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

[1]Noorin Bhimani, M.D, Addl. Dean, Dahisar Jumbo Covid Facility, and Associate Professor (Physiology) LTMMC and General Hospital Mumbai, Maharashtra, India.

[2]Deepa R. Shriyan, M.D, Dean, Dahisar Jumbo Covid Facility and Associate Professor (Anaesthesiology) HBT and Dr RN. Cooper Hospital, Mumbai, Maharashtra, India.

[3]Sameer Lakhani, Ph. D, Associate Professor XIMR and Consultant, Mumbai

Corresponding Author: Noorin Bhimani, M.D, Addl. Dean, Dahisar Jumbo Covid Facility, and Associate Professor (Physiology) LTMMC and General Hospital Mumbai, Maharashtra, India.

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Abstract

Introduction: It was reported across the globe that healthcare workers are exposed to stress, anxiety, depression and various other mental ailments. This was the first time that the frontline and healthcare workers were amidst the deadly disease due to high infectivity of the virus. They themselves were the victims of the disease yet they were trying to save other human lives. The healthcare workers had to face isolation due to quarantine. The disease and isolation seemed to be a perfect recipe for affecting the mental wellbeing. It was decided to implement universal mental health intervention and study mental health and heart rate variability in them. Methods: Subjects were recruited. Baseline demographic data, anthropometric parameters, vitals and heart rate variability were recorded. **Intervention:** Universal mental health invention consisting positive psychology and lifestyle. Tool used were DASS 21 Questionnaire and HRV. Descriptive statistics and T test was applied were reported for T test, $P < 0.05$ was considered statistically significant. Results: On administration of DASS 21, it was found that 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 LF value, 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 in maintaining mental wellbeing of healthcare and frontline workers which is vital for better patient outcome.

Keywords: DASS21, HRV, mental health, COVID 19 pandemic

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Introduction

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

Bueno-NotivolJ et al reported 12 studies in the meta-analysis, with prevalence rates of depression ranging from 7.45% to 48.30%. The pooled prevalence of depression was 25% (95% CI: 18% − 33%).[(2)]Lenzo V and co-authors found that used DASS 21 as toolmoderate to extremely severe symptoms of 8% for depression, 9.8% for anxiety, and 8.9% for stress. Results of correlational analysis highlighted that enhance ability was inversely associated with depression and stress. Suppression ability was inversely associated with depression, anxiety, and stress. The ability to perceive contextual cues was inversely associated with depression and anxiety.[(3)]

An Indian study by Selvaraj et al inferred that 55% of medical officers in the study reported having moderate levels of depression. It was found that 52% of men experienced severe anxiety and 24% had moderate levels of anxiety whereas females reported as high as 68% and 48% of moderate and severe anxiety, respectively. In their study, around 30% and 44% of male doctors reported mild and moderate levels of stress, respectively, whereas 70% and 56% of female doctors reported mild and moderate levels of stress, respectively. It was also observed that among female doctors the rates of moderate insomnia were especially high (65%), whereas a high level of male participants reported sub-threshold insomnia (52%).[(4)]

Another Indian by Garg S found that health-care practitioners, 49.65% had depressive symptoms, 41.15% had anxiety symptoms, and 30.95% were distressed. Around 25%–35% of health-care practitioners had moderate-to-severe symptoms. Mean age was 28.78 years, and mean score of DASS-21 was 31.29 (standard deviation SD = 27.07). Binary logistic regression analysis revealed that working as specialists and as frontline workers was significantly associated with different psychological outcomes (anxiety and stress). A statistically significant correlation was found between stress, anxiety, and depression.[(5)]

An Italian study by Marijanović revealed a statistically significant difference in the levels of depression, anxiety, and stress (P=0.003, P=0.011, and P=0.022, respectively) among participants with comorbidities connected with increased risk of severe illness caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) compared with participants without comorbidities. [6]

