# HEALTH RESOURCES AND SCORES IN EUROPEAN COUNTRIES, 1996-2019: EXPENDITURE PER CAPITA AND RATES OF DOCTORS, NURSES AND HOSPITAL BEDS IN FRANCE, GERMANY, ITALY, SPAIN, SWITZERLAND AND THE UK GUISAN. Maria-Carmen

# Abstract

We analyze the evolution of several indicators of Health Services Resources for the period 1996-2019 in 6 European countries; Health Expenditure at constant prices, and rates fo Hospital Beds, Doctors and Nurses per thousand people. We include a comparison of these 6 European countries with the United States and the World average. As indicators of outcomes we compare the rates of Hospital Discharges, as an indicator of the number of patients treated per year, and indicators of quality of the Health Services, like the Accessability Score and the Global Scores of the Euro Health Consumer Index (EHCI). We present several econometric equations that relate indicators of outcomes /(Accessability Score, Global Score and Rate of Hospital Discharges) with health resources. Finally we present a comparison of some health resources at regional level in Spain and in 216 regions of the European Union. In the Annex we include some indicators among OECD countries. Switzerland presents, in year 2019, high rates of Doctors and Nurses and high value of Health Expenditure per capita, and gets the first position in the Global Score of the EHCI. The order of the ranking position in the Global Score, among the 6 European countries of ths study, was: Switzerland, France, Germany, the UK, Italy and Spain. Italy and Spain had a Doctors Rate similar to Switzerland but a much lower value of the Nurses Rate and Health Expenditure per capita. Although there was a positive evolution of the Nurses rate, for the period 1996-2019 in Italy (from around 5.4 to 6.4) and Spain (from 3.4 to 6.1), the values in year 2019 were yet too low in comparison with Switzerland (18.3), Germany (14.2), France (11.8), the UK (8.9) and the United States (15.7). A low value of the Nurses rate has negative consequences on the quality service for patiens, and also may imply overwork and stress for Nurses and Doctors working in health services. Keywords: Health Resources in Europe, Health Global Score, Health Econometric

Model, Health Expenditure 1996-2019. Regional Health Resources.

JEL codes: C5, I1, H51, H75, N34, N94, O52, R58

# 1. Introduction

This study presents a comparison of several indicators of Health Assistance inputs and outputs. From the point of view of the inputs we include: Health Expenditure per capita, and number of Doctors, Nurses and Hospital Beds per thousand people in 6 European countries and the United States, with data around year 2019. We also analyze the evolution of Health Expenditure per capita and the evolution of the rates of human resources and hospital beds per thousand people for the period 1996-2019.

----

Maria-Carmen Guisan, Professor and Researcher at the Faculty of Economics of the University of Santiago de Compostela (spain) for 1970-2022), E-mail <u>mcarmen.guisan@usc.es</u>. Website: <u>https://www.usc.gal/economet/guisan2.htm</u>

From the point of view of the outcomes we analyze some indicators of Quality of services (Accessability Score and Global Score, published by European Health Consumer Index (EHCI).

Section 2 presents a summary of our previous international studies on Health resources, published for the period 2001-2010 and several international reports published by the OCDE, the Health Consumer Powerhouse, (EHCI, 2018)), the European Federation of Salaried Doctors (Spedicato, 2022), and other ones.

Section 3 analyses the general trend of increase of real Expenditure per capita and health employment of Doctors and Nurses. For the period 1980-2019 there was a diminution in the number of Hospital Beds per thousand people, in countries with high rates in year 1980, thanks to the positive advances of Medicine, particularly related with shorter postoperatory processes.

Section 4, presents a summary of data in the 6 European countries of the study, related with Health Resources Inputs and Outputs, including some comparisons with the United States and the World average. We includee some exploratory econometric estimations with the sample of 6 European countries.

Section 5 analyzes some indicators of regional distribution of health services in Spain and in the European Union

# 2. International studies on Health services published for 2001-2022.

### Some international studies published for 2001-2010

For the period 2001-2010, our research team has published several studies on international comparisons and econometric models related with Health Expenditure, as the following ones:

Guisan and Arranz(2001) and (2003) analyze the evolution of Consumption Expenditure on Health in OECD countries for 1970-1996. They estimate an equation, with a sample of 12 OECD countries, that relates the real value of Private Expenditure per capita on Health in year 1996 with the lagged value of year 1990 and with the increases, for 1990-1996, of two explanatory variables: X1=real value of Total Private Consumption per capita and X2=real value of Public Consumption per capita on Health.

The estimated effect of X1 was positive (0.2463) and the effect of X2 was negative (-0.4274). The parameters where significant and the value of the determination coefficient was 0.9236. Expenditure on Health per capita, of 24 OECD countries in year 1996 varied between a minimum lower than 1000 Dollars (in Turkey and Portugal) and a maximum of more than 3000 Dollars in Iceland, the United States and Japan, with data at current prices of year 1996 and Purchasing Power Parities. The equivalence of 1000 Dollars of 1996 is 1407 Dollars of year 2017. The equivalence of 3000 Dollars of 1996 is 4221 Dollars of year 2017.

Guisan and Exposito(2006 a, b) published 2 studies studies on the impact of economic development on Health expenditure in Africa for the period 2000-2005. Guisan and Exposito(2007) analyze the impact of economic development on Health expenditure in Latin America, for 2000-2005 and Guisan and Exposito (2010) analyze the positive

effect of the Education on economic development and Health expenditure per capita in countrie Africa and Asia, for the period 2000-2005.

Guisan and Aguayo(2007), analyze health expenditure in Latin America.

Guisan(2009) presents a survey of studies relating Education, Health resources and Economic Development and analyses the relationships of health, education and income per capita in developed and developing countries in year 2005, and the relationship between Years of Potential Life Lost (YPLL) and Health E xpenditure per capita in 30 OECD countries.

The lowest values of *Years of Potentital Life Lost (YPLL)*, or *Potential Years of Life Lost (PYLL)*, corresponded to Iceland, Japan, Sweden and Switzerland. There was a general effect of health expenditure per capita on the diminution of average YPLL, although in the cases of the United States there was an average YPLL in year 2005 higher than expected accordingly to the model.

Not only health conditions and health services affect to the value YPLL, but also risks of accidents or violent conflicts. In all the OECD countries the female YPLL was lower than the male YPLL:

The conclusions show that the initiatives to increase coverage of health care to all the population in the United States is an important step to lower the relatively high value of YPLL in this country in comparison with other developed countries of Europe and other areas. Regarding developing countries we call attention to the positive role of Education to foster real income per capita and health expenditure per capita and to increase Health Services and Life Expectancy.

### Some international comparison for the period 2011-2022:

There are several interesting comparisons of several countries from the OECD, which show a great variability of Expenditure per capita in OECD countries and other areas.

The publications of the Europe Health Consumer Index (EHCI), present a comparison of health services scores in 35 European countries, mainly related with patients satisfaction.

EHCI(2018) includes points and ranking in 6 sections, and a Global Score. The sections are: 1. Patients rights and Info. 2. Accessability. 3. Outcomes. 4. Range and reach of services. 5. Prevention. 6. Pharmaceuticals. The 5 top positions in the global scores, corresponded to: Switzerland, Netherlands, Norway, Denmark and Belgium. France appear in the 11<sup>th</sup> postion, Germany in the 12<sup>th</sup>, UK in the 16th, Spain in the 19<sup>th</sup> and Italy in the 20<sup>th</sup> position. The 5 lowest positions corresponded, in decreasing order to, Bulgaria, Poland, Hungary, Romania and Albania.

