Original article

Trends in cardiovascular care in the National Health System in Spain. Data from the RECALCAR project 2011-2020

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ABSTRACT

Introduction and objectives: The RECALCAR project (Resources and Quality in Cardiology), an initiative of the Spanish Society of Cardiology, aims to standardize information to generate evidence on cardiovascular health outcomes. The objective of this study was to analyze trends in the resources and activity of cardiology units and/or services and to identify the results of cardiovascular care during the last decade in Spain.

Methods: The study was based on the 2 annual data sources of the RECALCAR project: a survey on resources and activity of cardiology units and/or services (2011-2020) and the minimum data set of the National Health System (2011-2019), referring to heart failure (HF), STEMI, and non-STEMI.

Results: The survey included 70% of cardiology units and/or services in Spain. The number of hospital beds and length of stay decreased, while there was a notable increase in the number of cardiac imaging studies and percutaneous therapeutic procedures performed. Age- and sex-adjusted admissions for HF tended to decrease, despite an increase in mortality and the percentage of readmissions. In contrast, the trend in mortality and readmissions was highly favorable in STEMI; in non-STEMI, although positive, the trend was less marked.

Conclusions: The information provided by the RECALCAR project shows a favorable trend in the last decade in resources, activity and results of certain cardiovascular processes and constitutes an essential source for future improvements and decision-making in health policy.

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Evolución de la asistencia cardiovascular en el Sistema Nacional de Salud de España. Datos del proyecto RECALCAR 2011-2020

R E S U M E N

Introducción y objetivos: El proyecto RECALCAR (Recursos y Calidad en Cardiología), iniciativa de la Sociedad Española de Cardiología, pretende estandarizar la información para generar evidencia sobre los resultados en salud cardiovascular. Su objetivo es analizar la evolución de los recursos y la actividad de las unidades y los servicios de cardiología y conocer los resultados en la asistencia cardiovascular durante la última década en España.

Métodos: Este estudio se basa en las dos fuentes anuales de datos del proyecto RECALCAR: una encuesta sobre recursos y actividad de las unidades y servicios de cardiología (2011-2020) y el conjunto mínimo básico de datos del Sistema Nacional de Salud (2011-2019), referido a insuficiencia cardiaca (IC), infarto agudo de miocardio con (IAMCEST) y sin (IAMSEST) elevación del segmento ST.

Resultados: La encuesta incluye el 70% de las unidades y servicios de cardiología de España. Se ha observado una disminución en el número de camas de hospitalización y la estancia media y un incremento notable en el número de estudios de imagen cardiaca y procedimientos terapéuticos percutáneos. Los ingresos por IC ajustados por edad y sexo han disminuido, aunque su mortalidad y el porcentaje de reingresos han ido en aumento. La evolución de la mortalidad y los reingresos ha sido muy favorable en el IAMCEST; en el IAMSEST, aunque positiva, ha sido menos relevante.

Conclusiones: La información aportada por el proyecto RECALCAR demuestra una evolución favorable en la última década en recursos, actividad y resultados en determinados procesos cardiovasculares y constituye una fuente esencial para mejoras futuras y facilitar la toma de decisiones en política sanitaria.
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Abbreviations

HF: heart failure
MDS: minimum data set
NHS: National Health System
NSTEMI: non–ST-segment elevation myocardial infarction
RECALCAR: Resources and Quality in Cardiology
STEMI: ST-segment elevation myocardial infarction

INTRODUCTION

Improvements in health care efficiency and sustainability require organizational reforms achieved by preparing and promoting scientific, technical, and clinical management standards to ensure health care quality, safety, and efficiency.[1,2] The continuous improvement process of any organization, including health care institutions, is based on systematic records and adequate interpretation of the data.[3] Information must first be homogenized and standardized before data can be shared and evidence can be generated on health outcomes, particularly in terms of health care quality and equity.[2] For more than a decade, the objectives of the Spanish Society of Cardiology (SEC) have included preparing and promoting clinical standards through a policy of working with public agencies to ensure and encourage continuous improvements in cardiovascular care quality. The RECALCAR (Resources and Quality in Cardiology) project, one of its initiatives, uses a survey to evaluate the resources, organization, and activity of cardiology units and departments in Spain and analyzes how this information relates to cardiovascular outcomes by analyzing the minimum data set (MDS) and other SEC registries. This project is widely recognized as a powerful instrument for cardiovascular health care research.[4–9]

The purpose of this study was to analyze trends in the structures, resources, activity, and outcomes of cardiology units and departments in the past decade and to identify, according to these parameters, the current status of cardiovascular health care in Spain. To analyze health outcomes, trends of usage rates, mortality, and readmissions were assessed for the 3 most common processes in inpatient cardiovascular health care: heart failure (HF), ST-segment elevation myocardial infarction (STEMI), and non–ST-segment elevation myocardial infarction (NSTEMI).

METHODS

The RECALCAR project is based on 2 sources of data recorded yearly: a survey on the resources, structure, activity, and quality of cardiology units and departments, undertaken since 2011, and an analysis of the Spanish National Health System (NHS) MDS database for cardiovascular health care.

RECALCAR survey

The survey is carried out in cardiology units and departments at Spanish NHS hospitals for acute patients with 200 or more installed beds and also includes responses from cardiology units at smaller facilities wishing wished to participate in the registry. Since 2013, the data have been collected by an ad hoc questionnaire available on the SEC website (table 1 of the supplementary data). Any errors or discrepancies are corrected, and the latest version is sent to the department heads to confirm that the information collected is accurate. Additionally, the reliability and consistency of the data and indicators are confirmed by comparing them with other available sources. Information from the National Institute of Statistics and the health care maps of the autonomous communities are consulted to identify any discrepancies when assigning population to the hospital. The Survey of Inpatient Health Establishments and the MDS database of the Spanish NHS are also consulted to compare pooled structure and activity data for the autonomous communities. Likewise, the registries of the scientific associations of the SEC are analyzed to check if the activity data in the registries are consistent with those provided in the survey.

Minimum data set for cardiology

The Spanish Ministry of Health (MoH) provided the SEC with the MDS database for cardiology (MDS_CAR) for use in the

RECALCAR project. MDS_CAR includes the following: *a)* inpatient episodes coded in Spanish NHS hospitals with a principal diagnosis of "diseases of the cardiac system" (DCS)[10] (since 2016, ICD-10: diseases of the circulatory system); *b)* episodes that, without listing a DCS diagnosis, include cardiologic interventional procedures in the procedure fields, and *c)* episodes recorded that, without DCS as the principal diagnosis or cardiologic interventional procedures, were discharged by a cardiology or cardiac surgery department. Although MDS_CAR data are available for 2007 to 2019, activity data have only been available since 2011. Therefore, this study, as it relates to the MDS-CAR, covers 2011 to 2019. In 2016, the MoH began to use ICD-10 for diagnostic and procedure coding (ICD-9 was used until 2015).

