# Remote HRV Biofeedback to Manage Stress in COVID-19 Frontline Hospital Workers

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## Background and Purpose

To meet the urgent need for innovative, effective, and accessible approaches to mitigate the impact of stress on healthcare workers during the COVID-19 pandemic, we developed a remote biofeedback program. Our objective was to implement a heart rate variability biofeedback (HRV-BF) stress management program in a population of frontline healthcare workers and measure its effectiveness when offered through telemedicine compared to an in-person HRV-BF program. Biofeedback is a process by which an individual's physiological markers such as heart rate, respiration, muscle tension, surface temperature, and/or sweat (measures of sympathetic nervous system activation) are measured and "fed" back to them on a computer screen[1]. HRV-BF is a form of cardiorespiratory biofeedback during which a patient is shown real-time heart rate data and guided through breathing techniques to maximize heart rate variability and produce a state of calm alertness[2]. Proposed mechanisms for HRV-BF include the restoration of autonomic homeostasis, stimulation of vagal afferent pathways, or modulation of inflammatory responses by the parasympathetic nervous system[3].
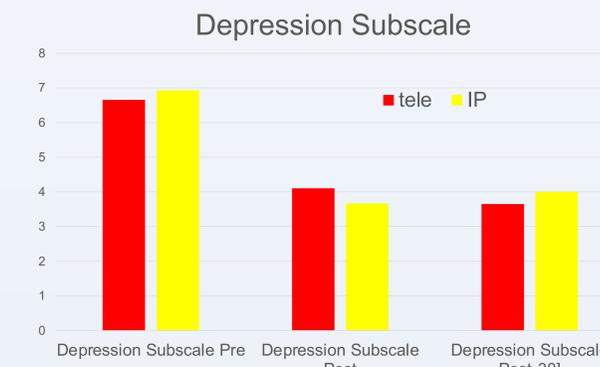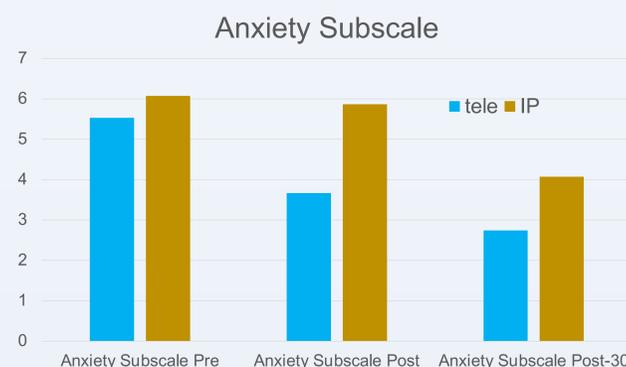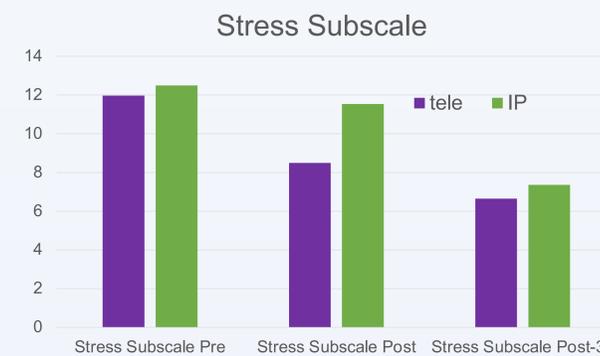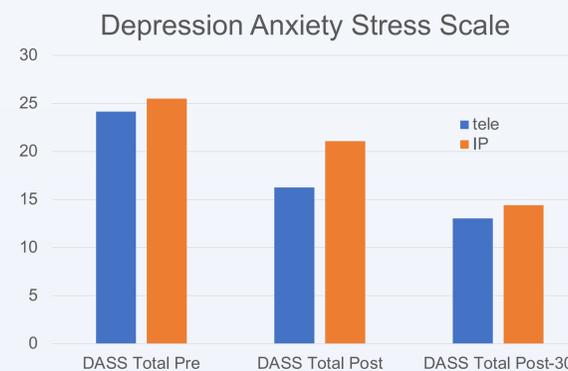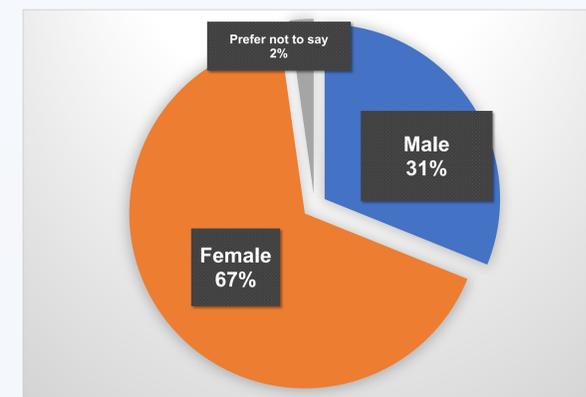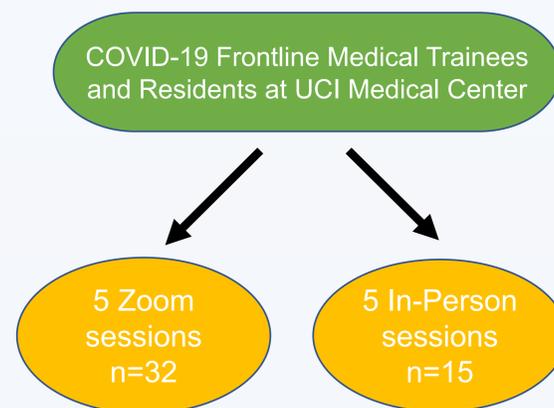
Our focus in this study was on trainees and residents, a population among whom anxiety is prevalent[4] and among whom burnout appears to increase and persist as training progresses[5,6], making them particularly vulnerable to stress during the pandemic. A meta-analysis examining the effect of HRV-BF on stress and anxiety showed a large reduction in self-reported stress and anxiety across a variety of treatment conditions and patient characteristics[8]. Another meta-analysis analyzing all problems addressed by HRV-BF showed significant effect sizes, with largest effect sizes for anxiety, depression, anger, as well as improved symptomology and functioning in both normal and pathological ranges[9].

