AUTHORS' CONTRIBUTIONS

J. Castillo García: concept, methodology, formal analysis, investigation, results, data management, drafting the manuscript, review and editing of the manuscript, supervision, project management. M.I. Barrionuevo Sánchez: concept, methodology, drafting the manuscript, supervision, project management. J.C. Sánchez-Salado: concept, methodology, review and editing of the manuscript, supervision, project management. C-S. Molina Mazón and D. Arbonés Arqué: methodology, writing, review and editing. Albert Ariza-Solé: concept, methodology, drafting the manuscript and review and editing of the manuscript, supervision, project management.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

1. Greif R, Lockey A, Conaghan P, et al. European Resuscitation Council Guidelines for Resuscitation 2015 Section 10. Education and implementation of resuscitation. *Resuscitation.* 2015;95:288–301.
2. Nolan JP, Soar J, Smith GB, et al. Incidence and outcome of in-hospital cardiac arrest in the United Kingdom National Cardiac Arrest Audit. *Resuscitation.* 2014;85:987–992.
3. Farah R, Stiner E, Zohar Z, Zveibil F, Eisenman A. Cardiopulmonary resuscitation surprise drills for assessing, improving and maintaining cardiopulmonary resuscitation skills of hospital personnel. *Eur J Emerg Med.* 2007;14:332–336.
4. Castillo J, Gallart A, Rodríguez E, Castillo-Monsegur J, Gomar C. Basic life support and external defibrillation competences after instruction and at 6 months comparing face-to-face and blended training. Randomised trial. *Nurse Educ Today.* 2018;65:232–238.
5. Castillo J, Gomar C, Rodriguez E, Trapero M, Gallart A. Cost minimization analysis for basic life support. *Resuscitation.* 2019;134:127–132.

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Spanish Cardiovascular Imaging Registry. Third Official Report from the Cardiovascular Imaging Association of the Spanish Society of Cardiology (2020)

Registro Español de Imagen Cardiaca. III Informe Oficial de la Asociación de Imagen Cardiaca de la Sociedad Española de Cardiología (2020)

To the Editor,

The Cardiovascular Imaging Association of the Spanish Society of Cardiology conducted a survey in 2017[1] and 2020[2] to collect data on cardiovascular imaging activity in Spanish hospitals. To ensure longitudinal continuity and add to the cardiovascular imaging registry, it conducted a third survey in June 2021 to collect data for the previous year. Ninety-four hospitals were contacted and 52 (55%) responded; 92% were public hospitals and all of Spain's autonomous communities except the Canary Islands were represented.

A summary of human and material resources and volume of cardiovascular imaging activity by modality is provided in table 1. In brief, 73% of attending physicians spent more than 50% of their working hours on cardiovascular imaging activities. Sixty-eight percent of the echocardiography systems were less than 10 years old and more than 59% of those in large hospitals (> 500 beds) had advanced analysis capabilities (strain and 3D imaging). In total 48% of echocardiography laboratories kept records of indications, 58% of events, and 60% of internal quality control procedures. Of the physicians who performed echocardiography, 46% were accredited in transthoracic echocardiography, 26% in transesophageal echocardiography, and 7% in transesophageal echocardiography. The studies were performed outside the laboratory in the vast majority of hospitals; 88% of hospitals, for example, performed echocardiograms in outpatient clinics; 55% prepared a semiquantitative/standard report and 52% stored data on a DICOM server. Focused cardiac ultrasounds were performed by other departments in 73% of hospitals. In departments supervised by cardiology, the level of diagnostic agreement was good (84%). In total, 89% of hospitals included a written report on findings in the patients' medical records.

Fifty hospitals (96%) performed cardiac computed tomography (CT) and 8 performed more than 500 studies a year. A cardiologist was involved in 60% of cases (mean time spent, 5.4 h/wk). All the scanning systems used at least 64 detectors and were on average 4 years old; 78% of hospitals recorded radiation doses but only 46% kept a record of results. Twenty-eight percent of cardiologists who participated in cardiac CT scanning had completed the European accreditation process (available since 2019).