Types of cardiology units and departments

Based on experience with the registry, cardiology units and departments were classified into 5 groups (table 2 of the supplementary data). Type 1 units have no hospital beds assigned to cardiology; type 2 have hospital beds for cardiology but no catheterization lab; type 3 units have beds assigned to cardiology and a catheterization lab, but no cardiovascular surgery department at the hospital; type 4 have beds assigned to cardiology, a catheterization lab, and a cardiovascular surgery department at the hospital, and last, type 5 units have no beds assigned to cardiology but do perform catheterization lab or cardiovascular surgery work.

Statistical analysis

Qualitative variables are reported with their frequency distribution, and quantitative variables are reported as the mean ± standard deviation or median [interquartile range]. For qualitative variables, the difference of proportions was analyzed by the chi-square test. To compare quantitative variables, the normality of distribution and the homogeneity of variances were studied and the Student *t* test was used, or the Mann-Whitney U test when applicable; to compare 2 groups, and the analysis of variance with the Bonferroni correction, the Kruskal-Wallis test, or the median test were used to compare 3 or more groups. Trends over time were evaluated by using Poisson regression models. Changes in usage

trends due to switching the coding system in 2016 were analyzed using the Joinpoint regression program developed by the National Cancer Institute.[11]

The risk adjustment methods by multivariate logistic regression used in the project are based on the Krumholz methodology for CMS (Centers for Medicare and Medicaid Services)[12–16] adapted to the possibilities of the MDS_CAR. Unlike the CMS methodology, the RECALCAR project calculated inpatient mortality instead of overall 30-day mortality. Readmissions have only been estimated for circulatory diseases since 2016, as the Ministry has not provided the entire database. The risk factors and coefficients definitively used in the adjustment models are derived from those derived from the MDS_CAR database.

In all comparisons, the null hypothesis is rejected with an α error $< .05$. All analyses were performed with SPSS 21.0 v13 (IBM, United States) and STATA v16 (StataCorp ER, United States).

RESULTS

Since 2011, responses to the RECALCAR survey have been received each year from 107 to 151 cardiology units and departments (figure 1), accounting for $\approx$70% of the universe. The units responding to the survey account for $\approx$75% of the entire population assigned, although their installed beds account for $\approx$80% of all beds in Spain (figure 1). Type 1 and 2 units are less represented than type 3 and 4 units, with the latter accounting for more than 90%.

Indicators of resource availability, activity, and productivity. Trends (2011-2020)

table 1 shows the trend of indicators obtained from the data provided by the RECALCAR survey from 2011 to 2020.

Infrastructure and resources

The findings for the study period were as follows: *a)* a slight increase in the number of cardiologists per 100 000 inhabitants (at present, between 5.4 and 5.5); *b)* a decrease in the availability of

RECALCAR responses

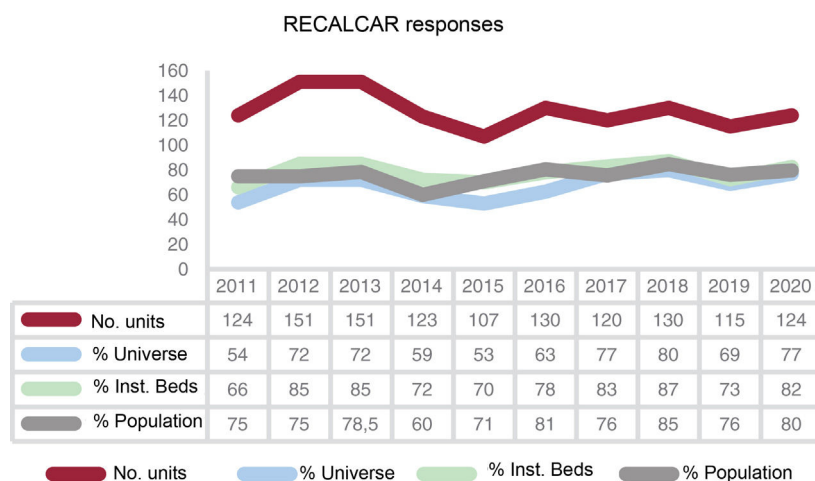|	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
No. units	124	151	151	123	107	130	120	130	115	124
% Universe	54	72	72	59	53	63	77	80	69	77
% Inst. Beds	66	85	85	72	70	78	83	87	73	82
% Population	75	75	78,5	60	71	81	76	85	76	80

Figure 1. Trend in the number of responses to the RECALCAR survey and sample representativeness compared with all data from Spain. % universe for the survey: percentage of cardiology units providing information compared with the total for all hospitals in Spain; % inst. beds (installed beds): percentage of existing hospital beds in the units answering compared with the total number of beds in the hospitals identified[a]; % population: percentage of population in the hospital catchment area for the units answering compared with the total population covered by the Spanish NHS.[b]
[a]Source: National Catalog of Hospitals.
[b]Source: Annual RECALCAR surveys.

Table 1
Annual trend of indicators for resources, activity, and productivity for 2011-2020. RECALCAR survey

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	IRR (2011-2019)	P
Resources and infrastructure												
No. cardiologists/100 000 inhab.		5.1	4.7	5.3	4.9	4.9	5.2	5.3	5.5	5.4	1.013	.036
No. cardiology beds/100 000 inhab.		8.4	7.8	9.5		9.2	8.2	7.7	7.9	7.4	.990	.285
No. type 2 and 3 cardiology beds/100 000 inhab.		1.0	1.0	1.4		1.1	1.1	1.1	1.2	1.1	1.010	.491
U/D with cardiology ODPs and more than 1500 discharges/y	63%	69%	72%	76%	75%	81%	85%	87%	86%	94%	1.040	<.001
U/D with heart failure unit	42%	44%	53%	56%	60%	63%	72%	79%	84%	90%	1.091	<.001
U/D with cardiac rehabilitation unit	31%	28%	36%	45%	40%	33%	53%	59%	65%	65%	1.102	<.001
Population (inhab.)/ catheterization lab	308 000	300 000	293.000	318 000	300 000	366 164	333 007	317 884	344 805	330 445	1.017	<.001
Population (inhab.)/ electrophysiology lab	450 000	504 000	445 000	500 000	450 000	521 273	495 159	466 357	488 162	479 499	1.006	.343
Health care activity												
No. outpatient visits/1000 inhab.	16.7	15.4	15.3	16.1	14.7	18.0	16.0	15.0	21.0	14.0	1.020	.249
No. admissions/1000 inhab.	4.1	4.8	4.9	5.3	5.3	5.0	5.0	4.9	4.8	4.2	1.010	.315
No. stress tests/1000 inhab.	4.0	4.1	4.0	4.0	3.4	4.0	3.8	3.3	3.5	2.4	.979	<.001
No. ultrasounds/1000 inhab.	20	23	21	24	24	25	27	27	29	21	1.043	<.001
No. diagnostic hemodynamic studies/100 000 inhab.	311	260	260	280	290	308	303	289	286	260	1.005	.539
PCIs/100 000 inhab.	134	129	130	132	147	148	147	139	143	131	1.014	.001
PPCIs/100 000 inhab.	30	27	32	31	36	38	38	37	36	38	1.037	<.001
TAVRs/million inhab.			26.0	33.0	33.0	39.0	61.0	68.7	84.0	81.7	1.228	<.001
No. diagnostic EPs/100 000 inhab.	36.8	18.3	25.1	45.6	29.4	31.4	31.9	34.5	32.7	26.8	1.017	.563
No. therapeutic EPs/100 000 inhab.	30.3	32.3	33.2	23.0	39.9	36.8	33.0	34.7	42.5	31.6	1.035	.003
Productivity												
Median hospital stay, d	5.6	5.3	5.5	6.2	5.2	5.2	5.0	5.0	5.0	4.8	.984	<.001
No. studies/ultrasound machine	1643	2243	1873	1831	1900	1937	1967	1933	1907	1636	1.004	.785
No. procedures/ catheterization lab	1481	1403	1213	1424	1325	1562	1519	1479	1614	1342	1.018	.054
No. cardiac catheterization procedures/cardiologist	184	180	199	177	192	207	200	197	207	170	1.015	<.001
No. procedures*/EP lab	296	217	308	230	274	276	242	247	282	280	1.018	.498

