Physical Activity in Cardiac Implantable Electronic Device Recipients During the COVID-19 Pandemic

Abhishek J. Deshmukh, MBBS, Camden Harrell, MS, Jacob Hicks, MS, Ammar M. Killu, MBBS, Siva K. Mulpuru, MD, Samuel J. Asirvatham, MD, Paul A. Friedman, MD, Yong Mei Cha, MD, Malini Madhavan, MBBS

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Physical Activity in Cardiac Implantable Electronic Device Recipients

During the COVID-19 Pandemic

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Short title: PA Trends during COVID pandemic

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Conflicts of interest

Deshmukh: None

Camden Harrell, and Jacob Hicks are employees of BIOTRONIK

Killu: None

Mulpuru: None

Friedman: None

Cha: Research grant from Medtronic.

Asirvatham:

Relevant financial relationship(s) with industry: receives royalties for work licensed through Mayo Clinic to a privately held company for contributions related to the use of nerve signal modulation to treat central, autonomic and peripheral nervous system disorders, including pain. Mayo Clinic receives royalties and owns equity in this company. The company does not currently license or manufacture any drug or device in the medical field. Co-patent holder for technique to minimize coagulum formation during radiofrequency ablation. Inventions/startup companies that include Nevro, Aegis and the Phoenix Corp.

Honoraria/Speaker: Abiomed, Atricure, BIOTRONIK, Blackwell Futura, Boston Scientific, Medtronic, Medtelligence, Spectranetics, St. Jude, Zoll

Consulting: Aegis, ATP, Nevro, Sanovas, Sorin Medical, FocusStart

Madhavan: Serves on the steering committee of CERTITUTDE, BIOTRONIK, Inc.
Abstract

Objective: To characterize the physical activity (PA) level in patients with a cardiac implantable electronic device (CIED) during the COVID-19 pandemic and compare PA level during the pandemic in 2020 to the year 2019.

Methods: We performed a retrospective analysis of PA activity in individuals implanted with a CIED enrolled in the BIOTRONIK CERTITUDE Registry. Mean daily and weekly PA from January to August 2020 was compared to 2019.

Results: A total of 21,660 individuals met eligibility criteria, with mean age of 72.6 ± 11.6 years, and 57.4% were males. A significant decline in daily PA was noted following the pandemic declaration in 2020, with a maximum mean reduction of -24.5 ± 36.3 minutes (p<0.0001) observed in April 2020 compared to 2019. PA in 2020 increased from April to May (120.6 ± 67.4 to 129.2 ± 70.9 minutes/day). PA was lower for all months in 2020 compared to 2019. The decrease in PA was seen in all pre-specified groups based on age, gender, type of device, and region of the country.

Conclusion: Following the declaration of the COVID-19 pandemic a significant decline in daily PA was observed in individuals with a CIED. Future investigation to establish the impact of this reduction on short and long-term cardiovascular outcomes is required.

Keywords: COVID-19 pandemic, physical activity, pacemaker, ICD
Abbreviations

COVID-19 : Coronavirus disease 2019

PA : Physical activity

CIED : cardiac implantable electronic device

ICD : Implantable cardiac defibrillator

CRT – Cardiac resynchronization therapy
**Introduction**

The World Health Organization declared the coronavirus disease 2019 (COVID-19) a global pandemic on March 11, 2020. ¹ To curb the disease's spread, varying degrees of social distancing guidelines have been established. ² Although the time frame, adoption, and enforcement of these restrictions have varied, these restrictions are anticipated to reduce PA amongst the general population. ³ Patients with chronic heart diseases and related comorbidities are particularly vulnerable to severe COVID-19 and, consequently, strongly recommend adhering to public health guidelines to avoid contracting the disease. ⁴, ⁵

Cardiac implantable electronic devices (CIED) implanted in patients with bradyarrhythmia, ventricular tachyarrhythmias, and heart failure collect daily PA data using an implanted sensor. ⁶, ⁷ Prior studies have shown that CIED detected increased PA correlate with reduced incidence of ICD shocks, improved heart failure outcomes, and survival. ⁸ The reduction of PA in patients with CIED, specifically during the pandemic, may result in deleterious effects on long-term mortality and morbidity. We sought to characterize the PA level and differences in activity level during the COVID-19 pandemic compared to the year 2019 in recipients of a cardiac implantable electronic device (CIED) enrolled in the BIOTRONIK CERTITUDE registry.

