Principles and Practice of Clinical Research
A Global Journal in Clinical Research

PPCR
ISSN: 2378-1890

Mindfulness-based stress reduction or aerobics exercise for reducing burn-out in medical residents- a study protocol for a phase III, open-label, multi-center, randomized controlled trial: The MINDER study.

The MINDER Collaborative group[#]

[#]Author's list provided at the end of the manuscript
**Corresponding author: Fathima Minisha MRCOG, Hamad Medical Corporation, PO Box 3050, Doha- Qatar, email: fathim999@gmail.com*

Received May 8, 2020; accepted June 19, 2020; published June 30, 2020.

Abstract:

Background and objectives: *Burn-out results from chronic workplace stress leading to emotional exhaustion, negativity, and decreased professional efficiency. In the healthcare system, this can have consequences like increased medical errors, absenteeism, substance abuse, depression, and suicide among health professionals, adversely affecting patient care. Various individual-directed measures like the mindfulness-based stress reduction program (MBSR), one of the most studied and widely adopted techniques, and physical activity, like aerobics or sports, have shown to be effective against burn-out. With this study, we intend to increase awareness regarding this public health issue among the residents and the faculty. Our aim is to define a successful intervention that can be incorporated as a yearly requirement for the completion of medical residency programs.*

Methodology: *This study will be a phase III, multicentric, open-label, placebo (waiting list) controlled trial. Our sample size will be 720 residents sampled from 6 university hospitals from across the world, randomized into 3 parallel arms (1:1:1 ratio stratified according to site and specialty). Residents, diagnosed with burn-out based on baseline Maslach Burnout Inventory score (MBI) and having no prior physical or mental health issues, will be included. The first group will undergo the MBSR program for 8 weeks, the second group will undergo a supervised aerobics program for 8 weeks, and the third group will be put into a waiting list for any of the interventions. The primary outcome will be the change in MBI scores after the intervention. The secondary outcomes will be the change in MBI score 3 months after the intervention, and changes in measures like heart rate, blood pressure, glycated hemoglobin, cortisol levels, quality of sleep and quality of life after the intervention and 3 months later. We also plan to do a subgroup analysis to see the difference based on specialty and gender.*

Study impact: *The residency training period is considered one of the most stressful phases in medical education. Higher rates of burn-out are noted in the residents, and this can negatively impact patient care and the progression of their careers. This trial will look at multiple interventions to combat burnout, recruiting residents of different specialties in different work environments across the world. We hope to remove the stigma surrounding burnout in the healthcare system. This study will show the short and long term benefits of these interventions and would help us recommend their inclusion in various residency programs.*

Keywords: *Burn-out, mindfulness, aerobics, resident doctors, MBI*

DOI: http://dx.doi.org/10.21801/ppcrj.2020.62.3

Abbreviations
ANOVA: Analysis of variance
DP: Depersonalization
EE: Emotional Exhaustion
GAD 7: Generalized Anxiety Disorder 7
HR: Heart rate
MBI-HSS (MP): Maslach Burnout Inventory-Human Services Survey (Medical professionals)
MBSR: Mindfulness-based stress reduction
PA: Personal Accomplishment
PHQ: Patient Health Questionnaire
PSI: Pittsburg Sleep Index
QOLS: Quality of life scale
REDCap: Research electronic data capture
SBP: Systolic Blood Pressure

INTRODUCTION

Background

Burn-out, a result of unsuccessfully managed chronic workplace stress, is a specific occupational syndrome characterized by emotional exhaustion, negativity toward one's job, depersonalization, and reduced professional efficacy (World Health Organization, 2018). Individuals with risk factors like a low sense of control or openness to change, defensive coping mechanisms, poor self-esteem and unrealistic job expectations are prone to burn-out when placed in high-stress environments (Maslach, Schaufeli, & Leiter, 2001).

