ORIGINAL ARTICLE

Physical structure, human resources, and health care quality indicators in public hospital emergency departments in the autonomous communities of Madrid and Catalonia: a comparative study

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Objective. To compare the general, structural, and organizational characteristics of public hospital emergency departments in the Spanish autonomous communities of Madrid and Catalonia.

Methods. Descriptive survey-based study covering 3 areas of inquiry: general hospital features (18 questions), structural features of the emergency department (14 questions), and organizational and work-related policies of the emergency department (30 questions). Hospitals were grouped according to complexity: local hospitals (level 1), high-technology or referral hospitals (levels 2–3).

Results. We studied 26 hospital departments in Madrid (21, levels 2–3; 5, level 1) and 55 in Catalonia (24, levels 2–3; 31, level 1). Hospitals in Madrid are in newer buildings (*P*=.002), have more beds on conventional wards and in critical care units (*P*<.001, both comparisons), are more often affiliated with a university (*P*<.001), and serve larger populations (*P*=.027). The emergency departments in Madrid have larger surface areas available for clinical care and more cubicles for preliminary evaluations and observation beds (*P*=.001, all comparisons). Hospitals in Madrid also attended a larger median number of emergencies (*P*<.001). More physicians were employed in Catalonia overall, but the numbers of physician- and nurse-hours per hospital were higher in Madrid, where it was more usual for physicians to work exclusively in the emergency department (92.5% in Madrid *vs* 56.8% in Catalonia, *P*<.001). However, fewer of the employed physicians had permanent contracts in Madrid (30.5% *vs* 75.1% in Catalonia, *P*<.001). The ratio of resident physicians to staff physicians differs between the 2 communities on afternoon/evening, night, and holiday shifts (3:1 in Madrid; 1:1 in Catalonia).

Conclusions. The physical and functional structures of hospital emergency departments in the communities of Madrid and Catalonia differ significantly. The differences cannot be attributed exclusively to geographic location.

Keywords: Health care resource planning. Administration. Autonomous community of Madrid. Emergency medicine. Emergency health services.

Estudio comparativo de la estructura física, recursos humanos e indicadores de actividad asistencial entre los servicios de urgencias hospitalarios públicos de las comunidades autónomas de Madrid y Cataluña

Objetivos. Comparar las características generales, estructurales y organizativas de los servicios de urgencias de hospitales públicos (SUHP) de la Comunidad de Madrid con los de Cataluña.

Método. Estudio descriptivo tipo encuesta estructurada con 3 apartados: aspectos generales del hospital (18 preguntas), aspectos generales y estructurales de urgencias (14 preguntas), y aspectos organizativos y laborales de urgencias (30 preguntas). Los centros se agruparon según complejidad: niveles I-hospital comarcal y niveles II y III-hospital de alta tecnología o de referencia.

Resultados. Se incluyeron los 26 SUHP de la Comunidad de Madrid (21 nivel II-III y 5 nivel I), y 55 de Cataluña (24 nivel II- III y 31 nivel I). En Madrid, comparada con Cataluña: los hospitales son de construcción más reciente (p = 0,002); tienen mayor número de camas de hospitalización (p < 0,001) y de cuidados críticos (p < 0,001); están más frecuentemente vinculados a la universidad (p < 0,001) y cubren mayor población (p = 0,027). Los servicios de urgencias: tienen mayor superficie para la actividad clínica (p < 0,001) y la primera asistencia (p < 0,001); mayor número de puestos de primera asistencia (p < 0,001) y camas de observación (p = 0,001) y la mediana del número de atenciones urgentes es mayor (p < 0,001). De forma global, hay más facultativos contratados en Cataluña, pero el número de horas de médico y enfermera contratadas por centro es mayor en Madrid, donde los médicos suelen reali-

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zar su actividad exclusivamente en urgencias (92,5% frente a 56,8%; p < 0,001), muy pocos con contrato fijo indefinido (30,5% frente a 75,1%; p < 0,001) con relación médico residente/adjunto diferente en turnos de tarde, noche y días festivos en comparación con los SUHP catalanes (3:1 frente a 1:1).

Conclusiones. La estructura física y funcional de los SUHP madrileños y catalanes difiere de forma significativa sin que pueda explicarse, exclusivamente, por los aspectos geográficos.

Palabras clave: Gestión. Planificación. Administración. Comunidad de Madrid. Medicina de Urgencias y Emergencias. Servicios de Urgencias.

Introduction

The SUHCAT study was one of the first studies that allowed to know in a fairly comprehensive and reliable way the structural and functional map of the emergency department (ED) in Catalonia[1,2]. This community is characterized for having an extensive geographic area (32,110 km^2), very populated (7,518,903 inhabitants in 2016), with a medium-high population density (235 inhabitants/m^2 in 2016), and with high macroeconomic productivity indicators and economic development (204,666 M€ of GDP and 26,996 € GDP per capita €)[3]. These aspects, together with others recognised by the authors, such as the transfers of health competence to each of the autonomous communities, the proximity policy, concerting services to hospitals of diverse ownership for public use and the wide network of private hospitals, they probably condition the results of the study and make them difficult to extrapolate to other autonomous communities[2].

The Community of Madrid has an economic situation similar to Catalonia (GDP, 203,626 M€ and its GDP per capita of 31,004 €), but unlike it, it has a high population (6,454,610 inhabitants in 2016) in a geographical area of four times smaller (8,028 km^2), which originates the highest population density of the Spanish autonomous communities after Ceuta and Melilla[3]. It is known that regional planning of hospital centres is based mainly on population density and communication systems[4]. Therefore, this differentiating circumstance between Catalonia and the Community of Madrid could be conditioning the public network of hospital centres and, therefore, of their corresponding ED.

At present, the specific characteristics of Madrid's public hospital emergency department (PHED) in relation to its physical structure are unknown and functional, and if these differ from the Catalan PHED. The objective of the present work was to study the general, structural, organizational and labour characteristics of the PHED of the Community of Madrid (SUHMAD) and compare it with the PHED of Catalonia (SUHCAT).

Method

Descriptive study type survey that included the 26 PHED of the Community of Madrid collected in the National Catalogue of Hospitals of 2015 following the same previously published selection methodology[1]. The comparison group consisted of the 55 PHED of Catalonia included in the SUHCAT[1] study (Table 1 of supplementary material). In both cases hospitals are for public use regardless of their ownership and therefore comparable. The study was approved by the Clinical Research Ethics Committee of the San Carlos Clinical Hospital (Internal Code 16/053-E).

