



Physicians' Ratings of their Supervisor's Leadership Behaviors and Their Subsequent Burnout and Satisfaction: A Longitudinal Study

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Abstract

Objective: To evaluate the relationships between immediate supervisors' leadership qualities and the subsequent levels and changes in burnout and satisfaction of supervised physicians 2 years later.

Participants and Methods: In 2015 and 2017 physicians were asked to complete surveys that included the 9-item Mayo Clinic Leadership Score (range, 9 to 45) assessing their supervisor, an item about satisfaction with the organization, and two items from the Maslach Burnout Inventory. Individual participants' responses to the surveys were linked.

Results: Among the 3698 physicians invited to complete both the 2015 and 2017 survey, 1795 (48.5%) responded. The mean composite baseline leadership score was 38.1 (SD, 8.4). Lower mean baseline leadership scores were reported by physicians who had burnout (mean [SD], 36.0 [9.7] vs 39.1 [7.3]; $P < .001$) 2 years later in comparison to those who did not have burnout 2 years later. In multivariable analysis, higher baseline leadership score of supervisors was independently associated with lower odds of physicians having burnout 2 years later (for each 1-point increase, odds ratio, 0.98; 95% CI, 0.96 to 0.99; $P = .002$) after adjusting for burnout at baseline, age, gender, length of service, and specialty. Baseline composite leadership score of supervisors was also independently associated with physicians' satisfaction with the organization 2 years later (odds ratio, 1.05; 95% CI, 1.03 to 1.07; $P < .0001$).

Conclusion: Physicians' ratings of their immediate supervisors' leadership qualities were associated with their subsequent levels and changes in burnout and satisfaction 2 years later. Additional studies are needed to determine the effect of sharing such scores with immediate supervisors and providing additional leadership training to those with low scores, and if doing so ultimately reduces burnout and improves satisfaction of the supervised physicians.

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Symptoms of burnout are prevalent among physicians,^{1,2} and they are associated with indicators of suboptimal patient care and professional behaviors, as well as lower productivity and turnover.³⁻⁹ As a result, leaders in medicine have called for national as well as local health system response.^{2,10,11} There are factors within the control of health care organizations that impact work stress and, ultimately, burnout prevalence among physicians.^{2,3,12,13} For example, local

leadership behaviors have previously been shown to relate to physicians' symptoms of burnout and satisfaction with the organization on cross-sectional analysis.¹⁴ In a study of 3896 physicians who rated their immediate physician supervisor across 12 leadership dimensions, each 1-point higher composite leadership score was associated with a 3.3% lower odds of burnout and 9% higher odds of satisfaction of the physicians supervised.¹⁴

These findings resonate with other studies inside and outside of medicine

showing that behaviors of immediate supervisors are associated with stress and symptoms of burnout among those they oversee.^{15,16} Much of this work, however, has been cross-sectional,¹⁵ limiting not only our understanding regarding the direction of the relationship, but also of how to react when local leaders receive poor ratings by those who they supervise. We used a prospective longitudinal study design to evaluate the relationships between immediate supervisor's leadership qualities and the subsequent levels and changes in burnout and satisfaction of supervised physicians 2 years later.

PARTICIPANTS AND METHODS

Participants

We conducted a longitudinal multisite, single-institution study including physicians who worked at Mayo Clinic in Rochester, Minnesota; Phoenix and Scottsdale, Arizona; Jacksonville, Florida; and Mayo Clinic Health System campuses in Wisconsin and Minnesota (community-based hospitals and health care facilities). All non-trainee physicians received an invitation to complete the all-staff survey administered by an external consulting firm in 2015 and 2017. Physicians who responded to both these surveys were included in this study. Survey completion was voluntary, and all data were confidential.

An external consulting firm administered the survey, tracked responses, and matched individual survey responses at both timepoints. These data were also linked to Mayo Clinic—provided employee personnel data (gender, age, specialty, and duration of employment at Mayo Clinic). The subsequent de-identified, linked data set was forwarded for analysis. The study was approved by the Mayo Clinic Institutional Review Board.