Forty-nine hospitals (94%) offered cardiac magnetic resonance imaging (MRI) and 9 performed than 500 studies a year; cardiologists were involved in 65% of acquisitions (mean time spent, 6.1 h/wk). Stress cardiac MRI was available at 17 hospitals (11%), 4 of which performed more than 100 studies a year. Field intensity was 1.5 T in 76% of cases and 3.0 T in 24%; the machines was on average 6 years old. Sixty percent of cardiologists performing cardiac MRI had international accreditation.

Thirty-seven hospitals (71%) performed cardiac nuclear medicine studies, with 5 hospitals performing more than 500 studies a year; a cardiologist was involved in 36% of cases. Overall, 43% of hospitals recorded radiation doses and 27% results. Just 3 of the cardiologists had European accreditation in cardiac nuclear medicine.

Data from the 50 hospitals that participated in the surveys to collect data for 2019 and 2020 are compared in table 2.

In relation to the impact of coronavirus disease 2019 (COVID-19) on activity in 2020, 60% of hospitals had at least 1 cardiovascular imaging staff member infected by severe acute respiratory syndrome coronavirus 2 during the first wave of the pandemic. The respective percentages for the second and third waves were 38% and 37%. During the initial phases of the pandemic, 25% of hospitals experienced a shortage of surgical masks (25%), 63% of filtering face

Table 1
Human and material resources and volume of activity according to hospital size

	Beds per hospital				
	< 250	250-500	500-750	750-1000	> 1000
Hospitals	4	9	11	15	13
Cardiology department, %	25	89	91	100	100
Attending cardiologists	3.5	13.1	23.1	28.2	29.3
Cardiovascular imaging unit, %	25	77.8	90.9	100	92.3
Attending physicians who perform imaging	1.4	3.7	4.1	4.7	5.4
Attending physicians who spend > 50% of their time on imaging, %	100	72.3	74.2	82.8	68
Registered nurses in imaging	0.8	1.3	1.6	1.8	2.4
Imaging assistants	0.3	1.2	1.4	1.8	1.5
Diagnostic imaging technicians	0.3	0.6	0.5	0.6	0.6
Administrative staff in imaging	0.3	0.2	0.1	0.7	0.9
Janitors	0.3	0.3	0.7	1.2	0.9
Echocardiography systems in cardiology	2.8	7.4	7.3	9.8	10.5
Echocardiography systems in imaging	2.3 (82)	3.9 (53)	4.5 (62)	6 (61)	5.9 (56)
Echocardiography studies	2.330	7.023	8.205	10.881	12.279
TTE/TEE/stress echocardiography, %	90/4/3	84/7/4	90/4/2	90/4/3	90/4/3
TEE probes	1	1.9	2.5	3.5	3.5
3D/STE machines, %	25/58	38/57	65/88	54/76	71/82
Echocardiography systems > 10 y, %	15.4	18	37.4	39.2	28.3
CT studies	159	179	370	352	734
MRI studies	103	270	459	353	669
SPECT scans	10	300	308	436	550
MUGA studies	5	-	114	-	263
PET studies	10	-	15	16	33

3D, 3-dimensional; MUGA, multigated acquisition; PET, positron emission tomography; SPECT, single photon emission computed tomography; STE, speckle-tracking echocardiography; TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.
Unless otherwise indicated, values are expressed as No., No. (%), or median.

Table 2
Comparison of cardiovascular imaging activity between II and III Spanish Cardiovascular Imaging Registry Surveys

	2019	2020	Difference	*P*
Attending physicians in imaging	4.2	4.4	0.2	.54
Echocardiography				
Echocardiography systems in cardiology	7.6	8.6	1	.19
Echocardiography systems in cardiovascular imaging unit	4.7 (61.8)	5.0 (58.2)	0.3	.45
Echocardiography systems > 10 y, %	25.4	26.6	1.2	.76
Studies				
Transthoracic echocardiography	9.411	8.260	−1.151 (−12.2)	.04
Transesophageal echocardiography	435	502	67 (15.4)	.64
Stress echocardiography	340	275	−65 (−19.2)	.02
Computed tomography				
Studies	403	419	16 (4)	.61
Attending physicians	1.9	2.1	0.2	.61
Time spent, h/wk	10	12.5	2.5	.28
Age of systems, y	4.9	3.9	−1	.20
Magnetic resonance imaging				
Studies	428	422	−6 (−1.4)	.83
Attending physicians	1.9	2.1	0.2	.54
Time spent, h/wk	12.7	12.3	−0.4	.87
Age of systems, y	5.9	5.8	−0.1	.91
Nuclear medicine				
SPECT studies	578	503	−75 (−13)	.43
MUGA studies	165	119	−46 (−28.5)	.12
PET studies	50	39	−11 (−22)	.07

