

# **SUPPLEMENTAL MATERIAL**

**Table S1. Baseline characteristics according to date of ICD implant.**

	2005-2009	2010-2014	2015-2017
N (%)	344 (8)	2744 (63.9)	1208 (28.1)
Age (years), mean ( $\pm$ SD)	61.5 $\pm$ 13.7	61.9 $\pm$ 13.2	62.3 $\pm$ 12.0
Sex (male)	290 (84.3)	2259 (82.4)	978 (81.0)
Hypertension	158 (47.7)	1449 (54.4)	668 (56.3)
Diabetes	72 (21.9)	742 (28.0)	364 (30.8)
Hypercholesterolaemia	157 (49.5)	1315 (52.0)	568 (54.7)
Smoking status	115 (39.9)	867 (35.4)	433 (42.8)
History of atrial fibrillation	116 (34.8)	745 (27.9)	374 (31.4)
Previous stroke	18 (6.0)	167 (6.8)	67 (7.0)
Chronic kidney disease	42 (12.9)	410 (15.6)	181 (15.4)
Family history of SCD	29 (9.0)	241 (9.3)	86 (7.3)
LV ejection fraction			
$\leq$ 35%	217 (63.5)	1807 (66.1)	817 (68.0)
36-50%	57 (16.7)	399 (14.6)	175 (14.6)
$>$ 50%	68 (19.9)	528 (19.3)	210 (17.5)
QRS width			
$<$ 120 ms	160 (47.6)	1398 (52.0)	644 (54.9)
120-150 ms	72 (21.4)	575 (21.4)	230 (19.6)
$>$ 150 ms	104 (31.0)	717 (26.7)	298 (25.4)
Previous heart failure	152 (76.8)	1088 (82.8)	481 (83.2)
Type of device			
VR	159 (46.2)	1237 (45.1)	631 (52.1)
DR	77 (22.4)	682 (24.9)	213 (17.6)
CRT-D	108 (31.4)	825 (30.1)	364 (30.1)
Primary prevention	210 (61.0)	1735 (63.2)	818 (67.7)

Data are given as n (%) unless otherwise noted. CRT-D: cardiac resynchronization therapy defibrillator; LV: left ventricle; SCD: sudden cardiac death; SD: standard deviation.

**Table S2. Number of patients in whom baseline data are available.**

<b>Baseline characteristics</b>	<b>Valid data, n (%)</b>
Age	4296 (100)
Sex	4296 (100)
Hypertension	4184 (97.4)
Diabetes	4166 (97)
Hypercholesterolaemia	3884 (90.4)
Smoking status	3752 (87.3)
History of atrial fibrillation	4198 (97.7)
Previous stroke	3702 (86.2)
Chronic kidney disease	4132 (96.2)
Family history of SCD	4090 (95.2)
LV ejection fraction	4278 (99.6)
QRS width	4198 (97.7)
Previous heart failure	4259 (99.1)
Type of device	4296 (100)
ICD indication (primary vs. secondary prevention)	4296 (100)
<b>ICD programming</b>	
Detection zones enabled	4293 (99.9)
VF detection interval	4295 (99.9)
NID within VF detection zone	4295 (99.9)
Fast VT detection zone enabled	4293 (99.9)
Fast VT detection interval*	1557 (100)
VT detection interval	4295 (99.9)
NID within VT detection zone**	2440 (100)
SmartShock™ Technology capable device	4065 (94.6%)

ICD: Implantable cardioverter-defibrillator; LV: left ventricle; NID: number of intervals to detect; SCD: sudden cardiac death; VF: ventricular fibrillation; VT: ventricular tachycardia.

\*Data correspond to total of patients with a fast VT zone enabled.

\*\*Data correspond to total of multizone patients.