Burn-out has been most commonly measured using the Maslach Burnout Inventory (MBI), developed in 1981 and validated through 35 years of extensive research (Maslach & Jackson, 1981). The human services version (MBI-HSS) measures emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA) using a 22-item survey. Higher EE/DP and lower PA scores are indicative of burn-out.
In the healthcare sector, competitive hostile work environment, long working hours, lack of freedom in decision making, heavy caseload, lack of rewards or incentives, substantial administrative and clerical work contribute to burn-out in medical professionals (Green, Albanese, Shapiro, & Aarons, 2014). Around half of the doctors, especially resident trainees, report burn-out, incurring costs as high as 4.6 billion a year due to absenteeism, resignations, and decreased clinical hours (Han et al., 2019). Other consequences include increased medical errors, lower patient satisfaction, and overall reduced quality of care. There is an increased risk of cardiovascular disease, hypertension, obesity, diabetes, sleep, and gastrointestinal disturbances in burned-out physicians. A higher rate of suicide, mental health problems, and substance abuse can also be linked to burn-out (Salvangioni et al., 2017; Patel, Bachu, Adikey, Malik, & Shah, 2018).

The problem is compounded by a lack of awareness and a fear of being considered incompetent. In a recent survey, 60% of burned-out physicians were not planning to seek help and felt it's an organizational problem that cannot be resolved. One half said their workplaces did not offer any stress-reduction measures, with 20% not even aware of any such programs (Kane, 2020). There is a need for increased awareness about this public health problem and to have burn-out prevention measures incorporated into residency programs, so that physicians learn to deal with burn-out from an early stage in their careers.

Although organizational-directed measures can change the long-term incidence of burnout, they might not be easy to tackle and involves bringing a chance in the entire system. Individual-directed steps like mindfulness, exercise, stress management, and communication training, cognitive-behavioral training, etc. are therefore required for those already in burn-out (Wiederhold, Cipresso, Pizzioli, Wiederhold, & Riva, 2018). Mindfulness-based stress reduction (MBSR) deepens self-knowledge, self-acceptance, and compassion for self and others. It has been shown to moderately help physicians handle stress, anxiety, as well as burn-out (Spinelli, Wisener, & Khoury, 2019). Exercise is one of the methods used by residents to self-manage burn-out and traditionally thought to help manage stress. However, a meta-analysis of a few studies looking at exercise for burn-out gave no conclusive evidence of this benefit (Ochentel, Humphrey, & Pfeifer, 2018).

In this study, the aim is to quantify the effects of MBSR and exercise on the different components of burnout and to show that these effects are superior to no intervention. It is also possible that various interventions are beneficial to improve one or more different components of burnout. The results would allow us to recommend one or both interventions to be included in residency programs allowing residents to choose whichever intervention would help them the most according to their MBI scores.

Objectives

The hypothesis is that either MBSR or aerobics is more effective than no intervention (waiting list) in reducing

burnout in resident doctors. The primary aim is to determine the effect of these interventions by comparing the MBI-HSS scores before and after the intervention. The secondary objectives include evaluation of the long term effect, measured by the change in the MBI-HSS scores 3 months after the interventions; the impact on overall resident well-being, measured as changes in heart rate (HR), systolic blood pressure (SBP), HbA1c, serum cortisol, quality of sleep and quality of life.

METHODS

Study design

This study will be a phase III, multicenter, three-arm parallel, open-labeled, randomized controlled trial. It's a superiority design against a no-intervention control group.

Study setting

The study sites include tertiary care university hospitals in Brazil, Chile, Dominican Republic, Mexico, Qatar, and Spain. All trainees of medical specialties (internal medicine, cardiology, nephrology, family medicine, psychiatry, etc.), pediatrics, obstetrics, surgical specialties (surgery, urology, orthopedics, cardiothoracic, etc.), anesthesiology, and emergency medicine will be made aware of the study via social media platforms, and hospital email addresses. The medical education department, residency program coordinators and resident counselors will be invited to encourage their resident doctors to enroll in the study.