It is important to analyze the satisfaction with working conditions of the Health staff, because it has impact on the quality of their lifes and also on patients attention. The studies related with the assessment of Nurses and Doctors on working conditions show several problems, derived from overwork and other factors, in many countries.

The study by Linda H. Aiken, Douglas M. Sloane, Luk Bruyneel, Koen Van den Heede, Walter Sermeus, for the RN4CAST Consortium (See Aiken et al.(2013), includes the results of a survey to Nurses in 12 European countries.

Alessandra Spedicato, presented a survey on Doctors satisfaction in 12 European countries, in the Viena Meeting of the European Federation of Salaried Doctors (See Spedicato(2022). Some of the main conclussions of this study are the following ones:

1) "In general, over the last 10 years, the quality of services in healthcare facilities in their country (7) is considered to have declined by 59% (Austria, Germany, Portugal, Italy, France, Sweden, Spain).

2) Their opinion of the quality of services in the facility where they work (8) is not positive. For 58% of doctors, the quality has deteriorated (Croatia, Germany, Portugal, Italy, France and Spain).

3) Question 14 How do you rate your pay? 33% consider it satisfactory..., particularly in Sweden, Germany, Austria and Croatia. The remaining 66% consider it not very satisfactory (25% of these are over 60, especially in Cyprus and Spain).

4) Question 20.3 You would define your relations with your work colleagues in terms of friendship as Good 75% Moderate 15% (Italy and Spain) Very good 10%

5) Do you believe that the healthcare system in your country responded to the Covid-19 emergency in a manner that was... Inadequate 42% (Spain) Quite adequate 50% (including Italy and Germany) Extremely inadequate 8%".

In that study we may notice a negative evaluation of the working conditions of many Doctors in the case of Spain, due to the high level of stress that many of them suffer in their specialities, and to the low wages in comparison with other developed countries.

Bouza et al (2020) present as special article entitled "Work-related burnout syndrome in physicians in Spain, with a team of members of a Group of study of burn out among Doctors in Spain, from the Hospital Gregorio Marañon of Madrid, Department of Medicine from the University Complutense of Madrid (UCM), and other institutions.

Spain appears as a case with a lot of stress complains by many Nurses and Doctors, due to shortage of Nurses, with low ratio Nurses/Doctors, what implies an overcharge of work for Nurses and Doctors in many hospitals and other centers.

There are also complains by Doctors due to shortage of Doctors employments in some specialities and the slow bureaucratic process to increase resources. Overwork, low salaries, unpolite or aggressive tendencies from some patients and lack of support from bureaucratic managers and politicans, generate a bad level of working conditions in Health services. In spite of the stress and difficulties that the health staff suffer there is an average good level of formation and quality of health services in Spain, where many services have a very high score in indicators of quality of health assitance.

Shortages of health assistance, usually lead to long waiting times and lack of enough information, fuelling unpolite and aggressive behaviour from some patiens, increasing rates of abuse against health staff. This is pointed out, in the case of doctors, by BMJ(2023), based on a survey by the Medical Protection Society (MPS) indicating that

"half of 861 UK doctors who responded to a survey said they had experienced or witnessed abuse by patients or relatives in the past 12 months. The survey was sent to 5495 Doctors in year 2023 and had a 15% response rate.

Efrat-Treister at al (2020) analyzes the effect of waiting on aggressive tendencies toward emergency department staff and that providing information may mitigate, sometimes, those tendencies.

#### 3. Health resources and scores in 6 European countries

Section 3.1 analyzes the evolution of the rate of Hospital Beds in the country of this study for the period 1980-2028.

Section 3.2 show the evolution of the rates of Doctors and Nurses, and the real value of Health Expenditure per capita for 1996-2019.

Section 3.3 present a comparison of several indicators of outcomes from Health services: number of patiens at Hospitals per year and 1000 population (rate of Discharges) and the European score of Accessibility and Global Score.

#### 3.1. Hospital Beds per thousand people, 1980-2018

The evolution of hospital beds per thousand people, in countries with levels higher than World average in year 1970, has experienced an important diminution for the period 1970-2019.

Table 1 presents a summary of the evolution of the rate of hospital beds per thousand people for the period 1980-2018, with data from the World Bank.

Country	1980	1990	2000	2010	2108
France	11.1	9.7	8	6.4	5.9
Germany	11.5	10.7	9.1	8.3	8.0
Italy	9.6	7.2	4.7	3.6	3.1 *
Spain	5.4	4.6	3.6	3.1	3.0
Switzerland	-	19.9	6.3	5.2	4.6
UK	5.4	4.6	3.6	3.1	3.0
USA	6.0	4.9	3.5	3.0	2.9
World	3.6	3.6	2.9	3.6	2.9

Table 1. Hospital beds per one thousand people in 7 OECD countries and World average

Data from World Bank (2023). \* The most recent data for Italy corresponds to year 2012.

A review of World evolution: The rate of hospital beds has diminished from 3.6 in year 1980 to 2.9 in year 2019. This evolution is the results of two trends: A trend to diminish the rate in some countries with high levels, and the rate to increase the rate in many developing countries with low levels.

The countries with more resources have diminished the number of beds per thousand people, for the period 1980-2018, as a consequence of advances of Medicine as those related with the shorter duration of postoperatory care.

On the other hand, many countries with few resources, with ratio of beds per thousand people, below World average, have increase the indicato trying to converge to

the World average, but in some cases it is yet too low. To increase opportunities of Health services in low income countries should be one of the priorities of the international cooperation for development.

# 3.2. Doctors, Nurses and Health Expenditure per capita, 1996-2019

Table 2 presents a comparison of the rates of Doctors, Nurses and Beds, per one thousand people, asweel as the value of Expenditure per capita and the results of two scores: Global European Score, and Accessability European Score.

Real Expenditure per capita is expressed in Dollars at 2019 Prices at Purchasing Power Parities, increased in all the countries of table 2,

Number of Doctors per one thousand people also increase in all the countries, for th eperiod 1996-2019, but in France where the rate of Doctors per thousand people remained stable for the period 1996-2019, after a high increase from 1.2 to 3.3 for the period 1970-1996.