Measures

The 2015 and 2017 surveys included questions on immediate supervisor leadership qualities, professional burnout, and satisfaction with the organization.

Mayo Clinic Leadership Score. The surveys included 9 of the original 12 Mayo Clinic Leadership items (see [Supplemental Table 1](#), available at <http://www.mayoclinicproceedings.org>).^{14,16} Three items were eliminated after the 2013 administration as subsequent factor analysis suggested these items did not contribute meaningfully to the overall score. For eight of the items, the response options included a 5-point scale for responders to indicate their level of agreement (1 = strong disagree; 5 = strongly agree). For the ninth item, responders rated their overall level of satisfaction with their immediate supervisor using a 5-point scale (1 = very dissatisfied; 5 = very satisfied). We summed the responses for the nine items to obtain a composite leadership score (range, 9 to 45), with higher scores indicating more favorable views of the immediate physician supervisor.^{14,16} The name of each physician's immediate supervisor was obtained from personnel records and provided to the external consulting firm along with pictures of immediate supervisors. The external consulting firm embedded the name and picture of each physician's immediate supervisor within each survey just prior to the leadership items. This step was taken to help ensure the responder was reflecting on the leadership behaviors of their designated immediate supervisor.

Burnout. Similar to methodology in other large studies,¹⁶⁻²⁰ we used two single-item measures ("I feel burned out from my work" [a question on emotional exhaustion] and "I've become more callous toward people since I started this job" [a question on depersonalization]) from the Maslach Burnout Inventory to measure symptoms of burnout. Response options range from "never" to "every day" on a 7-point scale. Previous studies including more than 10,000 physicians and medical students have established that these two single-item measures stratify the risk of burnout.^{21,22} Consistent with former studies,^{17,18} those who indicated a frequency of once or more per week (a high score) on either item were considered to have overall burnout.^{21,22}

Satisfaction With the Organization. The survey included an item that asked about overall satisfaction with the organization: “Considering everything, how would you rate your overall satisfaction with Mayo Clinic as a whole at the present time?” with response options across five levels from very dissatisfied (1) to very satisfied (5). Responses were dichotomized, with those who responded “very satisfied” or “satisfied” considered satisfied with the organization.

Analyses

We calculated basic summary statistics and used analysis of variance to compare the mean baseline leadership score across each level of burnout and satisfaction. Next, we conducted multivariable logistic regressions to evaluate the relationship between baseline composite leadership score and subsequent overall burnout, high emotional exhaustion, or high depersonalization. These multivariable models included age, gender, length of service, and specialty in addition to the relevant baseline variable: overall burnout, high emotional exhaustion, or high depersonalization. We also conducted multivariable logistic regression to evaluate the relationship between baseline composite leadership score and subsequent overall satisfaction with the organization. These multivariable models included age, gender, length of service, and specialty, along with baseline satisfaction with the organization. We used a 5% type I error rate and two-sided alternative hypotheses. SAS version 9 (SAS Institute, Inc., Cary, NC) was used for all analyses.

RESULTS

Among the 3698 physicians invited to complete both the 2015 and 2017 survey, 1795 (48.5%) responded. Demographics of these 1795 physicians (reported in 2015) are shown in [Table 1](#). In 2015 and 2017, these 1795 physicians were somewhat more likely to be midcareer or later than study nonparticipants ([Supplement Table 2](#), available at <http://www.mayoclinicproceedings.org>).