EPs, electrophysiological studies; inhab., inhabitants; ODP, on-duty physician; PCI, percutaneous coronary intervention; PPCI, primary PCI; TAVR, transcatheter aortic valve replacement; U/D, cardiology unit/department.
* Does not include device implantation.
P values < .05 indicate statistically significant differences.

conventional hospital beds assigned to cardiology; *c)* a similar number of critical care beds (Intensive Care Society levels 2 and 3[17]), although the trend was not statistically significant; *d)* a large increase in the percentage of cardiology units and departments with more than 1500 discharges per year and with on-duty staff, and *e)* a very large increase in cardiology units and departments with HF[4] and cardiac rehabilitation units, which in 2020 were 90% and 65%, respectively. Population figures assigned per catheterization lab or electrophysiology lab have risen very slightly over the decade.

Health care activity

The number of outpatient visits and admissions per 1000 inhabitants held steady. The various types of remote activity are not included in the indicators, as this information has only been collected since the 2020 RECALCAR survey (COVID-19 pandemic).

In terms of imaging activities, usage increased considerably for echocardiography (3% year-over-year), magnetic resonance imaging, and computed tomography studies performed by cardiology units and departments (records were first kept in 2015, data not included).

Activity indicators for catheterization lab units showed stable levels in the usage of diagnostic studies per 100 000 inhabitants/y, with a significant increase in percutaneous coronary interventions (PCI) and primary PCI (PPCI) procedures, especially in the case of latter (+3.7% year-over-year; $P < .001$).[6] A noticeable increase was observed in percutaneous implantation procedures on the aortic valve (year-over-year rate of growth, +22.8%; $P < .001$).[18] The number of procedures per lab on workdays increased, although not significantly (year-over-year rate of 1.8%), and the annual number of PCIs per cardiologist managing the catheterization lab increased considerably.

Activity indicators for electrophysiology units remained steady in the number of electrophysiology labs per population, but lower than the recommended guidelines for resources.[10] The population rate of diagnostic electrophysiological studies remained stable, whereas the rate for therapeutic procedures increased considerably (year-over-year rate, 1.5%; $P < .003$). Electrophysiology lab usage levels (number of studies per workday) remained stable.

Impact of the COVID-19 pandemic: in 2020, there was a large decrease in the number of consultations, admissions, additional tests, and catheterization and electrophysiology procedures (table 1). In addition, the number of procedures per invasive or noninvasive equipment unit dropped considerably in contrast with the growth trend seen in previous years. Likewise, the number of outpatient visits decreased in 2020, which may be partially offset by the increase in the various types of remote consultations and department referrals.[19] There were no data for comparison with previous years, but remote consultations in 2020 showed a 1:2 ratio for initial consultations, and telephone consultations were the most common remote type (62.6%), followed by electronic referrals by primary care physicians (26.7%). Video (3.2%) and email (7.6%) consultations were of minimal importance. There was a significant drop in the mean length of stay in cardiology units and departments (1.6% year-over-year; $P < .001$).

The current status in terms of structure and staff, hospitalization data, and activity in cardiology units and departments in Spain is shown in table 2, which summarizes the average annual data on

Table 2

Average annual data on resources, activity levels, and productivity obtained from the 2018 and 2019 RECALCAR survey from 124 cardiology units and departments

Structure/staff	
Types of U/D	Type 1: 23%
	Type 2: 15%
	Type 3: 23%
	Type 4: 35%
	Type 5: 3%
U/D structure	Unit: 21%
	Department: 58%
	Institute, areas, or clinical management units: 17%
	No in-house organizational identity: 4%
No. cardiologists per U/D	17 (17 ± 10)
No. cardiologists/million inhab.	55
Hospitalization data	
Conventional hospitalization	Beds per U/D: 30 (31 ± 18)
	Cardiology beds/100 000 inhab.: 9
	Level 0 and 1 beds: 87%
	Level 2 and 3 beds: 13%
	Admissions/1000 inhab./y: 4
	Mean length o fstay: 5 (5 ± 1.4) days
Critical care	Level 2 to 3 beds (U/D with > 1500 admissions/y): 65%
	Critical patient beds per U/D: 8 (10 ± 6)
	Mean length of stay: 3.1 ± 1.1 days
	On-duty care (U/D with ≥ 1500 admissions/y): 94%
Consultations/functional units	
Consultations	Initial consultations/1000 inhab./y: 14
	Successive/initial consultations: 1.8/1
Units	Heart failure unit: 90%
	Cardiac rehabilitation unit: 65%
Noninvasive image/scans	Imaging as an organizational unit in cardiology units and departments: 65%
	No. echocardiographies/1000 inhab./y: 22
	No. studies per ultrasound machine/y: 1700 (7 per workday)
	Cardiologists affiliated with imaging: 20%
	No. echocardiographies/y per cardiologist: 2100 (2200 ± 900)
	No. echocardiographies/d/cardiologist assigned to the unit: 10
	No. studies per nurse or technician/y assigned to the unit: 2100
	No. Holter studies/1000 inhab./y: 4
	No. stress tests/1000 inhab./y: 2.4

Table 2 *(Continued)*
Average annual data on resources, activity levels, and productivity obtained from the 2018 and 2019 RECALCAR survey from 124 cardiology units and departments

