Effect of Universal Intervention on Mental Health and Heart Rate Variability in COVID Center Workers

ABSTRACT

Introduction: It has been reported globally that health-care workers are exposed to stress, anxiety, depression, and various other mental ailments. This was the 1st time that frontline and health-care workers were amidst the deadly disease due to the high infectivity of the virus. They themselves were the victims of the disease, yet they were trying to save other human lives. The health-care workers had to face isolation due to quarantine. The disease and isolation seemed to be the perfect recipe for affecting mental well-being. It was decided to implement universal mental health interventions and study mental health and heart rate variability (HRV) in them. **Methods:** Subjects were recruited. Baseline demographic data, anthropometric parameters, vitals, and HRV were recorded. Intervention: A universal mental health invention consisting of positive psychology and lifestyle. Tool used were the Depression Anxiety Stress Scale-21 (DASS-21) Questionnaire and HRV. Descriptive statistics and the *t*-test were applied, and for the *t*-test, a $P < 0.05$ was considered statistically significant. **Results:** On administration of the DASS-21, it was found that the mean total score, stress score, anxiety score, and depression score were 3.76, 1.04, 2.13, and .59, respectively. On analysis of HRV, it was found that the low frequency (LF) value, high frequency (HF) value, and LF/HF ratio were normal, which indicates that the sympathetic tone, parasympathetic tone, and sympathovagal balance were within the normal range. **Conclusion:** Universal mental health and lifestyle measures help maintain the mental well-being of health-care and frontline workers, which is vital for better patient outcomes.

Key words: COVID-19 pandemic, Depression anxiety stress scale-21, Heart rate variability, Mental health

INTRODUCTION

The coronavirus illness 2019 (COVID-19) pandemic in India was a component of the worldwide COVID-19 outbreak brought on by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) coronavirus. With 43, 710, 027 recorded instances of COVID-19 infection, India has the second-largest number of confirmed cases in the world (the highest being the USA), and it also has the third-highest number of COVID-19 deaths (525, 604 deaths; the USA and Brazil had greater numbers).[1] India witnessed three waves when the number of COVID cases and deaths abruptly surged and posed the greatest challenge to the health-care system. The second wave was most devastating as it caused a sudden increase in the number of cases and deaths in the shortest time and strain on health-care workers and the medical inventory. Many healthcare and frontline workers had to work throughout the pandemic. It was reported globally that they are exposed to stress, anxiety, depression, and various other mental ailments. This was the 1st time that the frontline and health-care workers were amidst the deadly disease due to the high infectivity of the virus. They were the victims of the disease, yet they were trying to save other human lives. The health-care workers had to face isolation due to quarantine. The disease and isolation seemed to be the perfect recipe for affecting mental well-being.

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The meta-analysis by Bueno-Notivol *et al.* included 12 studies with prevalence rates of depression ranging from 7.45% to 48.30%. Depression was present in 25% of the population overall (95% confidence interval: 18–33%).[2] Lenzo *et al.* discovered that moderate to extremely severe symptoms of 8% for depression, 9.8% for anxiety, and 8.9% for stress were observed using the Depression Anxiety Stress Scale-21 (DASS-21) as a tool. The results of the correlational study showed that improved ability was negatively correlated with stress and depression. Depression, anxiety, and stress were all negatively correlated with suppression capacity. Contextual cue perception was inversely related to anxiety and depressive symptoms.[3]

According to a Selvaraj *et al.*'s study conducted in India, 55% of the medical officers in the study reported having moderate depression. Men were found to have moderate anxiety levels at 24% and severe anxiety levels at 52%, whereas women had moderate and severe anxiety levels as high as 68% and 48%, respectively. In their study, male doctors reported mild and moderate levels of stress at about 30% and 44%, respectively, while female doctors reported mild and moderate levels of stress at 70% and 56%, respectively. In addition, it was noted that the rates of moderate insomnia were particularly high among female doctors (65%), although a high percentage of male participants reported sub-threshold insomnia (52%).[4] Another Indian study by Garg *et al.* reported that among medical professionals, 30.95% were upset, 41.15% had anxiety symptoms, and 49.65% had depressive symptoms. Between 25% and 35% of health-care professionals reported having mild to severe symptoms. The DASS-21 mean score was 31.29 (standard deviation = 27.07), and the mean age was 28.78 years. Working as a specialist or as a frontline employee was strongly associated with distinct psychological outcomes (anxiety and stress), according to a binary logistic regression study. Stress, anxiety, and depression were found to be statistically significantly correlated.[5]

