Likert-type for importance
Existence of situations of discrimination in the workplace	5-point Likert-type for importance
Balance between time dedicated to work and personal and family life	5-point Likert-type for importance
Influence of work on your quality of life	5-point Likert-type for importance
Perspectives on the future career	
Career progression prospects	5-point Likert-type for importance
Existence of employment relationship	5-point Likert-type for importance
Possibility of choosing a workplace close to the affective circle	5-point Likert-type for importance
Possibility to perform different tasks at work	5-point Likert-type for importance
Choice of working hours	5-point Likert-type for importance
Possibility of carrying out complementary work	5-point Likert-type for importance
Training opportunities	5-point Likert-type for importance
Teaching opportunities	5-point Likert-type for importance
Research opportunities	5-point Likert-type for importance
Access to equipment, infrastructure, technology, and innovation	5-point Likert-type for importance
Personal identification with the foundational principles and values of the NHS	5-point Likert-type for importance
Evolution of the functioning of the NHS	5-point Likert-type for importance
Satisfaction and career in the National Health Service	
Satisfaction with the specialty chosen as a future career	5-point Likert-type for importance
Satisfaction with the current work	5-point Likert-type for importance
Satisfaction with the current functioning of the NHS	5-point Likert-type for importance
Likelihood of pursuing a career in the NHS upon completion of the specialty	5-point Likert-type for probability

Annex 3. Calculation of population sizes.

1. Specialized physicians who migrated from the NHS (N1)

$$N1 = total\ of\ physcians\ in\ Portugal - physicians\ without\ medical\ specialized\ residency - specialized\ physicians\ in\ the\ NHS - specialized\ physcians\ who\ were\ more\ than\ 65\ years\ old$$ [13]

$$(=)\quad N1 = 59{,}545 - 23{,}134 - 18{,}835 - (14{,}276 - 2{,}386)$$

$$(=)\quad N1 = 5{,}686$$

2. Resident physicians (N2)

$$N2 = total\ of\ resident\ physcians\ in\ Portugal - resident\ physicians\ in\ the\ general\ residency\ year$$

$$(=)\quad N2 = 8{,}906 - 2{,}179$$

$$(=)\quad N2 = 6{,}727$$

[13] [$specialized\ physcians\ who\ were\ more\ than\ 65\ years\ old = total\ physicians\ who\ were\ more\ than\ 65\ years\ old - non\ specialized\ physicians\ who\ were\ more\ than\ 65\ years\ old$]

Annex 4. General characteristics of specialized physicians who migrated from the Portuguese NHS, and correlations with the outcome: likelihood of returning to a career in the NHS. (IQR: inter-quartile range, NHS: National Health Service; r_s : Spearman's rank correlation coefficient)

		r_s	p-value
Age, median (IQR)	40,00 (34,00-48,00)	-0.224	0.005
Nationality			
Portugal, n (%)	156 (98.1%)		
Colombia, n (%)	1 (0.6%)		
Uruguay, n (%)	1 (0.6%)		
Netherlands, n (%)	1 (0.6%)		
Gender			
Female, n (%)	95 (59.7%)		
Male, n (%)	64 (40.3%)		
Marital status			
Married, n (%)	80 (50.3%)		
Divorced, n (%)	12 (7.5%)		
Single, n (%)	42 (26.4%)		
Domestic partnership, n (%)	24 (15.1%)		
Widowed, n (%)	1 (0.6%)		
Dependents		0.048	0.550
Yes, n (%)	90 (56.6%)		
No, n (%)	69 (43.4%)		

Annex 5. Medical residency characteristics of specialized physicians who migrated from the Portuguese NHS, and correlation with the outcome: likelihood of returning to a career in the NHS. (GHC: Group of Health Centres, IQR: inter-quartile range, LHU: Local Health Units, NHS: National Health Service, r_s: Spearman's rank correlation coefficient)

		r_s	p-value
Year of conclusion of residency, median (IQR)	2013,50 (2006,75-2019,00)	0.265	0.001
Specialty of residency, n (%)			
Pathological anatomy	2 (1.3%)		
Anaesthesiology	10 (6.3%)		
Cardiology	2 (1.3%)		
General surgery	5 (3.1%)		
Plastic surgery	2 (1.3%)		
Infectious diseases	7 (4.4%)		
Stomatology	2 (1.3%)		
Gynaecology/Obstetrics	6 (3.8%)		
Clinical haematology	2 (1.3%)		
Immuno-allergology	3 (1.9%)		
Sports Medicine	1 (0.6%)		
Physical and Rehabilitation Medicine	2 (1.3%)		
General and family medicine	45 (28.3%)		
Intensive medicine	1 (0.6%)		
Internal Medicine	18 (11.3%)		
Nuclear Medicine	1 (0.6%)		
Occupational Medicine	3 (1.9%)		
Nephrology	1 (0.6%)		
Neurology	2 (1.3%)		
Neuroradiology	2 (1.3%)		
Ophthalmology	4 (2.5%)		
Medical Oncology	4 (2.5%)		
Orthopaedics	6 (3.8%)		
Otorhinolaryngology	3 (1.9%)		
Clinical pathology	3 (1.9%)		
Paediatrics	4 (2.5%)		
Pulmonology	1 (0.6%)		
Psychiatry	7 (4.4%)		
Child and Adolescent Psychiatry	1 (0.6%)		
Radiology	1 (0.6%)		
Radio-oncology	1 (0.6%)		
Rheumatology	1 (0.6%)		
Public health	4 (2.5%)		
Urology	2 (1.3%)		

