Evidence-Based Interventions for Medical Student, Trainee and Practicing Physician Wellbeing: A CHARM Annotated Bibliography

For the Collaborative for Healing and Renewal in Medicine (CHARM) ***Best Practices Subgroup***

Thomas L[1], Harry E[2], Quirk R[3], Gooding H[4], Ripp J[5], James T[6], Kosub KY[7], Pinto-Powell RC[8], Orrange S[9], Panagioti M[10], Duckles AB[11], Brown C[12], Feingold J[13], Co JP[14], Wallach S[15], Tan WW[16], McManamon AC[17], Palamara K[18], Block L[19], Quinn M[20], Lukela M[21], Tomescu O[22]

[1]Larissa Thomas, MD, MPH; University of California San Francisco; San Francisco, CA USA

[2]Elizabeth Harry, MD; Harvard Medical School; Boston, MA USA

[3]Rosemary Quirk, MD; Hennepin County Medical Center; Minneapolis, MN USA

[4]Holly Gooding, MD, MSc; Harvard Medical School; Boston, MA USA

[5]Jonathan Ripp. MD, MPH; Icahn School of Medicine at Mount Sinai; NY, NY USA

[6]Tricia James, MD; Providence Portland Medical Center; Portland, Oregon USA

[7]Kristy Y Kosub, MD; UT Health San Antonio; San Antonio, TX USA

[8]Roshini C. Pinto-Powell, MD; Geisel School of Medicine; Dartmouth, NH USA

[9]Susan M. Orrange, PhD; Jacobs School of Medicine and Biomedical Sciences; University at Buffalo; Buffalo, NY USA

[10]Maria Panagioti, PhD; NIHR School for Primary Care Research; University of Manchester; Manchester, UK

[11]Anne Duckles, MD/MSCR candidate; Perelman School of Medicine at the University of Penn.; Philadelphia, PA USA

[12]Courtney Brown, Research Assistant; Boston Children's Hospital; Boston, MA USA

[13]Jordyn Feingold, MAPP, MD/MSCR candidate; Icahn School of Medicine at Mount Sinai; New York, NY USA

[14]John Patrick T. Co, MD, MPH; Harvard Medical School; Boston, MA USA

[15]Sara Wallach MD; Seton Hall Hackensack Meridian School of Medicine; Trenton, NJ USA

[16]Winston W. Tan MD; Mayo Clinic Florida; Jacksonville, FL USA

[17]Alyssa C. McManamon, MD; Uniformed Services University of the Health Sciences; Bethesda, MD USA

[18]Kerri Palamara, MD; Massachusetts General Hospital, Harvard Medical School; Boston, MA, USA

[19]Lauren Block MD MPH; Donald and Barbara Zucker School of Medicine at Hofstra/Northwell; Hempstead, NY USA

[20]Mariah Quinn, MD MPH; University of Wisconsin School of Medicine and Public Health; Madison, WI USA

[21]Michael Lukela, MD; University of Michigan; Ann Arbor, MI USA

[22]Oana Tomescu, MD, PhD; Perelman School of Medicine at the University of Pennsylvania; Philadelphia, PA USA

Correspondence to: Oana Tomescu, MD, PhD, Division of General Internal Medicine, Hospital of the University of Pennsylvania; Perelman School of Medicine at the University of Pennsylvania; Philadelphia, PA 19104
E-mail: oana.tomescu@uphs.upenn.edu

PHYSICAL HEALTH INTERVENTIONS

General Physical Health Interventions

Kushner RF, Kessler S, McGaghie WC. Using behavior change plans to improve medical student self-care. ***Acad Med*** **2011;86(7):901-906. doi: 10.1097/ACM.0b013e31821da193.**

Impetus: Medical students have been shown to experience decreased self-care behaviors when their workload increases. This study evaluates medical students' ability to modify their health behaviors via Behavioral Change Plans (BCPs) grounded in the principles and techniques of behavioral therapy.