**Methods**

**Data Sources**

The CERTITUDE program was established to analyze data for US patients implanted with a BIOTRONIK CIED collected via the BIOTRONIK Home Monitoring® remote cardiac device monitoring system (BIOTRONIK SE & Co. KG, Berlin, Germany), which gained initial
Food and Drug Administration approval in 2001, and has been described previously. The CERTITUDE registry consists of approximately 50,000 US patients implanted with 60,000 market released BIOTRONIK implantable loop recorder (ILR), pacemaker, CRT-P, ICD, and CRT-D device(s) with BIOTRONIK Home Monitoring® capability, who have provided authorization for the use of their data for research purposes. The Advarra Institutional Review Board (Columbia, MD) reviewed and approved the CERTITUDE program, which granted a Waiver of Informed Consent and a Full Waiver of HIPAA Authorization. A Steering Committee of independent physicians reviews Investigator-initiated CERTITUDE proposals before execution. A charter establishes the conduct of the CERTITUDE Steering Committee and BIOTRONIK personnel.

The CERTITUDE registry dataset consists of remote monitoring transmission data for these 60,000 CIEDs, supplemented by device registration and demographic data obtained from the BIOTRONIK US device tracking database. Remote monitoring data from January 2019 to August 2020, including PA, atrial arrhythmia burden (Atrial tachycardia/Atrial Fibrillation (AT/AF) burden), heart rate variability, mean ventricular heart rate, and corresponding demographic and device registration data were evaluated for this study.

Study Population

Individuals from the CERTITUDE registry implanted with a BIOTRONIK pacemaker, CRT-P, ICD, or CRT-D on or after January 1, 2010, were eligible for inclusion in this analysis. Patients with an eligible device implanted after December 31, 2018, patients without at least one remote transmission per month in January to August of 2019 and 2020 (e.g., missing remote transmission, patient death, device explant without replacement), and patients who underwent a
procedure to change device type during the study time period (e.g., ICD to CRT-D) were excluded.

*Home Monitoring Parameters*

Patient PA is reported daily as a percentage value, representing the time in a state of "activity" determined by comparing the acceleration measured by a capacitive single-axis accelerometer at ~ 0.4 Hz to a threshold value. The accelerometer collects PA data independent of the programming of rate-responsive mode. PA values were converted to minutes per day, and activity data obtained within the first 45 days of the device implant were excluded due to potential restrictions on activity for patients immediately after the implant. Heart rate variability is assessed based on the standard deviation of the 5-minute mean normal to normal interval over the recorded time based on the atrial p-p rate. Mean ventricular heart rate reports the daily mean ventricular rate calculated using sensed ventricular events, paced ventricular events, premature ventricular contractions, and ventricular rate stabilization (Vs, Vp, PVC, and Vrs) events. The atrial arrhythmia burden (AT/AF burden) is reported as a percentage value, representing the time per day spent in device-detected atrial tachyarrhythmia.

*Statistical Analysis*

Continuous variables were reported using means with standard deviation (SD), while categorical variables were reported using frequencies with percentages. Paired t-tests (two-tailed) were used to compare continuous variables between months for 2020 and 2019. Using a reduction threshold of 10 min/day between 2019 and 2020, subjects were classified as above or below the threshold, and a two-tailed binomial proportional test was conducted to determine if a majority of subjects had higher reductions between the time periods. Plots of weekly averages
were generated for continuous variables across the study's total time frame (1/1/2019 to 8/31/2020), and for January to August, stratified by year. Spearman's rank-order correlation was used to assess the correlation between PA and atrial arrhythmia burden in each month of 2020. All statistical analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC) using a significance level of 0.05.