		r_s	p-value
Local of medical residency, n (%)			
Alto Trás-os-Montes GHC	1 (0.6%)		
Cávado I GHC	2 (1.3%)		
Entre Douro e Vouga I GHC	1 (0.6%)		
Grande Porto II GHC	2 (1.3%)		
Grande Porto III GHC	1 (0.6%)		
Grande Porto IV GHC	1 (0.6%)		
Grande Porto VI GHC	1 (0.6%)		
Grande Porto VIII GHC	1 (0.6%)		
Tâmega I GHC	1 (0.6%)		
Matosinhos LHU	4 (2.5%)		
Nordeste LHU	1 (0.6%)		
Baixo Mondego GHC	6 (3.8%)		
Baixo Vouga GHC	2 (1.3%)		
Dão Lafões GHC	4 (2.5%)		
Pinhal Interior Sul GHC	1 (0.6%)		
Pinhal Litoral GHC	2 (1.3%)		
Guarda LHU	1 (0.6%)		
Castelo Branco LHU	2 (1.3%)		
Amadora GHC	3 (1.9%)		
Arco Ribeirinho GHC	1 (0.6%)		
Arrábida GHC	1 (0.6%)		
Lisboa Norte GHC	1 (0.6%)		
Lisboa Ocidental and Oeiras GHC	1 (0.6%)		
Médio Tejo GHC	1 (0.6%)		
Oeste Norte GHC	4 (2.5%)		
Sintra GHC	1 (0.6%)		
Algarve I GHC	3 (1.9%)		
Algarve III GHC	1 (0.6%)		
São Miguel Island Health Unit	1 (0.6%)		
National School of Public Health	1 (0.6%)		
Entre-Douro and Vouga Hospital Centre	1 (0.6%)		
São João Hospital Centre	5 (3.1%)		
Trás-os-Montes e Alto Douro Hospital Centre	1 (0.6%)		
Senhora da Oliveira Hospital - Guimarães	2 (1.3%)		
Porto Hospital Centre	6 (3.8%)		
Tâmega e Sousa Hospital Centre	2 (1.3%)		
Vila Nova de Gaia/Espinho Hospital Centre	1 (0.6%)		
Portuguese Oncology Institute of Porto Francisco Gentil	1 (0.6%)		
National Centre of Sports Medicine of Porto	1 (0.6%)		
Leiria Hospital Centre	3 (1.9%)		
Tondela-Viseu Hospital Centre	1 (0.6%)		
Baixo Vouga Hospital Centre	2 (1.3%)		
Coimbra Hospital and University Centre	26 (16.4%)		

		r_s	p-value
Figueira da Foz District Hospital	1 (0.6%)		
Portuguese Oncology Institute of Coimbra Francisco Gentil	1 (0.6%)		
Barreiro Montijo Hospital Centre	1 (0.6%)		
Lisboa Norte Hospital Centre	10 (6.3%)		
Lisboa Ocidental Hospital Centre	7 (4.4%)		
Setúbal Hospital Centre	1 (0.6%)		
Oeste Hospital Centre	1 (0.6%)		
Médio Tejo Hospital Centre	2 (1.3%)		
Lisboa Central Hospital Centre	5 (3.1%)		
Garcia de Orta Hospital	1 (0.6%)		
Prof. Dr. Fernando Fonseca Hospital	3 (1.9%)		
Portuguese Oncology Institute of Lisboa Francisco Gentil	2 (1.3%)		
Espírito Santo of Évora Hospital	3 (1.9%)		
Algarve Hospital Centre	8 (5.0%)		
Santo Espirito of Terceira Island Hospital	1 (0.6%)		
Divino Espírito Santo of Ponta Delgada Hospital	2 (1.3%)		
Funchal Central Hospital	1 (0.6%)		
Abroad	3 (1.9%)		
Does not respond	1 (0.6%)		

Annex 6. Descriptive statistics of studied factors for specialized physicians who migrated from the NHS, and correlations with the outcome: likelihood of returning to a career in the NHS. (NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Variable	n (%)	r_s	p-value
Specialized Medical Residency			
Training quality		**0.156**	**0.050**
Not Important - 1	27 (17.0%)		
2	16 (10.1%)		
3	31 (19.5%)		
4	37 (23.3%)		
Extremely Important - 5	48 (30.2%)		
National homogeneity of residency		0.131	0.100
Not Important - 1	25 (15.7%)		
2	15 (9.4%)		
3	38 (23.9%)		
4	44 (27.7%)		
Extremely Important – 5	37 (23.3%)		
Supervision and mentorship by tutor		0.016	0.845
Not Important - 1	29 (18.2%)		
2	20 (12.6%)		
3	28 (17.6%)		
4	47 (29.6%)		
Extremely Important – 5	35 (22.0%)		
Teaching opportunities		0.102	0.200
Not Important - 1	30 (18.9%)		
2	27 (17.0%)		
3	55 (34.6%)		
4	27 (17.0%)		
Extremely Important – 5	20 (12.6%)		
Research opportunities		0.006	0.941
Not Important - 1	33 (20.8%)		
2	26 (16.4%)		
3	39 (24.5%)		
4	38 (23.9%)		
Extremely Important - 5	23 (14.5%)		
Expenses paid by themselves associated with training		-0.050	0.530
Not Important - 1	22 (13.8%)		
2	21 (13.2%)		
3	37 (23.3%)		
4	48 (30.2%)		
Extremely Important – 5	31 (19.5%)		
Other expenses paid by themselves associated with residency		0.073	0.358

Variable	n (%)	r_s	p-value
Not Important - 1	24 (15.1%)		
2	24 (15.1%)		
3	38 (23.9%)		
4	40 (25.2%)		
Extremely Important - 5	33 (20.8%)		
Work characteristics			
Working hours performed		0.042	0.598
Not Important - 1	4 (2.5%)		
2	6 (3.8%)		
3	12 (7.5%)		
4	29 (18.2%)		
Extremely Important - 5	108 (67.9%)		
Uncomfortable hours load		-0.046	0.569
Not Important - 1	6 (3.8%)		
2	10 (6.3%)		
3	22 (13.8%)		
4	27 (17.0%)		
Extremely Important - 5	94 (59.1%)		
Occupation with bureaucratic or administrative work		0.004	0.960
Not Important - 1	5 (3.1%)		
2	8 (5.0%)		
3	28 (17.6%)		
4	42 (26.4%)		
Extremely Important - 5	76 (47.8%)		
Remuneration		-0.049	0.540
Not Important - 1	1 (0.6%)		
2	4 (2.5%)		
3	18 (11.3%)		
4	36 (22.6%)		
Extremely Important – 5	100 (62.9%)		
Supervision and support by specialized doctors		0.072	0.370
Not Important - 1	13 (8.2%)		
2	21 (13.2%)		
3	48 (30.2%)		
4	46 (28.9%)		
Extremely Important – 5	31 (19.5%)		
Teamwork		**0.183**	**0.021**
Not Important - 1	11 (6.9%)		
2	17 (10.7%)		
3	39 (24.5%)		
4	46 (28.9%)		
Extremely Important – 5	46 (28.9%)		
Equipment, infrastructure, technologies and innovation available		0.010	0.900
Not Important - 1	7 (4.4%)		