An Italian study by Marijanović *et al.* found that participants with comorbidities linked to an increased risk of developing a severe illness brought on by SARS-CoV-2 had higher levels of depression, anxiety, and stress than participants without comorbidities ($P = 0.003$, $P = 0.011$, and $P = 0.022$, respectively).[6]

According to a study by Shekhar *et al.*, 8.3 and 3.1% of the study participants had severe or extremely severe depression, respectively. The prevalence of severe and very severe anxiety was determined to be 9.4% and 13.8%, respectively. There were 2.4 and 2.4% more people who experienced severe and extremely severe stress, respectively. A doctor's profession, post-graduate education, being single, the presence of an influenza-like sickness in the previous 3 months, and comorbid headaches all demonstrated a statistically significant correlation with a high depression score. A statistically significant link between having a high anxiety score and a high stress score and being unmarried, working as a doctor, and having a COVID-19 duty that lasted for ≥8 h was observed.[7]

The study by Mekhemar *et al.* found that 732 dentists took part in the survey and reported overall scores for depression, anxiety, stress, intrusion, avoidance, and hyperarousal of (4.88 ± 4.85), (2.88 ± 3.57), (7.08 ± 5.04), (9.12 ± 8.44), and (10.68 ± 8.88) and (10.35 ± 8.68), respectively. For females, working at a dentistry office, being between the ages of 50 and 59, having immunological deficiencies or being chronically unwell, and believing that the COVID-19 pandemic poses a financial risk were reported as significant related factors ($P < 0.05$) with higher DASS-21 and Impact of Event Scale-Revised scores.[8]

The Dahisar Jumbo COVID facility was erected as a makeshift hospital comprising 950 oxygenated beds and 110 intensive care unit (ICU) beds. Apart from inpatient and intensive care services, it had a fully functional vaccination center and outpatients' service. It had catered to more than 10,000 inpatient department patients, thousands of outpatient department patients, and more than 2.75 lakh COVID vaccinations.[9] For rendering these services, various levels of healthcare and frontline workers were employed. As mental health was expressed as a cause of concern in health-care workers according to the above-mentioned studies, it was decided to implement a universal mental health intervention and study mental health and heart rate variability (HRV) in them.

METHODS

Study design

Interventional quantitative prospective study.

Setting

Dahisar Jumbo COVID facility, Mumbai. It was a field hospital with 950 beds in oxygenated and non-oxygenated facilities and 110 beds in an ICU facility. There were many levels of staffing to cater to this patient care facility.

Sampling frame

The target population was staff working at the Dahisar Jumbo COVID facility. The sample size was 54.

Subjects

Inclusion criteria
People have been working at the Dahisar Jumbo COVID Center for more than 1 year.

Exclusion criteria
People having any known condition that may affect HRV, like diabetes, hypertension, heart disease, etc.

Protocol of study

Subjects were recruited by the above method. Informed consent was taken. Baseline demographic data, anthropometric parameters, vitals, and HRV were recorded.

Intervention

Universal mental health invention[9] consisting of positive psychology and lifestyle as mentioned below: (1) Nutrition: Food was provided by the center. A high-protein diet and vitamin supplementation were provided. (2) Yoga, pranayama, meditation, and relaxation therapy were available and encouraged after duty hours. (3) Intermittent counseling, online counseling, and group discussion were part of the day-to-day affairs of the place. (4) A six hour duty was split into two parts. Four hours in PPE kit and 2 h in patient console. (5) Paid leave was sanctioned because of illness to mitigate

the financial burden. (6) The availabity of protection gear of appropriate sizes was ensured. (7) The availability of a clean bathroom for getting fresh and taking a bath was ensured. (8) Traveling was taken care of by the center with specialized vehicles, so public transport was avoided. (9) A proper work environment and culture were maintained. (10) The health-care workers were protected from political and medicolegal issues.