Eligibility criteria

Resident trainees who are at least 6 months into their programs will be included in the trial. A baseline assessment of MBI-HSS scores must show evidence of burnout, in the form of high EE (more than mean (N)+ 0.5Xstandard deviation (SD)), and/or high DP (more than N+ 1.25XSD) and/or a low PA (less than N+ 0.1XSD) (Maslach, Leiter, & Jackson, 2018).

The exclusion criteria includes simultaneous participation in other studies, extra clinical work outside of residency, meditation or competitive, regulated physical activity in last 6 months, and a history of alcohol (more than once daily for women and twice daily for men) or drug abuse within 2 months of the screening visit. Residents with known pre-existing endocrinopathy or metabolic disorders, mental health disorders, and the use of psychiatric medications will also be excluded. At the screening visit, the participants will complete the Generalized Anxiety Disorder (GAD-7) questionnaire for anxiety and the Patient Health Questionnaire (PHQ-9) for depression. Trainees with a GAD and/or a PHQ-9 score of 10 or more will be excluded from the study and referred for psychiatrist evaluation.

Interventions

Group A will participate in the MBSR program, developed by the Centre for Mindfulness (CFM), University of Massachusetts Medical School (Kabat-Zinn & Santorelli, 2004). It includes a live or recorded session with a duration of 2.5-3 hours once a week, with instructors who meet the 'Qualifications and Recommended guidelines for MBSR teachers' as developed by CFM, in addition to 45-60 minutes of daily home practice. The activities done include Yoga (sitting, standing, lying), mindful walking, eating, routine activities, body scan, awareness of breathing, group discussions, and didactic sessions.

Group B will participate in one structured moderate aerobic exercise session per week supervised by professional instructors with the necessary qualifications. In addition to this, they will have to do at least 2 individual standardized exercise sessions, making a total of at least 150min per week (U.S. Department of Health and Human Services, Physical Activity Guideline, 2018).

Both interventions will run for eight weeks, during which they will be instructed not to engage in any other exercise or mindfulness related activities outside of the study. The third group will be on a waiting list for any of the two interventions. After the study period, assessment, and data collection, they will get a chance to participate in any of the successful interventions.

Every participant will be expected to complete all group and individual sessions of either intervention. However, keeping in mind the busy work schedule of resident doctors, participants who attend at least 75% of the sessions will be considered as having completed the intervention.

Randomization and blinding

This study will adopt a simple randomization technique in a 1:1:1 ratio, stratified according to the site (six sites) and specialty (6 groups). The sequence will be computer-generated on a web-based system, known only to a central independent trial coordinator not involved in the recruitment process. The trial design specifics and stratification criteria will be locked on the website before randomization begins. The allocation

sequence will be generated after the participants have been recruited to the trial, thus reducing the chance of selection bias.

The baseline data of consented eligible participants will be conveyed from the sites to the trial coordinator via central email or telephone service to generate the allocation sequence on the website. Using a web-based system ensures allocation concealment. This study will be open-labeled since the nature of the interventions prevents the participants, and the staff supervising the groups from being blinded. The outcome adjudicators and data analysts will not be aware of the group distribution.

Adherence

The participants will be required to fill online electronic diaries recording their group and individual sessions, which can be used to assess adherence. Active participation from the medical education department will be sought to help send official email and text reminders to every participant 24hours before meetings. The research team at each site will meet with the residents at regular intervals to reinforce the importance of compliance with the intervention protocols, and to clarify any queries. There will be discussions with the residency program directors to arrange for the participants to get benefits, like extra credits for trial compliance, or to be released from their duties during the sessions without the need to compensate for hours lost, and to facilitate the timely participation.

After the recruitment and randomization process, the interventions will begin for all participants in all sites at the same time. The participants will be advised not to discuss the trial details with the other groups. At the end of the study, the most successful intervention will be offered to all residents enrolled in the study.

Participant timeline

Recruitment

The study timeline is as shown in Figure 1. The residents interested in the study would be able to contact the respective site coordinators via email. They can sign an online consent form on the study website, after going through the trial protocol and interventions. Alternatively, they can also request a meeting with the site coordinators if any queries and sign a written consent form. The recruitment phase will last for five months.