Variable	n (%)	r_s	p-value
2	8 (5.0%)		
3	26 (16.4%)		
4	46 (28.9%)		
Extremely Important – 5	72 (45.3%)		
Technical quality of the service provided		-0.022	0.786
Not Important - 1	2 (1.3%)		
2	9 (5.7%)		
3	15 (9.4%)		
4	46 (28.9%)		
Extremely Important – 5	87 (54.7%)		
Feedback and work experiences			
Personal satisfaction with the work performed		-0.067	0.400
Not Important – 1	2 (1.3%)		
2	0		
3	10 (6.3%)		
4	42 (26.4%)		
Extremely Important – 5	105 (66.0%)		
Appreciation of the work by the recipient of the service provided		-0.027	0.740
Not Important - 1	4 (2.5%)		
2	4 (2.5%)		
3	19 (11.9%)		
4	48 (30.2%)		
Extremely Important – 5	84 (52.8%)		
Appreciation of the work by peers		0.023	0.776
Not Important - 1	5 (3.1%)		
2	10 (6.3%)		
3	41 (25.8%)		
4	48 (30.2%)		
Extremely Important – 5	55 (34.6%)		
Appreciation of your work by superiors		0.029	0.717
Not Important - 1	5 (3.1%)		
2	11 (6.9%)		
3	33 (20.8%)		
4	47 (29.6%)		
Extremely Important – 5	63 (39.6%)		
Interpersonal relationships with other professional classes		-0.027	0.737
Not Important - 1	7 (4.4%)		
2	19 (11.9%)		
3	45 (28.3%)		
4	41 (25.8%)		
Extremely Important – 5	47 (29.6%)		
Good environment at work		0.046	0.563
Not Important - 1	5 (3.1%)		
2	6 (3.8%)		

Variable	n (%)	r_s	p-value
3	15 (9.4%)		
4	40 (25.2%)		
Extremely Important – 5	93 (58.5%)		
Participation in the dynamics of the service		-0.022	0.781
Not Important - 1	7 (4.4%)		
2	11 (6.9%)		
3	27 (17.0%)		
4	55 (34.6%)		
Extremely Important – 5	59 (37.1%)		
Involvement with the institution where you work and work commitment		0.002	0.983
Not Important - 1	5 (3.1%)		
2	15 (9.4%)		
3	27 (17.0%)		
4	57 (35.8%)		
Extremely Important – 5	55 (34.6%)		
Personal and family impact of work			
Extreme work-related fatigue		0.043	0.594
Not Important - 1	2 (1.3%)		
2	6 (3.8%)		
3	18 (11.3%)		
4	44 (27.7%)		
Extremely Important – 5	89 (56.0%)		
Situations causing emotional exhaustion		0.099	0.215
Not Important - 1	4 (2.5%)		
2	7 (4.4%)		
3	19 (11.9%)		
4	35 (22.0%)		
Extremely Important – 5	94 (59.1%)		
Existence of threats, violence and crime in the workplace		0.085	0.285
Not Important - 1	29 (18.2%)		
2	26 (16.4%)		
3	29 (18.2%)		
4	26 (16.4%)		
Extremely Important – 5	49 (30.8%)		
Existence of situations of moral harassment in the workplace		0.050	0.535
Not Important - 1	34 (21.4%)		
2	21 (13.2%)		
3	26 (16.4%)		
4	27 (17.0%)		
Extremely Important – 5	51 (32.1%)		
Existence of situations of discrimination in the workplace		-0.002	0.984
Not Important - 1	30 (18.9%)		
2	23 (14.5%)		
3	28 (17.6%)		

Variable	n (%)	r_s	p-value
4	31 (19.5%)		
Extremely Important – 5	47 (29.6%)		
Balance between time dedicated to work and personal and family life		0.001	0.994
Not Important - 1	2 (1.3%)		
2	4 (2.5%)		
3	12 (7.5%)		
4	31 (19.5%)		
Extremely Important – 5	110 (69.2%)		
Influence of work on your quality of life		0.004	0.961
Not Important - 1	0		
2	2 (1.3%)		
3	10 (6.3%)		
4	32 (20.1%)		
Extremely Important – 5	115 (72.3%)		
Perspectives on the (future) career			
Career progression prospects		0.011	0.895
Not Important - 1	17 (10.7%)		
2	19 (11.9%)		
3	43 (27.0%)		
4	37 (23.3%)		
Extremely Important – 5	43 (27.0%)		
Existence of employment relationship		**0.171**	**0.031**
Not Important - 1	19 (11.9%)		
2	21 (13.2%)		
3	39 (24.5%)		
4	43 (27.0%)		
Extremely Important – 5	37 (23.3%)		
Possibility of choosing a workplace close to the affective circle		0.084	0.290
Not Important - 1	14 (8.8%)		
2	8 (5.0%)		
3	23 (14.5%)		
4	47 (29.6%)		
Extremely Important – 5	67 (42.1%)		
Possibility to perform different tasks at work		0.028	0.725
Not Important - 1	7 (4.4%)		
2	13 (8.2%)		
3	41 (25.8%)		
4	58 (36.5%)		
Extremely Important – 5	40 (25.2%)		
Choice of working hours		-0.005	0.954
Not Important - 1	2 (1.3%)		
2	5 (3.1%)		
3	14 (8.8%)		
4	36 (22.6%)		