MRI, magnetic resonance imaging; MUGA, multigated acquisition; PET, positron emission tomography; SPECT, single photon emission computed tomography.
Unless otherwise indicated, values are expressed as No. or No. (%).
Comparison between 50 hospitals that participated in both surveys (7.7% had < 250 beds, 17.3% had 250-500 beds, 21.2% had 500-750 beds, 28.8% had 750-1000 beds, and 25% had > 1000 beds).

piece 2 (FFP2) masks, and 52% of personal protective equipment (PPE). Eighty-three percent cut their activity by at least 50% and restricted tests involving a high risk of infection to emergency situations. In subsequent waves of the pandemic, 71% of hospitals did not implement measures to reduce activity and 60% applied extraordinary measures to catch up with backlogs (61% increased working hours/volume of activity and 29% modified indications). Just over half of the hospitals (52%) recovered prepandemic response times. Most echocardiographic studies of patients with COVID-19 were performed by cardiovascular imaging staff (63% studied unstable patients and 87% studied unstable patients). The most common indications were clinical instability, clinical suspicion of myocarditis, thromboembolism, infective endocarditis, and elevated myocardial injury markers in blood tests. Use of cardiac CT scanning as an alternative to transesophageal echocardiography, stress echocardiography, and invasive coronary angiography increased in 20% of hospitals. Seventeen hospitals performed cardiac MRI in patients with COVID-19; the indications were acute infection in 46% of cases and follow-up of persistent symptoms in 54%. At the time of the survey, 73% of hospitals continued to use FFP2 masks and PPE and required polymerase chain reaction tests before transesophageal and stress echocardiograms.

Registries are essential tools for standardizing and reducing variability in health care. The current findings complement other initiatives such as the RECALCAR (Resources and Quality in Cardiology Units) project.[3] The results of the third edition of the Spanish Cardiovascular Imaging survey reflect the impact of the COVID-19 pandemic and in particular show a reduction in echocardiography and nuclear medicine practice. They also highlight the continuing trend for echocardiographic studies to be performed outside cardiovascular imaging units and for focus cardiac ultrasound examination to be performed by noncardiologists. Improvements continued to be noted in a number of areas, notably the performance of echocardiography studies outside cardiovascular imaging units, increasing accreditation rates for certain techniques, and a growing use of advanced imaging techniques with low annual volumes in most hospitals.

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AUTHORS' CONTRIBUTIONS

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CONFLICTS OF INTEREST

None declared.

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REFERENCES

1. Barreiro-Perez M, Galian-Gay L, Oliva MJ, Lopez-Fernandez T, Perez de Isla L; Spanish Cardiovascular Imaging Registry. First Official Report of the Spanish Society of Cardiology Working Group on Cardiovascular Imaging (2017). *Rev Esp Cardiol.* 2019;72:426–428.
2. Barreiro-Perez M, Martínez-Monzonis A, Li C, Jiménez-Borreguero L, López-Fernández T. Spanish Cardiovascular Imaging Registry. Second Official Report of the Cardiovascular Imaging Association of the Spanish Society of Cardiology (2019). *Rev Esp Cardiol.* 2020;73:1070–1073.
3. Iñiguez Romo A, Bertomeu Martinez V, Rodriguez Padial L, et al. The RECALCAR Project. Healthcare in the cardiology units of the Spanish National Health System, 2011 to 2014. *Rev Esp Cardiol.* 2017;70:567–575.

https://doi.org/10.1016/j.rec.2021.10.015