The researchers of the SUHMAD study, with representation from all the participating centres, held two face-to-face meetings and a discussion forum was opened via e-mail for the design of the present study and the selection of the most pertinent questions of the SUHCAT study survey. Finally, the survey was structured in 3 sections: general aspects of the hospital centre (18 questions), general and structural aspects of emergencies (14 questions), organizational and work aspects of emergencies (30 questions).

Following a methodology similar to that of the SUHCAT study, the survey was addressed to the maximum responsible of the ED via email, after telephone contact, to explain the project, request their collaboration and appoint a researcher in each centre. This researcher was responsible for collecting and recording all the information of the survey in a coded electronic data collection notebook after an interview with the emergency coordinator and the nursing supervisor. The interviews were conducted in the first quarter of 2016 and the data asked referred to the year 2015.

The data of the PHED of Catalonia were obtained from the results of the SUHCAT study[1,2] and with reference to 2011. In order to make comparisons, the centres were grouped according to the complexity level of the hospital according to the Observatory of the Madrid Health Service and the Observatory of the Catalan Health System (level III or high complexity - high technology hospital or high-resolution reference, level II or intermediate complexity - reference hospital and level I or low complexity - local hospital)[5,6].

The results of the qualitative variables were summarized in absolute numbers and percentages, and the quantitative ones in mean and standard deviation for the normal distributions (which was verified with the Kolmogorov-Smirnov test) or in medium and interquartile ranges (IQR) for the non-normal distributions. For the comparison between groups, the chi-square test or Fisher's test was used for the qualitative variables and the Mann-Witney U-test for the quantitative variables. The differences were considered as statistically significant if the p value was <0.05. The statistical analysis was performed with the SPSS programs version 18.0 for Windows (SPSS Inc, Chicago, Il).

Results

Public health care is covered by 26 hospitals in the Community of Madrid, of which 21 (80.8%) are centres of level II-III (intermediate or high complexity) and 5 (19.2%) of level I (low complexity), and for 55 hospitals in Catalonia, of which 24 (43.6%) are high-tech or reference hospitals and 31 (54.4%) are district hospitals ($p = 0.006$). During the respective periods of the studies, 2,946,428 annual emergency services were documented in the PHED of the Community of Madrid, 2,565,950 (87.1%) in hospitals of level II-III and 380.478 (12.9%) in level I hospitals. In Catalonia, 3,317,923 annual emergency care in the PHED, 2,083,625 (62.8%) in high-tech or referral hospitals and 1,234,298 (37.2%) in district hospitals.

Table 1 shows the characteristics and structural data of public hospitals, and their corresponding ED, in the Community of Madrid and in Catalonia, and the comparison in a global and grouped manner according to the complexity of the centre. In the Community of Madrid, compared to Catalonia, the construction of hospitals is more recent, have a greater number of beds of critics and conventional hospitalization, are more frequently linked to the university and cover a larger population of reference area. With regard to EDs, they have a larger area for clinical activity and first assistance, and a greater number of positions for first aid and beds for observation units. In the analysis, according to the complexity of the centres, these trends are maintained except for the reference area population and the number of critical beds.

Table 2 documents the main healthcare data of hospitals and EDs. The most important data are the largest median number of emergency care in the Community of Madrid, compared to Catalonia, regardless of the complexity of the centres.

Table 3 reflects the data on the doctors and nurses hired and the organization of the days in the ED. The most striking results are related to the median hours of doctor and nurse hired by the centre, both on a working day and a holiday, these being higher in the Community of Madrid than in Catalonia. Those responsible for the HES in the Community of Madrid, compared to those of the HES in Catalonia, more commonly think that the personnel hired in the emergency department is insufficient.

Figure 1 shows the highest proportion of resident physicians in relation to the total of employed physicians (deputy doctors and residents) in public hospitals with training via MIR from one or another Community, especially in the afternoon and evening shifts and holidays.

In the Community of Madrid, 781 (92.5%) of the 844 permanent and non-fixed physicians who perform some activity in the ED, perform it exclusively in the emergency department compared to the 1,127 (56.8%) of the 1984 permanent and non-fixed physicians who perform some activity in the ED in Catalonia ($p < 0.001$). Of the total physicians who perform exclusive activity in the emergency room, only 238/781 (30.5%) have permanent fixed-term contracts in the Community of Madrid compared to 846/1.127 (75.1%) in Cataluña ($p < 0.001$). Tables 4 and 5 reflect the contractual typology, training and origin of the deputy doctors working in the PHEDs of both communities, globally and by type of centre. The most relevant findings indicate that in the Community of Madrid, in comparison with Catalonia, there is a greater median of physicians per centre that performs its activity exclusively in the emergency department, most frequently its "non-fixed" contract linked to emergencies, its training based on Family and Community Medicine or Internal Medicine, and they are mostly of Spanish nationality.

Discussion

The results of the present study provide greater evidence on the characteristics of EDs[1,2,7,8] and show that the planning of public hospitals and the physical and functional structure of their EDs differs significantly between the autonomous communities of Madrid and Catalonia. Catalonia has a network of public hospitals significantly more numerous (55 compared to 26), especially of regional hospitals (31 compared to 5), than the Community of Madrid, which seems more related to its greater geographical extension (4 times more) than with the highest number of emergency care in absolute values (12.5% more). Therefore, this has forced Catalonia to have a greater supply of doctors and nurses to cover urgent healthcare in public hospitals. The SUHMAD study was carried out after the construction of new hospitals in the Community of Madrid and the practical remodelling of almost all EDs. This data, and possibly the year in which the structure was built more than the one of the remodelling, is what can explain the differences in square meters of surface and number of posts dedicated to the first attendance in the Madrid PHED. In fact, in the SUHCAT study, it was found that a third of the PHED in Catalonia had been reformed in the 4 years prior to the survey, and despite this, the remodelling did not provide enough space[1].

The need for a greater number of first aid resources and hospital beds in the Community of Madrid would be justified by the greater number of urgent assistance existing per service, regardless of the complexity of the centre, in that community. This increase in the number of urgent assistance could be due to the distribution of the population of the community in a smaller number of hospital centres, and in the case of centres of level I, in which the number of attendances is doubled with respect to Catalans, it would be added that these centres are located in urban areas of easy accessibility, an important factor in frequent visits[9]. A final aspect, not analysed, that could influence this situation, would be differences related to the organization of primary care and out-of-hospital emergency services.