Description: A one-group post-test design was used to evaluate the BCPs of 343 second year students at Northwestern University School of Medicine. Students in the classes of 2010 and 2011 participated in a six-week, 12-hour Healthy Living course, during which they completed the BCP activity. The activity targeted exercise, nutrition, sleep, personal habits/hygiene, study/ work habits, or mental/emotional health. 87.2% of students elected to modify exercise, nutrition, or sleep behavior. After self-monitoring behavior for six weeks, 40.5% of students indicated that they achieved their goal, 49.6% of students failed to achieve their goal, and 9.9% of students were uncertain about whether they met their goal. Overall, 79.9% of students felt that they were healthier after implementing the BCP, and 81.9% of students noted that they would use a BCP to monitor and set goals for individual behavior change in the future.

Contribution: This study suggests that a BCP can be a useful tool that allows medical students to reflect on their behaviors, devise a plan to modify their behavior, and self-monitor their progress towards an individual goal. The quantitative and qualitative data collected during the study revealed individual barriers and facilitators that influence student's behavior modifications. Only two student cohorts were studied at a single institution. The authors acknowledge that the lack of pre-test data is a limitation to the study design, and future studies should include both pre-test data and follow-up studies.

Cost: Unknown.

Physician Health-Care Utilization

Carvour ML, Ayyar BK, Chien KS, *et al.* A patient-centered approach to postgraduate trainee health and wellness: an applied review and health care delivery model. ***Acad Med*** **2016;91(9):1205-10. doi: 10.1097/ACM.0000000000001301.**

Impetus: Authors reviewed the literature analyzing the health care needs of postgraduate trainees, and provide data to show care afforded to this population often falls short of current standards. After identifying this gap, they explored a possible solution: the patient-centered medical home.

Description: This study evaluated the patient-centered medical home model as a potentially effective way to address the unmet or partially met health care needs of trainees. Several practical interventions to improve access to care are described, including care coordination and referral support, confidential care without perceived conflicts of interest in the training environment, co-location of medical and mental health care and accommodations for schedule constraints. The authors also explored the role of the medical home in developing and supporting broader institutional efforts to promote resident wellness.

Contribution: This paper alerts programs to the unmet or partially met health care needs of many residents, and suggests a solution: the medical home. Several practical interventions to increase residents' access to

care and use of services are described. Authors concluded that a critical step toward improving health and wellness in residents is to apply the relevant, evidence-based, and patient-centered principles of the primary care field to the wellbeing of those who train within it.

Cost: Appointment of a care coordinator (ideally someone separated from any supervisory or promotional role involving trainees) was the main cost identified by authors. The coordinator position could be 0.2-0.5 full time equivalents (FTE), depending on program size and anticipated resident needs. Medical and mental health care providers could be hired specifically for trainee healthcare. Alternately, some FTE share could be added to existing providers (e.g. within an employee health clinic, medical student clinic, primary care clinic, or another medical home).

Sleep/Fatigue Management

Shea JA, Bellini LM, Dinges DF, *et al.* Impact of protected sleep period for internal medicine interns on overnight call on depression, burnout, and empathy. *J Grad Med Educ* 2014;6(2):256-53.
doi: 10.4300/JGME-D-13-00241.1.

Impetus: This publication assessed burnout, depression and empathy after a randomized controlled intervention: protected sleep periods for Internal Medicine interns during overnight in-house call. This study was part of a larger protocol conducted in the 2009-10 academic year on the internal medicine service at Philadelphia Veterans Affairs Medical Center (PVAMC) and on the oncology service at the Hospital of the University of Pennsylvania (HUP).

Description: A total of 106 internal medicine interns on overnight call were randomized to usual practice or a protected sleep period between 12:30AM and 5:30AM over a four-week rotation. Interns in the intervention group slept more during on-call days (3.23 vs. 2.54 hours at the PVAMC, $P = 0.004$; 3.36 vs. 2.42 hours at HUP, $P < .001$). The impact of the protected sleep period on burnout, depression and empathy scores was assessed using the Beck Depression Inventory (BDI-II), Interpersonal Reactivity Index (IRI) and Maslach Burnout Inventory (MBI). Pre-post rotation surveys were administered. Results showed that despite the expected increases in sleep, a protected sleep period produced no statistically significant improvements in depression, burnout or empathy. One possible explanation is that the absolute difference in the time slept is not clinically significant enough to impact sleep debt or the affective complications of sleep deprivation, such as burnout, empathy and depression. Additionally, the indicator subscales may have not been sensitive enough to detect small changes in outcomes that might occur with such small increases in sleep.