Variable	n (%)	r_s	p-value
Extremely Important – 5	102 (64.2%)		
Possibility of carrying out complementary work		0.065	0.415
Not Important - 1	18 (11.3%)		
2	15 (9.4%)		
3	24 (15.1%)		
4	37 (23.3%)		
Extremely Important – 5	65 (40.9%)		
Training opportunities		0.150	0.060
Not Important - 1	15 (9.4%)		
2	14 (8.8%)		
3	34 (21.4%)		
4	46 (28.9%)		
Extremely Important – 5	50 (31.4%)		
Teaching opportunities		0.153	0.054
Not Important - 1	30 (18.9%)		
2	23 (14.5%)		
3	48 (30.2%)		
4	39 (24.5%)		
Extremely Important – 5	19 (11.9%)		
Research opportunities		0.065	0.415
Not Important - 1	32 (20.1%)		
2	29 (18.2%)		
3	43 (27.0%)		
4	31 (19.5%)		
Extremely Important – 5	24 (15.1%)		
Access to equipment, infrastructure, technology and innovation		0.029	0.718
Not Important - 1	9 (5.7%)		
2	11 (6.9%)		
3	34 (21.4%)		
4	54 (34.0%)		
Extremely Important – 5	51 (32.1%)		
Personal identification with the foundational principles and values of the NHS		0.113	0.155
Not Important - 1	18 (11.3%)		
2	15 (9.4%)		
3	49 (30.8%)		
4	33 (20.8%)		
Extremely Important – 5	44 (27.7%		
Evolution of the functioning of the NHS		-0.042	0.599
Not Important - 1	15 (9.4%)		
2	12 (7.5%)		
3	26 (16.4%)		
4	37 (23.3%)		
Extremely Important – 5	69 (43.4%)		
Satisfaction and career in the NHS			

Variable	n (%)	r_s	p-value
Satisfaction with the specialty chosen as a future career		-0.061	0.445
Dissatisfied - 1	9 (5.7%)		
2	8 (5.0%)		
3	21 (13.2%)		
4	59 (37.1%)		
Extremely Satisfied – 5	62 (39.0%)		
Satisfaction with the current work		**-0.240**	**0.002**
Dissatisfied - 1	7 (4.4%)		
2	2 (1.3%)		
3	25 (15.7%)		
4	66 (41.5%)		
Extremely Satisfied – 5	59 (37.1%)		
Satisfaction with the current functioning of the NHS		**0.262**	**0.001**
Dissatisfied - 1	95 (59.7%)		
2	41 (25.8%)		
3	19 (11.9%)		
4	1 (0.6%)		
Extremely Satisfied – 5	3 (1.9%)		
Typology of work currently performed			
Clinician in Portugal	116 (73.0%)		
Clinician abroad	25 (15.7%)		
Teacher in Portugal	5 (3.1%)		
Teacher abroad	4 (2.5%)		
Consultant in Portugal	14 (8.8%)		
Consultant abroad	12 (7.5%)		
Other	10 (6.3%)		
Likelihood of returning to a career in the NHS			
Very low - 1	95 (59.7%)		
2	38 (23.9%)		
3	20 (12.6%)		
4	4 (2.5%)		
Very high – 5	2 (1.3%)		

Annex 7. Output of ordered logistic regression for the likelihood of specialized physicians who migrated from the NHS returning to a career in the NHS. (B: parameter estimates; df: degrees of freedom; Exp(B): exponentiated values of the coefficients, odds ratio; NHS: National Health Service; Sig: statistical significance, p-value)

Test of Parallel Lines[a]				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	188.864			
General	184.548[b]	4.315[c]	9	**0.889**
The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.				
a. Link function: Logit.				
b. The log-likelihood value cannot be further increased after maximum number of step-halving.				
c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.				

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	127.749	173	0.738
Scaled Deviance	127.749	173	
Pearson Chi-Square	203.034	173	1.174
Scaled Pearson Chi-Square	203.034	173	
Log Likelihood[b]	-94.432		
Akaike's Information Criterion (AIC)	202.864		
Finite Sample Corrected AIC (AICC)	203.605		
Bayesian Information Criterion (BIC)	224.346		
Consistent AIC (CAIC)	231.346		
Dependent Variable: Return_NHS Model: (Threshold), Teamwork, Satisfaction_current_work, Satisfaction_NHS			
a. Information criteria are in smaller-is-better form.			
b. The full log likelihood function is displayed and used in computing information criteria.			

Omnibus Test[a]		
Likelihood Ratio Chi-Square	df	Sig.
18.466	3	**<0.001**
Dependent Variable: Return_NHS Model: (Threshold), Teamwork, Satisfaction_current_work, Satisfaction_NHS		
a. Compares the fitted model against the thresholds-only model.		

Tests of Model Effects			
Source	Type III		
	Likelihood Ratio Chi-Square	df	Sig.
Teamwork	4.600	1	**0.032**
Satisfaction_current_work	5.082	1	**0.024**
Satisfaction_NHS	7.533	1	**0.006**
Dependent Variable: Return_NHS Model: (Threshold), Teamwork, Satisfaction_current_work, Satisfaction_NHS			

Parameter Estimates											
Parameter		B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
				Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
Threshold	[Return_NHS =1]	0.821	0.938	-1.017	2.658	0.766	1	0.381	2.272	0.362	14.270
	[Return_NHS =2]	2.181	0.951	0.317	4.045	5.261	1	0.022	8.857	1.374	57.113
	[Return_NHS =3]	3.882	1.022	1.880	5.885	14.436	1	0.000	48.536	6.551	359.593
	[Return_NHS =4]	5.019	1.176	2.715	7.324	18.228	1	0.000	151.334	15.107	1515.970
Teamwork		0.302	0.144	0.020	0.585	4.395	1	**0.036**	**1.353**	**1.020**	**1.795**
Satisfaction_current_work		-0.367	0.163	-0.687	-0.047	5.052	1	**0.025**	**0.693**	**0.503**	**0.954**
Satisfaction_NHS		0.504	0.185	0.140	0.867	7.381	1	**0.007**	**1.655**	**1.151**	**2.380**
(Scale)		1[a]									
Dependent Variable: Return_NHS Model: (Threshold), Teamwork, Satisfaction_current_work, Satisfaction_NHS											
a. Fixed at the displayed value.											