Among responders, 392 (22.2%) had symptoms of chronic burnout (burnout in both 2015 and 2017), 196 (11.1%) recovered

TABLE 1. Demographic Characteristics, Burnout, and Satisfaction of 1795 Physicians, 2015

Characteristics	n (%)
Age, years	
<35	115 (6.4)
35-44	519 (28.9)
45-54	588 (32.8)
55-64	474 (26.4)
≥65	99 (5.5)
Sex	
Female	557 (31.0%)
Male	1238 (69.0)
Duration of employment at Mayo Clinic, years	
<5	549 (30.6)
6-10	319 (17.8)
11-15	349 (19.4)
>15	578 (32.2)
Specialty ^a	
Primary care	140 (7.8)
Internal medicine or pediatric subspecialty	392 (21.8)
Surgical	218 (12.1)
Radiology	99 (5.5)
Anesthesia	113 (6.3)
Pathology/laboratory medicine	106 (5.9)
Other medical specialties	446 (24.8)
Other	281 (15.7)

^aPrimary care included general internal medicine, general pediatrics, family medicine. Other medical specialties area included dermatology, neurology, physical medicine and rehabilitation, psychology, radiation oncology.

from symptoms of burnout from 2015 to 2017, 211 (12.0%) had new symptoms of burnout in 2017, and 963 (54.7%) did not have symptoms of burnout at either time-point. In terms of satisfaction with the organization, 1293 (73.3%) were satisfied at both time points, 144 (8.2%) were dissatisfied at baseline but were satisfied 2 years later, 149 (8.4%) were satisfied at baseline but dissatisfied 2 years later, and 179 (10.1%) were dissatisfied at both time points. The mean composite baseline leadership score was 38.1 (SD, 8.4).

Burnout

Lower mean baseline composite leadership scores (reflecting less favorable views of immediate supervisors) were reported by physicians who had burnout (mean [SD], 36.0 [9.7] vs 39.1 [7.3], $P<.001$), high emotional

exhaustion (36.2 [9.6] vs 39.0 [7.5], $P<.001$), and high depersonalization (35.4 [10.2] vs 38.6 [7.8], $P<.001$) 2 years later in comparison to those who did not have burnout, high emotional exhaustion, or high depersonalization 2 years later. Similarly, baseline composite leadership score of immediate physician supervisors was associated with subsequent severity of emotional exhaustion ($P<.001$) (Figure A) and depersonalization ($P<.001$) (Figure B), when treated as continuous variables, of physicians they supervised 2 years later.

After adjusting for age, gender, length of service, and specialty, burnout at baseline was the strongest predictor of burnout 2 years later (odds ratio [OR], 8.26; 95% CI, 6.43 to 10.61; $P<.001$) (Table 2). However, higher baseline composite leadership score of immediate supervisors remained independently associated with lower odds of physicians having burnout 2 years later (for each 1-point increase OR, 0.98; 95% CI, 0.96 to 0.99; $P=.002$) after adjusting for burnout at baseline, age, gender, length of service, and specialty. When we repeated the multivariable analyses for high emotional exhaustion or high depersonalization, rather than overall burnout, higher baseline composite leadership score of immediate supervisors was independently associated with lower odds of physicians having high emotional exhaustion (for each 1-point increase OR 0.98; 95% CI, 0.96 to 0.99; $P=.004$) (Supplemental Table 2) or high depersonalization (for each 1-point increase OR, 0.98; 95% CI, 0.96 to 0.99; $P=.04$) (Supplemental Table 3, available at <http://www.mayoclinicproceedings.org>) 2 years later, controlling for baseline high emotional exhaustion or depersonalization, respectively. Other factors independently associated with increased odds of burnout included age and specialty, with older physicians at lower risk for burnout, high emotional exhaustion, and high depersonalization and primary care physicians at higher risk for burnout and high emotional exhaustion than most other specialties (Table 2; and Supplemental Tables 3 and 4, available at <http://www.mayoclinicproceedings.org>).