Results

Physical Activity

A total of 21,660 individuals from the CERTITUDE registry were implanted with a BIOTRONIK pacemaker, CRT-P, ICD, or CRT-D, meeting all eligibility requirements. Figure 1 details the derivation of the study cohort. The baseline characteristics of the cohort are presented in Table 1. The mean age of the cohort was 72.6 ± 11.6 years, and 57.3% were male. The mean follow-up duration, defined as first to last remote transmission, was 1.66 ± 0.01 years (607.0 ± 3.64 days), and a total of 12.3 million days with transmission were analyzed. Mean transmission days per individual was 568.66 ± 3.64 days, and mean transmission completeness per individual during the follow-up period was 93.45%. The mean daily and weekly duration spent being physically active in January through August in 2020 is compared to 2019 in Table 2 and Figure 2A, respectively. A significant decline in time spent being physically active was noted following the pandemic declaration in 2020, with a maximum mean reduction of -24.5 ± 36.3 minutes (p<0.0001) observed in April 2020 compared to 2019. PA in 2020 increased from April to May, with PA for all months in 2020 at lower levels than 2019. Over half of the cohort experienced a reduction in PA of 10 minutes or more in March through August 2020, consistent with widespread effect across the cohort (Table 2).
PA declined in both men and women in this period (Figure 2B). A similar degree of decline in PA was seen in all strata of age in March and April 2020. However, individuals over the age of 80 years notably showed less rebound in the subsequent months. A reduction in activity was noted from June through August 2020 (Figure 2C and Table 3). A similar trend in reduction in PA was noted across different device types (Figure 2D). PA data were stratified by the country's region and are presented in Figure 3.

Heart rate, heart rate variability, and atrial arrhythmia burden

Corresponding to the decline in PA, we noted a small reduction in the ventricular rate following the pandemic declaration (Supplementary Table 1). Heart rate variability represented by variability in the atrial rate was lower in March through August 2020 than corresponding months in 2019 (Supplementary Table 1). These changes were, however, small and of unknown clinical significance. The burden of atrial arrhythmia progressively increased throughout the study (Supplementary Figure). There was no correlation between PA and atrial arrhythmia burden in each month of the pandemic (Supplementary Table 2).

Discussion

Utilizing data from a large patient cohort from the BIOTRONIK CERTITUDE registry, we report a significant decrease in device detected PA following the global COVID-19 pandemic declaration in March 2020, compared to the same period in 2019. This decline in PA was noted across all genders, ages, regions, and device types.

The global COVID-19 pandemic declaration in March 2020 was followed by social distancing guidelines and various degrees of restrictions on daily activities.
The corresponding reduction in PA in individuals with CIEDs may be secondary to decreased daily activity such as exercise. Our findings parallel those of Tison et al., who reported a 27% decline in the average PA at 30 days following the pandemic declaration across the globe using data from a smartphone-based application. Sassone et al. also reported a 25% reduction in PA in a small cohort of Italian patients with ICDs in the first 40 days of government-imposed quarantine. An extensive study on 185,000 US subjects reported a steep fall in PA (by 48%) measured by Fitbit trackers since a Federal emergency was declared through April 6.

There were regional differences in the type of restrictions (spanning from the closure of all non-essential activities and quarantine to limits to social gatherings), enforcement, and the timeline of lifting restrictions. Besides, the timing and severity of the COVID-19 infection peak have also varied between states. Despite these variations from state to state, we observed a parallel reduction in PA in all regions of the country. However, the majority of the states had stringent restrictions in the months of March and April compared to the rest of the study period, which corresponded to the most significant decline in recorded PA. This observation may be secondary to self-imposed quarantine in patients with chronic diseases due to public knowledge of the reported higher mortality and need for intensive care unit support in individuals over the age of 60 years and those with known cardiovascular diseases. For instance, Guo et al. reported that patients with pre-existing cardiovascular diseases had higher mortality and a higher likelihood of myocardial injury with COVID-19 infection. Another potential reason for the noted reduction in PA may be related to COVID-19 illness in some patients in the cohort, although this could not be ascertained from the registry.

