Supplementary file 1. Pairwise comparisons using a Wilcoxon rank sum test.

The P value adjustment method shows a false discovery rate (FDR) [Benjamin and Hochberg (1995)]

(1) Pacemakers

	1	2	3	4	5	6	7	8	9	10	11
2	0.0001	-	-	-	-	-	-	-	-	-	-
3	0.0000	0.0051	-	-	-	-	-	-	-	-	-
4	0.0001	0.1721	0.4305	-	-	-	-	-	-	-	-
5	0.0000	0.0185	0.7212	0.5906	-	-	-	-	-	-	-
6	0.0000	0.0000	0.0006	0.0003	0.0001	-	-	-	-	-	-
7	0.0000	0.0000	0.0014	0.0007	0.0007	0.6670	-	-	-	-	-
8	0.0000	0.0004	0.0302	0.0302	0.0185	0.2452	0.1235	-	-	-	-
9	0.0000	0.0157	0.5533	0.6832	0.7592	0.0000	0.0001	0.0302	-	-	-
10	0.0000	0.0007	0.0350	0.0157	0.0133	0.1721	0.0935	0.6832	0.0051	-	-
11	0.0000	0.0032	0.6832	0.2652	0.6286	0.0003	0.0018	0.0817	0.2652	0.0274	-
12	0.0000	0.0350	0.1395	0.7969	0.2912	0.0000	0.0000	0.0051	0.1568	0.0018	0.0302

(2) Implantable cardioverter-defibrillator

	1	2	3	4	5	6	7	8	9	10	11
2	0.2860	-	-	-	-	-	-	-	-	-	-
3	0.2860	0.4550	-	-	-	-	-	-	-	-	-
4	0.3300	0.8190	0.7580	-	-	-	-	-	-	-	-
5	0.1860	0.9500	0.4550	0.8500	-	-	-	-	-	-	-
6	0.1370	0.2860	0.8500	0.5110	0.3310	-	-	-	-	-	-
7	0.1860	0.8190	0.5700	1.0000	1.0000	0.3310	-	-	-	-	-
8	0.1390	0.3310	0.9250	0.8190	0.5110	0.8190	0.4290	-	-	-	-
9	0.4550	1.0000	0.3300	0.8190	0.8500	0.3220	0.8190	0.3220	-	-	-
10	0.3920	0.8190	0.6150	1.0000	1.0000	0.4290	0.9500	0.7580	0.7580	-	-
11	0.0210	0.3300	0.8190	0.8500	0.4290	0.6150	0.4550	0.9500	0.3300	0.6150	-
12	0.0210	0.1030	0.5700	0.2090	0.1710	0.9500	0.1390	0.3310	0.1150	0.2090	0.3310

(3) Cardiac resynchronization therapy with defibrillators

	1	2	3	4	5	6	7	8	9	10	11
2	0.1590	-	-	-	-	-	-	-	-	-	-
3	0.0220	0.3870	-	-	-	-	-	-	-	-	-
4	0.0220	0.4180	0.9200	-	-	-	-	-	-	-	-
5	0.1140	1.0000	0.5610	0.6640	-	-	-	-	-	-	-
6	0.0100	0.1590	0.4710	0.2460	0.1770	-	-	-	-	-	-
7	0.3870	0.6640	0.2460	0.1590	0.5610	0.0280	-	-	-	-	-
8	0.1030	0.6640	0.8640	0.5260	0.9200	0.2460	0.4180	-	-	-	-
9	0.6180	0.1140	0.0120	0.0100	0.0490	0.0100	0.1590	0.0360	-	-	-
10	0.7340	0.1430	0.0280	0.0120	0.1030	0.0100	0.3480	0.1140	0.4710	-	-
11	0.7930	0.4180	0.1030	0.0910	0.1770	0.0220	0.5610	0.1770	0.5610	0.9740	-
12	0.3480	0.7930	0.2160	0.1770	0.6180	0.0360	0.9740	0.3870	0.1140	0.4180	0.5260

Supplementary file 2. Geographical variation in PM implantations.

It is a value obtained by dividing the quarterly fluctuation component of the seasonality by the average value of the quarter of 2012 - 2016. Data were analyzed by 4 seasons as follows: Q1 (winter from January to March), Q2 (spring from April to June), Q3 (summer from July to September), and Q4 (fall from October to December). The first row presents the number of implantations (black line) and trend components (dotted red) of PMs, and are shown for (A) all over Japan, (B) north area, (C) central area, and (D) south area. The second row indicates the seasonal variation pattern S (t) estimated by seasonal-trend decomposition procedure based on loess (STL). The third row is a fitted cosine curve to the time series obtained by subtracting the trend T (t) from the original data N (t). The bottom row indicates the seasonal component of implants (S(t): blue horizontal line), detrended data (N (t) − T (t): gray vertical line) and cosinor fit (red line). In the 3 areas, PM implantations had a significant peak in Q3. PM: pacemaker.

Supplementary file 3. Geographical variation in the ICD implantations.
The number of implantations (black line) and trend components (dotted red) of ICDs is shown for (A) all over Japan, (B) north area, (C) central area, and (D) south area. Please refer to the Figure legends of Supplementary file 2. There was a significant variation in the ICD implantations only in the south area ($p<0.005$). ICD: implantable cardioverter-defibrillator.

Supplementary file 4. Geographical variation in the CRT-D implantations.
The number of implantations (black line) and trend components (dotted red) of CRT-Ds is shown for (A) all over Japan, (B) north area, (C) central area, and (D) south area. Please refer to the Figure legends of Supplementary file 2. There was a significant variation in the ICD implantations in all 3 areas (north: $p=0.04$, central: $p<0.0001$, and south: $p=0.02$). CRT-Ds: cardiac resynchronization therapy with defibrillators.

Supplementary file 5. Number of PM implantations by prefecture.
The number of implantations (black line) and trend components (dotted red) of PMs between the low-volume regions (37 prefectures) and high-volume regions (10 prefectures) is shown. A significant variation in the PMs were observed for both the low-volume and high-volume prefectures with a peak in Q3 and trough in Q1 (all p-values <0.000001). The number of PM implantations was divided between 10 prefectures that exceeded the national average and 37 prefectures that were below the national average.

Supplementary file 6. Number of ICD implantations by prefecture.

The number of implantations (black line) and trend components (dotted red) of ICDs between the low-volume regions (35 prefectures) and high-volume regions (10 prefectures) is shown. There were no significant variations in the ICD implantations both in the low-volume regions and high-volume regions.

Supplementary file 7. Number of CRT-D implantations by prefecture.

The number of implantations (black line) and trend components (dotted red) of CRT-Ds between the low-volume regions (35 prefectures) and high-volume regions (10 prefectures) is shown. A significant variation in the PMs was observed in both the low-volume and high-volume prefectures with a peak in Q2 and trough in Q4 (all p-values <0.001).