Number of Nurses per one thousand people experienced a high increase in several countries of table 2, reaching in year 2019 the highest values in the countries with the highest value of Health Expenditure per capita,

The Nurses rate reached, in year 2019, a value of 14.2 in Germany, 18.3 in Switzerland and 15.7 in the United States. Spain had a low value in year 1996, with a rate of 3.4 close to the value of 3 of World average, and experienced an important increase for the period 1996-2019, reaching a value of 6.1 in 2019, althout yet ver low in comparison with Switzerland and other developed countries.

r	1	1		1		
Country	Doctors	Doctors	Nurses	Nurses	Expendi	Expen
	Rate	rate	rate	rate	ture	diture
	1996	2019	1996	2019	1996	2019
France	3.3	3.3	6.6	11.8	4213	5452
Germany	3.1	4.4	9.6*	14.2	3509	6515
Italy	3.9	4.0	5.4*	6.4	2432	3853
Spain	2.7	4.4	3.4	6.1	1596	3600
Switzerland	3.2	4.3	11.1*	18.3	3520	7138
UK	1.8	2.9	8.0	8.9	2564	4500
USA	2.4	2.6	9.0	15.7	5360	10948
World	1.4	1.6	3	4	647	1427

Table 2. Doctors and Nurses Rates and real Expenditure per capita, 1996-2019 (Rates per 1000 people and Expenditure per capita Dollars at 2019 prices and PPPs)

Source: World Bank for Doctors and Nurses rates. Expenditure per capita elaborated from OECD Health at a Glance. Notes on the estimation for Nurses Rate in year 1996: 1) in France, Germany and Switzerland: we have calculated values applying the ratio of each country to France in year 2000 to the value of France in year 1996. 2) We took the value of France in year 1998 (the first year of the series) as an approximated value for year 1996.3) The World data of 1996 was based on the ratio World/Spain in year 2000 applied to the value of Spain in year 1996.

Expenditure per capita experienced an important increase in the countries of table 2. The World average reached a value in year 2019 close to the value of Spain in 1996, indicating a great improvement of Health assistance in countries close or over the World average.

The United States and Switzerland got the highest values in year 2019, among the 7 countries of table 2. Real Expenditure per capita has increased more than 100% in Spain (125%), the United States (104%) and Switzerland (103%).

The non weighted average of the rates of these tables in year 2019 was 3.90 for Doctors rate, 10.93 for Nurses rate, 154.5 for Accessability Score, 5147 for Health Expenditure per capita and 4.6 for the rate of Hospital Beds.

OECD, Health Spending 2021, includes data of Expenditure per capita and rates of Doctors, Nurses and Hospital Beds of OECD countries for the period 2018-2021. In the Annex we include data in this regards.

The World Health Organization (WHO) recommends between 2 and 3 Doctors per thousand people but rates between 4 and 5, like in Switzeland, seem to be good and necessary for a a good quality of Health Services. The recommended number of nurses is related with the number of Doctors and Hospital Beds. The usual suggestion is of at least 3 Nurses per Doctor. Spain and Italy have a very low ratio between the number of Nurses and the number of Doctors.

#### 3.3. Discharges, Accesability and Global Score of Health services

Table 3 shows the values of the European Score elaborated by Euro Health Consumer Index (EHCI). The European Score presents results for 6 indicators and a global classification for 35 European countries. The highest the value of the indicator indicates better quality of the indicator.

	Disenarges in	yeur 2017	per 1000 p	copie	
Country	Accessability	Global	Global	Rate of	Discharges
	Score	Score	Ranking	Discharges	/Beds
			position	2019	
France	188	796	11	182.6	31
Germany	163	785	12	253.0	32
Italy	138	687	20	113.0	36
Spain	113	698	19	103.4	34
Switzerland	225	893	1	168.8	37
UK	100	728	16	128.7	43

Table 3. European Score 2018 (Accessibility and Global) and Rate ofDischarges in year 2019 per 1000 people

Source: EHCI(2018). European Score for Accessability and Global Score and OECD Healthcare: Discharges and Hospital Beds.

The highest ranking position of best quality, among the 6 countries of table 6, corresponded to Switzerland, with a Global Score of 893 points, followed by France (796 points) and Germany (785 points). Switzerland also got the top position in the

ranking of Accessability with 225 points. Other European countries with Global Score higher than 800 points were: Netherlands, Norway, Denmark, Belgium, Finland and Luxembourg. The lowest values of the Global Score, in EHCI(2018). with less than 600 points, were Albania, Romania, Hungary, Poland and Bulgaria.

The OECD presents data of waiting times for comparison between the United States and other countries. Regarding the differences between the U.S. and Europe, World Population Review(2023) declares:

"The U.S. was on the higher side for the share of people who sometimes, rarely, or never get an answer from their regular doctor on the same day at 28%. <u>Canada</u> had the highest at 33% and <u>Switzerland</u> had the lowest at 12%. The U.S. was towards the lower end for the share of people waiting one month or more for a specialist appointment at 27%. Canada and <u>Norway</u> tied for the highest at 61% each and Switzerland had the lowest at 23%.

# 4. Econometric relationships of Health Outcomes and Health Resources

An exploratory analysis with a sample of the 6 European countries of this study in year 2019, shows the positive effect of some indicators on Accessability and Global Scores. Due to the small size of the sample there and a high degree of correlation among several indicators, some variables do not show its significant impact in some regressions, but all the indicators shows a positive impact. Estimatons with larger samples, of more countries and more years, will allow to show more clearly the significant effects of the indicators.

Equation 1 relates the Accessability Score with the Doctors rate and the Nurses rate.

*Equation 2.1 to 2.5* for Global Score: The equation shows the positive impacts of several indicators on Global Score.

The explanatory variables are the following ones:

DOCTORS: Rate of Doctors (Number of Doctors per thousand people)

NURSES: Rate of Nurses (Number of Nurses per thousand people)

BEDS: Rate of Hospital Beds (Number of Hospital Beds per thousand people)

EXPENDH: Health Expenditure per inhabitant

ACCESS: Accesability Score

X1= NURSES – XNURSES

X2 = ACCESS - XACCESS

# X3= EXPEDNH- XEXPENDH

X1 to X3 are the differences of the variables of each country to the non weighted averages of the explanatory variables in the sample of 6 European countries. Those averages are: XDOCTORS, XNURSES, XPENDH.

*Equation 3.1 to 3.3* relates the explained variables DISCHARGES (rate of discharges per thousand population) in 6 European countries, in year 2019, with the rates of Doctors, Nurses and Beds.

Equation 1 for Accessability Score in 6 European countries in year 2019

*Equation 1 for ACCESS (Accesability Score):* The equation shows a positive impact of the rates of Doctors and Nurses on the indicator of Accesability. The average coefficient was 16.26 points per each increase of 1 point in the rate of Doctors and 8.26 points per each increase of 1 point in the rate of Nurses.

Accessability Score related with rates of Doctors and Nurses						
Dependent Variable: ACCESS						
Method: Least Squares. Sample	Method: Least Squares. Sample 1 yo 6					
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
DOCTORS	16.26417	8.097430	2.008560	0.1150		
NURSES	8.258045	2.710056	3.047187	0.0381		
R-squared	0.719875	Mean depen	dent var	154.5000		
Adjusted R-squared	0.649844	S.D. depend	lent var	47.17944		
S.E. of regression	gression 27.91796 Akaike info criterion					
Sum squared resid	3117.651	Schwarz cri	terion	9.688206		
Log likelihood	elihood -27.27286 Hannan-Quinn criter.					
Durbin-Watson stat	2.564514					

Equation 1. ACCESS score in 6 European contries in year 2019 Accessability Score related with rates of Doctors and Nurses

Source: Elaborated by Guisan, in this study, with data of sections 2 and 3.