Table 1. Comparative study between the public centres of the SUH-MAD and SUH-CAT of the main structural data of the hospital and the emergency services

	Public SUH_MAD Total (N = 26)	Public SUH_CAT Total (N = 55)	p	Public Level II-III SUH_MAD (N = 21)	Public Level II-III SUH_CAT (N = 24)	p	Public Level I SUH_MAD (N = 5)	Public Level I SUH_CAT (N = 31)	p
CHARACTERISTICS									
Teaching									
– University relationship [n (%)]	25 (96.2)	26 (47.3)	< 0.001	20 (95.2)	19 (79.2)	0.114	5 (100)	7 (22.6)	0.001
– MIR training program [n (%)]	21 (80.8)	36 (65.5)	0.159	18 (85.7)	22 (91.7)	0.526	3 (60.0)	14 (45.2)	0.650
Reference population									
– Number of inhabitants of area (in thousands) [median (IQR)]	215 (159-328)	150 (67-275)	0.027	291 (167-369)	300 (160-480)	0.466	125 (91-175)	85 (38-150)	0.219
– Number of residences in the area [median (IQR)]	17 (8-45)	–	–	14 (7-35)	–	–	10 (7-28)	–	–
STRUCTURAL DATA									
Hospital									
Year of structure [median (IQR)]	2008 (1997-2008)	1993 (1984-2006)	0.002	2005 (1993-2008)	1989 (1975-2008)	0.035	2008 (2007-2009)	1995 (1988-2005)	0.006
Year of structural reform [median (IQR)]	2011 (2008-2015)	2010 (2008-2011)	0.138	2010 (2007-2015)	2010 (2008-2011)	0.441	2011 (2008-2015)	2007 (2009-2011)	0.190
Total number of hospital beds [median (IQR)]	302 (201-635)	140 (58-350)	< 0.001	398 (259-823)	373 (213-482)	0.246	115 (95-168)	92 (40-128)	0.224
No. ICU beds [median (IQR)]	14 (8-23)	0 (0-14)	< 0.001	16 (12-39)	14 (9-31)	0.294	6 (3-8)	0 (0-0)	0.014
Emergency Department									
M^2 for clinical activity [median (IQR)]	2,297 (1.660-3,090)	681 (300-1.762)	< 0.001	2,304 (1.887-3.340)	1,960 (681-2.925)	0.116	1,114 (493-2.118)	324(200-815)	0.076
M^2 for first aid [median (IQR)]	1,467 (883-1772)	200 (98-751)	< 0.001	1.575 (1.310-1.902)	800 (199-1.584)	0.011	553 (229-1.038)	150 (80-270)	0.063
Single entry [n (%)]	20 (76.9)	50 (90.9)	0.086	15 (71.4)	20 (83.3)	0.338	5 (100)	30 (96.8)	0.999
– Medical-surgical	26 (100)	55 (100)	0.999	21 (100)	24 (100)	0.999	5 (100)	31 (100)	0.999
– Traumatology	26 (100)	55 (100)	0.999	21 (100)	24 (100)	0.999	5 (100)	31 (100)	0.999
– Paediatric	24 (92.3)	47 (85.5)	0.381	19 (90.5)	19 (79.2)	0.296	5 (100)	28 (90.3)	0.999
– Gynaecology	24 (92.3)	47 (85.5)	0.381	19 (90.5)	19 (79.2)	0.296	5 (100)	28 (90.3)	0.999
– Psychiatric	25 (96.2)	43 (78.2)	0.040	20 (95.2)	18 (75.0)	0.062	5 (100)	25 (80.6)	0.564
No. of places of first assistance [medium (IQR)]									
– Total	58 (44-98)	21 (11-41)	< 0.001	74 (45-100)	46 (22-66)	0.026	46 (41-56)	13 (7-26)	< 0.001
– Critics	2 (2-3)	2 (1-3)	0.101	2 (2-3)	2 (2-4)	0.757	2 (2-2)	1 (1-2)	0.147
UNITS LINKED TO THE EMERGENCY SERVICE									
Observation unit (OU)									
– Existence OU [n (%)]	20 (76.9)	35 (63.6)	0.232	16 (76.2)	18 (75.0)	0.926	4 (80.0)	17 (54.8)	0.376
– Nº. beds OU [medium (IQR)]	17 (12-30)	10 (6-17)	0.001	18 (14-34)	13 (8-27)	0.046	12 (10-20)	6 (4-12)	0.081
– Nº of beds OU maximum [median (IQR)]	20 (16-37)	12 (6-18)	< 0.001	19 (16-40)	13 (8-28)	0.039	21 (16-26)	8 (4-12)	0.006
– M^2 destined to the OU [medium (IQR)]	195 (80-443)	51 (30-120)	0.089	195 (80-443)	51 (30-120)	0.089	195 (80-443)	51 (30-120)	0.089
Short stay unit (SSU)									
– Existence of SSU [n (%)]	7 (26.9)	20 (36.4)	0.400	6 (28.6)	10 (41.7)	0.360	1 (20.0)	10 (32.3)	0.999
– Linked to HES [n (%)]	6/7 (85.7)	14/20 (70.0)	0.414	5/6 (83.3)	9/10 (90.0)	0.696	1/1 (100)	5/10 (50.0)	0.999
– Nº beds SSU [median (IQR)]	12 (6-16)	11 (6-19)	0.999	14 (10-16)	14 (10-21)	0.635	5 (5-5)	7 (5-16)	0.545
Home based care (HBC)									
– Existence of HBC [n (%)]	7 (26.9)	–	–	7 (33.3)	–	–	0 (0)	–	–
– Linked to HES[n (%)]	2/7 (28.6)	–	–	2/7 (28.6)	–	–	0 (0)	–	–

HES: Hospital Emergency Services; MAD: Madrid; CAT: Catalonia; n: number; MIR: In Spain, intern/resident doctors; IQR: Interquartile range SSU: Short Stay Unit; OU: Observation Unit; HBC: Home Based Care.

Table 2. Comparative study between the public centres of the SUH-MAD and SUH-CAT of the main care data of the hospital and the emergency services