A study by Shekhar S and coauthors found that prevalence of severe and extremely severe depression among study participants was 8.3 and 3.1 percent. Severe and extremely severe anxiety prevalence was found to be 9.4 and 13.8 percent. The prevalence of severe and extremely severe stress was 2.4 and 2.4 percent each. Education till post-graduation, unmarried, occupation of doctor, Comorbidity of headache and occurrence of influenza-like illness in last 3 months had a statistically significant association with high depression score. With high Anxiety score and high-stress score statistically significant association was seen in education till postgraduation, unmarried, occupation of doctor, duration of 1 COVID-19 duty of ≥8 hours. [7]

The research by Mekhemar M et al concluded that seven hundred-and-thirty-two dentists participated in the survey and reported overall scores of (4.88 ± 4.85), (2.88 ± 3.57), (7.08 ± 5.04), (9.12 ± 8.44), (10.68 ± 8.88) and (10.35 ± 8.68) for depression, anxiety, stress, intrusion, avoidance, and hyperarousal, respectively. For females, being between 50–59 years of age, being immune deficient or chronically ill, working at a dental practice, and considering the COVID-19 pandemic a financial hazard were reported as significant associated factors ($p < 0.05$) with higher DASS-21 and IES-R scores.[8]

Dahisar Jumbo COVID facility was erected as a makeshift hospital comprising of 950 oxygenated beds and 110 ICU beds. Apart from in patient and intensive care services, it had fully functional vaccination centre and out patients' service. It had catered to more than 10000 IPD patients, thousands of OPD 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 cause of concern in healthcare workers according to above mentioned studies, it was decided to implement universal mental health intervention and study mental health and heart rate variability in them.

Methods

Study Design: Interventional quantitative prospective study

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

Sampling frame: Target population was staff working at Dahisar Jumbo COVID facility. Sample size was 54.

Subjects: Inclusion criteria: People working at Dahisar Jumbo COVID center for more than one year. Exclusion criteria: People having any known condition which may affect HRV like diabetics, hypertension, heart disease, etc.

Protocol of study: Subjects were recruited by above method. Informed Consent was taken. Baseline demographic data, anthropometric parameters, vitals and heart rate variability were recorded.

Intervention: Universal mental health invention(9) consisting positive psychology and lifestyle as mentioned below: 1) Nutrition: Food was provided by

the center. High protein diet and vitamins supplementation was provided. 2) Yoga, pranayama, meditation and relaxation therapy was available and encouraged after duty timings. 3) Intermittent counselling, online counselling and group discussion was part of day to day affair of the place. 4)6 hour duty was split into 2 parts. 4 hours in PPE kit and 2 hours in patient console. 5) Paid leave was sanction because of illness to mitigate financial burden. 6) Availability of protection gears of appropriate sizes was ensured. 7) Availability of clean bathroom for getting fresh and taking bath was ensured. 8) Travelling was taken care by the center with specialized vehicles so public transport was avoided. 9) Proper work environment and culture was maintained. 9) The healthcare workers were protected from political and medico legal issues.

Tool: DASS 21 Questionnaire: The DASS-21 scale is a self-report measure that is frequently used to assess the emotional states of depression, anxiety, and stress. Each of these three scales within DASS contains seven items. The scale of depression assesses feelings of hopelessness, loss of interest and pleasure, dysphoria, self-deprecation, etc. The anxiety scale measures autonomic arousal, subjective, situational aspects of anxiety, etc. The stress scale assesses aspects such as inability to relax, being easily upset or irritated, and being impatient or over reactive. It is a self-rated Likert scale with scores of 0 (did not apply to me at all) to 3 (mostly applied to me) in the past 1 week. The final score for the shorter version is multiplied by two to obtain the cumulative score. [10] The details of scoring are as follows.

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+

Anthropometric parameter noted was height and weight using digital weighing scale k4-003a and stadiometer of Ezlife. BMI was calculated thereof in Excel sheet using the formula BMI=weight in Kg/height in meter ^2. Vitals were recorded using multipara monitor Contec CMS 6000 and heart rate, respiratory rate, blood pressure and SPO2 were noted down to get an idea of baseline characteristics.