Satisfaction With the Organization

On unadjusted univariate analysis, higher baseline composite leadership score of immediate supervisors was associated with more favorable overall satisfaction with the organization among physicians ($P<.001$) (Figure C). Satisfaction with the organization at baseline was the strongest predictor of satisfaction with the organization 2 years later (OR, 9.42; 95% CI, 6.68 to 13.30; $P<.001$) (Table 3). Baseline composite leadership score of immediate supervisors was also independently associated with physicians' satisfaction with the organization 2 years later (OR, 1.05; 95% CI, 1.03 to 1.07; $P<.001$) on multivariable analysis adjusting for baseline satisfaction with the organization, age, gender, length of service, and specialty. Specialty was independently associated with satisfaction with the organization in 2017, with primary care physicians less likely to be satisfied than most other specialties (Table 3).

DISCUSSION

This prospective study shows that higher ratings of immediate supervisor leadership behaviors were associated with lower odds of burnout, high emotional exhaustion, and high depersonalization, and higher odds of satisfaction with the organization among physicians supervised 2 years later. This finding persisted across physician specialties, and after adjusting for burnout and satisfaction with the organization at baseline, as well as for demographics and length of employment.

Baseline composite leadership score of immediate supervisors was independently associated with lower odds of physicians having burnout (for each 1-point increase OR, 0.98; 95% CI, 0.96 to 0.99), high emotional exhaustion (for each 1-point increase OR, 0.98; 95% CI, 0.96 to 0.99), and high depersonalization (for each 1-point increase OR, 0.98; 95% CI, 0.96 to 0.99) and higher odds of satisfaction (for each 1-point increase OR, 1.05; 95% CI, 1.03 to 1.07) 2 years later on multivariable analysis. The ORs and accompanying 95%