	Public SUH_MAD Total (N = 26)	Public SUH_CAT Total (N = 55)	p	Public Level II-III SUH_MAD (N = 21)	Public Level II-III SUH_CAT (N = 24)	p	Public Level I SUH_MAD (N = 5)	Public Level I SUH_CAT (N = 31)	p
ASSISTANCE DATA									
Hospital									
Nº of hospital admissions (in thousands) (median [IQR])	15 (9-19)	10 (4-16)	0.030	15.5 (10.2-21.8)	15.7 (11.7-22.0)	0.682	6.2 (2.8-7.7)	4.7 (1.8-8.3)	0.708
Admissions from emergencies (in %) [median (IQR)]	69 (41-74)	54 (44-66)	0.074	67 (51-73)	54 (44-66)	0.139	69 (60-74)	51 (43-66)	0.790
Hospital occupation (in %) [median (IQR)]	84 (81-87)	83 (70-90)	0.741	84 (78-87)	86 (80-93)	0.203	87 (83-93)	80 (62-90)	0.166
Emergency services									
Nº of emergency care (in thousands) [median (IQR)]	106 (91-125)	55 (31-84)	<0.001	111.5 (97.6-133.9)	84.7 (52.0-116.5)	0.004	79.9(49.2-101.1)	43.0 (16.8-57.2)	0.016
Patients admitted (in %) [median (IQR)]	10.6 (8.2-14.0)	9.0 (6.7-12.5)	0.184	11.3 (9.2-14.6)	11.9 (8.8-13.0)	0.925	7.0 (6.3-9.9)	8.0 (4.6-9.3)	0.825
Deaths in emergencies (in %) [median (IQR)]	0.05 (0.03-0.07)	0.09 (0.03-0.20)	0.084	0.06 (0.03-0.08)	0.14 (0.07-0.23)	0.005	0.03 (0.02-0.06)	0.05 (0.02-0.10)	0.348
Discharges without being attended (in %) [median (IQR)]0.9 (0.7-1.1)		1.5 (0.5-2.6)	0.163	0.9 (0.6-1.7)	2.2 (0.5-3.0)	0.108	1.0 (0.3-1.1)	1.5 (0.5-2.3)	0.407
Return < 72 hours to ED (in %) [median (IQR)]	4.4 (1.5-6.0)	4.8 (3.8-5.7)	0.352	4.6 (1.6-5.9)	5.3 (3.9-6.4)	0.240	1.5 (1.3-5.9)	4.8 (3.6-5.4)	0.310

HES: Hospital Emergency Services; MAD: Madrid; CAT: Catalonia; n: number; MIR: In Spain, Intern/resident doctors; IQR: Interquartile range SSU: Short Stay Unit; OU: Observation Unit; HBC: Home Based Care

With regard to the other ED indicators recommended by the Ministry of Health and Social Policy[10], the Spanish Society of Emergency Medicine[11,12] and the Catalan Society of Urgency and Emergency Medicine[13], it should be noted that they are among the established ranges (emergency department visits in 72 hours < 2.5-5%, mortality < 0.1-0.2% and discharged patients < 2-3%), and no statistically significant differences were found between the two communities exception of the number of admissions per centre, justified by the greater number of attentions made in the Madrid urgencies, since there are no differences in the percentage of admissions.

The hiring of doctors and nurses by centre, both on work days and holidays, is greater in the PHED of the Community of Madrid than in Catalonia. As previously mentioned, this can be a response mechanism to the greatest number of urgent care per centre. The people in charge of the Catalan PHED think less frequently than the people of Madrid that the staffing is insufficient. This fact is even more striking after it was recently shown that the opinion would be even worse if the medical or nursing staff[14] had been surveyed, especially if their working hours are changing instead of fixed[15].

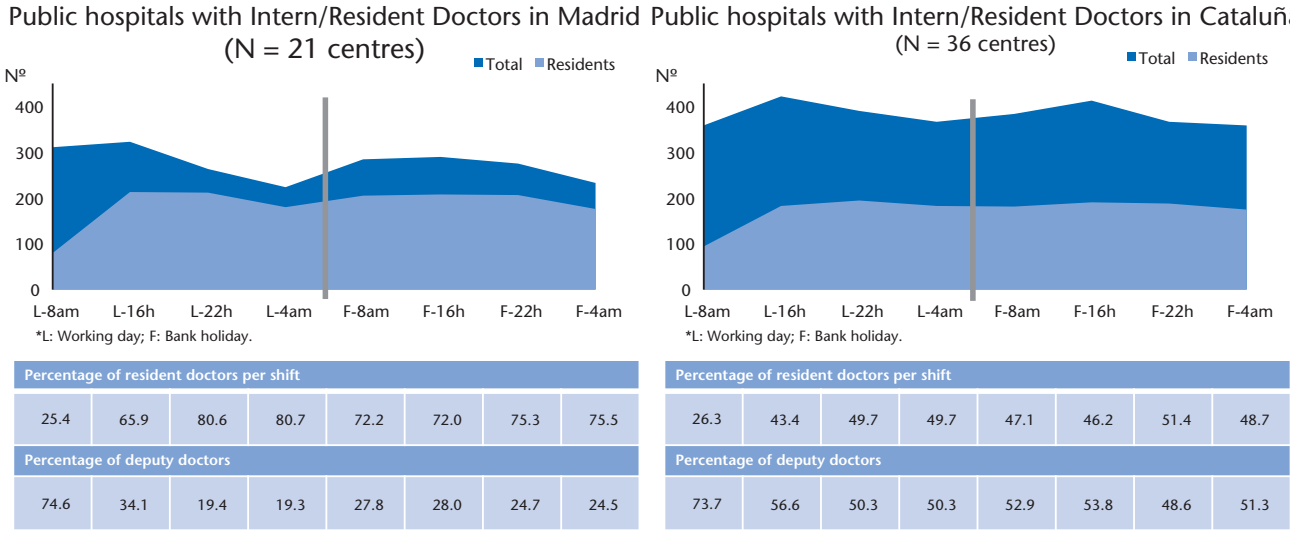
Another fact of the present study is the ratio between the resident doctors and the deputy doctors of the Madrid PHED with training program of resident medical doctors in front of the Catalan PHED, especially in the afternoon and evening shifts and public holidays. Morning of the working days, the ratio is 1 resident doctor for every 3 deputy doctors in both communities; however, during the evenings, nights and the whole weekend, the number of total residents almost triples, to represent 3 residents for each deputy in the Community of Madrid, while in Catalonia this increase is smaller, since it only doubles, with a ratio of 1 resident for each attachment approximately. The explanation can be twofold: on the one hand the existence of a fixed rotation by the ED of residents, during their first year of training, on the morning shift of the working days, which require direct supervision by the deputies, and on the other the obligatory nature of the afternoon/evening and festive warnings contemplated in the training programs of practically all specialties[16] which would enhance the numerical disproportion in the centres with the greatest number of residents or specialties offered.