DASS-21 Scoring	Depression	Anxiety	Stress
Normal	0–4	0–3	0–7
Mild	5–6	4–5	8–9
Moderate	7–10	6–7	10–12
Severe	11–13	8–9	13–16
Extremely Severe	14+	10+	17+

Tool

DASS-21 questionnaire

A common tool for evaluating the emotional states of depression, anxiety, and stress is the self-reported DASS-21 scale. Within DASS, there are three scales, with each having seven items. The depression scale evaluates negative emotions like helplessness, lack of interest and pleasure, dysphoria, and self-loathing. The anxiety scale assesses various components of anxiety, including situational, subjective, and autonomic arousal. The stress scale rates traits including difficulty relaxing, the ease of getting upset or annoyed, and impatience or being overly reactive. It is a Likert scale that you rate yourself on, with values ranging from 0 (did not apply to me at all) to 3 (applied to me largely) throughout the past week. The cumulative score for the shorter version is calculated by multiplying the final score by two.[10] The details of the scoring are as follows:

Anthropometric parameters noted were height and weight using the digital weighing scale k4-003a and the stadiometer of Ezlife. Body mass index (BMI) was calculated in an Excel sheet using the formula BMI = weight in Kg/height in meter ^2. Vitals were recorded using the multiparameter monitor Contec CMS 6000, and HR, respiratory rate, blood pressure, and % saturation of hemoglobin with oxygen were noted down to get an idea of baseline characteristics.

Recording of HRV

Sinus arrhythmia occurs due to normal respiration. HR increases during inspiration and decreases due to expiration. Conversely, the RR interval decreases during inspiration and increases during expiration.[11] The sinus arrhythmias in electrocardiography convey normal cardiovascular health.[12] This physiological phenomenon of variation in the time interval between heartbeats is defined as HRV, and in 1996, the "European Cardiology Society and the North American Society of Pacing and Electrophysiology Special Task Force" compiled a method and guidelines for analyzing

HRV.[13] Numerous recent studies have demonstrated the connection between HRV and a variety of physiological and psychological processes in the human body. Balance and autonomic nervous system activity lead to HRV.[14] Normal physiological activities will maintain a certain HRV change value. When the human body encounters stress, anxiety, and other external environmental influences, it will inhibit the variation of heart rhythm and reduce HRV. In current studies, HRV was recorded using RMS digital polygraphs, with HRV analysis software. The frequency domain and time domain parameters were analyzed further.

Statistic evaluation data analysis was performed using SPSS for Windows Inc. Version 22 and MS Excel. Illinois's Chicago. Reports included descriptive statistics and *t*-test results. $P < 0.05$ was regarded as statistically significant for the *t*-test.

RESULTS

Table 1 shows the results of the DASS-21 questionnaire for all participants, which were 49 males and 5 females out of 54 people.

Though it appears that stress, anxiety, depression, and total score are higher than zero, they do not fall into the mild, moderate, or severe forms of stress, anxiety, and depression.

DISCUSSION

Though there are many studies on mental health among frontline and health-care workers, there is a paucity of studies that have designed interventions to take care of mental health during the COVID pandemic. Universal, or population-based, mental health interventions are defined as non-clinical, primary prevention strategies directed at an entire population that address generic mental health risk and protective factors.[15] We designed the universal intervention to take care of possible stressors acquired through basic communication techniques. The details of it are provided in the intervention heading of methods and materials. The intervention was part of the continuous implementation in order to mitigate any stressors, thereby ensuring the well-being of healthcare and frontline workers, which in turn plays a significant role in better patient outcomes. It was further decided to evaluate subjectively and objectively the effect of the above intervention on mental

