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Sleep, health behaviors, and behavioral interventions:
Reducing the risk of cardiovascular disease in adults

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Abstract
Numerous health behaviors, including physical activity, diet, smoking, and sleep, play a major role in preventing the development and progression of cardiovascular disease (CVD). Among these behaviors, sleep may play a pivotal role, yet it has been studied somewhat less than other behaviors and there have been few well-designed sleep intervention studies targeting CVD. Furthermore, despite the fact that these behaviors are often inter-related, interventions tend to focus on changing one health behavior rather than concurrently intervening on multiple behaviors. Psychological constructs from depression to positive affect may also have a major effect on these health behaviors and ultimately on CVD. In this review, we summarize the existing literature on the impact of sleep and other cardiac health behaviors on CVD onset and prognosis. We also describe interventions that may promote these behaviors, from established interventions such as motivational interviewing and cognitive behavioral therapy, to more novel approaches focused on mindfulness and other positive psychological constructs. Finally, we outline population-health-level care management approaches for patients with psychiatric conditions (e.g., depression) that may impact cardiac health, and discuss their potential utility in improving mental health, promoting health behaviors, and reducing CVD-related risk. Much work is still needed to better understand how sleep and other health behaviors may uniquely contribute to CVD risk, and additional high-quality studies of interventions designed to modify cardiac health behaviors are required to improve cardiovascular health in individuals and the population at large.

Key words: Sleep; Diet; Physical activity; Cardiovascular disease; Care management

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Core tip: This manuscript discusses the link between modifiable health behaviors; including sleep, diet, activity, and their relationship to adult risk for cardiovascular disease. Despite knowing that these behaviors are...
often interrelated, interventions to date have primarily focused on changing one health behavior vs intervening on multiple behaviors simultaneously. Population health level care management approaches are outlined to aide providers in counseling their patients.

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INTRODUCTION
Recent guidelines for adequate sleep duration from the American Academy of Sleep Medicine and Sleep Research Society state that a typical adult needs at least 7 h of sleep each night to maintain optimal health[1,2]. Population-based studies estimate that one in three adults in the United States report sleeping fewer than 7 h per night[3,4]. This statistic is alarming as research has shown that individuals with insufficient sleep are at a significantly greater risk for many chronic diseases, including cardiovascular disease (CVD)[5-8], which is responsible for one in four deaths in the United States[9]. Additional health behaviors beyond sleep, including poor diet, low levels of physical activity, and prolonged sedentary time, are also major risk factors for the development of CVD[9]. This review will discuss the current literature linking these modifiable health behaviors to an increased risk of CVD, and the evidence-based interventions that can modify them, in order to guide future intervention targets and strategies aimed at reducing CVD risk in adults.

IMPORTANCE OF SLEEP IN REDUCING CVD RISK
In recent literature, both insufficient sleep duration (most often defined as fewer than 7 h) and long sleep duration (more than 9 h) have been associated with poor health outcomes and increased mortality risk[6,10]. In one such large, population-based study, individuals who reported fewer than 6 h of sleep had a 15% higher incidence of CVD compared to those who reported sleeping between 7-8 h[10].

Many biomarkers related to CVD risk have been examined in relation to insufficient sleep duration. The relationship between short sleep duration and hypertension is well documented, extending from experimental studies to longitudinal epidemiological studies and intervention studies[11-13]. Short sleep duration (collected via self-report questionnaire) has been associated with higher blood pressure in cross-sectional studies and greater overall incidence of hypertension in population studies. Studies tend to vary in their definition of short sleep duration, but overall conclude that 5 or fewer hours of sleep each night is related to the worst blood pressure outcomes. These poor blood pressure outcomes are reported to be most common in women and adults who are less than 65 years old. Racial/ethnic differences have been found showing that relationships between short sleep duration (fewer than six hours per night) and hypertension are strongest in non-Hispanic whites, blacks, and Hispanics/Latinos populations[14].

Insufficient sleep has also been associated with other conditions linked with CVD, such as obesity and type 2 diabetes mellitus (T2DM). Short sleep duration has been strongly linked to an increased risk of obesity across all populations[15], and, conversely, for each additional hour of sleep an individual’s body mass index (BMI) decreases by 0.35 units[14]. Racial/ethnic differences have been found, with the strongest relationship of very short sleep (less than five hours per night) and obesity in individuals who identify as African American/black[15]. Further research has shown that women who reported sleeping less than 6 h per night over the course of 16 years gained significantly more weight compared to women that slept at least 7 h[15]. Individuals with short sleep duration (fewer than 6 h per night) have also been shown to have an increased risk of T2DM[16,17]. It remains unclear whether this increased risk is mediated by obesity or if there are other mechanisms, including glucose metabolism, that may explain the increased risk of T2DM.

There is less data on the connection between short sleep duration and other biological markers of health[6]. Regarding inflammatory markers, when sleep is experimentally restricted to fewer than four hours per night, increases in C-reactive protein and interleukin-1 receptor have resulted[18,19]. Studies examining the effects of short sleep duration and insulin resistance are also rare. Self-report of fewer than 6 h of sleep per night has been associated with increased insulin and hemoglobin A1C (HbA1c), but this result was attenuated when BMI was added to the model[20]. Studies of sleep restriction (fewer than 6 h in bed) have found an increase in insulin resistance[21,22]; however, these studies were limited to healthy, young males. Therefore, the relevance of these associations to the general population remain unclear.

Importance of other health behaviors in reducing CVD risk
Dietary intake, physical activity, and sedentary time have also been associated with CVD risk in adults. The effects of numerous dietary components on CVD risk have been examined[23]. For example, adherence to a Mediterranean diet, consisting of a high intake of fruits and vegetables, fish, olive oil, and dairy, has been associated with a lower risk of CVD events including myocardial infarction and stroke as well as lower cardiovascular mortality[24]. A similar dietary eating pattern, the DASH eating plan, consisting of fruits and vegetables, low-fat dairy, whole grains, poultry, fish, and nuts, has also been found to lower incidence of adverse cardiovascular events[25]. Specific dietary components have also been associated...
with a reduced risk of CVD. Diets high in polyunsaturated fatty acids and low in sodium have been linked to fewer cardiovascular events\(^\text{22}\). Increasing physical activity levels, at any intensity level, has been shown to lower CVD risk. Individuals with higher daily overall physical activity (measured \textit{via} accelerometer) and moderate-vigorous physical activity have been shown to have lower CVD mortality\(^\text{26}\). Although reducing sedentary time appears important to overall health, sedentary time has generally not been associated with CVD mortality\(^\text{26}\).

**POTENTIAL RELATIONSHIPS BETWEEN MULTIPLE HEALTH BEHAVIORS IN REDUCING CVD RISK**

Despite the strong evidence of increased CVD risk associated with each of the above behaviors on poor health outcomes, an important issue in this line of research is detangling the effects of these health behaviors from one another, as they tend to be strongly correlated within individuals. Due to this, it can be difficult to discern which health behaviors independently contribute to improved health outcomes. For example, there is limited data regarding how sleep combines with the other behaviors. Additional evidence is needed to define how these behaviors may cluster or pattern together resulting in an increased risk of disease; such knowledge can help to inform future public health intervention guidelines and policy in this area. Intervention and policy strategies to date have focused on changing individual behaviors, with very few strategies attempting to target multiple lifestyle behaviors simultaneously\(^\text{27}\). A study in over 50,000 United Kingdom adults aged 37-63 years found that individuals with CVD were more likely to report low levels of physical activity, more than 3 h of TV viewing per day, and fewer than 7 h of sleep per night, compared to individuals without CVD\(^\text{27}\). The clustering of these behaviors was termed a “unhealthy phenotype” and individuals with this unhealthy phenotype had poorer disease outcomes.