Both the Doctors rate and the Nurses rate show a positive impact on the Accessability Score. There is some degree of multicollinearity due to the small size of the sample, with a low precision for Doctors coefficient. In equation 1.1 there are positive residuals (actual value of the dependent variable higher than expected by the econometric model) in France, Spain, Switzerland and the United Kingdom, and negative residuals (actual value below expected by the model) in Germany and Italy.

obs	Country	Actual	Fitted	Residual
1	France	796	789	7
2	Germany	785	808	-23
3	Italy	687	701	-14
4	Spain	698	688	10
5	Switzerland	893	883	10
6	UK	728	718	10

Table 4. Actual and fifed values of Global Score in Equation 1

Equations 2.1 to 2.4 for Global Score in 6 European countries in year 2019

Equation 2.1 relates Global Score with Nurses and Accsss, it provides the highest value of the Adjusted R-Square in comparison with equations 2.2 to 2.4. Equation 2.1 includes an intercept and the effect 2 explanatory vairables: X1=the difference of the Nurses rate with the average Nurses rate (Xnurses) and X2=the difference of the Accessability score and the average Accessability Score (Xaccess) in the grup of 6

European countries. Equation 2.2 only includes intercept and X1, while Equation 2.3 includes intercept and X2 and equation 2.4 includes an intercept and the variable X3=the difference between Expendh and the aveage Xexpendh.

Dependent Variable: GLOBAL SCORE.						
Method: Least Squares. Sample 1 6						
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
С	764.5000	7.720437	99.02290	0.0000		
X1=NURSES-XNURSES	12.27157	3.388086	3.621978	0.0362		
X2=ACCESS-XACCESS	0.403136	0.343882	1.172308	0.3257		
R-squared	0.963858	Mean dependent var		764.5000		
Adjusted R-squared	0.939763	S.D. dependent var		77.05258		
S.E. of regression	18.91113	Akaike info criterion		9.024231		
Sum squared resid	1072.893	Schwarz criterion		8.920111		
Log likelihood	-24.07269	Hannan-Quinn criter.		8.607429		
F-statistic	40.00299	Durbin-Watson stat		1.452460		
Prob(F-statistic)	0.006871					

Equation 2.1. Global Score in 6 European countries in year 2019 Global Score function of C X1 X2

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

The results indicate an average Global Score of 764 points for a country with average values of Nurses Rate and Average Accessability Score. There is an estimated increase of 12.27 points per each unity of difference of Nurses Rate with the average, and of 0.40 points per each unity of difference of Accessability Score and the average.

Dependent Variable: GLOB				
Method: Least Squares. San				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	764.5000	8.073586	94.69151	0.0000
X1= NURSES-XNURSES	15.66112	1.846923	8.479577	0.0011
R-squared	0.947301	Mean dependent var		764.5000
Adjusted R-squared	0.934127	S.D. dependent var		77.05258
S.E. of regression	19.77617	Akaike info criterion		9.068033
Sum squared resid	1564.387	Schwarz criterion		8.998620
Log likelihood	-25.20410	Hannan-Quinn criter.		8.790166
F-statistic	71.90322	Durbin-Watson stat		2.271723
Prob(F-statistic)	0.001060			

Equation 2.2. Global Score in 6 European countries in year 2019, as function of C X1

Source: Elaborated by Guisan (2023), in this study, with data of sections 2 and 3. C is the intercept, an represents the average score for countries with X1 close to cero.

The goodness of fit is also high in equation 2.2, but the Adjusted R-square is slightly lower than in equation 2.1.

The conclusion is that a high rate of Nurses is a good indicator of health services resiyrces and quality of management, and that other factors that also improve Accessability are also important for the Global Score.

Dependent Variable: GLOI				
Method: Least Squares. San				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	764.5000	15.49806	49.32877	0.0000
X2=ACCESS-XACCESS	1.466059	0.359845	4.074144	0.0152
R-squared	0.805812	Mean dependent var		764.5000
Adjusted R-squared	0.757266	S.D. dependent var		77.05258
S.E. of regression	37.96233	Akaike info criterion		10.37227
Sum squared resid	5764.554	Schwarz criterion		10.30285
Log likelihood	-29.11680	Hannan-Quinn criter.		10.09440
F-statistic	16.59865	Durbin-Watson stat		1.383344
Prob(F-statistic)	0.015171			

Equation 2.3. Global Score in 6 European countries in year 2019 as function of C X2

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

The goodness of fit of equation 2.3 is high but the Adjusted R-Square is lower than in equations 2.1 and 2.2.

Equation 2.4. Global Score in 6 European countries in year 2019, as function of	of C	X	3
---	------	---	---

Dependent Variable: GLOBAL				
Method: Least Squares. Sample				
Variable	Prob.			
С	764.5000	13.03452	58.65195	0.0000
X3=EXPENDH-XEXPENDH	0.049751	0.009926	5.012064	0.0074
R-squared	0.862641	Mean dep	bendent var	764.5000
Adjusted R-squared	0.828301	S.D. dependent var		77.05258
S.E. of regression	31.92792	Akaike info criterion		10.02604
Sum squared resid	4077.569	Schwarz	criterion	9.956627
Log likelihood	-28.07812	Hannan-Quinn criter.		9.748173
F-statistic	25.12078	Durbin-Watson stat		2.100598
Prob(F-statistic)	0.007427			

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

The estimated Global Score would be 764 for countries with Expenditure per capita close to the average (5147), in this group of 6 countries. There is a significant effect of the increase of Expendh, estimated in 0.049751 per one point of positive difference of Expendh of the country with the average of the 6 countries (Xexpendh). The goodness of fit is good but lower than in equations 2.1 to 2.3.

The positive impact of Nurses rate for Global Score may be due to two types of effects: a direct effect on better attention by Nurses to patients of health services and an indirect effect on the doctors efficiency. An increase of the ratio Nurses/Doctors usually contributes to diminish overwork and stress of Doctors and to increase the efficiency of the health services. It also contributes to better experience of the patients and better scores of health services quality.

Equations 3.1 to 3.3 for Dicharges rates in 6 European countries in year 2019

Equations 3.1 relates Hospital Discharge rate per thousand inhabitants (DISCHARGES) with the variables DOCTORS, NURSES and BEDS.

Dependent Variable:				
Method: Least Squar	es. Sample: 1	6		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOCTORS	5.477256	4.216719	1.298938	0.2848
NURSES	1.986796	1.606172	1.236976	0.3041
BEDS	24.84636	3.736851	6.649011	0.0069
R-squared	0.966056	Mean dependent var		158.2500
Adjusted R-squared	0.943427	S.D. dependent var		55.87678
S.E. of regression	13.29038	Akaike info criterion		8.318810
Sum squared resid	529.9022	Schwarz criterion		8.214690
Log likelihood	-21.95643	Hannan-Quinn criter.		7.902008
Durbin-Watson stat	1.552254			

Equation 3.1. Discharges rate in 6 European countries, 2019: Y=f(Doctors, Nurses, Beds)

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

The 3 explanatory variables have a positive coefficient. The sample size is small and there is a high degree of multicollinearity, what contributes to some degree of imprecision in the coefficients of Doctors rate and Nurses that do not allow to show that the parameters are significant. The coefficient of Beds is positive and significantly difference from zero with a t of Student of 6.64. In the next section, with a sample of higher size, of 17 Spanish regions, this equation provides positive and significant coefficients for all the explanatory variables.

With the sample of 7 countries, including the United States and the 6 European countries the estimated coefficients would be 6.06 for Doctors, 2.39 for Nurses and 23.85 for Beds, and the Adjusted R-Squared was 0.921092.