Annex 8. General characteristics of resident physicians, and correlations with the outcome: likelihood of pursuing a career in the NHS. (IQR: inter-quartile range, NHS: National Health Service, r_s: Spearman's rank correlation coefficient)

		r_s	p-value
Age, median (IQR)	29 (27-30)	-0.053	0.207
Nationality			
Spain, n (%)	1 (0.2%)		
Portugal, n (%)	573 (99.5%)		
Brazil, n (%)	2 (0.3%)		
Gender			
Female, n (%)	394 (68.4%)		
Male, n (%)	181 (31.4%)		
Non binary, n (%)	1 (0.2%)		
Marital status			
Married, n (%)	80 (13.9%)		
Divorced, n (%)	2 (0.3%)		
Single, n (%)	411 (71.4%)		
Domestic partnership, n (%)	82 (14.2%)		
Widowed, n (%)	1 (0.2%)		
Dependents		0.059	0.160
Yes, n (%)	63 (10.9%)		
No, n (%)	513 (89.1%)		

Annex 9. Medical residency characteristics of resident physicians, and correlation with the outcome: likelihood of pursuing a career in the NHS. (GHC: Group of Health Centres, LHU: Local Health Units; NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Variable	n (%)	r_s	p-value
Year of medical residency		0.004	0.918
1st	104 (18.1%)		
2nd	128 (22.2%)		
3rd	150 (26.0%)		
4th	111 (19.3%)		
5th	72 (12.5%)		
6th	11 (1.9%)		
Specialty of residency			
Pathological anatomy	14 (2.4%)		
Anaesthesiology	55 (9.5%)		
Cardiology	12 (2.1%)		
Paediatric cardiology	1 (0.2%)		
Cardiac surgery	1 (0.2%)		
General surgery	12 (2.1%)		
Maxillofacial surgery	6 (1.0%)		
Plastic surgery	2 (0.3%)		
Dermatology	3 (0.5%)		
Infectious diseases	10 (1.7%)		
Endocrinology/nutrition	3 (0.5%)		
Stomatology	3 (0.5%)		
Clinical Pharmacology	1 (0.2%)		
Gastroenterology	6 (1.0%)		
Gynaecology/Obstetrics	13 (2.3%)		
Clinical haematology	1 (0.2%)		
Immuno-allergology	3 (0.5%)		
Immuno-hemotherapy	2 (0.3%)		
Physical and Rehabilitation Medicine	13 (2.3%)		
General and family medicine	169 (29.3%)		
Intensive medicine	12 (2.1%)		
Internal Medicine	55 (9.5%)		
Nuclear Medicine	1 (0.2%)		
Occupational Medicine	2 (0.3%)		
Nephrology	8 (1.4%)		
Neurosurgery	3 (0.5%)		
Neurology	10 (1.7%)		
Neuroradiology	2 (0.3%)		
Ophthalmology	7 (1.2%)		
Medical Oncology	5 (0.9%)		

Variable	n (%)	r_s	p-value
Orthopaedics	13 (2.3%)		
Otorhinolaryngology	5 (0.9%)		
Clinical pathology	13 (2.3%)		
Paediatrics	28 (4.9%)		
Pulmonology	13 (2.3%)		
Psychiatry	28 (4.9%)		
Child and Adolescent Psychiatry	3 (0.5%)		
Radiology	8 (1.4%)		
Radio-oncology	3 (0.5%)		
Rheumatology	7 (1.2%)		
Public health	15 (2.6%)		
Urology	5 (0.9%)		
Local of medical residency			
Alto Ave GHC	1 (0.2%)		
Alto Trás-os-Montes GHC	2 (0.3%)		
Ave GHC	2 (0.3%)		
Cávado I GHC	2 (0.3%)		
Cávado II GHC	2 (0.3%)		
Douro I GHC	4 (0.7%)		
Entre Douro e Vouga I GHC	2 (0.3%)		
Entre Douro e Vouga II GHC	2 (0.3%)		
Grande Porto I GHC	2 (0.3%)		
Grande Porto II GHC	4 (0.7%)		
Grande Porto III GHC	2 (0.3%)		
Grande Porto IV GHC	1 (0.2%)		
Grande Porto VI GHC	2 (0.3%)		
Grande Porto VII GHC	4 (0.7%)		
Grande Porto VIII GHC	4 (0.7%)		
Tâmega I GHC	2 (0.3%)		
Tâmega II GHC	2 (0.3%)		
Matosinhos LHU	14 (2.4%)		
Alto Minho LHU	5 (0.9%)		
Nordeste LHU	4 (0.7%)		
Baixo Mondego GHC	20 (3.5%)		
Baixo Vouga GHC	14 (2.4%)		
Cova da Beira GHC	1 (0.2%)		
Dão Lafões GHC	14 (2.4%)		
Pinhal Interior Norte GHC	4 (0.7%)		
Pinhal Litoral GHC	7 (1.2%)		
Guarda LHU	6 (1.0%)		
Castelo Branco LHU	4 (0.7%)		
Almada/Seixal GHC	1 (0.2%)		
Amadora GHC	4 (0.7%)		
Arco Ribeirinho GHC	4 (0.7%)		

Variable	n (%)	r_s	p-value
Arrábida GHC	4 (0.7%)		
Cascais GHC	2 (0.3%)		
Estuário do Tejo GHC	4 (0.7%)		
Lezíria GHC	1 (0.2%)		
Lisboa Central GHC	3 (0.5%)		
Lisboa Norte GHC	1 (0.2%)		
Lisboa Ocidental and Oeiras GHC	2 (0.3%)		
Loures/Odivelas GHC	7 (1.2%)		
Médio Tejo GHC	2 (0.3%)		
Oeste Norte GHC	4 (0.7%)		
Oeste Sul GHC	7 (1.2%)		
Sintra GHC	4 (0.7%)		
Baixo Alentejo LHU	1 (0.2%)		
Alentejo Central GHC	8 (1.4%)		
Norte Alentejano LHU	3 (0.5%)		
Litoral Alentejano LHU	2 (0.3%)		
Algarve I GHC	4 (0.7%)		
Algarve II GHC	1 (0.2%)		
São Miguel Island Health Unit	2 (0.3%)		
Terceira Island Health Unit	1 (0.2%)		
Zona Leste GHC	1 (0.2%)		
Zona Câmara de Lobos GHC	2 (0.3%)		
Estreito de Câmara de Lobos Health Centre	1 (0.2%)		
Bom Jesús Health Centre	1 (0.2%)		
Póvoa/Vila do Conde Hospital Centre	1 (0.2%)		
Entre-Douro and Vouga Hospital Centre	4 (0.7%)		
São João Hospital Centre	21 (3.6%)		
Trás-os-Montes e Alto Douro Hospital Centre	13 (2.3%)		
Senhora da Oliveira Hospital - Guimarães	4 (0.7%)		
Médio Ave Hospital Centre	2 (0.3%)		
Porto Hospital Centre	30 (5.2%)		
Tâmega e Sousa Hospital Centre	7 (1.2%)		
Vila Nova de Gaia/Espinho Hospital Centre	16 (2.8%)		
Braga Hospital	6 (1.0%)		
Santa Maria Maior Hospital - Barcelos	1 (0.2%)		
Portuguese Oncology Institute of Porto Francisco Gentil	7 (1.2%)		
Magalhães Lemos Hospital	3 (0.5%)		
Cova da Beira Hospital Centre	3 (0.5%)		
Leiria Hospital Centre	15 (2.6%)		
Tondela-Viseu Hospital Centre	13 (2.3%)		
Baixo Vouga Hospital Centre	4 (0.7%)		
Coimbra Hospital and University Centre	51 (8.9%)		
Figueira da Foz District Hospital	2 (0.3%)		
Portuguese Oncology Institute of Coimbra Francisco Gentil	2 (0.3%)		