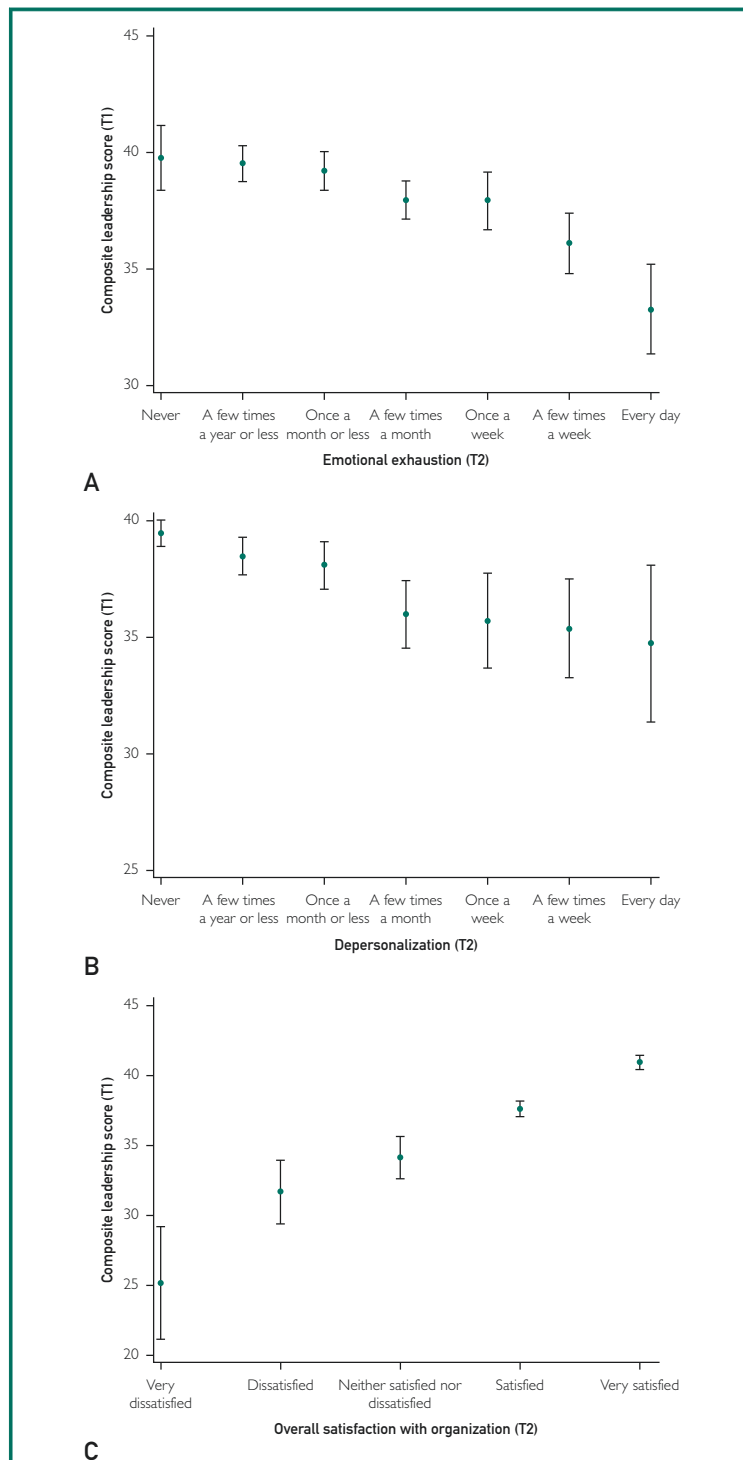


FIGURE. Mean Baseline Composite Leadership Score by (A) emotional exhaustion ($P<.0001$), (B) depersonalization ($P<.0001$), and (C) satisfaction with the organization ($P<.0001$) 2 years later. Significant differences in composite leadership scores across levels of burnout and satisfaction are seen. Error bars indicate 95% CIs. T1, first questionnaire; T2, second questionnaire.

CIs reflect associations with a 1-point change in leadership score, which has a large 9 to 45 point scale range. To show the magnitude of the observed associations, a half SD²³ (approximately 4-point) higher rating of their immediate supervisor at baseline by physicians was associated with an 8% lower odds of burnout, high emotional exhaustion, and high depersonalization, and the associated values at the ends of the 95% CIs are similarly larger than the 95% CIs a 1-point change might suggest. Given the large range of the leadership score scale, even small increases in the leadership score can have substantial impact on the odds of burnout experienced by direct reports.

More than 40% of physicians have substantial symptoms of burnout,¹ and burnout is associated with 1.4 to 2-fold greater odds of self-reported medical error, being involved in a medical malpractice litigation claim, turnover, and reduction in productivity among physicians.^{1,3-9,24,25} Given these prevalence and impact data, the observed reduction in the odds of burnout in this study is likely to have clinically meaningful impact on quality of care and access to care. Similarly, given the multitude of factors (eg, benefits, workload) that impact physicians' satisfaction with the organization, the magnitude of the association between composite leadership score and subsequent satisfaction with the organization is notable, especially as the leadership behaviors explored are likely to be modifiable through professional development activities.²⁶⁻²⁹

This study also highlights the challenges faced by primary care physicians. In general, physicians specializing in family medicine, general internal medicine, and general pediatrics were more likely to experience burnout and high emotional exhaustion and be dissatisfied with the organization in this study. Other large studies have similarly reported that physicians at the front lines of care (eg, primary care, emergency medicine, obstetrics and gynecology, and neurology) have an elevated risk of burnout.^{1,19} Whether this apparent elevated risk is due

TABLE 2. Multivariable Analysis to Identify Factors Associated With 2017 Symptoms of Burnout