**Table S3. Devices included in UMBRELLA study.**

<b>Single-chamber</b>	
<b>Models without SmartShock® Technology</b>	<b>n</b>
<b>EnTrust D154VRC</b>	47
<b>Maximo II VR D264VRM</b>	55
<b>Maximo II VR D284VRC</b>	141
<b>Secura VR D214VRM</b>	35
<b>Secura VR D234VRC</b>	179
<b>Virtuoso II VR D294VRC</b>	58
<b>Virtuoso VR D164VWC</b>	130
<b>Subtotal</b>	<b>645 (29%)</b>
<b>Models with SmartShock® Technology</b>	
<b>Evera MRI S VR DVMC3D4</b>	234
<b>Evera MRI XT VR DVMB2D4</b>	140
<b>Evera S VR DVBC3D1</b>	67
<b>Evera S VR DVBC3D4</b>	171
<b>Evera XT VR DVBB2D1</b>	42
<b>Evera XT VR DVBB2D4</b>	24
<b>Protecta VR D364VRG</b>	135
<b>Protecta VR D364VRM</b>	293
<b>Protecta XT VR D354VRG</b>	115
<b>Protecta XT VR D354VRM</b>	121
<b>Visia AF MRI S VR DVFC3D4</b>	70
<b>Visia AF MRI XT VR DVFB2D4</b>	102
<b>Visia AF MRI™ S VR</b>	5
<b>Visia AF MRI™ XT VR</b>	4
<b>Visia AF S VR DVAC3D1</b>	7
<b>Visia AF XT VR DVAB2D1</b>	12
<b>Subtotal</b>	<b>1542 (71%)</b>
<b>TOTAL</b>	<b>2187</b>

<b>Dual-chamber</b>	
<b>Models without SmartShock® Technology</b>	<b>n</b>
<b>EnTrust D154ATG</b>	20
<b>Maximo II DR D264DRM</b>	17
<b>Maximo II DR D284DRG</b>	44
<b>Secura DR D214DRM</b>	12
<b>Secura DR D234DRG</b>	103
<b>Virtuoso DR D164AWG</b>	57
<b>Virtuoso II DR D294DRG</b>	55
<b>Intrinsic ICD 7288</b>	1
<b>Subtotal</b>	<b>309 (30%)</b>
<b>Models with SmartShock® Technology</b>	<b>n</b>
<b>Evera MRI S DR DDMC3D1</b>	1
<b>Evera MRI S DR DDMC3D4</b>	54
<b>Evera MRI XT DR</b>	7
<b>Evera MRI XT DR DDMB2D4</b>	140
<b>Evera S DR DDBC3D1</b>	39
<b>Evera S DR DDBC3D4</b>	68
<b>Evera XT DR DDBB2D1</b>	38
<b>Evera XT DR DDBB2D4</b>	23
<b>Protecta DR D364DRG</b>	61
<b>Protecta DR D364DRM</b>	105
<b>Protecta XT DR D354DRG</b>	93
<b>Protecta XT DR D354DRM</b>	89
<b>Subtotal</b>	<b>718 (70%)</b>
<b>TOTAL</b>	<b>1027</b>

<b>Cardiac Resynchronization Therapy-Defibrillators</b>	
<b>Models without SmartShock® Technology</b>	<b>n</b>
Concerto C174AWK	63
Concerto II CRT-D D294TRK	28
Consulta CRT-D D214TRM	60
Consulta CRT-D D234TRK	194
Maximo II CRT-D D264TRM	12
Maximo II CRT-D D284TRK	52
<b>Subtotal</b>	<b>409 (29%)</b>
<b>Models with SmartShock® Technology</b>	<b>n</b>
Amplia MRI™ CRTD	8
Amplia MRI™ Quad CRTD	20
Brava CRT-D DTBC2D1	60
Brava CRT-D DTBC2D4	39
Brava Quad CRT-D DTBC2Q1	5
Brava Quad CRT-D DTBC2QQ	134
Claria MRI™ CRTD	17
Claria MRI™ Quad CRTD	45
Compia MRI™ CRTD	7
Compia MRI™ Quad CRTD	13
Protecta CRT-D D364TRG	46
Protecta CRT-D D364TRM	72
Protecta XT CRT-D D354TRG	109
Protecta XT CRT-D D354TRM	87
Viva Quad S CRT-D DTBB2Q1	1
Viva Quad S CRT-D DTBB2QQ	27
Viva Quad XT CRT-D DTBA2Q1	7
Viva Quad XT CRT-D DTBA2QQ	171
Viva S CRT-D DTBB2D1	10
Viva S CRT-D DTBB2D4	10
Viva XT CRT-D DTBA2D1	51
Viva XT CRT-D DTBA2D4	56
<b>Subtotal</b>	<b>995 (71%)</b>
<b>TOTAL</b>	<b>1404</b>