Sample selection

Consented participants will undergo eligibility assessment. At this screening visit, baseline demographics like age, gender, specialty, year of residency, marital status, body mass index, smoking status, number of weekly working hours, and other information required for the exclusion criteria will be collected. They will be required to complete the MBI-HSS, GAD-7, and PHQ-9 questionnaires. The aim is to screen at least 30% of residents from every site. Eligible participants will then be asked to come for a baseline assessment of HR, SBP, HbA1c, serum cortisol, and to fill the Pittsburg sleep index (PSI) and Quality of life (QOL) questionnaires. The data will be entered into a web-based password-protected database application accessible to every site coordinator. The sample selection and baseline evaluation will take place over two weeks.

Randomization

The central independent trial coordinator will enter the site and specialty information about each participant into the web-based system to get the allocation sequence, after the recruitment of all participants. Residents randomly allocated to the groups will participate in the interventions at the same time in all the sites, for eight weeks.

Assessments

The first assessments will be done immediately at the end of the eight weeks of intervention. The post-intervention HR, BP, HbA1c, cortisol, PSI, and QOL will be collected from all participants over one week. Information from the electronic diaries will be collected to calculate adherence. The second assessment of the same outcome measures will be done three months later. The investigators doing the assessments will be blinded and will have secure access to the online database.

End of study

At the end of the final assessments, the participants on the waiting list will be given a chance to attend an eight weeks MBSR or exercise program. All the participants will be made aware of the results of the study and will be offered an opportunity to attend the more successful intervention as a mean to tackle burnout.