Catheterization and percutaneous interventions	With catheterization unit: 61%
	1 lab per 330 000 inhab.
	Cardiologists affiliated with catheterization lab: 20%
	No. diagnostic studies/100 000 inhab./y: 270
	No. diagnostic studies/lab/y: 1400 ± 450 (6 per workday)
	No. studies/y per cardiologist: 700 ± 200 (3 per workday)
	No. PCIs/y per unit: 800 ± 350
	No. PCIs/million inhab./y: 1350
	No. PPCIs/million inhab./y: 400
	No. TAVRs/million inhab./y: 85
	No. atrial appendage closures/million inhab./y: 15
	No. mitral valve percutaneous interventions/million/y: 10
Electrophysiology	With electrophysiology unit: 62%
	1 lab per 480 000 inhab.
	Cardiologists affiliated with electrophysiology: 14%
	No. diagnostic studies/million inhab./y: 270
	No. studies/lab/y: 550 (2 studies per lab and workday)
	No. studies/y/cardiologist: 570 (3 per workday)
	No. simple therapeutic procedures/million inhab./y: 200
	No. ablations/million inhab./y: 120
Cardiac surgery	With cardiac surgery department: 35%
	1 cardiac surgery department every 975 000 inhab.
	No. major surgical procedures/million inhab./y: 350
	No. major surgical procedures/department: 375 ± 200
	Facilities with a multidisciplinary team: 87%
Training/research	Accredited for residency training: 60%
	No. residents per cardiol. U/D: 10
	Involved in CIBER/RETIC research: 35%
	Competitive research projects: 48%
	Perform clinical trials: 68%
	Publish at least 1 article in an indexed journal: 72%

Cardiol. U/D, cardiology unit/department; inhab., inhabitants; PCI, percutaneous coronary intervention; PPCI, primary PCI; RP, resident physician; TAVR, transcatheter aortic valve replacement.

resources and infrastructure, health care activity, and productivity for 2018 and 2019. The 2020 data were not included because the situation was distorted by the impact of the COVID-19 pandemic on cardiovascular health care.

Training, research, and management

A total of 60% of cardiology units and departments completing the RECALCAR survey in the past year had been accredited to provide specialist training to resident physicians (MIR) (97% of type 3 and 4 cardiology units and departments), with a median of 10 cardiology residents in training per unit, a level that has remained stable. Virtually all type 3 and 4 units are accredited for residency instruction.

A total of 35% of cardiology units and departments were members of a research network (CIBER/RETIC) under the auspices of the Carlos III Institute, 48% were carrying out research projects under competitive procedures, and 68% were conducting clinical trials. A total of 72% of cardiology units and departments had published at least 1 article in indexed journals.

An upward trend was observed in the number of units belonging to research networks and in the number of publications. Additionally, a clear difference was seen in research activity levels

between complex (types 3 and 4) and less complex (types 1 and 2) units.

RECALCAR data obtained from the analysis of the minimum data sets for cardiology

The last year with data available in the MDS-CAR registry is 2019. Considering that the survey was started in 2011 and is completed yearly, trends for the various indicators are only shown for 2011 to 2019. Age- and sex-adjusted usage rates and the risk-adjusted and nonrisk-adjusted indicators of hospital stays, inpatient mortality, and 30-day readmissions were analyzed for HF, STEMI, and NSTEMI (table 3, figure 2, and figure 3). The indicators refer as a whole to all processes admitted to the hospitals, not only to those admitted to cardiology units and departments.

The trend in hospital care for HF (figure 2 and figure 3) was fairly stable ($\approx$30 hospital admissions per 10 000 inhabitants and year, adjusted for age and sex). The adjusted mortality rate (10%-10.8%) increased significantly in recent years. The 30-day readmission rate increased considerably (2.7% year-over-year; $P < .001$), whereas the median stay for admissions for this reason was unchanged.

Hospital care indicators for STEMI (figure 2 and figure 3) showed a statistically significant favorable trend, with a large

Table 3
Annual trend of indicators for heart failure and myocardial infarction with and without ST-segment elevation (MDS). 2011-2019

Heart failure	2011	2012	2013	2014	2015	2016[b]	2017	2018	2019	IRR	P
Admissions/10 000 inhab./y[a]	30.11	30.68	30.11	30.50	31.34	28.43	28.69	29.39	28.81	.991	<.001
Crude annual mortality rate	10.30	10.40	10.02	9.94	10.69	10.46	10.79	11.16	11.27	1.013	<.001
Adjusted mortality	10.02	10.04	9.70	9.60	10.35	10.02	10.38	10.75	10.84	1.012	<.001
Annual 30-day readmission rate	9.58	10.03	11.64	11.75	10.95	12.38	12.50	12.34	11.78	1.027	.001
Adjusted readmission rate	9.72	10.27	11.90	12.05	11.23	12.75	12.87	12.64	12.08	1.028	.001
Median hospital stay, d	7	7	7	7	7	7	7	7	7	1.000	>.999
STEMI, ST-elevation myocardial infarction	2011	2012	2013	2014	2015	2016[c]	2017	2018	2019	IRR	P
Admissions/10 000 inhab./y[a]	7.7	7.57	7.53	7.13	7.01	6.38	6.49	6.48	6.46	.974	<.001
Crude annual mortality rate	10.84	10.18	9.84	9.95	9.75	9.73	9.20	8.78	8.79	.976	<.001
Adjusted mortality	10.24	9.54	9.22	9.29	9.12	9.00	8.39	8.07	8.06	.972	<.001
Annual 30-day readmission rate	5.59	5.64	6.20	5.93	5.41	6.00	5.49	5.75	5.35	.994	.295
Adjusted readmission rate	5.21	5.25	5.78	5.53	4.98	5.51	5.08	5.27	4.91	.992	.146
Median hospital stay, d	6	6	6	6	6	5	5	5	5	.970	<.001
NSTEMI, non–ST-segment elevation myocardial infarction	2011	2012	2013	2014	2015	2016[d]	2017	2018	2019	IRR	P
Admissions/10 000 inhab./y[a]	4.87	4.94	4.91	4.81	4.91	4.95	5.21	5.38	5.64	1.017	<.001
Crude annual mortality rate	5.83	5.78	5.70	5.33	5.83	5.17	5.45	5.76	5.13	.989	.026
Adjusted mortality	5.86	5.70	5.59	5.35	5.91	5.20	5.55	5.87	5.21	.993	.187
Annual 30-day readmission rate	6.24	7.18	7.31	7.49	6.80	6.88	6.51	6.91	6.44	.995	.552
Adjusted readmission rate	6.11	7.08	7.23	7.30	6.65	6.74	6.39	6.80	6.32	.994	.552
Median hospital stay, d	7.00	7.00	7.00	6.00	6.00	6.00	6.00	6.00	6.00	.977	<.001