**Table S4. Device programming according to date of ICD implant.**

	2005-2009 (N=344)	2010-2014 (N=2744)	2015-2017 (N=1208)	p value
Detection zones enabled				< 0.001
• Single-zone *	119 (34.6)	1116 (40.7)	618 (51.2)	
• Multi-zone	225 (65.5)	1627 (59.3)	588 (48.8)	
VF detection interval, ms	302.7 ± 21.4	303.5 ± 19.2	301.0 ± 18.9	0.001
NID				< 0.001
• < 30/40	314 (91.3)	1998 (72.8)	178 (14.6)	
• ≥ 30/40	30 (8.7)	746 (27.2)	1023 (85.3)	
Fast VT detection zone enabled**	119 (34.6)	951 (34.7)	487 (40.4)	0.002
Fast VT detection interval**, ms	270.59 ± 31.7	267.3 ± 31	263.6 ± 24.8	0.014
VT detection interval†, ms	368.4 ± 31.1	362.4 ± 25.4	357.9 ± 22.4	< 0.001
NID †				< 0.001
• ≤16	181 (80.4)	1014 (62.3)	200 (34.0)	
• ≥20	44 (19.6)	613 (37.7)	388 (66.0)	
SmartShock™ Technology-capable device	40 (16.6)	1740 (66.4)	1150 (95.5)	< 0.001

Data are given as n (%) or mean±standard deviation. ICD: Implantable cardioverter-defibrillator; NID: number of intervals to detect; VF: ventricular fibrillation; VT: ventricular tachycardia.

\* Patients with fast VT zone enabled through VF zone, but without any other VT zone activated were also considered as single-zone detection patients.

\*\* Through VF detection zone.

† Applies only to multi-zone detection programming patients.

**Table S5. Causes of death.**

<b>Cause of death</b>	<b>N (%)</b>
Heart failure	214 (36.3%)
Sudden cardiac death	26 (4.4%)
Non-cardiovascular	190 (32.2%)
Unknown	160 (27.1%)
<b>Total deaths</b>	<b>590 (100%)</b>

**Table S6. Causes of inappropriate shock.**

<b>Cause of inappropriate shock</b>	<b>Episodes, n (%)</b>
Atrial fibrillation	254 (42.3%)
Other SVT*	95 (15.9%)
Non-sustained MVT	52 (8.6%)
T-wave oversensing	95 (15.9%)
Noise	60 (10%)
Sinus tachycardia	24 (4%)
False detection	7 (1.2%)
Possible SVT	13 (2.1%)
<b>Total episodes</b>	<b>600 (100%)</b>

MVT: monomorphic ventricular tachycardia; SVT: supraventricular tachycardia.

\*i.e., atrial flutter, atrial tachycardia, atrioventricular node re-entry tachycardia.

**Table S7. Comparison between the UMBRELLA population and the patients enrolled in the last Spanish ICD registry.**

	UMBRELLA population	Spanish ICD registry <sup>22</sup>
Age (years), mean( $\pm$ SD)	61.9 $\pm$ 12.9	62.4 $\pm$ 13.5
Sex (male)	82.1	82
Hypertension	54.4	57
Diabetes	28.3	30
Hypercholesterolaemia	52.5	48
Smoking status	37.7	35
History of atrial fibrillation	29.4	27
Previous stroke	6.8	6
Chronic kidney disease	15.3	15
Family history of SCD	8.7	9
LV ejection fraction		
$\leq$ 35%	66.4	54
36-50%	14.7	27.4
$>$ 50%	18.9	18.5
QRS width		
$<$ 120 ms	52.4	N/R
120-150 ms	20.9	N/R
$>$ 150 ms	26.7	N/R*
Previous heart failure	69.8	N/R
Type of device		
VR	47.2	50.1
DR	22.6	13.4
CRT-D	30.2	30.6
Primary prevention	64.2	65.7
Underlying heart disease		
ICM	50	52.9
DCM	27.3	26.1
HCM	7.4	7.1
ARVC	1.9	1.1
VHD	2.8	1.6
BS	3.5	2.3
LQTS	1.1	0.6
ACHD	1.4	N/R

Data are given as % unless otherwise noted. ACHD: adult congenital heart disease; ARVC: arrhythmogenic right ventricular cardiomyopathy; BS: Brugada syndrome; CRT-D: cardiac resynchronization therapy defibrillator; DCM: dilated cardiomyopathy; HCM: hypertrophic cardiomyopathy; ICD: implantable cardioverter-defibrillator; ICM: ischaemic cardiomyopathy; LQTS: long QT syndrome; LV: left ventricle; N/R: not reported; SCD: sudden cardiac death; SD: standard deviation; VHD: valvular heart disease.

\*39% of patients had QRS  $>$  140 ms.