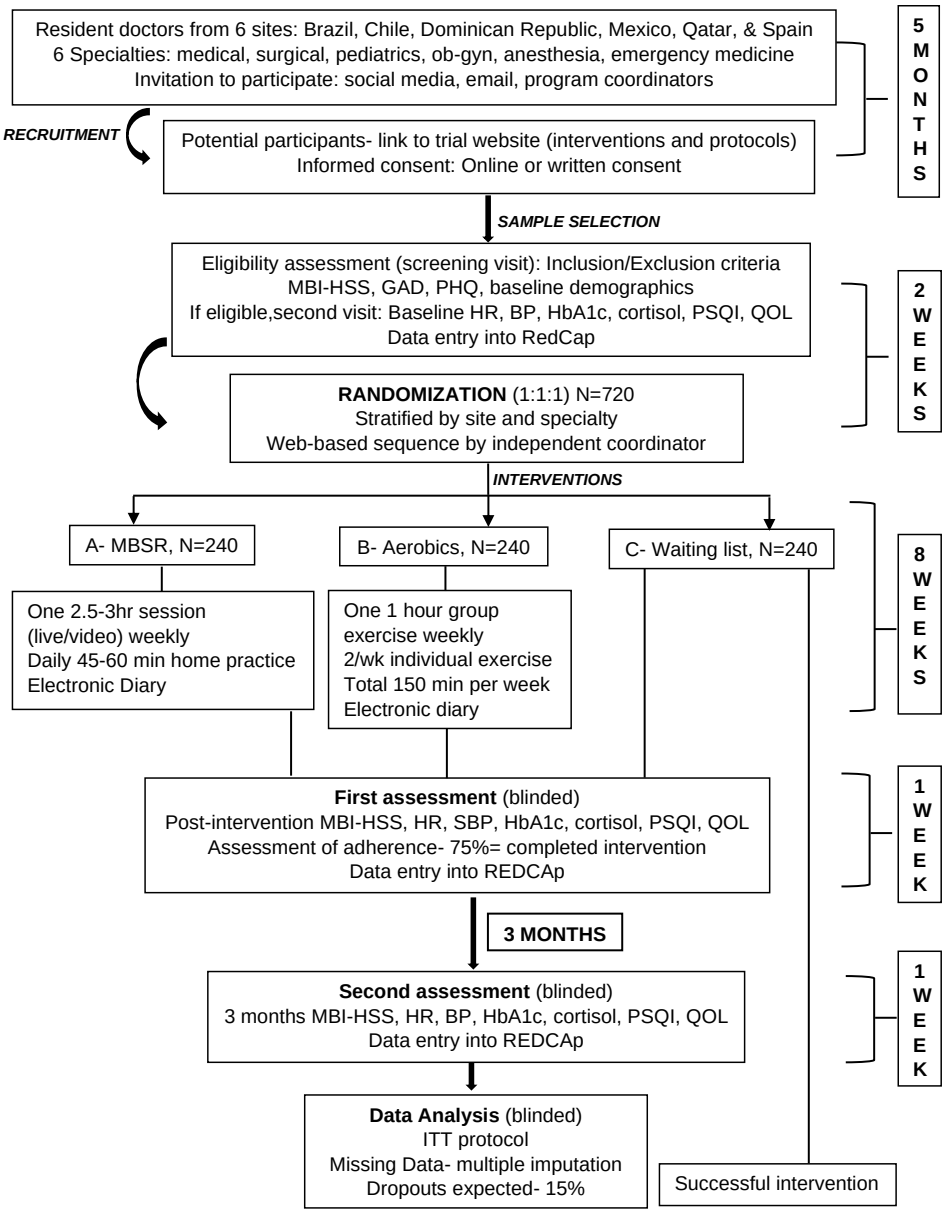

Figure 1: Study timeline. MBI- Maslach burnout inventory, GAD: Generalized anxiety disorder, PHQ: Patient Health Questionnaire, HR: heart rate, SBP: systolic blood pressure, HbA1c: Glycated hemoglobin, PSI: Pittsburg sleep quality index, QOL: Quality of life, REDCap: Research electronic data capture

Sample size calculation

The primary outcome is the change in 3 components of MBI. For sample size calculation, a two-sided alpha level of 0.01 (corrected for 3 outcome variables) was considered. The aim was to be able to detect an effect size of 15% between the means of the 3 groups using one-way analysis of variance (ANOVA) test, with a power of 80%. The sample size obtained using the G*power sample size calculator was 214 in each group. Accounting for a 15% dropout rate, the total sample size required for this study will be 720 (240 in each group).

Outcome measures

Instrument

Burn-out will be measured using the MBI-HSS form for medical professionals (MP). The EE, DP, and PA components have 9 items (score 0-54), 5 items (score 0-30), and 8 items (score 0-46), respectively. The scores are calculated based on a 7-level frequency scale starting from 0 (never) to 6 (every day). The license to use the form will be purchased from the authors' website https://www.mindgarden.com/maslach-burnout-inventory/685-mbi-manual.html.

Primary outcome

The primary outcome is the change in the three components of the MBI-HSS(MP) score after the intervention. This will be a continuous variable, calculated as the difference between the baseline score and the first assessment score.

Secondary outcomes

The following secondary outcomes will be considered:

- Changes in EE, DP, PA components of MBI, measured as the difference between baseline and second assessment (continuous variable)- this will help assess the long-term effects.
- Changes in the following variables, measured as the difference between baseline values and the values obtained in the first and second assessments. These represent surrogate markers for stress and burnout (PascoeMichaela, Thompson, Jenkins, & Ski, 2017).
    - Heart rate (beats per minute- continuous variable) and systolic blood pressure (mmHg- continuous variable), electronically measured using a Dinamap
    - HbA1c (%- continuous variable), and serum cortisol levels (mcg/dL- continuous variable), tested on blood samples.
    - Quality of life measured using QOLS that consists of 15 items with a score of 15-105 (continuous variable)
    - Quality of sleep measured using PSQI that consists of 9 items, with a global score of >5 implying poor sleepers and <5 indicating good sleepers (categorical variable)

Statistical Analysis

The analysis will be done on an intention-to-treat principle and reported by an independent blinded statistician. Categorical variables will be expressed as count and percentage and continuous variables as mean and standard deviation. Normality will be assumed based on the central limit theorem. The baseline demographic variables will be compared among the 3 groups in univariate analysis using Chi-Square/ Fisher's exact for categorical variables and one-way ANOVA for continuous variables.