[a] Adjusted for age and sex. Concatenated episodes. Hospital admissions did not include stays of 1 day or less with discharge to home or to a care facility.
[b] The coding method was switched in 2016 (Joinpoint P = 0.001), but no change in trend was detected.
[c] The coding method was switched in 2016 (Joinpoint P = .013), with the trend differing for the 2 periods: decreasing and significant for 2011-2015 (IRR = 0.976; P < .001) and insignificant in 2016-2019 (IRR = 1.004; P < .193
[d] The coding method was switched in 2016 (Joinpoint P = .153), but the trend was insignificant for 2011-2016 (IRR = 0.999; P = .713) and upward in the second period (IRR = 1.043; P < .001).
IRR, incidence rate ratio (Poisson regression).
Data are expressed as No. (%) or median.
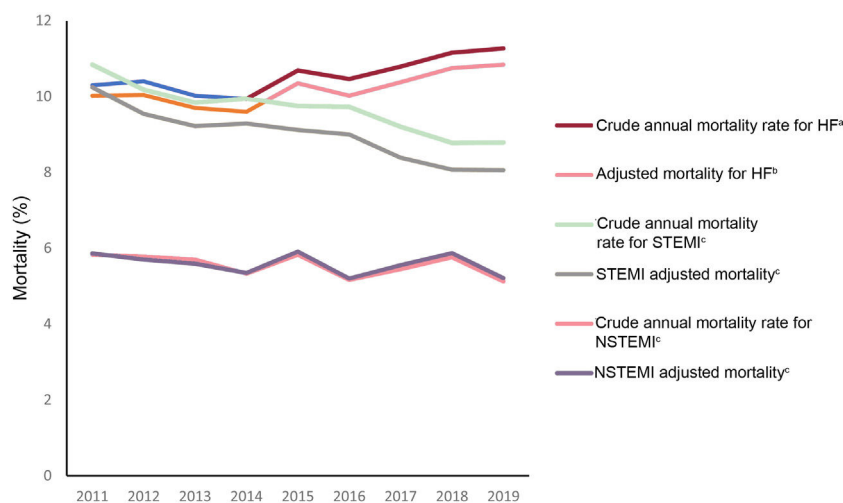P values < .05 indicate statistically significant differences.

Figure 2. Trend in adjusted and nonadjusted mortality rates for HF, STEMI, and NSTEMI (2011-2019). STEMI, ST-segment elevation myocardial infarction; NSTEMI, non–ST-segment elevation myocardial infarction; HF, heart failure.
[a]P = .001.
[b]P = .076.
[c]P < .001.

decline in absolute mortality and adjusted mortality. Both the readmission rate and the mean length of stay have gradually dropped.

The trend for NSTEMI care (figure 2 and figure 3) was rather stable in terms of usage rates. However, mortality, readmission rate, and mean stay showed a favorable trend, with some

decrease, although this drop was less important than that observed in STEMI and the trend of the changes was not statistically significant, except for the crude mortality rate and hospital stay.

Because risk adjustment was not possible for the respective populations, the indicators could not be compared with results
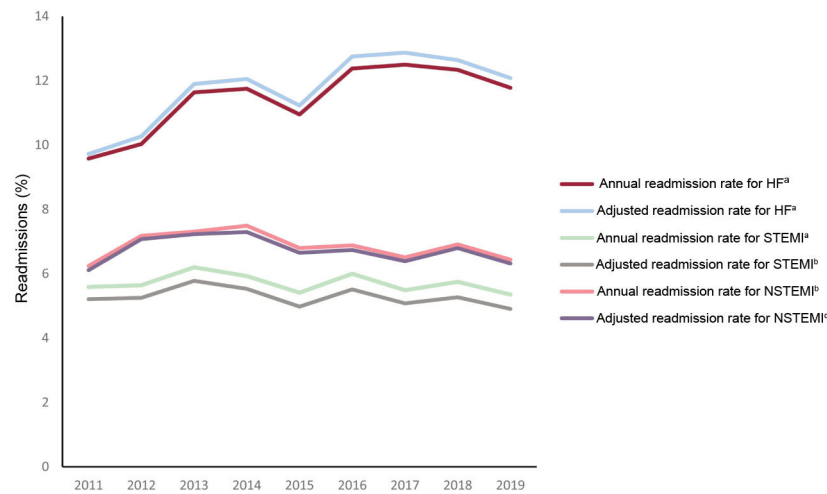
Figure 3. Trend in adjusted and nonadjusted readmission rates for HF, STEMI, and NSTEMI (2011-2019). HF, heart failure; NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.

[a]$P < .001.$
[b]$P = .03.$
[c]$P = .02.$

Table 4
Comparison of RECALCAR indicator results for 2019 with those proposed by INCARDIO[20]

	Recalcar	Incardio		Remarks
		Indicator	Definition	
Heart failure				
Crude mortality rate	11.27	< 7		The INCARDIO indicator applies to cardiology departments, while the RECALCAR indicator is overall for the hospital
Adjusted mortality	10.84			
Annual 30-day readmission rate	11.78			
Adjusted readmission rate	12.08			
Hospital stay	7	< 7		
STEMI				
Crude mortality rate	8.79	< 5	Excludes patients in Killip IV and patients who received cardiopulmonary resuscitation	
Adjusted mortality	8.06			The RECALCAR indicator applies to all STEMIs, adjusting for risk
Annual 30-day readmission rate	5.35			
Adjusted readmission rate	4.91			
Hospital stay	5	< 10		
NSTEMI				
Crude mortality rate	5.13	< 3	Excludes patients in Killip IV and patients who received cardiopulmonary resuscitation	
Adjusted mortality	5.21			The RECALCAR indicator applies to all NSTEMIs, adjusting for risk
Annual 30-day readmission rate	6.44			
Adjusted readmission rate	6.32			
Hospital stay	6.00	< 10		

NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.
Data are expressed as No. (%) or median (days).

obtained for the 3 processes with results published in other countries. Table 4 includes a comparison of the 3 process indicators obtained in RECALCAR with those proposed by INCARDIO.[20]

Table 5 describes the results between the various types of units and cardiology departments for cardiovascular diseases as a whole and in relation to the 3 health care processes mentioned; type 5 hospitals are not included (figure 4). The differences between hospitals were significant when analyzing total admissions, adjusted mortality, and readmission rate for all cardiovascular conditions. However, the individual analysis showed that HF mortality was significantly higher in less complex hospitals, with

Table 5

Comparisons of health care outcomes for the main cardiovascular conditions (heart failure and ST- and non–ST-segment elevation myocardial infarction) between the various types of cardiology departments and units