It is unknown what may be the impact of this fact when establishing the organic templates and the hiring of deputy doctors, in the internal performance of the ED or in the degree of training of the resident physician in emergency and emergency medicine. There is increasing evidence to show that the presence of residents is associated with a reduction in the time of first medical assessment and the total time of total stay in the ED[17,18] and that this ratio increases according to the year of residence[19]. With respect to the training of the resident, it is known that such work is

Table 3. Comparative study between the public centres of the SUH-MAD and SUH-CAT about the doctors and the contracted nursing and the organization of the day in the emergency services

	Public SUH_MAD Total (N = 26)	Public SUH_CAT Total (N = 55)	p	Public Level II-III SUH_MAD (N = 21)	Public Level II-III SUH_CAT (N = 24)	p	Public Level I SUH_MAD (N = 5)	Public Level I SUH_CAT (N = 31)	p
DOCTORS									
Doctor hours hired on a working day [median (IQR)]									
– Totals	241 (157-456)	143 (63-227)	0.001	315 (201-490)	261 (165-381)	0.467	120 (94-157)	77 (48-143)	0.192
– Dedicated to provide coverage to the SSU	0 (0-1)	0 (0-2)	0.665	0 (0-3)	0 (0-7)	0.360	0 (0-1)	0 (0-0)	0.921
– Residents	54 (0-254)	17 (0-72)	0.130	119 (0-322)	82 (32-166)	0.918	(0-42)	0 (0-17)	0.720
Doctor's hours hired on a holiday [median (IQR)]									
– Totals	260 (144-428)	144 (60-240)	0.002	288 (184-432)	241 (172-401)	0.524	110 (76-156)	84 (48-144)	0.313
– Dedicated to provide coverage to the SSU	0 (0-0)	0 (0-0)	0.656	0 (0-0)	0 (0-5)	0.313	0 (0-1)	0 (0-0)	0.916
– Residents	96 (0-300)	24 (0-96)	0.072	144 (0-350)	120 (54-222)	0.714	0 (0-60)	0 (0-24)	0.681
The coverage on Saturdays [n (%)]			0.089			0.749			0.158
– As a working day	1 (3.8)	13 (23.6)		1 (4.8)	2 (8.3)	0 (0.0)	11 (35.5)		
– As a holiday	22 (84.6)	37 (67.3)		17 (81.0)	20 (83.3)	5 (100)	7 (54.8)		
– As an intermediate scheme	3 (11.5)	5 (9.1)		3 (14.2)	2 (8.2)	0 (0.0)	3 (9.7)		
The working hours of doctors [n (%)]			0.003			0.382			0.022
– Morning schedule and guards	5 (19.2)	7 (12.7)		5 (23.8)	5 (20.8)	0 (0)	2 (6.5)		
– 8-hour shift	0 (0)	1 (1.8)		0 (0)	1 (4.2)	0 (0)	0 (0)		
– 12-hour shifts	1 (3.8)	13 (23.6)		1 (4.8)	2 (8.3)	0 (0)	11 (13.5)		
– Shifts of variable duration	2 (7.7)	18 (32.7)		1 (4.8)	5 (20.8)	1 (20.0)	13 (41.9)		
– Mixed model (shifts and guards)	18 (69.2)	16 (29.1)		14 (66.7)	11 (45.8)	4 (80.0)	5 (16.1)		
– Only guards	0 (0)	0 (0)		0 (0)	0 (0)	0 (0)	0 (0)		
The amount of medical personnel is [n (%)]			0.006			0.096			0.055
– Enough. except for exceptionalities	4 (15.4)	29 (52.7)		4 (19.0)	12 (50.0)	0 (0)	17 (54.8)		
– Occasionally insufficient	18 (69.2)	22 (40.0)		13 (61.9)	9 (37.5)	5 (100)	13 (41.9)		
– Frequently insufficient	4 (15.4)	4 (7.3)		4 (19.0)	3 (12.5)	0 (0)	1 (3.2)		
It has a fixed rotation of residents in the emergency department [n (%)]	19/21 (90.5)	28/36 (77.8)	0.224	16/18 (88.9)	18/22 (81.8)	0.533	3/3 (100)	10/14 (71.4)	0.541
It has rotation of R1 in the emergency department [n (%)]	18/19 (94.7)	27/28 (96.4)	0.778	16/16 (100)	18/18 (100)	0.999	2/3 (66.7)	9/10 (90.0)	0.423
It has rotation of R2 in the emergency department [n (%)]	4 /19 (21.1)	11/28 (39.3)	0.188	3 /16 (18.8)	8/18 (44.4)	0.110	1/3 (33.3)	3/10 (30.0)	0.913
It has rotation of R3-R5 in the emergency department [n (%)]	6/19 (31.6)	9/28 (32.1)	0.968	6/16 (37.5)	6/18 (33.3)	0.800	0/3 (0)	3/10 (30.0)	0.528
NURSING									
Hours of nurses hired [median (IQR)]									
– One working day	243 (190-343)	120 (62-216)	< 0.001	247 (202-333)	234 (120-324)	0.359	188 (49-552)	86 (48-142)	0.184
– A festive day	240 (189-338)	120 (69-216)	0.001	240 (202-333)	231 (120-324)	0.557	188 (49-552)	72 (48-132)	0.169
The amount of nursing is [n (%)]			0.099			0.443			0.105
– Enough, except for exceptionalities	5 (19.2)	22 (40.0)		5 (23.8)	7 (29.2)	0 (0)	15 (48.4)		
– Occasionally insufficient	11 (42.3)	22 (40.0)		7 (33.3)	11 (45.8)	4 (80.0)	11 (35.5)		
– Frequently insufficient	10 (38.5)	11 (20.0)		9 (42.9)	6 (25.0)	1 (20.0)	5 (16.1)		

HES: Hospital Emergency Services; MAD: Madrid; CAT: Catalonia; n: number; MIR: In Spain, Intern/resident doctors); IQR: Interquartile range; SSU: Short Stay Unit; OU: Observation Unit; HBC: Home Based Care; R1: Resident Doctor 1st year; R2: Resident Doctor 2nd year; R3: Resident Doctor 3rd year; R5: Resident Doctor 5th year



Percentage of resident doctors per shift							
25.4	65.9	80.6	80.7	72.2	72.0	75.3	75.5
Percentage of deputy doctors							
74.6	34.1	19.4	19.3	27.8	28.0	24.7	24.5

Percentage of resident doctors per shift							
26.3	43.4	49.7	49.7	47.1	46.2	51.4	48.7
Percentage of deputy doctors							
73.7	56.6	50.3	50.3	52.9	53.8	48.6	51.3

Figure 1. Comparative study between public centres with resident training programs via MIR of SUH-MAD and SUH-CAT of the relationship between the number of medical deputies and residents in the emergency services.

time consuming, especially during the first years of residence, and therefore it is unknown whether the medical relationship/resident doctor can affect the degree of satisfaction of residents about their training in the ED[20]. Taking into account all of the above, it would be necessary to adapt the templates of doctors attached to the real needs of care of EDs, considering that the training and supervision of resident doctors is one more activity of the assistant physician that takes time[21].