The three primary outcome variables will be compared between the three groups using one-way ANOVA, with Tukey's post-hoc-test done when results are statistically significant. This result will be adjusted for covariates like age, gender, BMI, specialty, and any other baseline variable that shows a difference between the groups in univariate analysis, using linear regression models.

The secondary outcome variables will be compared using one-way ANOVA for continuous variables and Chi-square/Fisher's exact test for categorical variables. Subgroup analyses will look at the outcomes in different specialties and gender, which will be analyzed using a two-way ANOVA, and Bonferroni corrected p-value.

A two-sided alpha of 0.01 for statistical significance will be used for the primary outcome. All statistical analyses will be done using STATA version 16 software. The missing data due to the expected 15% dropouts will be addressed using multiple imputations, taking into account the variables related to the primary outcome that is entirely available. The imputation models will be run to get 10-15 data sets, and the data set representing the median analytic result will be used. Rubin's method of multiple imputations will be used to get the results.

DISCUSSION

Study impact

The residency training period is filled with various personal and professional stressors. Many life events of trainees happen at the same time as very demanding training. Also, they will need to learn how to cope with situations of illness, life, and death, making them prone to burn-out (Mian, Kin, Chen, & Ward, 2018). Residency programs need to identify the short and long-term consequences of burn-out in this group of physicians and remove their fear of appearing incompetent if they show symptoms of burn-out. The impact we hope to achieve is a change in the perception and attitude towards burn-out and to recommend successful interventions that can be incorporated into residency programs.

Strengths

A systematic review shows that the rate and severity of burn-out vary according to specialty (Rodrigues et al., 2018). This study will be the first large multicentric phase-three trial, involving residents from all specialties working in different work environments, organizational systems, and duty hours in Europe, South America, and the Middle East. Although organizational changes are crucial in the prevention of burn-out, this study will be able to demonstrate the need for individual-directed measures to handle already burned-out residents, regardless of their specialty or work environment.

There is no gold-standard intervention for burn-out, hence the need for a no-intervention group. Previous studies have shown conflicting results, with MBSR showing moderate efficacy, especially on the EE component. Exercise is a popular method used by physicians to tackle burn-out. A meta-analysis done in 2018 (Ochentel, Humphrey, & Pfeifer, 2018Ochentel 2018) was not able to show the expected benefits of exercise on burnout. However, this could be attributed to the small sample sizes and missing data. Our study will be able to validate this popular intervention and provide robust evidence. If both interventions are found to be effective, the residents will have the option to choose whichever intervention is more suited to them.

Limitations

This will be an open-label trial due to differing active interventions impossible to be blinded. However, generating a web-based sequence, after the entire sample is recruited, controlled by a central coordinator not related to any of the sites, will reduce selection bias. Intervention contamination is a potential problem as the participants are health care workers and have access to studies showing the benefits of MBSR or exercise. Offering the more successful intervention to all the participants at the end of the trial could reduce this bias and help improve adherence. Maintaining adherence to the protocols is a challenge in this trial, considering the hectic duty hours of the participants and the nature and duration of the interventions. Commencing the interventions at the same time for all participants can help reduce drop-out rates. The active involvement of residency programs can help with reminders and incentives.

This study primarily uses a patient-reported outcome. This could affect internal validity due to inter-participant variation, especially since the participants of this trial are medically educated. However, the MBI scale has been validated extensively through 35 years of research. A recent review looking at the validity and reliability of MBI-HSS concluded that the three-factor analysis was the best (Fauzia, Erika & Irwan, 2020).

In conclusion, this proposal is the first large phase 3 multicenter trial investigating multiple interventions for the management of burned-out residents. The hypothesis is that MBSR and/or exercise is more effective than no intervention in combating burn-out.

Registration

The trial will be registered on www.clinicaltrials.gov.

Acknowledgment

We thank Professors Felipe Fregni, Anna Snavely, Ingeborg Friehs, Jorge Leite, Manuel Castillo, Miriam Haviland, Sandra Carvalho, Tarek Nafee, and Armando Teixeira for their valuable time in reviewing the proposal and critical comments that were crucial in improving this study proposal.