Multiple health behavior interventions have been shown to have improved health outcomes, such as blood pressure, cholesterol, and glucose, when changes to both diet and activity are changed simultaneously\(^\text{28}\). However, there is very limited evidence to date that these types of interventions directly impact CVD events or mortality\(^\text{28}\).

**STANDARD HEALTH BEHAVIOR INTERVENTIONS AND THEIR IMPACT IN CVD RISK POPULATIONS**

**Cognitive-behavioral therapy**

Cognitive-behavioral therapy (CBT) is an evidence-based intervention for improving cardiac health behaviors and outcomes. It is a short-term skills-based psychotherapy that teaches cognitive (\textit{e.g.}, cognitive restructuring, probability estimation) and behavioral strategies (\textit{e.g.}, behavioral exposures, behavioral activation) to reduce emotional distress, improve well-being, and promote healthy behavioral choices. Originally developed for treating emotional problems, CBT is often most useful for improving health behaviors among patients with or at risk for chronic medical conditions who may be more motivated for change, and psychiatric symptoms among individuals with mental health disorders who have the greatest room for symptom improvement. For example, in a study of CBT for improving sleep in healthy college students, only those with poor sleep at baseline showed significant improvement (Trockel \textit{et al.}, 2011). Thus, much of the work on CBT and cardiac risk factors has been aimed at improving sleep and other health behaviors and psychiatric symptoms in patients with insomnia, mental health problems, or those with or at risk for CVD. Table 1 shows representative studies examining the effects of standard health behavior interventions on health outcomes.

CBT is useful for improving sleep and other health behaviors in patients with or at risk for CVD. A recent review of CBT for insomnia (CBT-I) in CVD patients found that there is limited but promising evidence for CBT-I to improve sleep characteristics (\textit{e.g.}, sleep efficiency and quality), CVD biomarkers, symptom burden, functional impairment, and quality of life\(^\text{29,30}\). CBT has also been shown to improve health behaviors including diet (\textit{e.g.}, reduced sugar, increased fruits/vegetables), physical activity, and smoking cessation in some studies of healthy adults and those with or at risk for CVD\(^\text{31-35}\).

In line with the original aim of CBT, much of the research on CBT and cardiac health has focused on the efficacy of CBT in improving psychosocial problems in CVD patients given that these problems have a significant negative impact on cardiac morbidity and mortality\(^\text{36,37}\). The results of several randomized clinical trials (RCT) support the efficacy of CBT in improving depression, anxiety, and quality of life in CVD patients, patients suffering an acute coronary syndrome (ACS), heart surgery patients, and heart failure patients\(^\text{38-44}\). A systematic review and meta-analysis of psychological interventions for depression in CVD found that CBT had the strongest effects\(^\text{45}\), and the American Heart Association specifically recommends CBT for treating depression in CVD patients\(^\text{46}\). CBT is also associated with improved psychosocial outcomes among individuals at risk for CVD including those with type 2 diabetes, hypertension, and overweight and obesity\(^\text{31,34,47}\).

Evidence for direct effects of CBT on physical health outcomes is less consistent. A Cochrane review of 64 RCTs found that psychological interventions produced small-moderate improvements in depression and anxiety and a small effect on cardiac mortality in CVD patients, but no effect on total death or cardiac events\(^\text{46}\). Another systematic review found improvements in depression symptoms but no effect on all-cause mortality, cardiac mortality, or cardiac events\(^\text{43}\). In the Enhancing Recovery in Coronary Heart Disease Patients trial, a randomized trial of 2481 post-ACS patients, CBT was asso-
associated with improvements in depression symptoms, but did not affect survival or cardiac events at 6-mo follow-up\cite{48}. It is possible that longer-term follow-up is needed to identify physical health benefits of CBT, which may take time to develop and require continued use of CBT skills\cite{56,57}.

Recent studies have explored telephone-based and web-based CBT interventions for improving psychosocial outcomes in patients with CVD. These studies have shown mixed but promising results. For example, a RCT of telephone-delivered CBT for post-ACS patients with depression found greater improvements in depression symptoms following CBT as compared to usual care, with effects maintained up to one year later\cite{52}. A pilot study of web-based CBT for heart failure patients also found improvements in depression symptoms though there were no significant between-group differences\cite{51}. In a study of post-transplant patients, however, telephone-delivered CBT was not found to be acceptable, and while patients who did participate showed significant reductions in anxiety and depression symptoms, most (67%) continued to show elevated scores\cite{51}. Given that there is evidence of potential feasibility and efficacy, and mobile health interventions have the potential to improve access to mental health care for CVD patients\cite{53}, further controlled studies should explore virtual CBT interventions be delivered remotely by different avenues with good fidelity\cite{56,57}. MI interventions have led to improved health behaviors in patients with cardiac risk factors, including increased physical activity in patients with diabetes\cite{58} and hypertension\cite{59}. Additional studies have demonstrated improved medication adherence and significant reductions in systolic blood pressure in patients with hypertension\cite{60,61}. Furthermore, a Cochrane review of MI for smoking cessation showed a modest but significant increase in quitting compared to usual care\cite{62}. There are several ongoing trials assessing the potential of different MI-based interventions to improve other health behaviors and cardiac risk factors, including improving statin adherence in patients with hypercholesterolemia\cite{64}, optimizing risk factors in patients undergoing cardiovascular procedures\cite{65}, and comparing group-based to individual MI interventions in patients at high risk for CVD\cite{66}. Although few interventions have used MI to modify sleep behaviors\cite{67,68}, MI may be well-suited to address sleep in a manner similar to that used for other health behaviors. Further, despite MIs extensive use in research studies and clinical care, the effects of solely MI-based interventions for activity promotion in patients with T2D\cite{58} and other major cardiac risk factors may not be significant enough to prevent CVD or major cardiac events, raising the possibility that additional interventions may be necessary in these patients.