	Types of departments/units				
	Type 1	Type 2	Type 3	Type 4	P
All cardiovascular conditions					
Hospitals	125	30	40	44	
Discharges	497 ± 321	1297 ± 343	1985 ± 548	3133 ± 790	< .001
Median hospital stay, d	6.1 ± 1.3	5.6 ± 0.9	5.5 ± 1.2	5.6 ± 1.1	.003
Crude mortality rate	9.7 ± 3.9	6.4 ± 2	6.9 ± 1.9	6 ± 1	< .001
Adjusted mortality rate	7.5 ± 2.3	5.8 ± 1.6	6.7 ± 1.5	6.9 ± 1.3	< .001
Readmission rate	8.7 ± 2.8	8.5 ± 1.8	6.8 ± 1.7	6.2 ± 1.6	< .001
Heart failure[a]					
Hospitals	108	30	40	44	
Discharges	249 ± 134	536 ± 191	663 ± 223	889 ± 343	< .001
Median hospital stay, d	7 ± 1.2	6.9 ± 1.3	7.1 ± 1.3	7.3 ± 1.3	.592
Crude mortality rate	13.7 ± 5.1	10.1 ± 3.4	11.5 ± 3.6	10.9 ± 2.6	< .001
Adjusted mortality rate	12.7 ± 3.7	10.0 ± 3.1	11.3 ± 2.9	11.4 ± 3.1	.001
Readmission rate	11.4 ± 3.5	11.8 ± 2.9	10.8 ± 2.4	10.8 ± 2.3	.369
STEMI[b]					
Hospitals	23	22	39	44	
Discharges	53 ± 25	64 ± 27	193 ± 86	294 ± 83	< .001
Median hospital stay, d	5.6 ± 0.9	5.3 ± 1.1	5.5 ± 1.3	5.4 ± 1	.841
Crude mortality rate	13.2 ± 9.3	8.9 ± 4.2	9 ± 3.1	8.5 ± 2.8	.002
Adjusted mortality rate	9.3 ± 1.7	8.5 ± 1.0	9.0 ± 1.3	8.8 ± 1.8	.367
Readmission rate	7.5 ± 4.6	7.8 ± 4.8	5.1 ± 2.6	4.6 ± 1.8	< .001
NSTEMI[b]					
Hospitals	54	30	40	44	
Discharges	61 ± 27	87 ± 38	152 ± 52	185 ± 74	< .001
Median hospital stay, d	6.6 ± 1.4	5.9 ± 1.2	6 ± 1.4	5.7 ± 1.5	.025
Crude mortality rate	5.6 ± 4.2	5.6 ± 2.9	5.4 ± 3.1	4.8 ± 2.2	.655
Adjusted mortality rate	5.2 ± 0.6	5.3 ± 0.7	5.2 ± 0.7	5.3 ± 0.8	.994
Readmission rate	6.4 ± 3.7	7.6 ± 4	6.4 ± 2.6	5.5 ± 2.4	.058

HD, heart disease; HF, heart failure; NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.

[a] To calculate HF indicators, facilities with fewer than 100 discharges per year were excluded; for transfers between hospitals, the outcome of the episode was assigned to the facility first contacted by the patient.

[b] To calculate myocardial infarction indicators, facilities with fewer than 25 discharges per year were excluded; in the case of transfers between hospitals, the outcome was assigned to the most complex hospital.

Type 1: no beds assigned to cardiology department/unit; Type 2: beds assigned to the cardiology department/unit, but no catheterization lab; Type 3: beds assigned to the cardiology department/unit, catheterization lab, but no cardiac surgery department; Type 4: beds assigned to the cardiology department/unit, catheterization lab, and cardiac surgery.

Except for the number of hospitals and the hospital stay (median), all data are expressed as mean ± standard deviation.

P values < .05 indicate statistically significant differences.

no significant differences in adjusted mortality between the various types of hospital in relation to STEMI and NSTEMI.

DISCUSSION

One of the main objectives of the RECALCAR project is to obtain further information on the epidemiology of cardiologic diseases, as well as to identify any associations between cardiovascular care organization/activity and health outcomes. A strong point of this project is that it reports on a yearly survey with updated data on the health care structures of cardiology units and departments, then analyzes them together with a large database of inpatient cardiovascular events in the Spanish NHS. Furthermore, RECALCAR allows assessment of trends and progress in the most common cardiovascular care processes, which may facilitate improvements in health care and decision-making related to health policy.

RECALCAR survey results

Around 77% to 80% of cardiology units and departments in Spain provided information on their current situation with regard to human resources, technological equipment, and productivity. The universe of survey responses indicated adequate representativeness.

Although activity increased, there was no increase in the number of cardiologists per population attended. The number of hospital beds and the length of hospital stay cecreased, in keeping with the downward trend of recent years and possibly indicating a trend toward greater use of outpatient services for cardiological processes and procedures. Most notably, more units were specifically created for HF and cardiac rehabilitation in a large number of hospitals.

Regarding activity levels, usage rates were noticeably higher in the case of echocardiography, magnetic resonance imaging, and
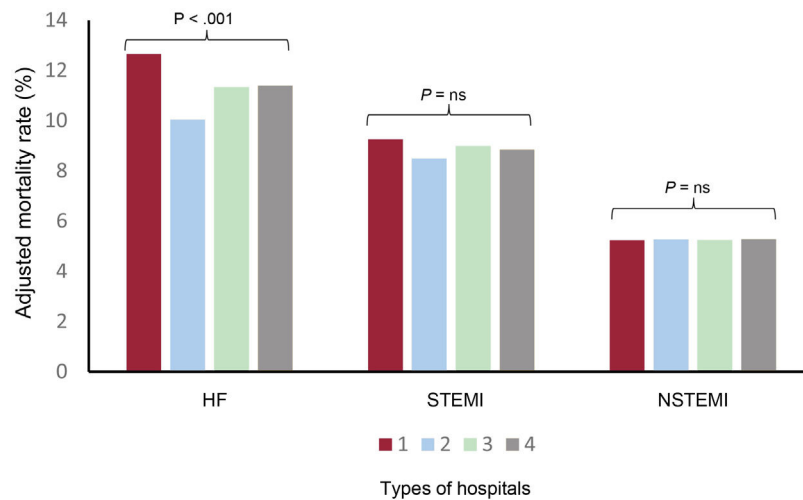
Figure 4. Adjusted mortality rates (%) between the various types of cardiology units and department for HF, STEMI, and NSTEMI. Type 1: no hospital beds assigned to cardiology. Type 2: hospital beds for cardiology, but no catheterization lab. Type 3: hospital beds for cardiology and catheterization lab, but no cardiovascular surgery department. Type 4: hospital beds assigned to cardiology, catheterization lab, and cardiovascular surgery department. HF, heart failure; NS, nonsignificant; NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.

computed tomography scans, while the number of stress tests was significantly reduced. Likewise, cardiac catheterization and electrophysiology labs showed a large increase in the number of procedures, with a marked increase in the rate of percutaneous aortic valve implantation.

Productivity, expressed as the number of procedures per echograph, per catheterization lab, or per electrophysiology lab, remained stable. A highly relevant aspect is that 82% of current cardiology units and departments are members of a health care network, probably because they belong to STEMI treatment networks, which already cover all autonomous communities. These figures showed a large upward trend, as only 14% to 17% of cardiology units and departments responded to this question affirmatively for the period of 2011 to 2014.[6]

In terms of training, research, and teaching, 60% of cardiology units and departments responding to the survey were accredited for residency training. A significant percentage (35%) belonged to a research network, and practically half the units were involved in competitive research projects.

Table 2 lists the average annual data on resources, activity, and productivity levels for 2018 and 2019, reflecting the current status in terms of structure and staff, hospitalization data, and cardiovascular health care activity in Spanish hospitals. Additionally, cardiology units and departments with no formal cardiology department provide important information on cardiologic activity in hospitals with smaller populations, which are often excluded from registries and research projects.