A significant cardiovascular involvement is reported with COVID-19. Early data suggest an increased risk of myocarditis, myocardial infarction, heart failure, and arrhythmias.
The potential effects of restricted PA during quarantine periods on cardiovascular outcomes have not been widely reported but cannot be ignored. The cardiovascular and mental health benefits of exercise are well established in patients with known cardiovascular diseases such as heart failure. Reduction in PA in patients with ICD and CRT-D devices has been associated with an increased risk of death and heart failure hospitalizations. 17-20 Kelly et al. reported a fourfold increased risk of death and heart failure hospitalization with a 10-minute reduction in PA within a particular patient.18 Furthermore, reduced PA has also been shown to be associated with a higher burden of atrial arrhythmia. 21 As a corollary, patients with heart failure and ICD undergoing exercise training have a lower risk of ICD therapies.22 While we report an increase in atrial arrhythmia burden during 2020 compared to 2019, it does not correlate with a drop in PA. Potential reasons include the aging of the population, limited access to healthcare, and anxiety.

The current study does not explore the health-related consequences of reduced PA in patients with a CIED, which should be the subject of future investigation. Future studies should be designed to combine patient-specific CIED data from remote monitoring with other clinical data sources to assess the risks associated with changes in activity and the impact on short and long-term cardiovascular outcomes as well as interventions to mitigate this risk. To identify significant population-level effects, large scale studies such as designs utilizing real-world data sets may be preferred over reports of single-center experience or other small scale studies.

This study has limitations inherent to the observational study design. While a reduction in PA is demonstrable, the database does not have data regarding the cause and effects of this reduction. The dataset does not contain clinical data regarding COVID-19 infection or cardiovascular outcomes such as heart failure hospitalization and death. Our study is limited to individuals with a CIED with underlying cardiac disease and predominantly included individuals
over 60 years of age. Hence these findings cannot be generalized to healthy individuals or younger populations. PA data were not obtained using a gold standard external accelerometer. Prior studies have, however, reported on the reliability of CIED derived PA data. For example, Pressler et al. reported an excellent intra-individual correlation between CIED PA sensor and an external accelerometer. 23 Subsequently, several studies have utilized CIED sensor derived data to assess PA and to predict early worsening of heart failure, establishing the validity of this technique.24, 25

**Conclusion**

Following the declaration of the COVID-19 pandemic a significant decline in daily PA was observed in individuals with a CIED. Future investigations to establish the impact of this reduction on short and long-term cardiovascular outcomes is necessary.

**Acknowledgment**

We are deeply grateful to the CERTITUDE Steering Committee for their thoughtful review of the manuscript.
References


Figures

Figure 1. Flow chart showing the derivation of the study cohort

Figure 2. Mean PA (minutes/day) in the year 2020 compared to 2019 in the (A) entire cohort and stratified by (B) gender (C) age and (D) device type.

Figure 3. Mean PA (minutes/day) stratified by region of the country.
Tables

Table 1. Baseline characteristics of the cohort

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N = 21660</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age at enrollment, yrs</strong></td>
<td></td>
</tr>
<tr>
<td>Mean, ± SD</td>
<td>72.6 ± 11.6</td>
</tr>
<tr>
<td>Range</td>
<td>9.2 to 102.5</td>
</tr>
<tr>
<td><strong>Gender, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12412 (57.3%)</td>
</tr>
<tr>
<td>Female</td>
<td>8054 (37.2%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1194 (5.5%)</td>
</tr>
<tr>
<td><strong>Implant Type</strong></td>
<td></td>
</tr>
<tr>
<td>ICD</td>
<td>4234 (19.6%)</td>
</tr>
<tr>
<td>CRT-D</td>
<td>2789 (12.9%)</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>14029 (64.8%)</td>
</tr>
<tr>
<td>CRT-P</td>
<td>608 (2.8%)</td>
</tr>
<tr>
<td><strong>Geographic Region, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Midwest</td>
<td>5195 (24.0%)</td>
</tr>
<tr>
<td>Northeast</td>
<td>2788 (12.9%)</td>
</tr>
<tr>
<td>South</td>
<td>8148 (37.6%)</td>
</tr>
<tr>
<td>West</td>
<td>5436 (25.1%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>93 (0.4%)</td>
</tr>
<tr>
<td><strong>Implant Year</strong></td>
<td></td>
</tr>
<tr>
<td>2010 to 2013</td>
<td>307 (1.4%)</td>
</tr>
<tr>
<td>2014 to 2015</td>
<td>990 (4.6%)</td>
</tr>
<tr>
<td>2016</td>
<td>3548 (16.4%)</td>
</tr>
<tr>
<td>2017</td>
<td>9313 (43.0%)</td>
</tr>
<tr>
<td>2018</td>
<td>7502 (34.6%)</td>
</tr>
</tbody>
</table>
Table 2. Comparison of daily PA (min / day) in January through August during the years 2020 versus 2019