**MI based interventions and their impact in CVD risk population**

An even more traditional approach to health behavior change is motivational interviewing (MI). Over 30 years of research have established MI, a patient-centered method for identifying and enhancing intrinsic motivation, as an effective and straightforward technique for promoting behavioral change\cite{54,55}. MI is effective and can

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**Table 1** Representative studies examining the effects of cognitive behavioral therapy and motivational interviewing on health-related outcomes

| Ref. | Population | Intervention | Outcome |
|------|------------|--------------|---------|
| Tsirons et al\cite{50}, 2008 | n = 47 adolescents with overweight or obesity | CBT vs no-treatment | Greater improvements in weight, BMI, body fat, sugar intake (soft drinks) in CBT group at 20-wk follow-up |
| Welschen et al\cite{51}, 2013 | n = 154 diabetes patients | CBT vs managed care | Greater improvement in physical activity, quality of life, and depression in CBT group at 6-mo follow-up; no group differences at 12-mo follow-up |
| Freedland et al\cite{52}, 2009 | n = 123 CABG patients with depression | CBT vs supportive stress management | Greater depression remission in CBT than supportive stress management group at 3-mo and 9-mo follow-up |
| Berkman et al\cite{53}, 2009 | n = 2481 MI patients | CBT vs usual care | Greater improvement in depression and social support in CBT group at 6-mo follow-up; no group differences in survival at 29-mo follow-up |
| Woolard et al\cite{54}, 1995 | n = 166 patients with hypertension | MI low dose vs MI high dose vs usual care | Greater improvements in alcohol and salt intake in low-MI vs usual care; greater improvements in weight and blood pressure in high-MI vs usual care at 18-wk follow-up |
| Ma et al\cite{55}, 2014 | n = 120 Chinese patients with hypertension | MI vs usual care | Greater improvements in treatment adherence and blood pressure in MI group |
| Ogedegbe et al\cite{56}, 2008 | n = 190 African American patients with hypertension | MI vs usual care | Greater improvements in medication adherence and blood pressure in the MI group at 12-mo follow-up |
| Cain et al\cite{57}, 2011 | n = 104 adolescents | MI and sleep education vs no intervention | Greater improvements in sleep knowledge and out-of-bed time in MI group; improvements in sleep and daytime functioning in both groups |

BMI: Body mass index; CABG: Coronary artery bypass graft; CBT: Cognitive behavioral therapy; MI: Motivational interviewing.
received increased attention for improving cardiac health behaviors and outcomes. Mind-body interventions encompass a range of techniques that aim to unite the body and mind to promote well-being, such as progressive muscle relaxation, meditation, yoga, and tai chi. Mindfulness is a specific approach that involves paying attention to present moment experiences with an attitude of openness, non-judgment, and curiosity[69]. A large body of research supports the efficacy of mind-body interventions, particularly mindfulness-based interventions that incorporate elements of CBT (e.g., mindfulness-based stress reduction, mindfulness-based cognitive therapy) for improving a range of physical and mental health outcomes (e.g., Hofmann et al[70], 2010).

Mindfulness-based interventions may improve cardiac health behaviors. Recent systematic reviews have concluded that mindfulness interventions promote smoking cessation[71] and healthy eating[72]. Evidence for improvements in sleep is somewhat limited, with a systematic review finding few randomized controlled trials and no significant between-group differences in sleep outcomes, but a significant correlation between amount of mindfulness meditation practice and improved sleep[73]. Subsequent RCTs, however, have found significant effects of mindfulness training on insomnia[74]. There has been less research using mindfulness-based interventions to promote physical activity, though there is some evidence to suggest that mindfulness training can increase physical activity in healthy young adults[29] and CVD patients[76], and that the ability to be mindful during daily life in general (i.e., trait mindfulness) might increase physical activity levels by making activity seem more satisfying[77].

Mindfulness-based interventions have also been associated with improved health outcomes in patients with and at risk for CVD. Research suggests that mindfulness training can promote weight loss among patients with obesity[78]; improve disease management and HbA1c levels among patients with diabetes[79]; and improve coping and blood pressure in patients with hypertension[80]. A systematic review among individuals with CVD or other risk factors (e.g., hypertension and diabetes patients) found significant improvements in stress, depression, anxiety, and quality of life following mindfulness interventions; however, similar to studies of CBT, effects on physical health outcomes were less consistent[81]. Among CVD patients specifically, a systematic review of 11 RCTs of mind-body practices found significant improvements in depression, anxiety, and QoL, though these studies were found to be of overall low quality[82]. Mindfulness-based interventions have also been integrated into cardiac rehabilitation programs[83], and several studies suggest that meditation, tai chi, and yoga may be useful for improving health outcomes in heart failure patients[84-85]. Indeed, a systematic review of 29 trials (9 RCTs) found that tai chi is associated with reduced blood pressure and exercise capacity in patients with CVD and risk factors[86]. Further research on mind-body interventions for CVD risk behaviors and outcomes is needed, though providers should be aware that existing mind-body approaches may be useful for cardiovascular outcomes.

**Positive psychological interventions for health behavior and cardiac outcome improvement**

There has been increasing interest in the use of positive psychology (PP) interventions that aim to boost positive emotional experiences and cognitive processes through the use of simple tasks focusing on positive psychological constructs, such as optimism and positive affect. These positive constructs have been shown to correlate with improved adherence to cardiac health behaviors, such as physical activity[77-78], diet[89-90], and medication adherence[91]. They have further been associated with improved rates of heart disease and cardiac mortality[92-94]. Specific PP exercises found effective in medically healthy persons include recalling and discussing positive events, identifying and deliberately using personal strengths, and planning and performing acts of kindness[95-96].

PP interventions are simple for patients and do not require extensive provider training, raising the attractive possibility of a cost-effective and efficient means of improving mood and cardiac health behaviors. Despite this, there has been limited study of PP-based interventions to promote health behaviors, improve sleep, or reduce cardiac events or mortality. PP interventions have been applied in studies of T2D[72] and immunodeficiency virus[97], and a meta analysis has shown that their successful implementation leads to improvements in psychological outcomes[98]. Positive psychology interventions focused on gratitude have also promoted improvement in sleep hours and quality in patients with neuromuscular disease[99].

Among patients with existing CVD, there is a small literature on PP interventions[100-103], generally finding that such interventions are well-accepted and have beneficial effects on both positive and negative psychological states[101-106]. Additionally, randomized controlled trials of positive affect interventions have shown increased medication adherence in hypertensive patients[104] and improved physical activity in patients post-percutaneous coronary intervention[105]. Furthermore, combining PP with established health behavior interventions could provide additional benefit, building on the literature showing that PP exercises lead to increases in self-efficacy, confidence, and interpersonal connectedness[105-106] and findings that these same characteristics can improve engagement in health behavior interventions[107].

**Management of mental health conditions/care management**

Additional novel approaches to modifying health behaviors via mental health-related interventions may include care management programs for patients with psychiatric conditions. Depression and other psychiatric syndromes are common in patients with, or at risk for,
CVD\textsuperscript{[114,115]}, and they can be identified via systematic screening in clinical cardiology settings\textsuperscript{[116]}. Patients with depression and related conditions are at substantially elevated risk for nonadherence, including nonadherence to cardiac health behaviors\textsuperscript{[114-116]}. Given the high prevalence and substantial impact of these psychiatric conditions, utilizing population-based interventions to efficiently manage these conditions is a promising approach to improving psychiatric symptoms, health behavior adherence, and overall cardiac risk in the largest number of patients. For example, “collaborative care” interventions utilize a non-physician care manager (often a nurse) to assess and longitudinally monitor psychiatric conditions for patients in inpatient and outpatient medical settings\textsuperscript{[117,118]}. The care manager can also provide psychotherapeutic interventions and support to patients, and receives psychiatric medication recommendations when indicated from a team psychiatrist. These medication recommendations are conveyed to primary care physicians, who then prescribe all medications. This allows a large number of patients to receive ongoing and expert management of psychiatric care, while maintaining such care within their existing medical home.