With a sample of 17 Spanish regions there was a diminution of multicollinearity and an increase of precision, and the results show the significant positive effect of the 3 explanatory variables, as we may see in Equation 4 in the nest section.

Equation 5.2. Discharges rate in 6 European countries, 2017. 1 (De						
Dependent Variable:						
Method: Least Square	es. Sample 16					
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
BEDS	33.36780	1.450444	23.00523	0.0000		
R-squared	0.900559	Mean dependent var		158.2500		
Adjusted R-squared	0.900559	S.D. dependent var		55.87678		
S.E. of regression	17.62036	Akaike info criterion		8.726999		
Sum squared resid	1552.386	Schwarz	8.692292			
Log likelihood	-25.18100	Hannan-Quinn criter.		8.588065		
Durbin-Watson stat	0.587837					

Equation 3.2. Discharges rate in 6 European countries, 2019: Y=f(Beds)

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

Equation 3.2 estimated with data of 7 countries, including also the United States, showed a significant effect of Beds and provided an estimated coefficient of 33.90 for Beds and an Adjusted R-Square of 0.8588.

Dependent Variable:				
Method: Least Square				
Sample: 1 6				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOCTORS	16.84164	13.24295	0.2724	
NURSES	8.348224	4.432163	1.883555	0.1327
R-squared	0.465842	Mean dep	158.2500	
Adjusted R-squared	0.332303	S.D. depe	55.87678	
S.E. of regression	45.65846	Akaike in	10.74146	
Sum squared resid	8338.780	Schwarz	10.67204	
Log likelihood	-30.22437	Hannan-Q	10.46359	
Durbin-Watson stat	1.289708			

Equation 3.3. Discharge rate in 6 European countries, 2019: Y= f(Doctors, Nurses)

Source: Elaborated by Guisan(2023), in this study, with data of sections 2 and 3.

The coefficients are positive. The goodness of fit is lower than in equations 3.1 and 3.2, but the goods of fit is worse than in equations 3.1 and 3.2.

The highest value of the Adjusted R-squared, corresponded to equatin 3.1 (0.9661), followed by equation 3.2 (0.9006) in comparison with equation 3.3 (0.3323). The Stardard Error has the lowest value in 3.1 (13.29) in comparison with 3.2 (17.62) and with 3.3 (45.66).

The estimation of equation 3.3 with 7 countries, including the United States, presents similar resultars, with an estimated coefficient for Doctors of 16.85 and for Nurses of 8.36. The adjusted R-square was 0.3945 and the Standard Error 40.84.

Hospital beds rate seems have an important role in the explanation of the rate fo Discharges, accordingly with the results of equations 3.1 to 3.3.

The indicators of quality of the services for patiens, measured by the Accessability Score and the Global Score, have a positive relation with

### 5. Regional resources in Spain and Europe

Table 5 shows the rates of Doctors, Nurses, Hospital Beds and Hospital Discharges, per 100 thousand people in the Spanish regions, around years 2019 and 2020, with data from Eurostat and from the Spanish National Statistical Institute (INE). Spanish regional data correspond to the 17 Autonomous Communities or *Comunidades Autónomas* (CCAA).

Population of some regions may require health assistance in other regions, and thus the rates of Doctors, Nurses and Hospital Beds may have important variations, with a few regions clearly over average and some regions clearly below averabe.

Regions	Doctors	Nurses	Beds	Total	Popula	Discharges
	2020	2017	2020	Discharges	tion	rates
Andalucía	3.68	5.58	2.19	694141	8402305	83
Aragón	5.76	4.15	3.65	155285	1325385	117
Asturias, P.	4.18	6.69	3.47	116616	1061756	110
Balears, Illes	4.90	6.54	2.82	123621	1103442	112
Canarias	4.47	5.28	2.78	179647	2104815	85
Cantabria	5.95	2.76	3.48	59985	588656	102
Castilla y León	4.39	6.34	3.53	269748	2494790	108
Castilla-la Mancha	2.77	6.89	2.34	173204	2078611	83
Cataluña	4.69	5.71	3.83	829556	7518903	110
Com. Valenciana	4.51	6.14	2.39	508486	5004844	102
Extremadura	3.70	5.20	3.50	111830	1099632	102
Galicia	4.64	6.53	3.30	293533	2748695	107
Madrid	5.70	5.20	2.73	692090	6454440	107
Murcia, Región	4.23	6.70	3.11	146541	1466818	100
Navarra, C.Foral	6.41	4.30	3.43	68592	640790	107
País Vasco	5.60	8.68	3.32	245801	2188985	112
Rioja, La	3.27	7.54	3.31	37009	319002	116.
Total	4 64	5 90	3 1 3	4719667	46771341	101

Table 5. Doctors, Nurses and Hospital Beds: Rates per thousand people

Total4.645.903.13471966746771341101Source: Elaborated from Eurostat Regions (Doctors and Beds) and INE (Nurses and Discharges)Notes: Data of Discharges rates corresponds to year 2014.

### Regional Rates of Doctors

Below 401: Andalucía, Castilla-La Mancha, Extremadura and Rioja.

Between 401 and 500: Asturias, Balears, Canarias, Castilla y León, Cataluña, Com. Valenciana, Galicia and Murcia.

Between 501 and 600: Aragon, Cantabria, Madrid, Navarra and Pais Vasco.

# Regional Rates of Nurses

Below 501: Aragon, Cantabria and Navarra

Between 501 and 600: Andalucía, Canarias, Cataluña, Extremadura and Madrid.

Betweem 601 and 700: Asturias, Balears, Castilla y León, Castilla-La Mancha,

Comunitat Valenciana, Galicia and Murcia.

Regions with more than 701: Pais Vasco and Rioja

# Regional Rates of Hospital Beds

Below 301: Andalucia, Balears, Canarias, Castilla-La Mancha, Comunitat Valenciana and Madrid.

Between 301 and 400: Aragon, Asturias, Cantabria, Castilla y León, Cataluña, Extremadura, Galicia, Murcia, Navarra, Pais Vasco and Rioja.

# Regional Discharges rates per thousand people

Below 101: Andalucia, Canarias, Castilla-La Mancha, Murcia.

Between 101 and 110: Asturias, Cantabria, Castilla y León, Cataluña, Com. Valencia, Extremadura, Galicia, Madrid, Navarra.

More tan 110: Aragon, Balears, Pais Vasco, Rioja.

We have estimated the relationship between the rate of Hospital Discharges and the explanatory variables X1=Doctors rate, X2=Nurses rate, and X3=Hospital Beds rate, with data of table 5. with the result that appear in Equation 4.

Dependent Variable: Y				
Method: Least Squares				
Sample: 1 17				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	6.028138	1.784540	3.377979	0.0045
X2	4.580651	0.985590	4.647622	0.0004
X3	15.51425	3.360535	4.616602	0.0004
R-squared	0.622010	Mean dep	endent var	103.7059
Adjusted R-squared	0.568012	S.D. deper	ndent var	10.68155
S.E. of regression	7.020536	Akaike in	fo criterion	6.894341
Sum squared resid	690.0310	Schwarz c	riterion	7.041379
Log likelihood	-55.60190	Hannan-Q	6.908957	
Durbin-Watson stat	2.349544			

Equation 4 estimated with a sample of 17 Spanish regions around year 2019

Source: Elaborated by Guisan(2023), in this study, with data of table 5.