	Odds ratio (95% CI)	P	Overall P
Baseline leadership score (for each 1-point increase) ^a	0.98 (0.96 to 0.99)		.002
Baseline burnout ^a	8.26 (6.43 to 10.61)		<.001
Gender (referent: male) ^a	0.85 (0.65 to 1.11)		.24
Age (referent: younger than 35) ^a	Reference		.02
35-44	1.20 (0.68 to 2.10)	.53	
45-54	1.18 (0.63 to 2.20)	.61	
55-64	0.96 (0.49 to 1.88)	.90	
≥65	0.28 (0.10 to 0.78)	.02	
Duration of employment (referent: 5 or fewer), ^a years	Reference		.55
6-10	0.95 (0.65 to 1.39)	.79	
11-15	1.23 (0.81 to 1.89)	.33	
>15	1.00 (0.64 to 1.56)	.99	
Specialty (referent: primary care)	Reference		<.001
Anesthesiology	0.17 (0.09 to 0.36)	<.001	
Pathology and laboratory medicine	0.62 (0.33 to 1.18)	.15	
Internal medicine or pediatric subspecialty	0.59 (0.36 to 0.96)	.03	
Other medical specialties	0.52 (0.32 to 0.84)	.01	
Other	0.31 (0.18 to 0.52)	<.001	
Radiology	0.70 (0.37 to 1.35)	.29	
Surgery	0.58 (0.34 to 0.99)	.05	

^a2015 survey.

to additional clerical burdens (eg, prior authorizations, prescription refills, durable medical equipment forms, assisted living and nursing home forms, and quality measures), inadequate appointment lengths to handle increasing rates of multiple comorbidities and an aging population, or other factors warrants exploration.^{2,30}

The variability in burnout and satisfaction by specialty emphasizes the need for tailored interventions to address factors within the local work environment contributing most to burnout and dissatisfaction within similar groups of physicians. Although overarching approaches at the level of the organizational and external regulatory environment are likely to benefit all physicians, these should be coupled with locally relevant approaches that address contributing factors within the sphere of influence of the work-unit leaders. Findings from this study build on previous cross-sectional findings¹⁴ and suggest that regularly measuring physician views of their immediate supervisor's behaviors may be a useful organizational strategy. Additional

studies are needed to determine the effect of sharing such scores with immediate supervisors (ie, consequential validity) and if providing additional leadership training to those with low scores improves the Mayo Clinic Leadership score (ie, demonstrates sensitivity to change) and, ultimately, reduces burnout and improves satisfaction of the supervised physicians. Although intervention studies to reduce burnout are limited,^{31,32} a strategy that leverages strong leaders to use a participatory management style to develop, implement, and measure the impact of local interventions is worth pursuing. Targets for such interventions could include work load, workflow, and distribution of work tasks, but should be co-created between physician leaders and physicians within each specialty or working group.^{2,33}

Study Limitations

This study has limitations. First, it was conducted at a single organization. The cohort, however, included physicians from all specialties working in academic hospitals in

TABLE 3. Multivariable Analysis to Identify Factors Associated With 2017 Satisfaction With the Organization

	Odds ratio (95% CI)	P	Overall P
Baseline leadership score (for each 1-point increase) ^a	1.05 (1.03 to 1.07)		<.001
Baseline satisfied with the organization ^a	9.42 (6.68 to 13.30)		<.001
Gender (referent: male) ^a	1.25 (0.91 to 1.73)		.17
Age (referent: younger than 35), ^a years	Reference		.13
35-44	0.76 (0.38 to 1.52)	.43	
45-54	1.17 (0.53 to 2.59)	.69	
55-64	1.57 (0.67 to 3.68)	.30	
≥65	1.03 (0.37 to 2.87)	.95	
Duration of employment (referent: ≤5), ^a years	Reference		.13
6-10	1.53 (0.94 to 2.49)	.09	
11-15	0.87 (0.52 to 1.47)	.61	
>15	0.86 (0.5 to 1.50)	.60	
Specialty (referent: primary care)	Reference		.001
Anesthesiology	4.22 (1.79 to 9.93)	.001	
Pathology and laboratory medicine	1.44 (0.68 to 3.05)	.34	
Internal medicine or pediatric subspecialty	1.01 (0.57 to 1.78)	.97	
Other medical specialties	1.90 (1.06 to 3.41)	.03	
Other	1.70 (0.89 to 3.27)	.11	
Radiology	2.22 (0.87 to 5.68)	.09	
Surgery	2.11 (1.07 to 4.14)	.03	

^a2015 survey.