Variable	n (%)	r_s	p-value
Rehabilitation Medicine Centre of the Centre Region Rovisco Pais	3 (0.5%)		
Barreiro Montijo Hospital Centre	2 (0.3%)		
Lisboa Norte Hospital Centre	29 (5.0%)		
Lisboa Ocidental Hospital Centre	15 (2.6%)		
Setúbal Hospital Centre	8 (1.4%)		
Oeste Hospital Centre	3 (0.5%)		
Médio Tejo Hospital Centre	6 (1.0%)		
Lisboa Central Hospital Centre	18 (3.1%)		
Beatriz Ângelo Hospital	6 (1.0%)		
Vila Franca de Xira Hospital	1 (0.2%)		
Santarém District Hospital	4 (0.7%)		
Garcia de Orta Hospital	5 (0.9%)		
Cascais Hospital	2 (0.3%)		
Prof. Dr. Fernando Fonseca Hospital	7 (1.2%)		
Portuguese Oncology Institute of Lisbon Francisco Gentil	2 (0.3%)		
CUF Descobertas Hospital	1 (0.2%)		
Alcoitão Rehabilitation Medical Centre	1 (0.2%)		
Psychiatric Hospital Centre of Lisbon	1 (0,2%)		
Espírito Santo of Évora Hospital	8 (1.4%)		
Algarve Hospital Centre	29 (5.0%)		
Divino Espírito Santo of Ponta Delgada Hospital	1 (0.2%)		
Funchal Central Hospital	5 (0.9%)		
Public Institution non specified	1 (0.2%)		
Private Institution non specified	1 (0.2%)		
Does not respond	2 (0.3%)		

Annex 10. Descriptive statistics of studied factors for resident physicians, and correlations with the outcome: likelihood of pursuing a career in the NHS upon completion of the specialty. (NHS: National Health Service; r_s: Spearman's rank correlation coefficient)

Variable	n (%)	r_s	p-value
Specialized residency			
Training quality		0.015	0.711
Not Important - 1	6 (1.0%)		
2	14 (2.4%)		
3	59 (10.2%)		
4	200 (34.7%)		
Extremely Important - 5	297 (51.6%)		
National homogeneity of residency		-0.060	0.150
Not Important - 1	12 (2.1%)		
2	21 (3.6%)		
3	98 (17.0%)		
4	212 (36.8%)		
Extremely Important – 5	233 (40.5%)		
Supervision and mentorship by tutor		-0.036	0.389
Not Important - 1	10 (1.7%)		
2	23 (4.0%)		
3	73 (12.7%)		
4	232 (40.3%)		
Extremely Important – 5	238 (41.3%)		
Teaching opportunities		0.032	0.450
Not Important - 1	17 (3.0%)		
2	46 (8.0%)		
3	148 (25.7%)		
4	214 (37.2%)		
Extremely Important – 5	151 (26.2%)		
Research opportunities		0.050	0.232
Not Important - 1	32 (5.6%)		
2	81 (14.1%)		
3	148 (25.7%)		
4	193 (33.5%)		
Extremely Important - 5	122 (21.2%)		
Expenses paid by themselves associated with training		**-0.102**	**0.014**
Not Important - 1	16 (2.8%)		
2	37 (6.4%)		
3	107 (18.6%)		
4	200 (34.7%)		
Extremely Important – 5	216 (37.5%)		
Other expenses paid by themselves associated with residency		-0.064	0.127

Variable	n (%)	r_s	p-value
Not Important - 1	18 (3.1%)		
2	38 (6.6%)		
3	107 (18.6%)		
4	180 (31.3%)		
Extremely Important - 5	233 (40.5%)		
Work characteristics			
Working hours performed		**-0.154**	**<0.001**
Not Important - 1	1 (0.2%)		
2	2 (0.3%)		
3	16 (2.8%)		
4	99 (17.2%)		
Extremely Important - 5	458 (79.5%)		
Uncomfortable hours load		**-0.094**	**0.025**
Not Important - 1	3 (0.5%)		
2	5 (0.9%)		
3	36 (6.3%)		
4	122 (21.2%)		
Extremely Important - 5	410 (71.2%)		
Occupation with bureaucratic or administrative work		**-0.162**	**<0.001**
Not Important - 1	2 (0.3%)		
2	11 (1.9%)		
3	75 (13.0%)		
4	160 (27.8%)		
Extremely Important - 5	328 (56.9%)		
Remuneration		**-0.203**	**<0.001**
Not Important - 1	1 (0.2%)		
2	4 (0.7%)		
3	25 (4.3%)		
4	108 (18.8%)		
Extremely Important – 5	438 (76.0%)		
Supervision and support by specialized doctors		**0.085**	**0.042**
Not Important - 1	2 (0.3%)		
2	4 (0.7%)		
3	73 (12.7%)		
4	250 (43.4%)		
Extremely Important – 5	247 (42.9%)		
Teamwork		**0.108**	**0.010**
Not Important - 1	1 (0.2%)		
2	5 (0.9%)		
3	49 (8.5%)		
4	208 (36.1%)		
Extremely Important – 5	313 (54.3%)		
Equipment, infrastructure, technologies and innovation available		**-0.095**	**0.022**
Not Important - 1	1 (0.2%)		