Collaborative care interventions have been found to be effective in improving psychiatric symptoms in over 90 prior trials\textsuperscript{[117]}. This includes several prior trials in patients with CVD or cardiac risk factors (e.g., diabetes)\textsuperscript{[118-124]}, with beneficial effects on depression and/or anxiety symptoms. They have not typically included specific interventions to improve sleep or other health behaviors, and they have had more mixed effects on adherence, with some trials finding improvement in adherence to health behaviors (e.g., diet, exercise, and medication adherence)\textsuperscript{[120,122]}, while others have not measured effects on adherence or found no significant change. Effects on cardiovascular outcomes have similarly been mixed, though an analysis of the large IMPACT trial of collaborative care found that the intervention was associated with lower risk of cardiovascular events among those participants with no CVD at the outset of the trial\textsuperscript{[126]}.

One promising approach to improving behavioral and cardiovascular outcomes is a “blended” collaborative care management approach that utilizes a nurse care manager to address depression, health behaviors, and medical targets (e.g., blood pressure) in patients with medical illness. The TEAMCare randomized trial tested such an approach in patients with diabetes or coronary artery disease, and found that such an intervention lead to improved medical outcomes, including hemoglobin A1c and blood pressure, using this combined psychiatric, behavioral, and medical approach\textsuperscript{[127,129]}. The COMPASS project then implemented this intervention in 172 real-world clinics among 3609 patients\textsuperscript{[128,129]}. Overall 40% had depression remission or response, one-quarter met criteria for control of blood glucose, and nearly 60% met criteria for blood pressure control, impressive findings for real-world implementation in a complex population.

CONCLUSION

The importance of sleep as a health behavior to lower the risk of CVD in adults has not been widely studied. With recent guidelines shedding light on the importance of adults maintaining adequate sleep (defined as at least seven hours) for optimal health and the growing number of Americans not meeting this recommendation, future research needs to include sleep when assessing CVD risk factors and intervention targets. Research to date has primarily focused on other health behaviors including diet, physical activity, and sedentary time. Many of these interventions have focused on one health behavior, rather than changing multiple behaviors, despite the fact that these behaviors tend to be inter-related. The same theories and intervention strategies used to change individual health behaviors, including CBT, MI, mindfulness and mind-body interventions, and PP-based interventions, could be adapted to promote all relevant health behaviors as we have outlined in this review. Further, moving toward blended collaborative care models may be a promising approach to improve health behaviors in those with psychiatric conditions. Such interventions that focus on psychological status, health behaviors, and medical targets may indeed hold substantial promise to modify sleep and other health behaviors to reduce cardiac risk.

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REFERENCES

1. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, Dinges DF, Gangwisch J, Grandner MA, Kushida C, Malhotra RK, Martin JL, Patel SR, Quan SF, Tasali E. Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult: Methodology and Discussion. J Clin Sleep Med 2015; 11: 931-952 [PMID: 26235159 DOI: 10.5664/jcsm.4950]
2. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, Dinges DF, Gangwisch J, Grandner MA, Kushida C, Malhotra RK, Martin JL, Patel SR, Quan SF, Tasali E. Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult: Methodology and Discussion. J Clin Sleep Med 2015; 38: 1161-1183 [PMID: 26194576 DOI: 10.5665/sleep.4886]
3. CDC Sleep and Sleep Disorders Program. 1 in 3 adults don’t get enough sleep U.S. Department of Health and Human Services, 2016. Available from: URL: http://www.cdc.gov/media/releases/2016/ p0215-enough-sleep.html
4. Liu Y, Wheaton AG, Chapman DP, Cunningham TJ, Lu H, Croft JB. Prevalence of Healthy Sleep Duration among Adults—United States, 2014. MMWR Mortal Mortal Wkly Rep 2016; 65: 137-141 [PMID: 2690214 DOI: 10.15585/mmwr.mm6506a1]
5. Grandner MA, Chakravorty S, Petlis ML, Oliver L, Gurubhagavatula I. Habitual sleep duration associated with self-reported...
and objectively determined cardiometabolic risk factors. Sleep Med 2014; 15: 42-50 [PMID: 24333222 DOI: 10.1016/j.sleep.2013.09.012]

6. Sterr ON, Mirel JP, Grandner MA, Brown D, Conroy MB, Jean-Louis G, Coons M, Bhattacharyya D. Sleep Duration and Quality: Impact on Lifestyle Behaviors and Cardiometabolic Health: A Scientific Statement From the American Heart Association. Circulation 2016; 134: e367-e386 [PMID: 27647451 DOI: 10.1161/circulationaha.116.00000000444]

7. Grandner MA, Alfonso-Miller P, Fernandez-Mendoza J, Shetty S, Shenoy S, Combs D. Sleep: important considerations for the prevention of cardiovascular disease. Curr Opin Cardiol 2016; 31: 551-565 [PMID: 27467177 DOI: 10.1097/hco.0000000000000224]

8. Hoenen-Blaom MP, Spijkerman AM, Kromhout D, Verschuren WM. Sufficient sleep duration contributes to lower cardiovascular disease risk in addition to four traditional lifestyle factors: the MORGEN study. Eur J Prev Cardiol 2014; 21: 1367-1375 [PMID: 23823570 DOI: 10.1177/2047487314539057]

9. Center for Disease Control. Underlying Cause of Death 1999-2013 on CDC WONDER Online Database, 2015

10. Grandner MA, Seixas A, Shetty S, Shenoy S. Sleep Duration and Diabetes Risk: Population Trends and Potential Mechanisms. Curr Diab Rep 2016; 16: 106 [PMID: 27660439 DOI: 10.1007/s11921-016-0805-8]

11. Dean E, Bloom A, Cirillo M, Hong Q, Jawl B, Judges N, Nijjar M, Sadovich S, Bruno SS. Association between habitual sleep duration and blood pressure and clinical implications: a systematic review. Blood Press 2012; 21: 45-57 [PMID: 21780953 DOI: 10.3109/08037051.2011.596320]

12. Gangwisch JE. A review of evidence for the link between sleep duration and hypertension. Am J Hypertens 2014; 27: 1235-1242 [PMID: 24778107 DOI: 10.1093/ajh/hpu071]

13. Wang Q, Xi B, Liu M, Zhang Y, Fu M. Short sleep duration is associated with hypertension risk among adults: a systematic review and meta-analysis. Hypertens Res 2012; 35: 1012-1018 [PMID: 22763475 DOI: 10.1086/hr.2012.911]

14. Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, Miller MA. Meta-analysis of short sleep duration and obesity in children and adults. Sleep 2008; 31: 619-626 [PMID: 18517032]

15. Patel SR, Malhotra A, White DP, Gottlieb DJ, Hu FB. Association between reduced sleep and weight gain in women. Am J Epidemiol 2006; 164: 947-954 [PMID: 16914506 DOI: 10.1093/aje/kwj020]

16. Anothaisintawee T, Reutrakul S, Van Cauter E, Tasali E, Brady MJ. Impaired insulin signaling in human adipocytes after experimental sleep deprivation on inflammatory markers in healthy young adults. PLoS One 2012; 7: e4859 [PMID: 19240794 DOI: 10.1371/journal.pone.0048599]