Table 1: Age and DASS-21 questionnaire score

	n	Minimum	Maximum	Mean	Standard deviation
Age	54	19	60	30.65	10.630
Stress	54	0	7	1.04	1.243
Anxiety	54	0	6	2.13	1.637
Depression	54	0	4	0.59	0.790
Total	54	0	11	3.76	2.691

DASS-21: Depression Anxiety Stress Scale-21

Table 2: DASS-21 questionnaire analysis

	Test value=0					
	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
					Lower	Upper
Stress	6.129	53	0.000	1.037	0.70	1.38
Anxiety	9.558	53	0.000	2.130	1.68	2.58
Depression	5.516	53	0.000	0.593	0.38	0.81
Total	10.265	53	0.000	3.759	3.02	4.49

DASS-21: Depression Anxiety Stress Scale-21

Table 3: Vitals and frequency domain parameters of HRV

	Minimum	Maximum	Mean	Standard Deviation
Height	1.34	1.82	1.6423	0.11130
Weight	44.0	95.0	63.885	11.6932
BMI	15.94	38.98	23.88	4.84
HR	62.0	99.0	74.500	10.0596
RR	18.0	74.0	21.788	7.4553
SpO$_2$	96.0	99.0	97	2
SBP	100.0	150.0	122.115	9.9206
DBP	64.0	110.0	76.750	9.2118
LF	14.163	79.890	59.20006	17.399800
HF	20.111	85.837	40.79994	17.399766
LF/HF	0.165	41.000	2.64094	5.520381

BMI: Body mass index, HR: Heart rate, RR: Respiratory rate, SpO$_2$: % saturation of hemoglobin with oxygen, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, LF: Low frequency in the frequency domain of HRV indicate sympathetic tone, HF: High frequency in frequency domain of HRV indicate parasympathetic tone, and LF/HF ratio indicate sympathovagal balance

health. The subjective way of assessing mental health was using the DASS 21 questionnaire, which has been validated by many studies to be used in COVID pandemic healthcare and by frontline workers. The objective assessment of mental health was done with HRV. HRV is a known technique to find out cardiovascular autonomic functions. There are various methods used for analyzing HRV, uncluding linear methods such as time domain (statistical and geometric) and frequency domain methods.[13] We had employed the short-term frequency-domain method. We considered low frequency (LF), high frequency (HF), and LF/HF ratio, which correspond to sympathetic tone, parasympathetic tone, and sympathovagal balance, respectively.

On administration of DASS 21, it was found that the total score, stress score, anxiety score, and depression score were 3.76, 1.04, 2.13, and 0.59, respectively, as shown in Table 1. On analysis of the scoring, it was found that none of the workers had mild, moderate, or severe stress, anxiety, or depression. The normal score indicates none of the workers had any mental health issues based on the aforementioned subjective analysis [Table 2]. On analysis of HRV, it was found that the LF value, HF value, and LF/HF ratio were normal, as shown in Table 3. It indicates that the sympathetic tone, parasympathetic tone, and sympathovagal balance were within the normal range. In psychological discomfort, HRV shows increased sympathetic discharge and decreased parasympathetic discharge with a tilt of sympathovagal balance towards increased sympathetic drive. On closer examination, it was concluded that the universal mental health and lifestyle interventions designed for continuous implementation were successful in mitigating stress and maintaining the mental health of healthcare and frontline workers, which is vital to ensuring a better patient outcome. The COVID pandemic was a challenge to the health-care system, and ensuring patient care services was most important. Along with having the proper infrastructure and inventory required for patient care services, it should be equally important to take care of the vital human force involved in the management of pandemics.

The scope of the study is that certain set of measures taken into consideration, as mentioned in our paper, helps in maintaining mental well-being of healthcare and frontline workers. The universal and lifestyle measures for mental health designed by the center were successfully implemented,

and outcomes were measured subjectively and objectively. Such universal measures can be taken into consideration in all health-care settings to yield better patient outcomes. The limitation of the study was that the mental health and people assessments were not done when they joined the center.

CONCLUSION

Universal mental health and lifestyle measures help in maintaining mental wellbeing of healthcare and frontline workers, which is vital for a better patient outcome.

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