Although the data from the past 2 years (2019 and 2020) were affected by the COVID-19 pandemic (2019 data were collected in the first few months of 2020, the period most impacted by the pandemic), health care coverage at the hospitals completing the survey still accounted for more than 75% of the total population covered by the Spanish NHS.

Data obtained from the analysis of the cardiology minimum data sets

Although the total number of admissions due to HF was stable during the long study period, inpatient mortality due to this cause

was not lower and 30-day readmissions were higher. The limited progress seen in these 2 markers and the expected aging of the Spanish population mean that addressing HF is probably one of the main health care issues at present. The HF process depends less on cardiology departments and is much more influenced by a multidisciplinary joint clinical approach (primary care, specialized care—usually by internal medicine—, and emergency departments). The higher level of HF mortality at less complex facilities (table 5) was reported by another Spanish study[21] and has been attributed to a higher volume of activity and to the existence of more structured HF units in more complex cardiology departments.

Conversely, the trend seen in hospital care indicators for STEMI from 2011 to 2019 showed a large, progressive improvement in both mortality (figure 5) and readmissions. These data reflect organizational improvements made in recent years in the clinical approach taken with these patients by implementing health care networks for infarction (Infarction Codes) and the increased number of primary angioplasties.[6]

The favorable trend seen with NSTEMI mortality, although not as important in terms of absolute values as in STEMI, possibly also resulted from more organized coordination between hospitals. Unlike what was observed for HF, mortality in STEMI and NSTEMI processes did not differ between hospitals. These findings may be explained by the fact that health care networks among hospitals have been strengthened in terms of the treatment of patients with acute coronary syndromes.

The various indicators of the 3 processes refer to the total number of episodes attended in hospitals and not strictly in cardiology units and departments. These units unquestionably influence the overall care provided in these health care processes, regardless of whether they are inpatients or discharged from cardiology units and departments or from other hospital departments. This comprehensive approach is the most suitable method for comparing health outcomes, given the variety seen in the organization and approach of hospitals toward cardiovascular diseases (HF patients admitted to internal medicine departments, critical cardiologic care managed by general intensive care units, availability or lack of availability of cardiac intensive care units,[22] etc.).
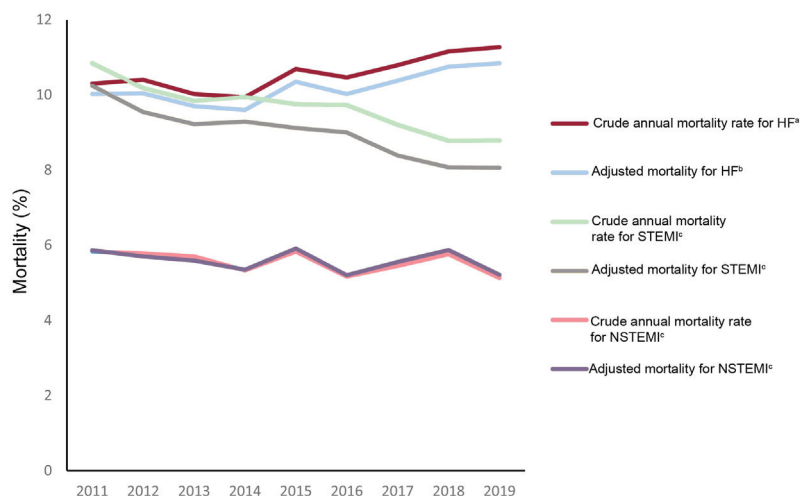
Figure 5. Central illustration. Trend of adjusted and nonadjusted mortality rates for HF, STEMI, and NSTEMI (2011-2019). Data from the RECALCAR project minimum data set. HF, heart failure; NSTEMI, non–ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction.
[a]P = .001.
[b]P = .076.
[c]P < .001.

Study limitations

The main limitation of the data obtained in the RECALCAR survey is that completion was voluntary, thus not covering the entire universe of cardiology units and departments. However, a response rate of ≈70% of the universe, ≈75% of the catchment population for the hospitals, and ≈80% of the installed beds at facilities with cardiology units and departments responding to the survey ensures good representativeness.

Data extraction from the MDS_CAR has several limitations. The complete database (with all discharge events) is not available, the overall 30-day mortality cannot be calculated, and readmissions can only be calculated when due to cardiovascular causes. Furthermore, the MDS has its own limitations, even though the use of administrative registries to evaluate the results of health services was validated by comparing with clinical registry data. Changes to the MDS structure in 2016 and to the coding system (switched to ICD-10) has led to problems, but also allowed more accurate differentiation between comorbidities and complications of secondary diagnoses.

Despite these limitations, the MDS is a highly useful tool for analyzing health outcomes and inequalities between facilities or territories that can be detected with real-life data. As a data source for analysis, it has disadvantages compared with clinical records, but some of its biases are offset as it covers a very large population, with a less narrow selection of facilities and settings.

CONCLUSIONS

The information provided by RECALCAR is an important source for improving cardiovascular health care and should be useful for facilitating decision-making in health policy. Differences detected between cardiology units and departments in structure, activity, and health outcomes will encourage further research and identify areas for improvement in cardiovascular health care quality and in the productivity of cardiology units and departments. Measuring health outcomes remains to be addressed in the Spanish health care system. In undertaking the RECALCAR project, the SEC has drawn attention to this shortcoming, which continues to weaken our health system, and underscores the valuable contribution provided by this information.

AUTHORS' CONTRIBUTIONS

All authors made key contributions to the idea and final text of this article and approved the final manuscript. Idea and design: Á. Cequier, C. Macaya, V. Bertomeu, J.R. González-Juanatey, A. Iñiguez, M. Anguita, N. del Prado, L. Rodríguez-Padial, J. Pérez-Villacastín, J.L. Bernal, C. Fernández-Pérez, J. Elola. Data collection, analysis, and interpretation: Á. Cequier, H. Bueno, C. Macaya, A. Iñiguez, M. Anguita, I. Cruz, D. Calvo, J.J. Gómez-Doblas, J.M. de la Torre Hernández, N. del Prado, J. Pérez-Villacastín, J.L. Bernal, C. Fernández-Pérez, J. Elola. Original text: Á. Cequier, C. Macaya, V. Bertomeu, J.R. González-Juanatey, A. Iñiguez, M. Anguita, I. Cruz, D. Calvo, J.J. Gómez-Doblas, J.M. de la Torre Hernández, L. Rodríguez-Padial, J. Pérez-Villacastín, J.L. Bernal, C. Fernández-Pérez, J. Elola. Critical review of intellectual content: Á. Cequier, H. Bueno, C. Macaya, V. Bertomeu, J.R. González-Juanatey, A. Íñiguez, M. Anguita, J. Pérez-Villacastín, J. Elola. Corresponding author: Á. Cequier.