17. Ford ES, Wheaton AG, Chapman DP, Li C, Perry GS, Croft JB. Associations between self-reported sleep duration and sleeping disorder with concentrations of fasting and 2-h glucose, insulin, and glycosylated hemoglobin among adults without diagnosed diabetes. J Diabetes 2014; 6: 338-350 [PMID: 24164804 DOI: 10.1111/jmds.121017]

18. Broussard JL, Ehrmann DA, Van Cauter E, Tassali E, Brady MJ. Impaired insulin signaling in human adipocytes after experimental sleep restriction: a randomized, crossover study. Ann Intern Med 2012; 157: 549-557 [PMID: 23070488 DOI: 10.7326/m3-4819-9-15-7-8-20120160-00005]

19. Madsen L, Donalhue RP, Stranges S, Lamontje MJ, Dmochowski J, Dean J, Trevisan M. Short sleep duration is associated with the development of impaired fasting glucose: the Western New York Health Study. Ann Epidemiol 2010; 20: 833-889 [PMID: 20620078 DOI: 10.1016/j.annepidem.2010.05.002]

20. Lander JB, Bury DC, Richardson SW. Diet and Physical Activity for Cardiovascular Disease Prevention. Am Fam Physician 2016; 93: 919-924 [PMID: 27281836]

21. Sofi F, Abbate R, Gensini GF, Casini A. Accruing evidence on benefits of adherence to the Mediterranean diet on health: an updated systematic review and meta-analysis. J Am Coll Cardiol 2010; 92: 1189-1196 [PMID: 20810976 DOI: 10.3945/ajcc.2010.29673]

22. Eckel RH, Jiacicim JC, Ard JD, de Jesus JM, Houston Miller N, Hubbard VS, Lee IM, Lichtenstein AH, Loria CM, Millen BE, Nonas CA, Sacks FM, Smith SC, Svetkey LP, Wadden TA, Yanovski SZ. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014; 63: 2960-2984 [PMID: 24239922 DOI: 10.1016/j.jacc.2013.11.003]

23. Eveson KR, Wen F, Herring AH. Associations of Accelerometry-Assessed and Self-Reported Physical Activity and Sedentary Behavior With All-Cause and Cardiovascular Mortality Among US Adults. Am J Epidemiol 2016; 184: 621-632 [PMID: 27760774 DOI: 10.1093/aje/kww070]

24. Cassidy S, Chau JY, Cat M, Bauman A, Treml MJ. Cross-sectional study of diet, physical activity, television viewing and sleep duration in 233,110 adults from the UK Biobank; the behavioural phenotype of cardiovascular disease and type 2 diabetes. BMJ Open 2016; 6: e001038 [PMID: 27008686 DOI: 10.1136/bmjopen-2015-010038]

25. Moyer VA. Behavioral counseling interventions to promote a healthful diet and physical activity for cardiovascular disease prevention in adults: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2012; 157: 367-371 [PMID: 22733153 DOI: 10.7326/m3-819-1575-20120904-00486]

26. Conley S, Redeker NS. Cognitive Behavioral Therapy for Insomnia in the Context of Cardiovascular Conditions. Curr Sleep Med Rep 2015; 1: 157-165 [PMID: 26500835 DOI: 10.1007/s40675-015-0019-7]

27. Trockel M, Manber R, Chang V, Thurstorn A, Taylor CB. An e-mail delivered CBT for sleep-health program for college students: effects on sleep quality and depression symptoms. J Clin Sleep Med 2011; 7: 277-281 [PMID: 21677808 DOI: 10.5666/jcsm.1072]

28. Rapee R, Clark M, Wardle J. Evaluation of a modified cognitive-behavioural programme for weight management. Int J Obes Relat Metab Disord 2004; 28: 1767-1737 [PMID: 11126231]

29. Stead LF, Lancaster T. Behavioural interventions as adjuncts to pharmacotherapy for smoking cessation. Cochrane Database Syst Rev 2012; 12: CD009670 [PMID: 23235680 DOI: 10.1002/14651858.CD009670.pub2]

30. Tsirou MD, Sinn N, Brennan L, Coates AM, Walkley JW, Petkov J, Howe PR, Buckley JD. Cognitive behavioral therapy improves diet and body composition in overweight and obese adolescents. Am J Clin Nutr 2008; 87: 134-140 [PMID: 18469231]

31. Welschen LM, van Opper P, Bot SD, Kostense PJ, Dekker JM, Nijpels G. Effects of a cognitive behavioural treatment in patients with type 2 diabetes when added to managed care; a randomised controlled trial. J Behav Med 2013; 36: 556-566 [PMID: 23054175 DOI: 10.1007/s10865-012-9451-2]

32. Schneider JK, Mercer GT, Herring M, Smith CA, Pryskak MD. Promoting exercise behavior in older adults: using a cognitive behavioral intervention. J Gerontol Nurs 2004; 30: 45-53 [PMID: 15109047]

33. Celano CM, Daunis DJ, Lokko HN, Campbell KA, Huffman JC. Anxiety Disorders and Cardiovascular Disease. Curr Psychiatry Rep 2016; 18: 101 [PMID: 27671918 DOI: 10.1007/s11920-016-0739-5]
Huffman JC, Celano CM, Beach SR, Motwali SR, Januzzi JL. Depression and cardiac disease: epidemiology, mechanisms, and diagnosis. *Cardiovasc Psychiatry Neurol* 2013; 2013: 695925

Beresnevitsë M, Benetis R, Taylor GJ, Rasinskiéne S, Stankus A, Kinduris S. Impact of a Cognitive Behavioral Intervention on Health-Related Quality of Life and General Heart Rate Variability in Patients Following Cardiac Surgery: An Effectiveness Study. *Psychosomatics* 2016; 57: 605-615 [PMID: 27452635 DOI: 10.1016/j.pysm.2016.04.004]

Freedland KE, Skala JA, Carney RM, Rubin EH, Lustman PJ, Dávila-Román VG, Steinmeyer BC, Hogue CW. Treatment of depression after coronary artery bypass surgery: a randomized controlled trial. *Arch Gen Psychiatry* 2009; 66: 387-396 [PMID: 19349308 DOI: 10.1001/archgenpsychiatry.2009.7]

Ghos RK, Ball S, Prasad V, Gupta A. Depression in heart failure: Intricate relationship, pathophysiology and most updated evidence of interventions from recent clinical studies. *Int J Cardiol* 2016; 224: 170-177 [PMID: 27657469 DOI: 10.1016/j.ijcard.2016.09.063]

Mendes de Leon CF, Czajkowski SM, Freedland KE, Bang H, Powell LH, Wu C, Burg MM, DiIlio V, Ironson G, Krumholz HM, Mitchell P, Blumenthal JA. The effect of a psychosocial intervention and quality of life after acute myocardial infarction: the Enhancing Recovery in Coronary Heart Disease (ENRICHD) clinical trial. *J Cardiopulm Rehabil* 2006; 26: 9-13; quiz 14-15 [PMID: 16617220]

O’Neill A, Taylor B, Hare DL, Sanderson K, Cyril S, Venugopal K, Chan B, Atherton JJ, Hawkes A, Walters DL, Oldenburg B. Long-term efficacy of a tele-health intervention for acute coronary syndrome patients with depression: 12-month results of the MoodCare randomized controlled trial. *Eur J Prev Cardiol* 2015; 22: 111-1120 [PMID: 25159700 DOI: 10.1177/2047487314547655]