Author list

The MINDER Collaborative

- *Ahmed Mubark Omer Elamin [1]*
- *Bruno Fu Lon Chen [2]*
- *Carlos Davila Peixoto, DDS., MPH., DHSc [3]*
- *Eduardo Barrera-Juarez, MD [4]*
- *Eltahir Mohammed Alhassan [1]*
- *Fathima Minisha, MRCOG (Corresponding author) [1]*
- *Francisco Eronildo Franco Rodrigues, MD [2]*
- *Hamzeh Khmour [5]*
- *Joao Paulo Cassiano de Macedo [6]*
- *Joao Vitor Miranda Porto de Oliveira [2]*
- *Katalina Bertran, MD [7]*
- *Katherine Judith Victorio Subervi [2]*
- *Lorena Ostios-Garcia [8]*
- *Luiz Antonio Brito Arruda Vasconcelos, MD [9]*
- *Mahmoud Ahmed Refaee [1]*
- *Maria de Lourdes Teran [2]*
- *Michelle Andrea Garlin-Politis, MD [2]*
- *Miosotis Josefina Valenzuela Jiminian, MD [2]*
- *Mohamed Abd El Hamid [5]*
- *Sandra Regina Bonfim Rodrigues [2]*
- *Saveria Sangiovanni, MD [2]*
- *Syed Muhammad Dildar Hussain [2]*
- *Thais Grigoleto Pimentel [2]*
- *Vivianne Aguilera Freitas, MD [10]*
- *Xavier De Pena-Pena, MD [11]*
- *Zohaib Yousaf, MD [1]*
- *Chantal Doucet, DC, MSc [12]*
- *Alejandro Gonzalez-Motta, MD [13]*
- *Danial Hassan MBBS, MSc, FISQua [2]*
- *Asli Ercan Dogan, MD [2]*
- *Paula Rojas, MD [7]*
- *Augusto Cesar Soares dos Santos Junior, MD, PhD [14]*

Author Affiliation

1. *Hamad Medical Corporation, Doha-Qatar*
2. *Principles and Practice of clinical research (PPCR) Alumni*
3. *American Dental Association (ADA), Hispanic Dental Association (HDA), Florida Dental Association (FDA), South Florida Dental Association (SFDA); American Public Health Association (APHA), American Association of Public Health Dentistry (AAPHD)*
4. *Tecnologico de Monterrey, Mexico*
5. *Primary Health Care Corporation, Doha-Qatar*
6. *University of São Paulo, Brazil*
7. *Department of Pediatrics, Clínica Alemana de Santiago, Chile*
8. *Beth Israel Deaconess, Harvard Medical School.*
9. *Hospital Israelita Albert Einstein, São Paulo, Brazil*
10. *University Health Network, Canada*

11. *Pontificia Universidad Católica Madre y Maestra, Dominican Republic*
12. *Université du Québec à Trois-Rivières, Québec, Canada*
13. *Centro Javeriano de Oncologia, Hospital Universitario San Ignacio, Bogotá, Colombia*
14. *Hospital das Clinicas, Universidade Federal de Minas Gerais, Brazil*

Conflict of Interest

The authors followed the International Committee or Journal of Medical Journals Editors (ICMJE) form for disclosure of potential conflicts of interest. All listed authors agree with the submission of this manuscript. The final version has been approved by all authors. The authors have no conflicts of interest to declare.

REFERENCES

Fauzia, L., Erika, K., & Irwan, A. (2020). Literature Study: Validity And Reliability Test of Maslach Instruments Burnout Inventory-Human Services Survey (MBI-HSS) In Nurses In Several Countries. Jurnal Ilmu Keperawatan: Journal of Nursing Science, 7(2), pp.160-166. doi:http://dx.doi.org/10.21776/ub.jik.2019.007.02.5

Green, A. E., Albanese, B. J., Shapiro, N. M., & Aarons, G. A. (2014). The roles of individual and organizational factors in burnout among community-based mental health service providers. Psychological services, 11(1), 41–49. https://doi.org/10.1037/a0035299

Han Shasha, Tait D. Shanafelt, Christine A. Sinsky, Karim M. Awad, Liselotte N. Dyrbye, Lynne C. Fiscus, Mickey Trockel, and Joel Goh (2019). "Estimating the Attributable Cost of Physician Burnout in the United States." Annals of Internal Medicine 170, no. 11 (June 4, 2019): 784–790.