Other of the most striking aspects of the present study is the contractual relationship, the training and

Table 4. Comparative study between the public centres of the SUH-MAD and SUH-CAT on the contractual typology of the deputy doctors who work in the emergency services

	Public SUH_MAD Total (N = 26)	Public SUH_CAT Total (N = 55)	p	Public Level II-III SUH_MAD (N = 21)	Public Level II-III SUH_CAT (N = 24)	p	Public Level I SUH_MAD (N = 5)	Public Level I SUH_CAT (N = 31)	p
Fixed and non-fixed facultative that perform some activity in the emergency department									
– Total	844	1,984		703	1,114		141	870	
– Median per centre (IQR)	30 (25-41)	29 (16-49)	0.488	31 (24-43)	41 (23-64)	0.260	28 (21-35)	23 (12-35)	0.537
Fixed and non-fixed facultative that perform activity exclusively in the emergency department									
– Total	781	1,127		662	534		119	593	
– Medium per centre (IQR)	28 (22-36)	18 (12-27)	<0.001	30 (23-38)	19 (15-31)	0.003	25 (19-27)	16 (12-24)	0.136
Facultative with permanent fixed-term contract linked to emergencies									
– Total	238	846		194	367		44	479	
– Medium per centre (IQR)	4 (2-17)	15 (10-19)	0.001	4 (2-17)	15 (11-20)	0.012	11 (0-16)	13 (10-19)	0.119
Facultative with permanent non-fixed contract (interim, eventual or guards) linked to the emergency department									
– Total	543	281		468	167		75	114	
– Medium per centre (IQR)	18 (15-27)	2 (0-9)	<0.001	19 (16-29)	6 (0-10)	<0.001	14 (8-22)	2 (0-6)	0.004
Facultative with permanent fixed contract linked a service other than emergencies and performing guards or shifts in the emergency department									
– Total	17	836		14	567		3	269	
– Medium per centre (IQR)	0 (0-1)	1 (0-19)	0.010	0 (0-1)	11 (1-32)	<0.001	0 (0-1)	0 (0-14)	0.449
Facultative with permanent non-fixed contract (includes interim) linked to another service different from emergencies that make guards or shifts in the emergency department									
– Total	46	21		27	13		19	8	
– Medium per centre (IQR)	0 (0-1)	0 (0-0)	0.077	0 (0-1)	0 (0-0)	0.526	0 (0-9)	0 (0-0)	0.062

HES: Hospital Emergency Services; MAD: Madrid; CAT: Catalonia; n: number; IQR: Interquartile range

Table 5. Comparative study between the public centres of the SUH-MAD and SUH-CAT on the origin and training of the deputy doctors who work in the hospital emergency services

	Public SUH_MAD Total (N = 26)	Public SUH_CAT Total (N = 55)	p	Public Level II-III SUH_MAD (N = 21)	Public Level II-III SUH_CAT (N = 24)	p	Public Level I SUH_MAD (N = 5)	Public Level I SUH_CAT (N = 31)	p
Fixed and non-fixed facultative that perform some activity in the emergency department									
Training [N (%) - median by centre (IQR)]									
– Family and community medicine	445 (53.4)/18 (11-24)	503 (27.7)/9 (5-13)	< 0.001	359 (51.6)/18 (8-24)	209 (19.0)/9 (5-12)	0.003	86 (61.9)/18 (14-20)	294 (41.0)/8 (4-14)	0.016
– Internal Medicine	270 (32.4)/9 (4-15)	349 (19.2)/5 (0-10)	0.002	232 (33.4)/10 (5-15)	251 (22.3)/8 (5-15)	0.425	38 (27.3)/8 (2-13)	98 (13.7)/1 (0-5)	0.048
– Intensive medicine	3 (0.4)/0 (0-0)	35 (1.9)/0 (0-0)	0.112	3 (0.4)/0 (0-0)	30 (2.7)/0 (0-2)	0.076	0 (0)/0 (0-0)	5 (0.7)/0 (0-0)	0.340
– Paediatrics	10 (1.2)/0 (0-0)	166 (9.2)/0 (0-4)	0.007	10 (1.4)/0 (0-0)	120 (10.9)/1 (0-7)	0.001	0 (0) /0 (0-0)	46 (6.4)/0 (0-0)	0.290
– Obstetrics and gynaecology	14 (1.7)/0 (0-0)	108 (6.0)/0 (0-0)	0.116	14 (2.0)/0 (0-0)	81 (7.4)/0 (0-3)	0.055	0 (0) /0 (0-0)	27 (3.8)/0 (0-0)	0.402
– Orthopaedic surgery and traumatology	1 (0.1)/0 (0-0)	191 (10.5)/0 (0-5)	< 0.001	1 (0.1)/0 (0-0)	126 (11.5)/2 (0-8)	< 0.001	0 (0) /0 (0-0)	65 (9.1)/0 (0-4)	0.209
– Surgery	3 (0.4)/0 (0-0)	184 (10.1)/0 (0-6)	0.004	2 (0.3)/0 (0-0)	128 (11.7)/1 (0-9)	< 0.001	1(0.7)/0 (0-0)	56 (7.8)/0 (0-1)	0.630
– Another medical specialty	79 (9.5)/2 (0-4)	212 (11.7)/1 (0-5)	0.488	65 (9.3)/2 (0-4)	121 (11.0)/2 (0-7)	0.880	14 (10.1)/1 (0-6)	91 (12.7)/1 (0-3)	0.671
– Another surgical specialty	2 (0.2)/0 (0-0)	15 (0.8)/0 (0-0)	0.598	2 (0.3)/0 (0-0)	8 (0.7)/0 (0-0)	0.419	0 (0) /0 (0-0)	7 (1.0)/0 (0-0)	0.565
– Without specialist qualification	7 (1.6)/0 (0-0)	51 (10.1)/0 (0-0)	0.156	7 (1.0)/0 (0-0)	23 (2.1)/0 (0-0)	0.464	0 (0) /0 (0-0)	28 (9.5)/0 (0-0)	0.246
Origin [medium (IQR)]									
– Spanish people	764 (91.7)/28 (23-36)	1328 (77.3)/19 (9-30)	0.005	646 (91.9)/29 (23-37)	731 (83.3)/24 (17-39)	0.265	118 (90.8)/25 (17-29)	597 (71.1)/16 (6-24)	0.114
– Non-Spanish community members	12 (1.4)/0 (0-1)	37 (2.2)/0 (0-1)	0.409	5 (0.7)/0 (0-0)	18 (2.1)/0 (0-2)	0.154	7 (5.4)/ 1 (0-3)	19 (2.3)/0 (0-1)	0.254
– Non-community	57 (6.8)/1 (0-2)	352 (20.5)/5 (1-9)	< 0.001	52 (7.4)/1 (0-2)	128 (14.6)/3 (0-7)	0.031	5 (3.8)/ 0 (0-4)	224 (26.7)/6 (2-11)	0.025
Fixed and non-fixed facultative that perform activity exclusively in the emergency department									
Training [N (%) - median by centre (IQR)]									
– Family and community medicine	443 (57.2)/18 (10-24)	468 (49.5)/7 (5-12)	<0.001	357 (54.4)/18 (8-24)	185 (36.8)/7 (5-11)	0.001	86 (72.3)/18 (14-20)	293 (64.7)/8 (4-13)	0.011
– Internal Medicine	247 (31.9)/9 (4-15)	236 (25.0)/2 (0-7)	<0.001	220 (33.5)/9 (5-15)	177 (35.2)/7 (3-10)	0.063	27 (22.7)/3 (1-10)	59 (13.0)/1 (0-2)	0.039
– Intensive medicine	3 (0.4)/0 (0-0)	12 (1.3)/0 (0-0)	0.304	3 (0.5)/0 (0-0)	8 (1.6)/0 (0-0)	0.295	0 (0)/0 (0-0)	4 (0.9)/0 (0-0)	0.401
– Paediatrics	4 (0.5)/0 (0-0)	34 (3.6)/0 (0-0)	0.154	4 (0.6)/0 (0-0)	26 (5.2)/0 (0-2)	0.056	0 (0) /0 (0-0)	8 (1.8)/0 (0-0)	0.474
– Obstetrics and gynaecology	5 (0.6)/0 (0-0)	4 (0.4)/0 (0-0)	0.654	5 (0.8)/0 (0-0)	4 (0.8)/0 (0-0)	0.835	0 (0) /0 (0-0)	0 (0)/0 (0-0)	0.999
– Orthopaedic surgery and traumatology	1 (0.1)/0 (0-0)	47 (5.0)/0 (0-1)	0.017	1 (0.2)/0 (0-0)	28 (5.6)/0 (0-2)	0.002	0 (0) /0 (0-0)	19 (4.2)/0 (0-0)	0.474
– Surgery	3 (0.4)/0 (0-0)	40 (4.2)/0 (0-0)	0.201	2 (0.3)/0 (0-0)	32 (6.4)/0 (0-2)	0.010	1 (0.8)/ 0 (0-0)	8 (1.8)/ 0 (0-0)	0.340
– Another medical specialtya	60 (7.7)/2 (0-3)	65 (6.9)/0 (0-2)	0.019	55 (8.4)/2 (0-3)	28 (5.6)/0 (0-2)	0.018	5 (4.2)/1 (0-1)	37 (8.2)/1 (0-2)	0.698
– Another surgical specialty	2 (0.3)/0 (0-0)	5 (0.5)/0 (0-0)	0.734	2 (0.3)/0 (0-0)	4 (0.8)/0 (0-0)	0.963	0 (0) /0 (0-0)	1 (0.2)/0 (0-0)	0.668
– Without specialist qualification	7 (1.6)/0 (0-0)	34 (7.3)/0 (0-0)	0.222	7 (1.1)/0 (0-0)	10 (2.0)/0 (0-0)	0.754	0 (0) /0 (0-0)	24 (8.2)/0 (0-0)	0.246
Origin [medium (IQR)]									
– Spanish people	712 (91.3)/26 (20-34)	826 (73.6)/15 (8-19)	< 0.001	606 (91.5)/29 (21-36)	425 (79.6)/15 (13-23)	< 0.001	106 (89.8)/21 (16-26)	401 (68.1)/12 (6-19)	0.022
– Non-Spanish community members	12 (1.5)/0 (0-1)	32 (2.8)/0 (0-1)	0.605	5 (0.8)/0 (0-0)	13 (2.4)/0 (0-1)	0.380	7 (5.9)/ 1 (0-3)	19 (3.2)/0 (0-1)	0.254
– Non-community	56 (7.2)/0 (0-2)	265 (23.6)/4 (1-8)	0.002	51 (7.7)/0 (0-2)	96 (18.0)/3 (0-7)	0.081	5 (4.2)/ 0 (0-4)	169 (28.7)/6 (2-8)	0.034