Ski CF, Jelinek M, Jackson AC, Murphy BM, Thompson DR. Psychosocial interventions for patients with coronary heart disease and depression: A systematic review and meta-analysis. *Eur J Cardiovasc Nurs* 2016; 15: 305-316 [PMID: 26475227 DOI: 10.1177/1474551156132004]

Whalley B, Thompson DR, Taylor RS. Psychological interventions for coronary heart disease: cochrane systematic review and meta-analysis. *Int J Behav Med* 2014; 21: 109-121 [PMID: 23179678 DOI: 10.1007/s12529-012-9282-x]

Dickens C, Cherrington A, Adeyemi I, Roughley K, Bower P, Garrett C, Bundy C, Coventry P. Characteristics of psychological interventions that improve depression in people with coronary heart disease: a systematic review and meta-regression. *Psychosom Med* 2013; 75: 211-222 [PMID: 23324874 DOI: 10.1097/PSY.0b10033e80277700]

Lightman JH, Froelicher ES, Blumenthal JA, Carney RM, Doering LV, Frasure-Smith NE, Freedland KE, Jaffe AS, Leifheit-Limson EC, Sheps DS, Vaccarino V, Wulsin LS. Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: systematic review and recommendations: a scientific statement from the American Heart Association. *Circulation* 2014; 129: 1350-1369 [PMID: 24566260 DOI: 10.1161/CIR.0000000000000197]

Sung J, Woo JM, Kim W, Lim SK, Chung EJ. The effect of cognitive behavior therapy-based “forest therapy” program on hypertensive patients. *Clin Exp Hypertens* 2016; 38: 518-526 [PMID: 27063622 DOI: 10.1080/21633836.2015.1111320]

Lee P, Park K, Kim MS, Kim Y, Oh SS, Yang JY. A randomized controlled trial of cognitive behavioral therapy vs standard treatment to prevent recurrent cardiovascular events in patients with coronary heart disease: Secondary Prevention in Uppsala Primary Health Care project (SUPRIM). *Arch Intern Med* 2011; 171: 134-140 [PMID: 21263103 DOI: 10.1001/archinternmed.2010.510]

Lundgren JG, Dahlström O, Andersson G, Jaarsma T, Kärner Kjellberg C, Johansson P. The Effect of Guided Web-Based Cognitive Behavioral Therapy on Patients With Depressive Symptoms and Heart Failure: A Pilot Randomized Controlled Trial. *J Med Internet Res* 2016; 18: e194 [PMID: 27489077 DOI: 10.2196/jmir.5556]

Conway A, Sheridan J, Maddicks-Law J, Fulbrook P. Pilot testing a model of psychological care for heart transplant recipients. *BMC Nurs* 2016; 15: 62 [PMID: 27799849 DOI: 10.1186/s12912-016-0183-1]

Huffman JC, Celano CM. Depression in cardiovascular disease: From awareness to action. *Trends Cardiovasc Med* 2015; 25: 623-624 [PMID: 25910599 DOI: 10.1016/j.tcm.2015.02.007]

Miller WR, Rollnick S. Motivational interviewing: Preparing people for change, 3rd edition. New York, NY: Guilford Press, 2012.

Woollard J, Beilin L, Lord T, Puddey I, MacAdam D, Rouleau J. A controlled trial of nurse counselling on lifestyle change for hypertensives treated in general practice: preliminary results. *Clin Exp Pharmacol Physiol* 1995; 22: 466-468 [PMID: 8582105]

Ingersoll KS, Banton T, Gorlin E, Vajda K, Singh H, Petersen N, Gonder-Frederick L, Cox DJ. Motivational Interviewing Support for a Behavioral Health Internet Intervention for Drivers with Type 1 Diabetes. *Internet Inter* 2015; 2: 103-109 [PMID: 25774342 DOI: 10.1001/jamainternal.2015.02.001]

Kealey KA, Ludman EJ, Marek PM, Mann SL, Bricker JB, Peterson AV. Design and implementation of an effective telephone counseling intervention for adolescent smoking cessation. *J Natl Cancer Inst* 2009; 101: 1393-1405 [PMID: 19822837 DOI: 10.1093/jnci/djp318]

Avery L, Flynn D, van Wersch A, Sniechotta FF, Trenell MI. Changing physical activity behavior in type 2 diabetes: a systematic review and meta-analysis of behavioral interventions. *Diabetes Care* 2012; 35: 2681-2689 [PMID: 23173137 DOI: 10.2337/dc11-2452]

Ma C, Zhou Y, Zhou W, Huang C. Evaluation of the effect of motivational interviewing counselling on hypertension care. *Patient Educ Couns* 2014; 95: 231-237 [PMID: 24530144 DOI: 10.1016/j.pec.2014.01.011]

Ogedegbe G, Chaplin W, Schoenthaler A, Stamatou D, Berger D, Richardson T, Phillips E, Spence J, Allegante JP. A practice-based trial of motivational interviewing and adherence in hypertensive African Americans. *Am J Hypertens* 2008; 21: 1137-1143 [PMID: 18654123 DOI: 10.1038/ajh.2008.240]

Conn VS, Rupper TM, Chase JA, Enriquez M, Cooper PS. Interventions to Improve Medication Adherence in Hypertensive Patients: Systematic Review and Meta-analysis. *Curr Hypertens Rep* 2017; 19: 94 [PMID: 26560139 DOI: 10.1007/s11906-015-0666-5]

Ren Y, Yang H, Browning C, Thomas S, Liu M. Therapeutic effects of motivational interviewing on blood pressure control: a meta-analysis of randomized controlled trials. *Int J Cardiol* 2014; 172: 509-511 [PMID: 24485630 DOI: 10.1016/j.ijcard.2014.01.051]

Lindson-Hawley N, Thompson TP, Begh R. Motivational interviewing for smoking cessation. *Cochrane Database Syst Rev* 2015; 3: CD006936 [PMID: 25726920 DOI: 10.1002/14651858.CD006936.pub3]

Rash JA, Lavoie KL, Sigal RJ, Campbell DJ, Manns BJ, Tonelli M, Campbell TS. The OPTIMIZE trial: Rationale and design of a randomized controlled trial of motivational enhancement therapy to improve adherence to statin medication. *Contemp Clin Trials* 2016; 49: 47-56 [PMID: 27282119 DOI: 10.1016/j.cct.2016.06.001]

Gianos E, Schoenthaler A, Mushailov M, Fisher EA, Berger JS. Rationale and design of the Investigation of Motivational Interviewing and Prevention Consults to Achieve Cardiovascular...
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Kaar JL et al. Health behaviors and CVD risk

Targets (IMPACT) trial. *Am Heart J* 2015; 170: 430-7.e9 [PMID: 26385025 DOI: 10.1016/j.ahj.2015.06.001]

Bayley A, de Zoya N, Cook DG, Whincup PH, Stahl D, Twist K, Ridge K, McCrone P, Treasure J, Ashworth M, Greenough A, Blyth C, Winkley K, Ismail K. Connectedness of an enhanced MOTiVational IntErviewing InTervention (MOVE IT) with usual care for reducing cardiovascular risk in high risk subjects: study protocol for a randomised controlled trial. *Trials* 2015; 16: 112 [PMID: 25886569 DOI: 10.1186/s13063-015-0593-5]

Willergerodt MA, Kreekheer GM, Ward TM, Lentz MJ. Feasibility of using actigraphy and motivation-based interviewing to improve sleep among school-age children and their parents. *J Sch Nurs* 2014; 30: 136-148 [PMID: 23686941 DOI: 10.1177/1059840513489711]

Cain N, Gradisar M, Moseley L. A motivational school-based intervention for adolescent sleep problems. *Sleep Med* 2011; 12: 246-251 [PMID: 21292553 DOI: 10.1016/j.sleep.2010.06.008]

Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, Segal ZV, Abbey S, Speca M, Velting D, Devins G. Mindfulness: a proposed operational definition. *Clin Psychol Sci Pract* 2004; 11: 230-243.