Variable	n (%)	r_s	p-value
2	8 (1.4%)		
3	67 (11.6%)		
4	278 (48.3%)		
Extremely Important – 5	222 (38.5%)		
Technical quality of the service provided		**0.085**	**0.040**
Not Important - 1	0		
2	4 (0.7%)		
3	18 (3.1%)		
4	177 (30.7%)		
Extremely Important – 5	377 (65.5%)		
Feedback and work experiences			
Personal satisfaction with the work performed		0.036	0.395
Not Important – 1	1 (0.2%)		
2	2 (0.3%)		
3	17 (3.0%)		
4	127 (22.0%)		
Extremely Important – 5	429 (74.5%)		
Appreciation of the work by the recipient of the service provided		0.010	0.805
Not Important - 1	4 (0.7%)		
2	5 (0.9%)		
3	69 (12.0%)		
4	215 (37.3%)		
Extremely Important – 5	283 (49.1%)		
Appreciation of the work by peers		0.070	0.093
Not Important - 1	3 (0.5%)		
2	11 (1.9%)		
3	109 (18.9%)		
4	267 (46.4%)		
Extremely Important – 5	186 (32.3%)		
Appreciation of your work by superiors		-0.013	0.759
Not Important - 1	8 (1.4%)		
2	14 (2.4%)		
3	98 (17.0%)		
4	253 (43.9%)		
Extremely Important – 5	203 (35.2%)		
Interpersonal relationships with other professional classes		0.005	0.905
Not Important - 1	4 (0.7%)		
2	5 (0.9%)		
3	72 (12.5%)		
4	266 (46.2%)		
Extremely Important – 5	229 (39.8%)		
Good environment at work		0.052	0.216
Not Important - 1	1 (0.2%)		
2	1 (0.2%)		

Variable	n (%)	r_s	p-value
3	6 (1.0%)		
4	129 (22.4%)		
Extremely Important – 5	439 (76.2%)		
Participation in the dynamics of the service		**0.111**	**0.008**
Not Important - 1	0		
2	4 (0.7%)		
3	58 (10.1%)		
4	244 (42.4%)		
Extremely Important – 5	270 (46.9%)		
Involvement with the institution where you work and work commitment		0.057	0.175
Not Important - 1	4 (0.7%)		
2	23 (4.0%)		
3	107 (18.6%)		
4	257 (44.6%)		
Extremely Important – 5	185 (32.1%)		
Personal and family impact of work			
Extreme work-related fatigue		**-0.122**	**0.003**
Not Important - 1	1 (0.2%)		
2	0		
3	11 (1.9%)		
4	99 (17.2%)		
Extremely Important – 5	465 (80.7%)		
Situations causing emotional exhaustion		**-0.138**	**<0.001**
Not Important - 1	1 (0.2%)		
2	4 (0.7%)		
3	24 (4.2%)		
4	96 (16.7%)		
Extremely Important – 5	451 (78.3%)		
Existence of threats, violence and crime in the workplace		-0.017	0.676
Not Important - 1	7 (1.2%)		
2	18 (3.1%)		
3	42 (7.3%)		
4	87 (15.1%)		
Extremely Important – 5	422 (73.3%)		
Existence of situations of moral harassment in the workplace		-0.009	0.835
Not Important - 1	5 (0.9%)		
2	14 (2.4%)		
3	39 (6.8%)		
4	118 (20.5%)		
Extremely Important – 5	400 (69.4%)		
Existence of situations of discrimination in the workplace		0.035	0.403
Not Important - 1	5 (0.9%)		
2	12 (2.1%)		
3	47 (8.2%)		

Variable	n (%)	r_s	p-value
4	137 (23.8%)		
Extremely Important – 5	375 (65.1%)		
Balance between time dedicated to work and personal and family life		0.023	0.580
Not Important - 1	0		
2	2 (0.3%)		
3	11 (1.9%)		
4	81 (14.1%)		
Extremely Important – 5	482 (83.7%)		
Influence of work on your quality of life		0.024	0.572
Not Important - 1	0		
2	1 (0.2%)		
3	7 (1.2%)		
4	79 (13.7%)		
Extremely Important – 5	489 (84.9%)		
Perspectives on the (future) career			
Career progression prospects		**-0.094**	**0.024**
Not Important - 1	0		
2	10 (1.7%)		
3	40 (6.9%)		
4	206 (35.8%)		
Extremely Important – 5	320 (55.6%)		
Existence of employment relationship		**0.103**	**0.014**
Not Important - 1	1 (0.2%)		
2	12 (2.1%)		
3	58 (10.1%)		
4	191 (33.2%)		
Extremely Important – 5	314 (54.5%)		
Possibility of choosing a workplace close to the affective circle		0.022	0.594
Not Important - 1	2 (0.3%)		
2	11 (1.9%)		
3	45 (7.8%)		
4	129 (22.4%)		
Extremely Important – 5	389 (67.5%)		
Possibility to perform different tasks at work		0.077	0.066
Not Important - 1	3 (0.5%)		
2	17 (3.0%)		
3	95 (16.5%)		
4	274 (47.6%)		
Extremely Important – 5	187 (32.5%)		
Choice of working hours		**-0.150**	**<0.001**
Not Important - 1	4 (0.7%)		
2	10 (1.7%)		
3	54 (9.4%)		
4	178 (30.9%)		