HES: Hospital Emergency Services; MAD: Madrid; CAT: Catalonia; n: number; MIR: In Spain, Intern/resident doctors); IQR: Interquartile range

the origin of the doctors who carry out their activity in the emergency department of the PHED of the Community of Madrid. Nine out of ten of the deputy doctors who perform any activity in Madrid's emergency department do so exclusively, and despite this, only one in three has an indefinite permanent contract. In Catalonia, just over one in two performs its activity exclusively, of which 3 out of 4 are fixed. The labour situation of instability has been related to the development of burn-out and favours the lack of involvement and involvement of physicians with their service[22,23].

Most of the doctors of the Community of Madrid have the specialty of Family and Community Medicine or Internal Medicine, followed by other medical specialties, such as Geriatrics. Although in Catalonia the two most frequent specialties are the same, there is a not insignificant percentage of doctors from other specialties, especially paediatricians or with surgical specialties, such as Orthopaedic Surgery and Traumatology, contractually linked to the PHED, more in highly complex hospitals. Another noteworthy fact is the percentage of doctors without specialty in the Catalan PHED, mainly in the regional hospitals, which almost reaches one in ten doctors. The specialty of Emergency and Emergency Medicine is the most tangible solution in order to homogenize the training of professionals who perform emergency assistance and encourage exclusive links with emergency services[24-27].

Finally, emergency deputy physicians in the Community of Madrid are mostly Spanish, while there is a high percentage of non-EU residents in Catalonia, especially in regional hospitals. This fact could be related to a higher demand for doctors, due to the greater number of existing hospitals in Catalonia, at a time of scarce national supply due to the shortage of jobseekers in our sector, to the greater geographical dispersion of public hospitals catalans that can be found far from large urban centres (making them less attractive), to the greater university link of the Madrid centres (which may be an attraction to work in them, or the need to have to know another language besides Spanish which could constitute a barrier).

The present study has a number of limitations. In the first place, the possible temporary effect that exists between conducting the surveys of the SUHCAT study (2012) and the SUHMAD study (2016). In the second place, private centers were excluded, which support one out of every five urgent care in Spain28. Third, data related to age, sex, the degree of complexity of the patients or the extra-hospital organization of health care were not included, which could have allowed a better understanding of the results[29,30].

In conclusion, the planning of public hospitals and the physical and functional structure of their EDs differs significantly between the Autonomous Community of Madrid and Catalonia, and these inequalities are not explained in their entirety by the geographical aspects.

Conflicting interests

The authors declare no conflict of interest in relation to this article.

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Ethical Responsibilities

The study was approved by the Clinical Research Ethics Committee of the San Carlos Clinical Hospital (Internal Code 16/053-E).

