

# The Daily Activity of Patients With Heart Failure During COVID-19 Pandemic

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## Abstract

**Background:** Sedentary behavior is thought to contribute to worsening heart failure syndromes. Here, we examined whether the shelter-in-place order during the coronavirus disease 2019 (COVID-19) pandemic changed daily activity duration, which was monitored by an implantable cardiac device-based multisensor index and alert algorithm called HeartLogic.

**Methods:** We performed a retrospective review of the HeartLogic data from patients with heart failure managed at our clinic and compared the individual daily activity duration 90 days prior to vs. after implementation of the shelter-in-place order. The activity data were prepared by Boston Scientific. Demographic data were extracted from our electronic medical record.

**Results:** In total, 29 patients were included in the analysis. Among them, 14 patients did not have any significant changes in daily activity duration compared to their baseline before the shelter-in-place order ( $108.62 \pm 45$  min vs.  $107.71 \pm 48.6$  min,  $P = 0.723$ ). Among the rest 15 patients with significant changes, seven patients had a significant reduction in activity duration; meanwhile, eight patients had a significant increase in activity duration. Overall, the mean daily activity duration 90 days before and after the shelter-in-place order are  $98.21 \pm 60.83$  min, and  $100.03 \pm 68.18$  min ( $P = 0.753$ ).

**Conclusions:** No significant changes in terms of activity duration were observed in our patients during the COVID-19 pandemic.

**Keywords:** COVID-19 pandemic; Heart failure; Physical activity

## Introduction

The coronavirus disease 2019, also known as COVID-19, is a multi-systemic disease. The World Health Organization announced it to be a pandemic within 3 months of the first reported case in March 2020. Many countries implemented strict quarantine and “lockdowns” to limit unnecessary outside and public activities [1]. A global trend of decreased physical activity was noted during this time, although the cause is multifactorial and likely relates to the pandemic, illness, mental health, deconditioning, and changes in social support and interactions [2, 3].

Lockdown severity and strictness varied among countries and regions and this likely contributed to at least some differences in activity level. A review out of France in 2022 showed significantly decreased active behavior amongst cardiovascular disease patients, healthy individuals, and athletes. However, they showed the greatest amount of decreased physical activity in heart failure patients specifically [4].

The importance of physical activity cannot be understated. Research on exercise has been developing since the 1950s, and shows that regular exercise is essential to maintain general health and decrease pathologies [4]. In cardiovascular disease patients specifically, exercise decreases incidence of coronary heart disease and stroke, reduces hypertension, improves cardiac output and perfusion, lowers resting heart rate, and decreases risk of cardiac hypertrophy [4-6]. Many studies have described the importance of exercise in heart failure specifically, as these patients experience not only improvement in exercise tolerance but also peak maximal oxygen consumption. Exercise studies have also shown improvement of heart rate variability, improved diastolic function, and fewer hospital readmissions for heart failure patients [5].

## Materials and Methods

We examined whether the shelter-in-place order during the COVID-19 pandemic changed daily activity duration. As patients may over-report their physical activity, we chose objective data by monitoring their activity through an implantable cardiac device-based multisensor index and alert algorithm called HeartLogic. This device measures physical activity by using an accelerometer within the pulse generator and multiple sensors that track physiologic trends and send proactive alerts about potential worsening heart failure [7]. In previous stud-

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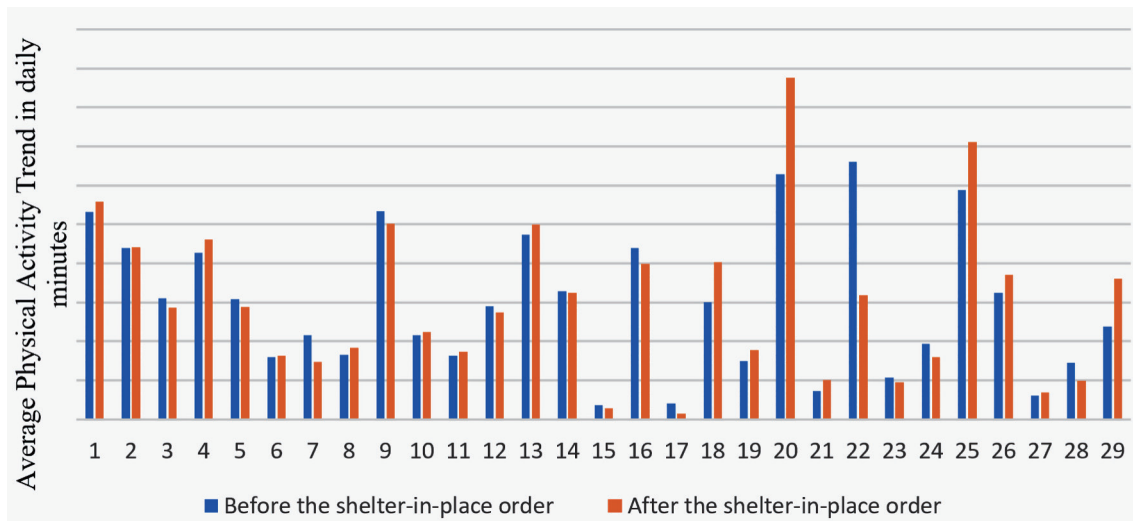
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**Figure 1.** Average physical activity amount 90 days before and after the shelter-in-place order for all 29 patients.

ies, the HeartLogic Boston Scientific monitor showed thoracic impedance, decrease in S1, presence of S3, and decreased activity levels are the most sensitive markers of congestive heart failure (CHF) exacerbation [8]. However, we were unable to identify any studies assessing the accuracy of physical activity from the HeartLogic accelerator specifically, which may be a limitation in data accuracy.