As expected, the increase of the sample size, in comparison with the sample of 6 European countries, diminished the multicollinearity and increased the precision of the estimators.

The results of equation 4, in comparison with equation 3.1 of 6 European countries, show the significant impact of the three explanatory variables. The coefficient of X1=Doctors Rate is higher in equation 4 (6.0281) than in equation 3.1 (5.4773). The coefficient of X2=Nurses Rate is also higher in equation 4 (4.5807) that in equation 3.1 (1.9868). The coefficient of X3=Hospital Beds Rate is lower in equation 4 than in equation 3.1.

The percentage of the S.E. on the Mean of the Dependent Variable is lower in equation 4 (6.77%) than in equation 3.1 (8.40%). The estimated effect of equation 4, for the average levels of the explanatory variables is:

For X1 = 6.0281\*4.64=27.97

For X2= 4.5807 \* 5.90=27.03

For X3 = 15.5148\*3.13=48.56

The 3 expalanatory variables have a positive impact on que quantity of patients treated in hospitals, with an important effect of X3 on the number of Entries and Discharges, but the other variables (X1 and X2) are usually more important than X3 for the indicators of quality of the health services.

In the Annex we include some supplementary data provided by the INE for Health resources in Spanish regions and the diminution of the Doctors rate for 1980-2021. We also include a reference to the study by Lopez-Casasnovas et al(2004) the Spanish system of health care services, where they include data of the evolution of health spending for the period 1980-201 and other interesting data.

Regional Doctors rates in 216 European regions

There are many differences regarding Health resources among European countries and regions. Here we analyze the differences in the rate of Doctors per thousand inhabitants in year 2019.

Graph 1 shows the distribution of the Rates of Doctors per 100000 people in 216 European regions. We may notice that only a few percentage of the regions take values below 200 or higher than 500. The usual is a rate between 2 and 5 Doctors per thousand people.



Graph1. Distribution of the Rates of Doctors in 216 European regions

A summary of Doctors rate, from Eurostat data in year 2019, indicates that 63% of regions have a Doctors rate below 2, 15.81% between 2 and 3; 36,28% between 3 and 4. 21.40% between 4 and 5, 10.23% between 5 and 6, and 4.65% higher than 6.

There are also important differences in the scores of Health services, among European countries, as seen in the Annex.

### 6. Conclussions

A summary of the main conclussions of this study are the following ones:

1) Regarding the evolution of real Expenditure per capita and the rates of Doctors, Nurses and Hospital Beds for the period 1996-2019. the trend has been of increase, in the countries of this study, for all the variables but the rate of Hospital Beds. Hospital beds ration has diminished, in developed countries, due to the advances of Medicine like the diminution of the duration of the post operatory processes and other advances.

2) The countries with the highest levels of Health Expenditure per capita usually present higher rates of Nurses, close to a ratio between 3 and 4 for the relationship Nurses/Doctors, than countries with lower levels of Health Expenditure per capita.

2) Among the 6 European countries of this study, Switzerland and Germany present high Nurses rates while Spain and Italy present low Nurses rate.

3) In the case of Spain, and other countries with low value of Nurses rate, there is a problem of overwork and stress for many Doctors and Nurses. The shortage of Nurses not only diminish the indexes of quality of health services for patients but also the quality of working conditions for Doctors and Nurses.

4) The analysis of data and the econometric models estimated show the important positive impact that Doctors and Nurses rates have in the quality indexes, like the Accessability score and the Global Score of the Euro Health Consumers Index (EHCI)

5) Regarding the indicator of number of patients, measured by the rate of Discharges, the econometric models show that the rate of hospital beds is important for the quantity of patiens, although human resources (Doctors, Nurses) are also important. Equation 4 shows the psisitive and significant effect of Doctors, Nurses and Beds con the quantitative indicator Discharges with data of 17 Spanish regions.

6) Regarding the indicators of quality of health services for patiens, equations 1 and 2.1 show the positive effect of the rates of Doctors and Nurses on the Accessability and Global Scores of health services to patiens, with a sample of 6 European countries.

# Bibliography

Aiken, H., Sloane, D.M., Bryneed, L., Van den Heede, K., Sermeus, W. (2013). <u>Nurses'</u> reports of working conditions and hospital quality of care in 12 countries in Europe. *International Journal of Nursing Studies, Volume 50, Issue 2.* Pages 143-153.

Bouza, E., Gil-Monte, P.R., Palomo E. (2020). <u>Síndrome de quemarse por el trabajo</u> (Burn out) en los médicos de España. Revista Clínica Española.

Efrat-Treister D, Moriah H, Rafaeli A. The effect of waiting on aggressive tendencies toward emergency department staff: Providing information can help but may also backfire. PLoS One. 2020 Jan 29;15(1):e0227729. doi: 10.1371/journal.pone.0227729. PMID: 31995583; PMCID: PMC6988907. <u>PubMed Central</u>

EHCI(2018). European Score for Accessability and Global Score. Euro Health Consumer Index. Available at <u>https://healthpowerhouse.com/publications/</u>

INE. Health resources. Spanish National Institute of Statitiscs. Madrid.

Guisan, Maria-Carmen, 2009. "<u>Education, Health And Economic Development: A</u> <u>Survey Of Quantitative Economic Studies, 2001-2009</u>," <u>Regional and Sectoral</u> <u>Economic Studies</u>, vol. 9(1), pages 129-148.

Guisan, M.C. & Arranz, M., 2001. "<u>Consumption expenditure on Health and</u> <u>Education: Econometric models and evolution of OECD countries 1970-</u> <u>96</u>," <u>Economic Development</u> 50, University of Santiago de Compostela. Faculty of Economics and Business. Econometrics..

Guisan, M.Carmen & Arranz, Matilde, 2003. "<u>Econometric Models of Private and</u> <u>Public Health Expenditure in OECD countries, 1970-96</u>," <u>Applied Econometrics</u> <u>and International Development</u>, vol. 3(3), pages 49-60.

Guisan, M.C. & Aguayo, E., 2007. "<u>Health Expenditure, Poverty and Economic</u> <u>Development in Latin America 2000-2005,</u>" <u>International Journal of Applied</u> <u>Econometrics and Quantitative Studies</u>, vol. 4(2), pages 5-24.

Guisan, M. Carmen & Exposito, Pilar, 2006 . "Desarrollo Económico De África En 2000-2005: Educación, Gasto En Salud, Población Y Renta," Estudios Economicos de Desarrollo Internacional, vol. 6(1).

Guisan, M.C. & Exposito, P., 2006 b. "<u>Health Expenditure, Poverty and Economic</u> <u>Development in Africa, 2000-2005</u>," <u>International Journal of Applied Econometrics</u> <u>and Quantitative Studies</u>, vol. 3(2), pages 5-20.

Guisan, M.C. & Exposito, P., 2007. "<u>Education, Development And Health</u> <u>Expenditure In Africa: Estimation Of Cross-Section Model Of 39 Countries In</u> <u>2000-2005," <u>Applied Econometrics and International Development</u>,vol.7(2), p.135-142.</u>

Guisan & Exposito, P., 2010. "<u>Health Expenditure, Education, Government</u> <u>Effectiveness and Quality of Life in Africa and Asia</u>," <u>Regional and Sectoral</u> <u>Economic Studies</u>, vol. 10(1).