Contribution: This randomized controlled trial showed that attempting to protect a 5-hour period of time during overnight call for interns did result in a small but statistically significant increase in sleep time on call, but did not impact measures such as burnout, depression or empathy.

Cost: Senior night float residents carried the interns' pagers during the protected sleep period.

Shea JA, Dinges DF, Small DS, *et al.* A randomized trial of three-hour protected nap period in a medicine training program: sleep, alertness and patient outcomes. *Acad Med* 2014;89(3):452-9.
doi: 10.1097/ACM.0000000000000144.

Impetus: Protected nap periods have been shown to increase sleep duration for medical interns, however, they also require additional personnel staffing. This study explored an alternative approach to the

optimization of fatigue management in interns who work extended duty periods of up to 30 hours with the goals of minimizing negative patient outcomes and the cost for additional personnel.

Description: This article used two randomized control trials at the Hospital of the University of Pennsylvania (HUP) and the Philadelphia Veterans Administration Medical Center (PVAMC) to evaluate the impact of three hour protected sleep periods on patient outcomes and medical interns' cognitive alertness and sleep duration. The three-minute Psychomotor Vigilance Test and Karolinska Sleepiness Scale were used to assess behavioral alertness. Sleep time was measured by the Actiwatch Spectrum wrist activity monitor, and interns reported sleep duration in diaries each morning. Participants were randomly assigned to the standard schedule or an intervention schedule, which included an alternating 3-hour protected nap period assigned either early or late in the course of the call night. Interns assigned to either protected period at HUP got significantly more sleep; while at PVAMC, only those assigned to the late-shift group slept more. All intervention groups (both early- and late-shifts at both hospitals) were significantly less likely to have call nights without sleep and had fewer attentional lapses on the Psychomotor Vigilance Test. Overall, patients did not experience worsened outcomes (length of stay, discharge to the medical intensive care unit, death, and 30-day readmission).

Contribution: This article summarizes the impact of protected sleep on medical intern's performance and offers a cost and personnel neutral approach to increase intern's sleep during prolonged shifts. These findings are consistent with previous studies on implementation of protected sleep periods for fatigue management.

Cost: Authors report no additional personnel to implement study design.

Avidan AY. Sleep and fatigue countermeasures for the neurology resident and physician. *Continuum (Minneap Minn)* 2013;19(1 Sleep Disorders):204–22. doi: 10.1212/01.CON.0000427205.67811.08.

Impetus: Reduced alertness in neurology residents has been shown to significantly impact cognitive and psychological function leading to errors and accidents. Implementation of limited hours of work alone has not been sufficient to help address these problems.

Description: This review article defines the problem in historical context and uses the Epworth Sleepiness Scale (ESS) to compare sleep deprived neurology residents with other conditions including narcolepsy and sleep apnea. The consequences of sleep deprivation on physical, cognitive, neurobehavioral, and patient care outcomes are described. A list of potential countermeasures used to combat this problem are reviewed.

Contribution: This articles reviews the pathobiology of sleep and fatigue in neurology residents, discussed the negative consequences of sleep deprivation and offers practical solutions that can be used to alleviate this problem through focused interventions to improve alertness, increase sleep duration, safety measures, circadian alignment and maximizing educational opportunities.

Cost: Unknown.

Wright KP, Bogan RK, Wyatt JK. Shift work and the assessment and management of shift work disorder (SWD). *Sleep Med Rev* 2012;17(1):41-54. doi: 10.1016/j.smrv.2012.02.002.

Impetus: Shift work disorder and its consequences and management are described.

Description: This is an in-depth review with 128 references which describes the assessment and management of sleepiness and sleep disruption associated with shift work schedules and shift work disorder (SWD). Management strategies for shift work disorder are discussed in the review and include approaches to promote sleep, wakefulness and adaptation of the circadian clock to the imposed work schedule. While shift work disorder has not been studied in medical residents or doctors, there is an extensive body of literature on the prevalence of SWD and the associated health and behavioral problems in nurses.

Contribution: The existing body of literature on shift work disorder is summarized, and may prove relevant to medical residents and staff physicians.

Cost: Unknown.