Recording of heart rate variability: Sinus arrhythmia occurs due to normal respiration. Heart rate increases during inspiration and decreases due to expiration. Conversely, RR interval decreases during inspiration and increases during expiration.[11] The sinus arrhythmias in ECG conveys normal cardiovascular health. This physiological phenomenon of variation in the time interval between heartbeats is defined as Heart rate variability (HRV), and in 1996, the "European Cardiology Society and the North American Society of Pacing and Electrophysiology Special Task Force" had compiled a method and guidelines for analysing heart rate variability (HRV). [13]Many current studies have shown that HRV is related to many physiological and psychological phenomena of the human body. HRV is the result of autonomic nervous system activity and balance.[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 polygraph with HRV analysis software. The frequency domain and time domain parameters were analysed further.

Statistical analysis Statistical software used to analyze data was MS Excel, SPSS for Windows Inc. Version 22. Chicago, Illinois. Descriptive statistics and T test was applied were reported. For T test, $P < 0.05$ was considered statistically significant.

Results

Table 1: Age and DASS Questionnaire Score

	N	Minimum	Maximum	Mean	Std. 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	.59	.790
Total	54	0	11	3.76	2.691

The above table is the results of DASS21 questionnaire of all participants which were 49 males and 5 females out of 54 people.

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	.000	1.037	.70	1.38
Anxiety	9.558	53	.000	2.130	1.68	2.58
Depression	5.516	53	.000	.593	.38	.81
Total	10.265	53	.000	3.759	3.02	4.49

Though it appears that stress, anxiety, depression and total score more than zero, it did not fall in mild, moderate and severe form of stress, anxiety and depression.

Table 3: Vitals and Frequency Domain Parameters of HRV

	Minimum	Maximum	Mean	Std. Deviation
Height	1.34	1.82	1.6423	.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
SPo2	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	.165	41.000	2.64094	5.520381

BMI- Body mass index, HR-heart rate, RR-respiratory rate, SPO2- % saturation of haemoglobin with oxygen, SBP- systolic blood pressure, DBP -diastolic blood pressure, LF- low frequency in 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.

Discussion

Though there are many studies on mental health in frontline and healthcare workers, there is paucity of studies which designed the interventions to take care of mental health during 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 by basic communication technique. The details of it are provided in intervention heading of methods and material. The intervention was part of the continuous implementation in order to mitigate any stressors thereby ensuring wellbeing of healthcare and frontline workers which in turn plays significant role in better patient outcome. It was further decided to evaluate subjectively and objectively the effect of the above intervention on mental health. The subjective way of assessing mental health was using DASS 21 questionnaire which is validated by many studies to be used in COVID pandemic healthcare and frontline workers. The objective assessment of mental health was done with heart rate variability (HRV). HRV is known technique to find out cardiovascular autonomic functions. There are various methods used for analysing HRV with linear methods such as timedomain(statistical and geometric) and frequency domain method.(13) We had employed short term frequency domain method. We considered LF, 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 total score, stress score, anxiety score and depression score were 3.76, 1.04, 2.13 and .59 respectively as in table 1. On analysis of the scoring it was found that none of the worker had mild, moderate or severe stress, anxiety or depression. The normal score indicates none of the workers had any mental health issues by the aforementioned subjective analysis. On analysis of HRV,it was found that 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 increase sympathetic discharge and decrease parasympathetic discharge with 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 mental health of healthcare and frontline workers which vital ensuring better patient outcome. COVID pandemic was challenge to healthcare system and ensuring patient care services was most important.

Along with having proper infrastructure and inventory required for patient care services, it should be equally important to take care of the vital human force involved in management of pandemic.

The scope of the study is that certain set of measures taken into consideration as mentioned in our paper helps in maintaining mental wellbeing 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 healthcare settings to yield better patient outcomes. Limitation of the study was the mental health and people assessment was not done when they joined the centre.

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

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