Hofman SG, Sawyer AT, Witt AA, Oh D. The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *J Consult Clin Psychol* 2010; 78: 169-183 [PMID: 20350028 DOI: 10.1037/a0018555]

Oikonomou MT, Arvanitis M, Sokolove RL. Mindfulness training for smoking cessation: A meta-analysis of randomized-controlled trials. *J Health Psychol* 2016; 21: 656-662 [PMID: 25139712a [DOI: 10.1177/1359107014556720]

Katterman SN, de Zoysa N, Cook DG, Whincup PH, Stahl D, Twist MG. Mind-body practices for patients with cardiac disease: a systematic review and meta-analysis. *Eur J Prev Cardiol* 2015; 22: 1385-1398 [PMID: 25227551 DOI: 10.1177/2047487314549927]

Griffiths K, Camic PM, Hutton JM. Participant experiences of a mindfulness-based cognitive therapy group for cardiac rehabilitation. *J Health Psychol* 2009; 14: 675-681 [PMID: 19515682 DOI: 10.1177/1359105309104911]

Howie-Esquivel J, Lee J, Collier G, Mehling W, Fleischmann K. Yoga in heart failure patients: a pilot study. *J Card Fail* 2016; 22: 742-749 [PMID: 20797598 DOI: 10.1016/j.cardfail.2010.04.011]

Yeh GY, Chan CW, Wayne PM, Conboy L. The Impact of Tai Chi Exercise on Self-Efficacy, Social Support, and Empowerment in Heart Failure: Insights from a Qualitative Sub-Study from a Randomized Controlled Trial. *PLoS One* 2016; 11: e0154678 [PMID: 22170741 DOI: 10.1371/journal.pone.0154678]

Yeh GY, McCarthy EP, Wayne PM, Stevenson LW, Wood MJ, Forman D, Davis RB, Phillips RS. Tai chi exercise in patients with chronic heart failure: a randomized clinical trial. *Arch Intern Med* 2011; 171: 750-757 [PMID: 21518942 DOI: 10.1001/archinternmed.2011.150]

Yeh GY, Wang C, Wayne PM, Phillips R. Tai chi exercise for patients with cardiovascular conditions and risk factors: A SYSTEMATIC REVIEW. *J Cardiopulm Rehabil Prev* 2009; 29: 152-160 [PMID: 19471133 DOI: 10.1097/HCR.0b013e3181a33379]

Steptoe A, Wright C, Kunz-Ebrecht SR, Iliffe S. Dispositional optimism and health behaviour in community-dwelling older people: associations with healthy ageing. *Br J Health Psychol* 2006; 11: 71-84 [PMID: 16480556 DOI: 10.1348/135910705X42850]

Celman CM, Beale EE, Moore SV, Wexler DJ, Huffman JC. Positive psychological characteristics in diabetes: a review. *Curr Diab Rep* 2013; 13: 917-929 [PMID: 24048687 DOI: 10.1007/s11892-013-0430-8]

Kelleniemi H, Ek E, Laitinen J. Optimism, dietary habits, body mass index and smoking among young Finnish adults. *Appetite* 2005; 45: 169-176 [PMID: 16009454 DOI: 10.1016/j.appet.2005.05.001]

GilTay EJ, Geleijse JM, Zitman FG, Buijsse B, Kromhout D. Lifestyle and dietary correlates of dispositional optimism in men: The Zutphen Elderly Study. *J Psychosom Res* 2007; 63: 483-490 [PMID: 17980220 DOI: 10.1016/j.jpsychores.2007.07.014]

Leedham B, Meyerowitz BE, Muirhead J, Frist WH. Positive expectations predict health after heart transplantation. *Health Psychol* 1995; 14: 74-79 [PMID: 7737077]

Rasmussen HW, Scheier MF, Greenhouse JB. Optimism and physical health: a meta-analytic review. *Ann Behav Med* 2009; 37: 239-256 [PMID: 19711142 DOI: 10.1007/s12160-009-9111-x]

Tindle HA, Chang YF, Kuller LH, Manson JE, Robinson JG, Rosal MC, Siegel GI, Matthews KA. Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women’s Health Initiative. *Circulation* 2009; 120: 656-662 [PMID: 19667234]

DuBois CM, Lopez OV, Beale EE, Healy BC, Boehm JK, Huffman JC. Relationships between positive psychological constructs and health outcomes in patients with cardiovascular disease: A systematic review. *Int J Cardiol* 2015; 195: 265-280 [PMID: 26048390 DOI: 10.1016/j.ijcard.2015.05.121]

Selgman ME, Steen TA, Park N, Peterson C. Positive psychology progress: empirical validation of interventions. *Am Psychol* 2005; 60: 410-421 [PMID: 16045394 DOI: 10.1037/0003-066X.60.5.410]

Lyubomirsky S, King L, Diner E. The benefits of frequent positive affect: does happiness lead to success? *Psychol Bull* 2005; 131: 803-855 [PMID: 16351326 DOI: 10.1037/0033-2909.131.6.803]

Cohn MA, Pietrucha ME, Sasaki LR, Hult JR, Moskowitz JT. An online positive affect skills intervention reduces depression in adults with type 2 diabetes. *J Posit Psychol* 2014; 9: 523-534 [PMID: 25214877 DOI: 10.1080/17439760.2014.920410]

Moskowitz JT, Hult JR, Duncan LG, Cohn MA, Maurer S, Bussohari C, Acree M. A positive affect intervention for people experiencing health-related stress: development and non-randomized pilot test. *J Health Psychol* 2012; 17: 676-692 [PMID: 22021272 DOI: 10.1177/1359105311425275]
May 26, 2017 | Volume 9 | Issue 5

Sin NL, Lybomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. *J Clin Psychol* 2009; 65: 467-487 [PMID: 19302141 DOI: 10.1002/jclp.20593]

Emmons RA, McCullough ME. Counting blessings versus burdens: an experimental investigation of gratitude and subjective well-being in daily life. *J Pers Soc Psychol* 2003; 84: 377-389 [PMID: 12588511 DOI: 10.1037/0022-3514.84.2.377]

Huffman JC, Mastromauro CA, Boehm JK, Seabrook R, Fricchione GL, Denninger JW, Lybomirsky S. Development of a positive psychology intervention for patients with acute cardiovascular disease. *Heart* Jul 2011; 6: e14 [PMID: 23857411]