Lopez-Casasnovas, G., Costa-Font, J., Planas, I.(2004). Diversity and regional inequalities: Assessing the outcomes of the Spanish system of health care services. Working Paper RCHE 745, Research Center on Health and Economics, University Pompeu Fabra, Barcelona.

MPS(2023). Staff shortages and long waiting times are fuelling abuse against doctors. Medical Protection Society. published in British Medical Journal, BMJ 2023; 381: p14441, doi: <u>https://doi.org/10.1136/bmj.p1441</u> (Published 22 June 2023).

OECD. <u>Health at a Glance 2015</u>. Organisation for Economic Co-operation and Development, Paris.

OECD. Health Spending. OECD, Paris.

OECD. Potential Years of Life Lost. OECD, Paris

Spedicato, Alessandra (2021). Questionnaire on Doctor's satisfaction results. <u>F22-019</u>. Federation Europeenne des Medicins Salaries (FEMS), European Federation of Salaried Doctors (EFSD)),

World Bank. World Development Indicators: Doctors, Nurses, Hospital Beds.

# ANNEX 1: HEALTH INDICATORS IN OECD COUNTRIES

Table A1. OLOD Health at a Glance 2021					
	Satisfac	Expenditure	Beds	Doctors	Nurses
	tion %	per capita	Rate	Rate	Rate
OECD	71.0	4087	4.4	3.6	8.8
Australia	83	4919	3.8	3.8	12.2
Austria	86	5705	7.2	5.3	10.4
Belgium	92	5458	5.6	3.2	11.1
Canada	78	5370	2.5	2.7	10.0
Chile	39	2291	2.0	2.6	2.9
Colombia	47	1276	1.7	2.3	1.4
Costa Rica	63	1600	1.1	3.1	3.4
Czech R	75	3417	6.6	4.1	8.6
Denmark	89	5478	2.6	4.2	10.1
Estonia	61	2507	4.5	3.5	6.2
Finland	85	4561	3.4	3.2	14.3
France	71	5274	5.8	3.2	11.1
Germany	85	6518	7.9	4.4	13.9
Greece	38	2319	4.2	6.2	3.4
Hungary	62	2170	6.9	3.5	6.6
Iceland	81	4541	2.8	3.9	15.4
Ireland	66	5083	2.9	3.3	12.9
Israel	72	2903	3.0	3.3	5.0
Italy	61	3653	3.2	4.1	6.2
Japan	73	4691	12.8	2.5	11.8
Korea	71	3406	12.4	2.5	7.9
Latvia		2074	5.4	3.3	4.4
Lithuania	51	2727	6.4	4.6	7.7
Luxembourg	85	5414	4.3	3.0	11.7
Mexico	48	1133	1.0	2.4	2.9
Netherlands	92	5739	3.1	3.7	10.7
New Zealand	77	4212	2.5	3.4	10.2
Norway	93	6745	3.5	5.0	17.9
Poland	26	2289	6.2	2.4	5.1
Portugal	67	3347	3.5	5.0	7.1
Slovak R	58	2189	5.8	3.6	5.7
Slovenia	85	3303	4.4	3.3	10.3
Spain	70	3600	3.0	4.4	5.9
Sweden	82	5552	2.1	4.3	10.9
Switzerland	91	7138	4.6	4.4	18.0
Turkey	62	1267	2.9	2.0	2.4
United Kingdom	75	4500	2.5	3.0	8.2
United States	83	10948	2.8	2.6	12.0

Table A1. OECD Health at a Glance 2021

Source: OECD. First column: Population satisfactied with availability and quality of health care. Table A2. Correlations between indicators of table A1 in OECD countries, 2021.

	satisfaction	expendh	beds	doctors	nurses
satisfaction	1.0000	0.7229	0.0487	0.1937	0.7818
expendh	0.7229	1.0000	0.0613	0.1862	0.7964
beds	0.0487	0.0613	1.0000	0.0144	0.1843
doctors	0.1937	0.1862	0.0144	1.0000	0.2683
nurses	0.7818	0.7964	0.1843	0.2683	1.0000

Guisan, M.C. (2023). Health Resources and Scores in 6 European Countries, 1996-2019

Source: Elaborated by Guisan(2023) in this study from OECD data of table A1.

We may notice that the percentage of satisfied population is high correlated with the Nurses rate and with Expenditure per capita. Nurses rate is an important indicator of Health services resources and has a correlation of 79.64% with Expenditure per capita. The Beds rate has little correlation with expenditure per capita, what is surprising due to the important financial resources needed for hospital buildings. In this regard it is important to know if data of Expenditure per capita only includes current expenditure on goods and services and not the stock of hospital capital (buildings, instalations and machinery).



Source: Elaborated by Guisan(2023) in this study from OECD data of table A1.

12,000

'n

'n

ģ

NURSES

12

16

20

Rates of Nurses per thousand inhabitants in the OECD 2019

Below 5: Brazil, Greece, Letonia, Mexico, Turkey. South Africa, China, India

Between 5 and 7: Estonia, Hungary, Israel, Italy, Slovakia, Spain,

2,000 4,000 6,000 8,000

Expendh

-2,000 0

Between 7 and 9: Zcech Republica, Korea South, Lithuania, Portugal, UK. Russia Between 9 and 12: Austria, Canada, Denmark, France, Germany, New Zealand, Slovenia, Sweden.

Between 12 and 15: Australia, Belgium Finland, Ireland, Japan, USA,

Between 15 and 18: Island, Norway, Switzerland

ANNEX 2. REGIONAL HEALTH CARE DATA IN SPAIN 132

Table A3 shows a diminution in the rate of Doctors per 100 thousand people in 13 out of the 17 Spanish regions for the period 2010-2020.

GEO (Labels)	2010	2015	2020
Andalucía	225.59	220.12	219.39
Aragón	372.09	367.57	365.25
Asturias	340.09	326.10	347.24
Balears	308.55	310.20	282.31
Canarias	334.06	314.45	278.32
Cantabria	334.07	330.00	348.39
Castilla y León	352.78	347.73	352.89
Castilla-la Mancha	251.13	229.98	233.68
Cataluña	402.79	382.81	383.29
ComValenciana	245.91	235.68	239.38
Extremadura	354.06	330.42	349.82
Galicia	357,17	334,61	330.35
Madrid	294.71	281.31	272.92
Murcia	313.46	323.93	310.53
Navarra	373.19	332.53	343.18
País Vasco	361.98	334.85	332.09
Rioja	291.51	319.93	330.77

Table A3. Doctors per 100 thousand people, 2010-2020

Source Eurostat.