<table>
<thead>
<tr>
<th>Month</th>
<th>N*</th>
<th>2019 – Mean PA (min/day) ± SD</th>
<th>2020 – Mean PA (min/day) ± SD</th>
<th>Difference (2020 - 2019)</th>
<th>p-value (paired T-Test) two sided</th>
<th>% Individuals with reduction in PA of 10 minutes/day or more in 2020</th>
<th>Binomial Proportion Test (Ho: % Difference = 50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>20,999</td>
<td>135.6 ± 68.5</td>
<td>131.9 ± 68.7</td>
<td>-3.7 ± 33.0</td>
<td>&lt;.0001</td>
<td>38.0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>February</td>
<td>21,034</td>
<td>137.4 ± 69.2</td>
<td>133.2 ± 69.6</td>
<td>-4.3 ± 33.9</td>
<td>&lt;.0001</td>
<td>38.5</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>March</td>
<td>21,047</td>
<td>141.5 ± 70.4</td>
<td>126.4 ± 67.7</td>
<td>-15.0 ± 33.2</td>
<td>&lt;.0001</td>
<td>56.6</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>April</td>
<td>21,037</td>
<td>145.1 ± 71.4</td>
<td>120.6 ± 67.4</td>
<td>-24.5 ± 36.3</td>
<td>&lt;.0001</td>
<td>69.0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>May</td>
<td>21,049</td>
<td>147.0 ± 72.5</td>
<td>129.2 ± 70.9</td>
<td>-17.8 ± 35.1</td>
<td>&lt;.0001</td>
<td>60.3</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>June</td>
<td>21,042</td>
<td>146.5 ± 72.8</td>
<td>132.0 ± 72.2</td>
<td>-14.5 ± 34.6</td>
<td>&lt;.0001</td>
<td>55.8</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>July</td>
<td>21,043</td>
<td>143.0 ± 71.4</td>
<td>129.1 ± 71.6</td>
<td>-13.9 ± 34.0</td>
<td>&lt;.0001</td>
<td>55.0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>August</td>
<td>21,036</td>
<td>142.5 ± 71.8</td>
<td>127.7 ± 71.3</td>
<td>-14.8 ± 33.9</td>
<td>&lt;.0001</td>
<td>55.7</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

*Remote transmissions with 0%, 100% or missing PA values were excluded from the analysis. Therefore, the total number of transmissions analyzed per month are variable and less than the total number of patients in the analyzed cohort.
Table 3. Reduction in mean daily PA in 2020 compared to 2019 in different strata of age. The mean ± standard deviation reduction in daily PA (minutes / day) in 2020 compared to the corresponding month in 2019 is presented.