Kabat-Zinn J, Santorelli S (2014). Mindfulness-Based Stress Reduction (MBSR): Standards of Practice, University of Massachusetts Medical School. 2014 https://www.umassmed.edu/contentassets/24cd221488584125835e2eddce7dbb89/mbsr_standards_of_practice_2014.pdf

Kane L (Jan 2020); Medscape National Physician Burnout & Suicide Report 2020: The Generational Divide; Medscape; https://www.medscape.com/slideshow/2020-lifestyle-burnout-6012460

Maslach C, Leiter M P, Jackson S E (2018); Maslach Burnout Inventory Manual 4th Edition https://www.mindgarden.com/documents/MBI-Cutoff-Caveat.pdf

Maslach C, Schaufeli W B, Leiter M P (2001); Job Burnout; Annual Review of Psychology 2001 52:1, 397-422, https://doi.org/10.1146/annurev.psych.52.1.397

Maslach, C. and Jackson, S.E. (1981), The measurement of experienced burnout. Journal of Organizational Behaviour, 2: 99-113. DOI:10.1002/job.4030020205

Mian A, Kim D, Chen D, Ward WL (2018) Medical Student and Resident Burnout: A Review of Causes, Effects, and Prevention. J Fam Med Dis Prev 4:094. doi.org/10.23937/2469-5793/1510094

Ochentel, O., Humphrey, C., & Pfeifer, K. (2018). Efficacy of Exercise Therapy in Persons with Burnout. A Systematic Review and Meta-Analysis. Journal of sports science & medicine, 17(3), 475–484. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6090391/

Patel, R. S., Bachu, R., Adikey, A., Malik, M., & Shah, M. (2018). Factors Related to Physician Burnout and Its Consequences: A Review. Behavioral sciences (Basel, Switzerland), 8(11), 98. https://doi.org/10.3390/bs8110098

Pascoe M, Thompson D, Jenkins Z, Ski C, (2017); Mindfulness mediates the physiological markers of stress: Systematic review and meta-analysis; Journal of Psychiatric Research, Volume 95, 2017, Pages 156-178, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2017.08.004

Rodrigues H, Cobucci R, Oliveira A, Cabral JV, Medeiros L, et al. (2018) Burnout syndrome among medical residents: A systematic review and meta-analysis. PLOS ONE 13(11): e0206840. https://doi.org/10.1371/journal.pone.0206840

Salvagioni, D., Melanda, F. N., Mesas, A. E., González, A. D., Gabani, F. L., & Andrade, S. M. (2017). Physical, psychological, and occupational consequences of job burnout: A systematic review of prospective studies. PloS one, 12(10), e0185781. DOI: 10.1371/journal.pone.0185781

Spinelli C, Wisener M, Khoury B (2019); Mindfulness training for healthcare professionals and trainees: A meta-analysis of randomized controlled trials; Journal of Psychosomatic Research, Volume 120, 2019, Pages 29-38; https://doi.org/10.1016/j.jpsychores.2019.03.003

U.S. Department of Health and Human Services (2018), Physical Activity Guidelines for Americans, 2nd edition. Washington, DC; 2018 https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf

Wiederhold, B. K., Cipresso, P., Pizzioli, D., Wiederhold, M., & Riva, G. (2018). Intervention for Physician Burnout: A Systematic Review. Open Medicine (Warsaw, Poland), 13, 253–263. https://doi.org/10.1515/med-2018-0039

World Health Organization. (2018). International classification of diseases for mortality and morbidity statistics (11th Revision). https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/129180281