Reed DA, Fletcher KE, Arora VM. Systematic review: association of shift length, protected sleep time, and night float with patient care, residents' health and education. ***Ann of Intern Med*** **2010;153(12):829-842. doi: 10.7326/0003-4819-153-12-201012210-00010.**

Impetus: This systematic review of literature published from 1989 through 2010 summarizes the impact of shift length, protected sleep time and night float on patient care, resident health and educational outcomes among residents.

Description: Sixty-four studies were included. Most studies used single-institution, observational designs and many were felt to be methodologically weak, with a high risk for bias. However, 73% of the studies that examined shift length showed that shorter shifts were associated with decreased medical errors, motor vehicle crashes, and percutaneous injuries. While heterogeneous, this body of evidence appears to support reducing shift length; however, optimal shift duration was not adequately addressed. Other recommendations about protected sleep time and night float were limited by the quality of the methodology used in the original studies and unclear generalizability for most outcomes.

Contribution: Because of limitations in study quality, the outcomes of broad-based changes in residency training, including decreased shift length, protected sleep time and night float systems, are uncertain and warrant further investigation.

Cost: Unknown.

Rosen IM, Gimotty PA, Shea JA, Bellini LM. Evolution of sleep quantity, sleep deprivation, mood disturbances, empathy and burnout among interns. ***Acad Med*** **2006;81(1):82-5. PMID: 16377826.**

Impetus: This paper addresses the relationship between sleep deprivation and the evolution of mood disturbances, empathy and burnout among a cohort of internal medicine interns prior to the 2003 ACGME duty hour reforms.

Description: This study evaluated a cohort of internal medicine interns (n=47) at a large academic medical center. Baseline and year-end outcome measures were: sleep quantity, subjective sleepiness (Epworth Sleepiness Scale), depression (Beck Depression Inventory–Short Form), empathy (Interpersonal Reactivity Index) and burnout (Maslach Burnout Inventory). Results confirmed previous findings showing that the prevalence of chronic sleep deprivation, depression, burnout and empathy increased from baseline to year end. There was non-significant association between sleep deprivation and depression.

Contribution: This study was one of the earliest to describe a potential relationship between sleep deprivation, burnout and loss of empathy. These findings informed future evaluation of the ACGME duty hour reform.

Cost: Unknown.

Nutrition

Hamidi MS, Boggild MK, Cheung AM. Running on empty: a review of nutrition and physicians' wellbeing. *Postgrad Med J* 2016;92:478-481. http://dx.doi.org/10.1136/postgradmedj-2016-134131.

Impetus: Poor nutrition can negatively impact a physician's performance, cognitive functioning and the quality of care provided. This review examines literature on physician nutrition and hydration and suggests potential multifactorial interventions to improve these measures.

Description: This review illustrates the influence that a balanced diet, meal timing, hydration, caffeine, nutrient deficiencies, and work hours have on physician fatigue, cognitive performance, and wellbeing.

Contribution: The findings highlight the need to incorporate physician wellbeing and nutrition in the workplace, and it indicates barriers that prevent physicians and physicians-in-training from receiving adequate nutrition including time, lack of healthy food options, and limited access to meals during night shifts. The authors suggest individual (taking nutrition and hydration breaks), professional (promoting a culture of physician self-care and nutrition), and organizational (implementing break schedules, increasing access to healthy food, and extending hours for food services near clinics operating overnight) interventions for physician wellbeing.

Cost: Unknown.

Lemaire JB, Wallace JE, Dinsmore K, *et al.* Physician nutrition and cognition during work hours: effect of a nutrition-based intervention. *BMC Health Serv Res* 2010;10:241. doi: 10.1186/1472-6963-10-241.

Impetus: Hectic scheduling often prevents physicians from receiving adequate hydration and nutrition. This study investigated the impact of a scheduled nutrition intervention on physician's cognitive functioning, glucose, and hypoglycemic symptoms.