<table>
<thead>
<tr>
<th>Month</th>
<th>&lt;60 years Mean PA (min/day) ± SD</th>
<th>60 - 70 years Mean PA (min/day) ± SD</th>
<th>70 - 80 years Mean PA (min/day) ± SD</th>
<th>&gt;80 years Mean PA (min/day) ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>-3.6 ± 40.3</td>
<td>-2.8 ± 36.7</td>
<td>-3.1 ± 30.8</td>
<td>-5.5 ± 27.1</td>
</tr>
<tr>
<td>February</td>
<td>-3.6 ± 42.0</td>
<td>-3.8 ± 38.1</td>
<td>-3.9 ± 31.3</td>
<td>-5.4 ± 27.7</td>
</tr>
<tr>
<td>March</td>
<td>-14.7 ± 42.1</td>
<td>-14.7 ± 36.3</td>
<td>-15.1 ± 31.0</td>
<td>-15.5 ± 27.2</td>
</tr>
<tr>
<td>April</td>
<td>-25.6 ± 45.8</td>
<td>-24.5 ± 39.6</td>
<td>-24.4 ± 33.8</td>
<td>-24.3 ± 29.8</td>
</tr>
<tr>
<td>May</td>
<td>-15.7 ± 44.7</td>
<td>-16.4 ± 38.1</td>
<td>-18.0 ± 32.6</td>
<td>-19.8 ± 28.6</td>
</tr>
<tr>
<td>June</td>
<td>-12.4 ± 43.3</td>
<td>-12.5 ± 37.6</td>
<td>-14.6 ± 32.4</td>
<td>-17.4 ± 38.4</td>
</tr>
<tr>
<td>July</td>
<td>-11.3 ± 42.4</td>
<td>-12.0 ± 36.9</td>
<td>-14.6 ± 32.4</td>
<td>-16.2 ± 27.3</td>
</tr>
<tr>
<td>August</td>
<td>-12.8 ± 44.4</td>
<td>-13.6 ± 35.7</td>
<td>-14.8 ± 31.4</td>
<td>-16.9 ± 28.1</td>
</tr>
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### CERTITUDE individuals assessed for eligibility

<table>
<thead>
<tr>
<th>Device Type</th>
<th>N</th>
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<tbody>
<tr>
<td>ICD</td>
<td>8724</td>
</tr>
<tr>
<td>CRT-DN</td>
<td>5562</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>27573</td>
</tr>
</tbody>
</table>

### CERTITUDE individuals excluded

<table>
<thead>
<tr>
<th>Reason</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device implanted after December 31, 2018</td>
<td>7799</td>
</tr>
<tr>
<td>No remote transmission data during study</td>
<td>4829</td>
</tr>
<tr>
<td>No remote transmissions during study</td>
<td>3710</td>
</tr>
<tr>
<td>Confirmed death of individual prior to study</td>
<td>840</td>
</tr>
<tr>
<td>Confirmed device explant without re-implant prior to study</td>
<td>279</td>
</tr>
<tr>
<td>Partial remote transmission data during study</td>
<td>8435</td>
</tr>
<tr>
<td>Remote transmission stopped during study*</td>
<td>4158 Missing</td>
</tr>
<tr>
<td>Confirmed death of individual</td>
<td>343</td>
</tr>
<tr>
<td>Confirmed device explant without re-implant</td>
<td>165</td>
</tr>
<tr>
<td>Changeout to different device type during study</td>
<td>492</td>
</tr>
</tbody>
</table>

*The devices for these individuals stopped transmitting during the study for unknown reasons. This category may include deaths, device explants, and replacements with devices from another manufacturer that were not reported in the BIOTRONIK device tracking database.

### CERTITUDE individuals analyzed

<table>
<thead>
<tr>
<th>Device Type</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD</td>
<td>4234</td>
</tr>
<tr>
<td>CRT-DN</td>
<td>2789</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>14029</td>
</tr>
<tr>
<td>CRT-PN</td>
<td>608</td>
</tr>
</tbody>
</table>
Figure 2A. Mean weekly physical activity for ALL subjects
Figure 2B. Mean weekly physical activity for subjects
By Gender

n=20,034
Figure 2C. Mean weekly physical activity for subjects
By Age

![Graph showing mean weekly physical activity for subjects by age. The graph includes data points for different age classes: <60, 60-70, 70-80, and ≥80. The x-axis represents time from January 1, 2019, to August 30, 2020, with specific months marked. The y-axis represents mean physical activity in minutes per day per week. The total number of subjects is 21,171.]
Figure 2D. Mean weekly physical activity for subjects
By Device

Mean physical activity
(min/day)/week

n=21,211

2019

2020

Jan 01  Mar 03  Jun 02  Sep 01  Dec 01  Mar 01  Jun 07  Aug 30

Implant
CRT-D
CRT-P
ICD
ICD
Pacemaker
Pacemaker
Figure 3. Mean weekly physical activity for subjects by region

Mean physical activity (min/day)/week

Region
Midwest
Northeast
South
West

n=21,119
Abhishek J. Deshmukh - Conceptualization, methodology, investigation, writing - original draft

Camden Harrell - Data curation, methodology, formal analysis, validation, writing - original draft.

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