## Methods

In this trial, we randomized frontline medical and nursing trainees at the University of California at Irvine Medical Center between November 2020 and May 2021 to either a 10-day HRV-BF intervention consisting of a series of five 30-minute one-on-one telemedicine sessions and accompanying home practices (n=32) or an identical intervention delivered in person (n=15). Validated survey tools were administered pre- (baseline) and post-intervention (at day 10), as well as follow-up (at day 30) for a total of three assessment points. Self-report outcomes included levels of depression, anxiety and stress based on the Depression, Anxiety, and Stress Scale (DASS-42) and objective outcomes included HRV change score (coherence score) pre- and post-intervention for each group.

## Results

Participants were 67.39% female; 69.57% of the sample were of ages 24-34 years. Preliminary analysis with paired samples t-tests showed an improvement in the mean total score of the DASS-42 between baseline versus post-intervention (Difference= -7.89, p<.0001) and baseline versus 30-day follow-up (Difference= -11.12, p<.0001) within the telemedicine group. Scores across all subscales (depression, anxiety, and stress) within the telemedicine group also showed significant improvement between time points following Bonferroni correction for multiple comparisons (all p<0.017). Similar improvement was observed in the mean total score of the DASS-42 between baseline versus 30-day follow-up (Difference=-11.10; p=.03) within the in-person group; however, no significant differences were found post-intervention (p=.22). Additionally, subscale scores did not show significant improvement over time within the in-person group. Independent samples t-tests comparing means between administration type (telemedicine versus in-person) did not show significant differences in total DASS-42 scores and all subscales (all p>.05). This tentatively confirms our hypothesis of non-inferiority of the telemedicine intervention compared to in-person delivery. We look forward to sharing the HRV results as data analysis is on-going



COVID-19 Frontline Medical Trainees and Residents at UCI Medical Center → 5 Zoom sessions n=32 / 5 In-Person sessions n=15

Prefer not to say 2% — Male 31% — Female 67%

Depression Anxiety Stress Scale (tele / IP): DASS Total Pre, DASS Total Post, DASS Total Post-30

Stress Subscale (tele / IP): Stress Subscale Pre, Stress Subscale Post, Stress Subscale Post-30

Anxiety Subscale (tele / IP): Anxiety Subscale Pre, Anxiety Subscale Post, Anxiety Subscale Post-30

Depression Subscale (tele / IP): Depression Subscale Pre, Depression Subscale Post, Depression Subscale Post-30

## Conclusions

Although we are eager to continue the analyses of our data, currently, we have shown that this brief, remote HRV biofeedback program improves self-reported depression, anxiety and stress levels. We have also demonstrated that telemedicine delivery is feasible and non-inferior to an in-person program. This study has implications for accessibility and effectiveness of stress management interventions for frontline workers and first responders during future pandemics/surges, natural disasters, and other emergencies that may add substantial strain to the healthcare system and its staff.



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