Variable	n (%)	r_s	p-value
Extremely Important – 5	330 (57.3%)		
Possibility of carrying out complementary work		**-0.165**	**<0.001**
Not Important - 1	5 (0.9%)		
2	22 (3.8%)		
3	80 (13.9%)		
4	164 (28.5%)		
Extremely Important – 5	305 (53.0%)		
Training opportunities		0.077	0.065
Not Important - 1	1 (0.2%)		
2	9 (1.6%)		
3	63 (10.9%)		
4	241 (41.8%)		
Extremely Important – 5	262 (45.5%)		
Teaching opportunities		0.069	0.100
Not Important - 1	18 (3.1%)		
2	49 (8.5%)		
3	165 (28.6%)		
4	198 (34.4%)		
Extremely Important – 5	146 (25.3%)		
Research opportunities		0.073	0.078
Not Important - 1	37 (6.4%)		
2	87 (15.1%)		
3	206 (35.8%)		
4	146 (25.3%)		
Extremely Important – 5	100 (17.4%)		
Access to equipment, infrastructure, technology and innovation		0.006	0.894
Not Important - 1	1 (0.2%)		
2	18 (3.1%)		
3	89 (15.5%)		
4	290 (50.3%)		
Extremely Important – 5	178 (30.9%)		
Personal identification with the foundational principles and values of the NHS		**0.150**	**<0.001**
Not Important - 1	12 (2.1%)		
2	26 (4.5%)		
3	89 (15.5%)		
4	209 (36.3%)		
Extremely Important – 5	240 (41.7%)		
Evolution of the functioning of the NHS		**0.107**	**0.010**
Not Important - 1	4 (0.7%)		
2	19 (3.3%)		
3	76 (13.2%)		
4	200 (34.7%)		
Extremely Important – 5	277 (48.1%)		
Satisfaction and career in the NHS			

Variable	n (%)	r_s	p-value
Satisfaction with the specialty chosen as a future career		**0.209**	**<0.001**
Dissatisfied - 1	14 (2.4%)		
2	22 (3.8%)		
3	74 (12.8%)		
4	200 (34.7%)		
Extremely Satisfied – 5	266 (46.2%)		
Satisfaction with the current work		**0.366**	**<0.001**
Dissatisfied - 1	37 (6.4%)		
2	76 (13.2%)		
3	169 (29.3%)		
4	229 (39.8%)		
Extremely Satisfied – 5	65 (11.3%)		
Satisfaction with the current functioning of the NHS		**0.462**	**<0.001**
Dissatisfied - 1	265 (46.0%)		
2	187 (32.5%)		
3	106 (18.4%)		
4	16 (2.8%)		
Extremely Satisfied – 5	2 (0.3%)		
Likelihood of pursuing a career in the NHS upon completion of the specialty			
Very low - 1	54 (9.4%)		
2	76 (13.2%)		
3	225 (39.1%)		
4	164 (28.5%)		
Very high – 5	57 (9.9%)		

Annex 11. Output of ordered logistic regression for the likelihood of resident physicians pursuing a career in the NHS upon completion of specialized medical residency. (B: parameter estimates; df: degrees of freedom; Exp(B): exponentiated values of the coefficients, odds ratio; NHS: National Health Service; Sig: statistical significance, p-value)

Test of Parallel Lines[a]				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	1051.984			
General	1027.899[b]	24.086[c]	18	**0.152**
The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.				
a. Link function: Logit.				
b. The log-likelihood value cannot be further increased after maximum number of step-halving.				
c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.				

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	844.842	1170	0.722
Scaled Deviance	844.842	1170	
Pearson Chi-Square	1585.141	1170	1.355
Scaled Pearson Chi-Square	1585.141	1170	
Log Likelihood[b]	-525.992		
Akaike's Information Criterion (AIC)	1071.984		
Finite Sample Corrected AIC (AICC)	1072.374		
Bayesian Information Criterion (BIC)	1115.545		
Consistent AIC (CAIC)	1125.545		
Dependent Variable: Future_career Model: (Threshold), Working_hours, Teamwork, Employment_relationship, Complementary_work, Satisfaction_current_work, Satisfaction_NHS			
a. Information criteria are in smaller-is-better form.			
b. The full log likelihood function is displayed and used in computing information criteria.			

Omnibus Test[a]		
Likelihood Ratio Chi-Square	df	Sig.
232.121	6	**<0.001**
Dependent Variable: Future_career Model: (Threshold), Working_hours, Teamwork, Employment_relationship, Complementary_work, Satisfaction_current_work, Satisfaction_NHS		
a. Compares the fitted model against the thresholds-only model.		

Tests of Model Effects			
Source	Type III		
	Likelihood Ratio Chi-Square	df	Sig.
Working_hours	7.641	1	**0.006**
Teamwork	8.057	1	**0.005**
Employment_relationship	5.565	1	**0.018**
Complementary_work	17.246	1	**<0.001**
Satisfaction_current_work	54.629	1	**<0.001**
Satisfaction_NHS	83.493	1	**<0.001**
Dependent Variable: Future_career Model: (Threshold), Working_hours, Teamwork, Employment_relationship, Complementary_work, Satisfaction_current_work, Satisfaction_NHS			

Parameter Estimates											
Parameter		B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
				Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
Threshold	[Future_career=1]	-0.141	0.963	-2.029	1.746	0.022	1	0.883	0.868	0.131	5.733
	[Future_career=2]	1.098	0.963	-0.791	2.986	1.298	1	0.255	2.997	0.454	19.807
	[Future_career=3]	3.384	0.977	1.469	5.299	11.996	1	0.001	29.494	4.345	200.179
	[Future_career=4]	5.622	0.991	3.680	7.564	32.188	1	<0.001	276.343	39.630	1926.977
Working_hours		-0.412	0.150	-0.706	-0.118	7.543	1	**0.006**	**0.662**	**0.494**	**0.889**
Teamwork		0.330	0.117	0.102	0.559	8.021	1	**0.005**	**1.391**	**1.107**	**1.748**
Employment_relationship		0.248	0.105	0.042	0.455	5.575	1	**0.018**	**1.282**	**1.043**	**1.576**
Complementary_work		-0.376	0.091	-0.554	-0.197	17.027	1	**<0.001**	**0.687**	**0.575**	**0.821**
Satisfaction_current_work		0.618	0.085	0.451	0.785	52.741	1	**<0.001**	**1.856**	**1.570**	**2.193**
Satisfaction_NHS		0.932	0.106	0.724	1.140	77.057	1	**<0.001**	**2.538**	**2.062**	**3.125**
(Scale)		1[a]									
Dependent Variable: Future_career Model: (Threshold), Working_hours, Teamwork, Employment_relationship, Complementary_work, Satisfaction_current_work, Satisfaction_NHS											
a. Fixed at the displayed value.											

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