Huffman JC, Albanese AM, Campbell KA, Celano CM, Milstein RA, Mastromauro CA, Healy BC, Chung WJ, Januzzi JL, Collins LM, Park ER. The Positive Emotions after Acute Coronary Events behavioral health intervention: Design, rationale, and preliminary feasibility of a factorial design study. *Clin Trials* 2016: 1740775416637365 [PMID: 28079394]

Huffman JC, Milstein RA, Mastromauro CA, Moore SV, Celano CM, Bedoya CA, Suarez L, Boehm JK, Januzzi JL. A Positive Psychology Intervention for Patients with an Acute Coronary Syndrome: Treatment Development and Proof-of-Concept Trial. *J Happiness Stud* 2016; 17: 1985-2006 [PMID: 28082831]

Ogedegbe GO, Boutin-Foster C, Wells MT, Allegretta JP, Isen AM, Joe B, Charlson ME. A randomized controlled trial of positive-affect intervention and medication adherence in hypertensive African Americans. *Arch Intern Med* 2012; 172: 322-326 [DOI: 10.1001/archinternmed.2011.1307]

Peterson JC, Carlson ME, Hoffman Z, Wells MT, Wong SC, Hollenberg JP, Joe B, Boschart K, Isen AM, Allegretta JP. A randomized controlled trial of positive-affect induction to promote physical activity after percutaneous coronary intervention. *Arch Intern Med* 2012; 172: 329-336 [PMID: 22269589 DOI: 10.1001/archinternmed.2011.1311]

Smeets E, Neff K, Alberts H, Peters M. Meeting suffering with kindness: effects of a brief self-compassion intervention for female college students. *J Clin Psychol* 2014; 70: 794-807 [PMID: 24691680 DOI: 10.1002/jclp.22076]

Fredrickson BL, Cohn MA, Coffey KA, Pek J, Finkel SM. Open hearts build lives: positive emotions, induced through loving-kindness meditation, build consequential personal resources. *J Pers Soc Psychol* 2008; 95: 1045-1062 [PMID: 18954193 DOI: 10.1037/a0013262]

Lyubomirsky S, Layous K. How do simple positive activities increase well-being? *Curr Dir Psychol Sci* 2013; 22: 57-62 [DOI: 10.1177/0963721412469000]

Joseph CL, Archer J, Gerszten K. Moderators of interventions designed to enhance positive affect in African Americans. *Arch Intern Med* 2016; 176: 67-73 [PMID: 26746419 DOI: 10.1001/jama.2015.17299]

Katon WJ, Von Korff M, Lin EH, Simon G, Ludman E, Russo J, Ciechanowski P, Walker E, Bush T. The Pathways Study: a randomized trial of collaborative care in patients with diabetes and depression. *Arch Gen Psychiatry* 2004; 61: 1042-1049 [PMID: 15466678 DOI: 10.1001/archpsyc.61.10.1042]

Huffman JC, Mastromauro CA, Sowden G, Fricchione GL, Healy BC, Januzzi JL. Impact of a depression care management program for hospitalized cardiac patients. *Circ Cardiovasc Qual Outcomes* 2011; 4: 198-205 [PMID: 21386067 DOI: 10.1161/CIRCOUTCOMES.110.959379]

Davidson KW, Bigger JT, Burg MM, Carney RM, Chaplin WF, Czajkowski S, Dornelas E, Duer-Hefele J, Frasure-Smith N, Freedland KE, Haas DC, Jaffe AS, Ladapo JA, Lespérance F, Medina V, Newman JD, Osario GA, Parsons F, Schwartz JE, Shaffer JA, Shapira PA, Sheps DS, Vaccarino V, Whang W, Ve S. Centralized, stepped, patient preference-based treatment for patients with post-acute coronary syndrome depression: CODIACS vanguard randomized controlled trial. *JAMA Intern Med* 2013; 173: 997-1004 [PMID: 23474120 DOI: 10.1001/jamainternmed.2013.915]

Rollman BL, Belnap BH, LeMenager MS, Mazumdar S, Houck PR, Cournihan JP, Kapoor WN, Schulberg HC, Reynolds CF. Telephone-delivered collaborative care for treating post-AVC BDI depression: a randomized controlled trial. *JAMA* 2009; 302: 2095-2103 [PMID: 19918088 DOI: 10.1001/jama.2009.1670]

Davidson KW, Rieckmann N, Clamow L, Schwartz JE, Shimbo D, Medina V, Albanese G, Kronshtel I, Hegel M, Burg MM. Enhanced depression care for patients with acute coronary syndrome and persistent depressive symptoms: coronary psychosocial evaluation studies randomized controlled trial. *Arch Intern Med* 2010; 170: 600-608 [PMID: 20386603]

Huffman JC, Beach SR, Suarez L, Mastromauro CA, DuBois CM, Celano CM, Rollman BL, Januzzi JL. Design and baseline data from the Management of Sadness and Anxiety in Cardiology (MOSAIC) randomized controlled trial. *Contemp Clin Trials* 2013; 36: 488-501 [PMID: 24908281 DOI: 10.1016/j.cct.2013.09.012]

Kronish IM, Rieckmann N, Burg MM, Edmondson D, Schwartz JE, Davidson KW. The effect of enhanced depression care on adherence to risk-reducing behaviors after acute coronary syndromes: findings from the COPES trial. *J Am Heart* 2012; 164: 524-529 [PMID: 23067910 DOI: 10.1016/j.jahn.2012.07.024]

Stewart JC, Perkins AJ, Callahan CM. Effect of collaborative care for depression on risk of cardiovascular events: data from the IMPACT randomized controlled trial. *Psychosom Med* 2014; 76: 29-37 [PMID: 24367124 DOI: 10.1097/PSY.0000000000000222]

Katon WJ, Lin EH, Von Korff M, Ciechanowski P, Ludman EJ, Young B, Peterson D, Rutter CM, McGregor M, McCulloch D. Collaborative care for patients with depression and chronic
illnesses. *N Engl J Med* 2010; **363**: 2611-2620 [PMID: 21190455 DOI: 10.1056/NEJMoa1003955]

128 Rossom RC, Solberg LI, Magnan S, Crain AL, Beck A, Coleman KJ, Katzelnick D, Williams MD, Neely C, Ohnsorg K, Whitebird R, Brandenfels E, Pollock B, Ferguson R, Williams S, Unützer J. Impact of a national collaborative care initiative for patients with depression and diabetes or cardiovascular disease. *Gen Hosp Psychiatry* 2017; **44**: 77-85 [PMID: 27558106 DOI: 10.1016/j.genhosppsych.2016.05.006]

129 Coleman KJ, Magnan S, Neely C, Solberg L, Beck A, Trevis J, Heim C, Williams M, Katzelnick D, Unützer J, Pollock B, Hafer E, Ferguson R, Williams S. The COMPASS initiative: description of a nationwide collaborative approach to the care of patients with depression and diabetes and/or cardiovascular disease. *Gen Hosp Psychiatry* 2017; **44**: 69-76 [PMID: 27558107 DOI: 10.1016/j.genhosppsych.2016.05.007]

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