 Table A4. Regional Hospital Discharges (number of patients) year 2017

	All	Male	Female
Total Spain	4862352	2319458	2542894
Andalucía	697960	319822	378138
Aragón	156138	76587	79551
Asturias, Principado De	120165	58673	61492
Balears, Illes	135909	64344	71565
Canarias	190203	89268	100935
Cantabria	57525	27957	29568
Castilla Y León	267463	138054	129409
Castilla - La Mancha	174308	84082	90226
Cataluña	907169	432469	474700
Comunitat Valenciana	510985	246407	264578
Extremadura	114392	54825	59567
Galicia	296874	144658	152216
Madrid, Comunidad De	716887	331947	384939
Murcia, Región De	152804	71161	81644
Navarra, Comunidad Foral De	69353	34131	35222
País Vasco	245409	123247	122162
Rioja, La	34677	17129	17548

Source: INE, 2019. Discharges (altas hospitalarias) in 17 Autonomous Communities. Note: All causes A00-Z99 (except codes V, W, X, Y)

The highest rates in year 2020, with more than 350 Doctors per 100 thousand inhabitants (3.5 Doctors per thousand people), correspond to Aragon, Castilla y Leon, and Cataluña,

	Primary	Hospital	Specialists	Urgencies	Average
	Services	Services	Services	_	_
SNS	6.2	7.2	6.1	6.2	6.43
Andalucía	5.9	6.8	5.9	5.9	6.13
Aragón	6.5	7.7	6.2	6.7	6.78
Asturias, Principado	6.2	7.4	6.4	6.7	6.68
Balears, Illes	6.5	7.2	6.0	6.2	6.48
Canarias	6.6	7.0	5.9	5.9	6.35
Cantabria	6.3	7.7	6.6	6.8	6.85
Castilla y León	6.5	7.2	6.2	6.4	6.57
Castilla-La Mancha	6.2	7.2	6.0	6.4	6.45
Cataluña	6.4	7.1	6.1	6.0	6.40
Comunitat Valenciana	6.2	7.3	6.2	6.3	6.50
Extremadura	6.2	7.3	6.0	6.8	6.58
Galicia	6.3	7.4	6.3	6.5	6.63
Madrid,Comunidad de	6.0	7.2	6.1	6.2	6.37
Murcia, Región de	6.4	7.1	6.2	6.4	6.53
Navarra, C. Foral de	6.5	7.6	6.5	6.7	6.83
País Vasco	6.6	7.5	6.3	6.9	6.82
Rioja, La	6.5	7.5	6.1	6.1	6.55
Ceuta	6.9	7.1	6.5	6.1	6.65
Melilla	6.0	6.5	5.6	5.9	6.00

Table A5. Health Services evaluation from 0 (minimum) to 10 (maximum), year 2022

Source. <u>https://www.sanidad.gob.es/estadEstudios/sanidadDatos/tabla33.htm</u>Note: Data of 17 Autonomus Communities and 2 Autonomous Cities.

Table A6. Waiting times for specialist consultancy (days)

CC.AA.	Años				
	2010	2015	2019	2022	
	Total	Total	Total	Total	
España (ES)	53,18	58,00	80,88	95,23	
Galicia (GA)		51,00	37,60	66,01	
Madrid, Comunidad de (MD)		36,00	34,74	75,41	
País Vasco (PV)		28,00	23,27	48,16	
Tiempo medio de espera para una primera consulta Atención Especializada					

Source: https://inclasns.sanidad.gob.es/main.html

The average waiting time for specialist consultancy increased in Spain, from 53.18 in year 2010 to 95.23 in year 2022. The 3 regions that appear in table A5 show waiting times lower thant average but they also have experienced an increase for the period 2015-2022.

GEO (Labels)	2010	2015	2019	2020
Galicia	357,17	334,61	329,67	330,35
Principado de Asturias	340,09	326,10	345,79	347,24
Cantabria	334,07	330,00	328,34	348,39
País Vasco	361,98	334,85	325,71	332,09
Comunidad Foral de Navarra	373,19	332,53	335,41	343,18
La Rioja	291,51	319,93	323,43	330,77
Aragón	372,09	367,57	362,29	365,25
Comunidad de Madrid	294,71	281,31	273,10	272,92
Castilla y León	352,78	347,73	349,97	352,89
Castilla-la Mancha	251,13	229,98	233,41	233,68
Extremadura	354,06	330,42	335,24	349,82
Cataluña	402,79	382,81	384,00	383,29
Comunitat Valenciana	245,91	235,68	231,90	239,38
Illes Balears	308,55	310,20	287,46	282,31
Andalucía	225,59	220,12	217,98	219,39
Región de Murcia	313,46	323,93	325,41	310,53
Canarias	334,06	314,45	290,96	278,32

Table A7. Hospital beds in years 2010, 2015, 2019 and 2020

Source: Eurostat.

GEO (Labels)	2010	2015	2019	2020
Galicia	357,17	334,61	329.67	330.35
Principado de Asturias	340.09	326.10	345.79	347.24
Cantabria	334.07	330.00	328.34	348.39
País Vasco	361.98	334.85	325.71	332.09
Comunidad Foral de Navarra	373.19	332.53	335.41	343.18
La Rioja	291.51	319.93	323.43	330.77
Aragón	372.09	367.57	362.29	365.25
Comunidad de Madrid	294.71	281.31	273.10	272.92
Castilla y León	352.78	347.73	349.97	352.89
Castilla-la Mancha	251.13	229.98	233.41	233.68
Extremadura	354.06	330.42	335.24	349.82
Cataluña	402.79	382.81	384.00	383.29
Comunitat Valenciana	245.91	235.68	231.90	239.38
Illes Balears	308.55	310.20	287.46	282.31
Andalucía	225.59	220.12	217.98	219.39
Región de Murcia	313.46	323.93	325.41	310.53
Canarias	334.06	314.45	290.96	278.32

Table A8. Doctors per 100 thousand people

Source: Eurostat

Definitions:

"Nurses are defined as all the "practising" nurses providing direct health services to patients, including self-employed nurses. However, for some countries (France, Ireland, Italy, the Netherlands, Portugal, Slovakia, Turkey and the United States), due to lack of comparable data, the figures correspond to "professionally active" nurses, including nurses working in the health sector as managers, educators, researchers, etc. For Austria and Greece, the data include only nurses working in hospitals. Midwives and nursing aides (who are not recognised as nurses) are normally excluded although some countries include midwives as they are considered specialist nurses. This indicator is measured per 1 000 inhabitants."

Other links with information about Health services.

https://healthpowerhouse.com/media/EHCI-2018/EHCI-2018-report.pdf

https://www.clm21.es/noticia/4916/sanidad/indice-europeo-de-salud:-la-sanidadsuspende-en-listas-de-espera-de-cirugia-y-de-especialista.html

https://www.oecd.org/health/waiting-times-for-health-services-242e3c8c-en.htm

https://worldpopulationreview.com/country-rankings/best-healthcare-in-the-world

https://www.atlasandboots.com/remote-work/countries-with-the-best-healthcare-in-the-world/.

https://www.who.int/data/gho/data/indicators/indicator-details/GHO/hospital-beds-(per-10-000-population)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5299814/#:~:text=There%20are%20a pproximately%2059%20million%20healthcare%20workers%20worldwide.

The health of the healthcare workers. Bobby Joseph and Merlyn Joseph

"A healthcare worker is one who delivers care and services to the sick and ailing either directly as doctors and nurses or indirectly as aides, helpers, laboratory technicians, or even medical waste handlers. There are approximately 59 million healthcare workers worldwide. Recognizing the vital role played by health care workers as "the most valuable resource for health" the World Health Organization (WHO) had declared the years 2006 to 2015 as the "The decade of the human resources for health."

Journal RSES published by the EAAEDS: https://www.usc.gal/economet/eaat.htm