Informed consent was obtained from participants.

All authors have confirmed the maintenance of confidentiality and respect for patients' rights in the author's responsibilities document, publication agreement and assignment of rights to EMERGENCIAS.

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Addendum

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Annex 1. Public hospital centres participating in the SUH-MAD and SUH-CAT studies

Hospital name	Location	Use of the centre	Typology of the centre
Hospitals of the study SUH_MAD			
H. La Princesa	Madrid	Level III	Public
H. Clínico San Carlos	Madrid	Level III	Public
H. Severo Ochoa	Leganés	Level II	Public
H. Rey Juan Carlos	Móstoles	Level II	Public with private management
H. Fundación Alcorcón	Alcorcón	Level II	Public
H. Ramón y Cajal	Madrid	Level III	Public
H. La Paz	Madrid	Level III	Public
H. Gregorio Marañón	Madrid	Level III	Public
H. 12 Octubre	Madrid	Level III	Public
H. Infanta Leonor	Madrid	Level II	Public
H. De Getafe	Getafe	Level II	Public
H. Del Henares	Coslada	Level I	Public

(Continúa)

Anexo 1. Centros hospitalarios públicos participantes en el estudio SUH-MAD y SUH-CAT (continuación)

Nombre del hospital	Localidad	Uso del centro	Tipología del centro
H. Del Tajo	Aranjuez	Level I	Public
H. Príncipe de Asturias	Alcalá De Henares	Level II	Public
H. Infanta Sofía	San Sebastián de los Reyes	Level II	Public
H. Del Escorial	San Lorenzo del Escorial	Level I	Public
H. Puerta de Hierro	Majadahonda	Level III	Public
H. Fundación Jiménez Díaz	Madrid	Level III	Public with private management
H. Fuenlabrada	Fuenlabrada	Level II	Public
H. Móstoles	Móstoles	Level II	Public
H. Sureste	Arganda Del Rey	Level I	Public
H. Infanta Elena	Valdemoro	Level I	Public with private management
H.G. Villalba	Villalba	Level II	Public with private management
H. Gómez Ulla	Madrid	Level II	Military public
H. Infanta Cristina	Parla	Level II	Public
H. Universitario de Torrejón	Torrejón de Ardoz	Level II	Public with private management
Hospitals of the study SUH_CAT			
Hospital Vall d'Hebron	Barcelona	Level III	Public
Hospital comarcal d'Amposta	Amposta	Level I	Public with private management
Hospital Residència Sant Camil CSG	Sant Pere de Ribes	Level II	Public with private management
Hospital Josep Trueta de Girona	Girona	Level II	Public
Hospital Universitari Joan XIII de Tarragona	Tarragona	Level II	Public
Hospital Verge de la Cinta	Tortosa	Level II	Public
Hospital de Santa Caterina	Salt	Level I	Public with private management
Fundació Hospital Comarcal Sant Antoni Abat	Vilanova i la Geltrú	Level I	Public with private management
Hospital de Mataró	Mataró	Level II	Public with private management
Hospital Universitari del Mar	Barcelona	Level III	Public with private management
Parc Sanitari Sant Joan de Déu	Sant Boi de Llobregat	Level I	Public with private management
Fundació Hospital Sant Joan de Déu de Martorell	Martorell	Level I	Public with private management
Fundació Althaia Xarxa Assistencial Manresa	Manresa	Level II	Public with private management
Hospital Clínic de Barcelona	Barcelona	Level III	Public with private management
Hospital CAPIO Sagrat Cor	Barcelona	Level II	Public with private management
Hospital Universitari Mútua de Terrassa	Terrassa	Level II	Public with private management
Hospital Sant Joan Despí Moisés Broggi	Sant Joan Despí	Level II	Public with private management
Hospital Comarcal de l'Alt Penedès	Vilafranca del Penedès	Level I	Public with private management
Hospital General de Vic	Vic	Level I	Public with private management
Hospital Universitari Germans Trias i Pujol	Badalona	Level III	Public
Hospital General de l'Hospitalet	L'Hospitalet	Level II	Public with private management
Hospital de Mollet	Mollet	Level I	Public with private management
Hospital de Viladecans	Viladecans	Level I	Public
Hospital de Palamós	Palamós	Level I	Public with private management
Fundació hospital Esperit Sant	Santa Coloma de Gramenet	Level I	Public with private management
Hospital comarcal Sant Bernabé	Berga	Level I	Public with private management
Hospital de Bellvitge	L'Hospitalet de Llobregat	Level III	Public
Hospital de Sabadell Corporació Sanitària Parc Taulí	Sabadell	Level II	Public with private management
Hospital Universitari Arnau de Vilanova	Lleida	Level II	Public
Fundació Hospital de Granollers	Granollers	Level III	Public with private management
Hospital d'Igualada, Consorci sanitari Anoia	Igualada	Level II	Public with private management
Consorci Sanitari de Terrassa	Terrassa	Level II	Public with private management
Hospital de la Santa Creu i Sant Pau	Barcelona	Level III	Public with private management
Hospital Comarcal de Figueres	Figueres	Level I	Public with private management
Hospital de Blanes	Blanes	Level I	Public with private management
Hospital Municipal de Badalona	Badalona	Level I	Public with private management
Hospital Sant Joan de Reus	Reus	Level II	Public with private management
Hospital Sant Jaume d'Olot	Olot	Level I	Public with private management
Clínica Terres de l'Ebre	Tortosa	Level I	Public with private management
Hospital de Sant Celoni	Sant Celoni	Level I	Public with private management
Clínica de Ponent	Lleida	Level II	Public with private management
Hospital de Sant Pau i Santa Tecla	Tarragona	Level I	Public with private management
Hospital Dos de Maig	Barcelona	Level II	Public with private management
Espitau Val D'Aran	Vielha	Level I	Public with private management
Hospital Sant Jaume Calella	Calella	Level I	Public with private management
Hospital del Vendrell	Vendrell	Level I	Public with private management
Hospital Comarcal Mòra d'Ebre	Mòra d'Ebre	Level I	Public with private management
Fundación Hospital de Puigcerdà	Puigcerdà	Level I	Public with private management
Fundació Sant Hospital	La Seu d'Urgell	Level I	Public with private management
Hospital Plató	Barcelona	Level I	Public with private management
Pius Hospital de Valls	Valls	Level I	Public with private management
Hospital de Campdevànol	Campdevànol	Level I	Public with private management
Hospital Comarcal del Pallars	Tremp	Level I	Public with private management
Clínica Salus Infirmorum	Banyoles	Level I	Public with private management
Centre MQ Reus	Reus	Level I	Public with private management