CONFLICTS OF INTEREST

There are no conflicts of interests in relation to this study.

WHAT IS KNOWN ABOUT THE TOPIC?

– Evidence on health outcomes can only be obtained by homogenizing and standardizing the information.
– For more than a decade, the SEC has been preparing clinical standards and developing a policy of collaboration with public agencies to promote continuous improvement in cardiovascular care quality.
– The RECALCAR project uses a yearly survey to evaluate the resources and activity of cardiology departments in Spain and their relationship with the analysis of the Ministry of Health's MDS.

WHAT DOES THIS STUDY ADD?

– The past decade has seen a decrease in Spain in the number of hospital beds and a considerable increase in cardiac imaging studies and percutaneous therapeutic procedures.
– Admissions for HF tended to drop, although mortality and readmissions for this condition increased.
– The trend of mortality and readmissions was highly favorable in STEMI, and less important in NSTEMI.
– The RECALCAR project is a key resource for future improvements and decision-making in health policy.

APPENDIX. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version, at https://doi.org/10.1016/j.rec.2022.09.017

REFERENCES

1. Cequier Á, Ortiga B. Clinical management levels. *Rev Esp Cardiol.* 2015;68:465–468.
2. Cequier Á, García-Altés A. Transparency and benchmarking for sustainability of the health system. *Med Clin (Barc).* 2015;144:449–451.
3. Milakovich ME. Creating a total quality health care environment. *Health Care Manage Rev.* 1991;16:9–20.
4. Anguita M, Lambert JL, Bover R, et al. Tipología y estándares de calidad de las unidades de insuficiencia cardiaca: consenso científico de la Sociedad Española de Cardiología. *Rev Esp Cardiol.* 2016;69:940–950.
5. Bertomeu V, Cequier A, Bernal JL, et al. Mortalidad intrahospitalaria por infarto agudo de miocardio. Relevancia del tipo de hospital y la atención dispensada. Estudio RECALCAR. *Rev Esp Cardiol.* 2013;66:935-492.
6. Cequier Á, Ariza-Solé A, Elola FJ, et al. Impact on Mortality of Different Network Systems in the Treatment of ST-segment Elevation Acute Myocardial Infarction. The Spanish Experience. *Rev Esp Cardiol.* 2017;70:155–161.
7. Rodriguez-Padial L, Elola FJ, Fernández-Pérez C, et al. Patterns of inpatient care for acute myocardial infarction and 30-day, 3-month and 1-year cardiac readmission rates in Spain. *Int J Cardiol.* 2017;230:14–20.
8. Ariza A, Alegre O, Elola FJ, et al. Management of myocardial infarction in the elderly. Insights from Spanish Minimum Basic Data Set. *Eur Heart J Acute Cardiovasc Care.* 2019;8:242–251.
9. Bernal JL, Barrabés JA, Íñiguez A, et al. Datos clínicos y administrativos en la investigación de resultados del síndrome coronario agudo en España. Validez del Conjunto Mínimo Básico de Datos. *Rev Esp Cardiol.* 2019;72:56–62.
10. Palanca I, Castro A, Macaya C, et al. *Unidades asistenciales del área del corazón. Estándares y recomendaciones.* Madrid: Ministerio de Sanidad, Política Social e Igualdad; 2011.
11. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med. 2000; 19:335-351. Correction in: Stat Med. 2001; 20:655.
12. Krumholz HM, Wang Y, Mattera JA, et al. An administrative claims model suitable for profiling hospital performance based on 30-day mortality rates among patients with an acute myocardial infarction. *Circulation.* 2006;113:1683–1692.
13. 2019 Condition-Specific Measures Updates and Specifications Report Hospital-Level 30-Day Risk-Standardized Mortality Measures. Acute Myocardial Infarction – Version 13.0. Chronic Obstructive Pulmonary Disease – Version 8.0. Heart Failure – Version 13.0. Pneumonia – Version 13.0. Stroke – Version 8.0. Yale New Haven Health Services Corporation, Centers for Medicare & Medicaid Services (CMS); 2019.
14. 2019 Condition-Specific Measures Updates and Specifications Report Hospital-Level 30-Day 30-Day Risk-Standardized Readmission Measures. Acute Myocardial Infarction – Version 12.0. Chronic Obstructive Pulmonary Disease – Version 8.0. Heart Failure – Version 12.0. Pneumonia – Version 12.0. Stroke – Version 6.0. Yale New Haven Health Services Corporation, Centers for Medicare & Medicaid Services (CMS); 2019.
15. 2019 Procedure-Specific Mortality Measure Updates and Specifications Report. Isolated Coronary Artery Bypass Graft (CABG) Surgery – Version 6.0. Yale New Haven Health Services Corporation, Centers for Medicare & Medicaid Services (CMS); 2019.
16. 2019 Procedure-Specific Readmission Measures Updates and Specifications Report. Isolated Coronary Artery Bypass Graft (CABG) Surgery – Version 6.0 Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) – Version 8.0. Yale New Haven Health Services Corporation, Centers for Medicare & Medicaid Services (CMS); 2019.
17. Dean P, Baldwin A, Mei-Lau Y, et al. Consensus statement. Levels of Critical Care for Adult Patients. *Intensive Care Society.* 2021. Available at: https://www.ics.ac.uk/Society/Patients_and_Relatives/Levels_of_Care. Accessed 3 Feb 2022
18. Ojeda S, Romaguera R, Cruz-González I, Moreno R. Registro Español de Hemodinámica y Cardiología Intervencionista. XXIX Informe Oficial de la Asociación de Cardiología Intervencionista de la Sociedad Española de Cardiología (1990-2019). *Rev Esp Cardiol.* 2020;73:927–936.
19. Barrios V, Cosín-Sales J, Bravo M, et al. La consulta telemática para el cardiólogo clínico en tiempos de la COVID-19: presente y futuro. Documento de consenso de la Sociedad Española de Cardiología. *Rev Esp Cardiol.* 2020;73:910–918.
20. López-Sendón J, González-Juanatey JR, Pinto F, et al. Quality Markers in Cardiology. Main Markers to Measure Quality of Results (Outcomes) and Quality Measures Related to Better Results in Clinical Practice (Performance Metrics). INCARDIO (Indicadores de Calidad en Unidades Asistenciales del Área del Corazón): A SEC/ SECTCV Consensus Position Paper. *Rev Esp Cardiol.* 2015;68:976–995.
21. Martínez-Santos P, Bover-Freire R, Esteban-Fernández A, et al. In-hospital mortality and readmissions for heart failure in Spain. A study of the index episodes and 30 days and 1-year cardiac readmissions. *Rev Esp Cardiol.* 2019;72:998–1004.
22. Valle V, Alonso A, Arós F, Gutiérrez J, Sanz G. Guías de práctica clínica de la Sociedad Española de Cardiología sobre requerimientos y equipamiento de la unidad coronaria. *Rev Esp Cardiol.* 2001;54:617–623.