Description: A pre/post-test design was used to examine the impact of scheduled nutrition breaks on 20 physicians from surgical, medical, and primary care specialties in a large, urban hospital. Participants selected two similar work days to undergo baseline and intervention testing. For baseline testing, physicians followed their typical hydration and nutrition habits. For intervention testing, physicians were provided nutritious food and drink by the research staff at scheduled intervals. The impact of the intervention was evaluated using simple and complex reaction tests, blood glucose levels, activity level, body mass, heart rate and reported hypoglycemic symptoms. On intervention day, physicians reported significantly increased caloric intake, better hydration status, lower mean glucose levels, less variable mean glucose levels, improved cognitive functioning, and fewer hypoglycemic symptoms (although this was not statistically significant). Participants felt that the wellness initiative they participated in increased their awareness of the importance and impact of workplace nutrition, and helped encourage intent to change nutrition habits.

Contribution: These findings show that physicians do not properly consume food and water at work, and that a physician-centered, workplace-based nutrition intervention can impact physician cognitive functioning, hypoglycemic symptoms and glucose levels. Future studies could evaluate alternate delivery methods to impact of increased physician access to food and drink.

Cost: Unknown, but resources for personalized delivery and healthy options would be necessary.

Lemaire JB, Wallace JE, Dinsmore K, Roberts D. Food for thought: an exploratory study of how physicians experience poor workplace nutrition. ***Nutr J 2011;*****10(1):18. doi: 10.1186/1475-2891-10-18.**

Impetus: Physicians often do not pay attention to nutrition during the workday. This study explored physician views on their nutrition in the workplace, including impact on personal wellness and professional performance.

Description: This qualitative study involved 20 physicians (10 from medical specialties, eight from surgical specialties, and two from primary care) from an urban teaching hospital who had agreed to participate in a nutrition-based wellness study participated in semi-structured interviews before and after the intervention. The two lead co-investigators independently reviewed the transcripts using an inductive strategy to derive predominant themes. Study participants identified several ways inadequate nutrition could negatively impact their emotional and physical health, cognitive and professional abilities and interpersonal interactions with colleagues, care providers, and patients. Barriers to good nutrition were identified, and included lack of time, stringent work ethic, poor access, limited choice, and cost.

Contribution: The study was helpful in elucidating some of the issues and impacts of inadequate nutrition for physicians in the workplace. The study findings could be used to design a larger study to better define and quantify the issues delineated around impact and barriers of workplace nutrition.

Cost: Unknown.

Exercise

Thordike AN, Mills S, Sonnenberg L, ***et al.*** **Activity monitor intervention to promote physical activity of physicians-in-training: randomized controlled trial.** ***PLoS One*** **2014;9(6):e100251. doi: 10.1371/journal.pone.0100251.**

Impetus: Research suggests that resident physicians exercise less than medical students and attendings. As residents spend most of their waking at work, this study evaluated the effect of using an activity tracker on resident's physical health and patient health counseling.

Description: The study was carried out over two 6-week phases with 104 residents at a large academic medical center in Boston. During the study, residents were granted free access to: an on-site fitness center; a weekly, one-hour personal training session; and two sessions with a nutritionist. Phase 1 was a randomized controlled trial in which 52 residents received an activity tracker with visible step data and 52 received an activity tracker with blinded step data. Phase 2 was a non-randomized team step competition, and all participants had visible step data. The impact of the intervention was analyzed by daily steps, compliance with wearing the activity tracker, diastolic and systolic blood pressure, HDL and LDL cholesterol, BMI, fitness center use, and nutritionist use. There was no difference in steps per day between intervention and

control groups in Phase 1, but all participants increased their daily steps during the team-competition of Phase 2. However, participants did have significant improvements in systolic blood pressure, HDL cholesterol, and use of fitness center resources (membership, personal trainer and nutritionist).

Contribution: The study contributes to the literature as the first randomized trial to use activity trackers to promote physical health among resident physicians. Moreover, the study indicates that multimodal interventions (activity trackers, team-based competitions, free access to fitness resources) can impact resident physicians' health, even if they are unable to participate in physical activity outside of duty hours. Future studies should collect baseline step activity and consider the impact of free fitness center access.

Cost: Unknown, but activity trackers cost about $100 each.

Weight CJ, Sellon JL, Lessard-Anderson CR, *et al.* Physical Activity, quality of life, and burnout among physician trainees: the effect of a team-based, incentivized exercise program. *Mayo Clinic Proc* 2013;88(12);1435-1442. doi: 10.1016/j.mayocp.2013.09.010.