We analyzed patients within our healthcare system in the state of Georgia, USA. A retrospective review of the HeartLogic data from patients with heart failure managed at our clinic was performed. We compared the individual daily activity duration 90 days prior to versus after implementation of the shelter-in-place order. The activity data were prepared by Boston Scientific. Demographic data were extracted from our electronic medical record.

The project was conducted for quality improvement and did not require approval from an Institutional Review Board. The study was conducted in compliance with the ethical standards of the responsible institution on human subjects as well as with the Helsinki Declaration.

## Results

In total, 29 patients were included in the analysis. Of the 29 patients, demographic data were unavailable for three patients due to them likely being deceased as they could not be identified in the system. Of the remaining 26 patients, nine were female and 17 male. Average age of all patients was 70 years old with range from 37 to 85 years old. Eight patients did not have the New York Heart Association (NYHA) classification documented, and the numbers of patients with NYHA class I, II, and III among the remaining patients were 1, 11, and 9, respectively. Among enrolled patients, 14 patients did not have any significant changes in daily activity duration compared to their baseline before the shelter-in-place order ( $108.62 \pm 45$  min per day vs.  $107.71 \pm 48.6$  min per day,  $P = 0.723$ ). Among the rest 15 patients with significant changes. There were seven

patients who had a significant reduction in activity duration (from 77.26 min/day to 52.85 min/day); meanwhile, eight patients had a significant increase in activity duration (from 98.33 min/day to 127.85 min/day). Overall, the mean daily activity duration 90 days before and after the shelter-in-place order are  $98.21 \pm 60.83$  min and  $100.03 \pm 68.18$  min ( $P = 0.753$ ). The individual trends of daily activities of patients with significant changes before vs. after the shelter-in-place order are shown in Figure 1.

## Discussion

Main findings of current analysis revealed no significant changes in physical activity of 29 patients with CHF monitored by HeartLogic implanted multisensory index and alert algorithm. While this study had a small sample size, it is representative of a wide age range of patients in our clinic. When analyzing physical activity levels during lockdown, it is important to note the region and lockdown regulations at that time. For example, a combination study out of Germany and Tunisia performed an international survey in 35 research organizations. Their study showed a 24% reduction of physical activity in 1,047 patients during initiation of the lockdown in April 2020. However, the data were based on surveys and actual numbers may be higher [9].

To obtain objective data we used HeartLogic monitoring rather than a survey. Our 29 patients had an implantable cardiac device with monitoring by multisensor index and alert algorithm called HeartLogic. While the device can monitor heart rate, thoracic impedance, and heart sounds, we chose to analyze physical activity specifically. The typical algorithm encompasses multiple sensors embedded within a certain Boston Scientific implantable cardioverter defibrillators and cardiac resynchronization therapy defibrillators. Data from the sensors are used to generate a daily heart failure index score that triggers an alert if the index exceeds the preset threshold, thus suggesting a high risk for a heart failure event.

It is known that exercise is important, and reduced level of physical activity have been shown to have four-fold increased risk of heart failure hospitalization within subsequent 30 days [10]. Additionally, HeartLogic activity level is shown to correlate with a 6-min walk test and shows number of hours per day a patient is active [11, 12]. Research using HeartLogic monitor showed thoracic impedance, decrease in S1, presence of S3, and decreased activity levels as the most sensitive markers of CHF exacerbation [8]. Using HeartLogic monitoring allows us to not only monitor physical activity but promote activity in patients to decrease frequency of heart failure exacerbations.

In conclusion, no significant changes in terms of activity duration were observed in our patients during the COVID-19 pandemic.

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None to declare.

## Financial Disclosure

Dr. Egolum did consults/served on advisory board for Akcea Therapeutics, Alnylam, AstraZeneca, Merck, Janssen, Boehringer Ingelheim, and Pfizer. Dr. Ling received honoraria from the American College of Clinical Pharmacy.

## Conflict of Interest

The authors declare no actual or potential conflicts of interest relevant to the conduct of this research and its subsequent publication.

## Informed Consent

This is a retrospective chart review, and the informed consent from the enrolled patients are not required.

## Author Contributions

Christine Sykalo: data curation and writing. Ugochukwu Egolum: writing - review and editing. Hua Ling: conceptualization, methodology, data curation, and writing.

## Data Availability

The authors declare that data supporting the findings of this study are available within the article.

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