Impetus: Research shows that regular physical activity affects physicians' quality of life, but the impact on burnout has not been well established. This study evaluated the effect of a voluntary, incentivized exercise program on resident and fellow physical activity, quality of life, and burnout.

Description: The voluntary, team-based, incentivized exercise program lasted 12-weeks, and all medical fellows and residents (n = 1060) at Mayo Clinic in Rochester, Minnesota were invited to participate in the exercise program, submit baseline data, and complete the exit survey. 628 residents and fellows completed the baseline survey, 532 completed the exit survey, and 230 enrolled in the program. Both participants and non-participants had access to the same institutional exercise facilities. The impact of the intervention was measured on self-reported gym attendance and aerobic activity; participation in baseline and exit surveys; participation in a wellness exam; body fat percentage; and leg press strength. Only 31% of all intervention participants and non-participants met the U.S. Department of Health and Human Services recommendations for physical activity. Residents and fellows who participated in the intervention showed significantly increased physical activity (with almost half meeting the daily recommendation) and had a significantly higher median quality of life. There was a small trend towards decreased burnout, but this finding was not statistically significant.

Contribution: This study supports the finding that physical activity is linked with higher quality of life in physicians. The study also shows that an incentivized exercise program can increase physical activity among medical residents and fellows.

Cost: Unknown.

Watson DT, Long WJ, Yen D, Pichora DR. Health promotion program: a resident wellbeing study. *Iowa Orthop J* 2009;29:83–7. PMCID: PMC2723698.

Impetus: Workplace health promotion programs have been shown to increase productivity. This study evaluated the impact of a workplace health promotion program on presenteeism among orthopedic and general surgery residents.

Description: In 2003, orthopedic and general surgery residents at a Tertiary Care Level 1 trauma center completed the Stanford Presenteeism Scale: Health Status and Employee Productivity Questionnaire (SPS-6) along with questions about exercise and absenteeism at baseline and end of the year. All residents were granted free, 24 hour, onsite access to a health promotion facility equipped with strength and cardiovascular equipment. Residents using the facility were asked to document their use of the equipment by signing into a logbook upon entering and exiting the room. Response rates were similar at baseline and end of the year: 78-79% of residents filled out the surveys. The data show a non-statistically significant improvement in residents mean presenteeism score post intervention. Furthermore, the data show a non-statistically trend toward improved SPS-6 scores among residents who document use of the facility in the logbook (2.7 $\pm$ 4.8) vs those who did not (0.4 $\pm$ 3.3).

Contribution: This study supports the finding that a workplace health promotion program has potential to improve presenteeism.

Cost: Unknown.

Rogers LQ, Gutin B, Humphries MC, *et al.* A physician fitness program: enhancing the physician as an "exercise" role model for patients. *Teach Learn Med* 2005;17(1):27-35. doi: 10.1207/s15328015tlm1701_6.

Impetus: Research shows that only 30% of physicians report regular physical activity. Physicians' personal health behaviors have been shown to alter their ability to counsel patients on nutrition and physical fitness. This study examined the effectiveness of a fitness program on resident cardiovascular fitness, body mass index, physical activity, and patient exercise counseling.

Description: This study was a non-randomized intervention with outcomes measured at baseline, three months (at the end of the intervention), and six months (three months post intervention). Forty-two internal medicine resident physicians completed testing at baseline and first follow-up. Twenty-five participants completed all three phases of data collection. The effectiveness of the physician fitness program was measured by (1) participant attendance at intervention activities (e.g. faculty/resident softball games, fun runs/walks, exercise testing, group conferences, Race Across America Contest), (2) changes in peak VO2, (3) self-reported physical activity, (4) body mass index (BMI), (5) knowledge and behavioral attitudes, and (6) patient counseling about physical fitness. At 3-month follow-up, results revealed a decrease in residents' BMI and an increase in residents' confidence in their ability to provide physical activity counseling. The results were not maintained at the 6-month follow-up.

Contribution: This study was the first to evaluate a fitness program in resident physicians. The study demonstrated that physician fitness programs can improve resident physicians' physical activity and BMI during the intervention, but not at three months post-intervention. However, study attrition at the 3- and 6-month time points limited the scope of the results.

Cost: Unknown.