Minnesota, Arizona, and Florida, as well as in community-based hospitals and health care facilities in the Midwest. Although the response rate of nearly 50% is higher than most longitudinal studies of physicians, response bias is possible. There were also differences in age, length of service, and sex between responders and nonresponders. Second, we cannot determine if the relationships are causal, although the temporal sequence of survey measures suggests that baseline composite leadership score acted as a predictor of subsequent burnout and satisfaction. Third, we explored a limited number of factors likely to be associated with burnout and satisfaction, and additional variables beyond those measured in this study may impact these outcomes. Strengths include use of a validated metric to assess symptoms of burnout and inclusion of physicians from multiple specialties and practice settings.

CONCLUSION

Leadership qualities of immediate supervisors predict the professional well-being and satisfaction of physicians they supervise.

Studies are needed to determine how best to enhance leadership attributes of immediate physician supervisors as a strategy to improve the work environment. Doing so could reduce physician burnout and improve satisfaction, both of which have the potential to improve quality of care and patient satisfaction.³⁻⁹

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at <http://www.mayoclinicproceedings.org>. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

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REFERENCES

- Shanafelt TD, West CP, Sinsky C, et al. Changes in burnout and satisfaction with work-life integration in physicians and the general US working population between 2011 and 2017. *Mayo Clin Proc.* 2019;94(9):1681-1694.
- National Academies of Sciences. *Engineering, and Medicine. Taking Action Against Clinician Burnout: A Systems Approach to Professional Well-Being.* Washington, DC: The National Academies Press; 2019.
- West CP, Dyrbye LN, Shanafelt TD. Physician burnout: contributors, consequences and solutions. *J Intern Med.* 2018; 283(6):516-529.
- Dyrbye LN, Shanafelt TD, Sinsky CA, et al. *Burnout Among Health Care Professionals: A Call to Explore and Address This Underrecognized Threat to Safe, High-Quality Care.* Washington, DC: National Academy of Medicine; 2017.
- Panagioti M, Geraghty K, Johnson J, et al. Association between physician burnout and patient safety, professionalism, and patient satisfaction: a systematic review and meta-analysis. *JAMA Intern Med.* 2018;178(10):1317-1330.
- Shanafelt TD, Mungo M, Schmitgen J, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work effort. *Mayo Clin Proc.* 2016; 91(4):422-431.
- Windover AK, Martinez K, Mercer MB, Neuendorf K, Boissy A, Rothberg MB. Correlates and outcomes of physician burnout within a large academic medical center. *JAMA Intern Med.* 2018;178(6):856-858.
- Hamidi MS, Bohman B, Sandborg C, et al. Estimating institutional physician turnover attributable to self-reported burnout and associated financial burden: a case study. *BMC Health Serv Res.* 2018;18(1):851.
- Willard-Grace R, Knox M, Huang B, Hammer H, Kivlahan C, Grumbach K. Burnout and Health Care Workforce Turnover. *Ann Fam Med.* 2019;17(1):36-41.
- Physician Burnout Is a Public Health Crisis: A Message To Our Fellow Health Care CEOs. 2017: <https://www.healthaffairs.org/doi/10.1377/hlthaff.2017.0328.059397/full>. Accessed October 3, 2018.
- Dzau VJ, Kirch DG, Nasca TJ. To care is human — collectively confronting the clinician-burnout crisis. *N Engl J Med.* 2018; 378(4):312-314.
- Swensen SMD, Kabacoff ARN, Shanafelt TMD. Physician-organization collaboration reduces physician burnout and promotes engagement: the Mayo Clinic experience. *J Healthc Manag.* 2016;61(2):105-127.
- Shanafelt T, Goh J, Sinsky C. The business case for investing in physician well-being. *JAMA Intern Med.* 2017;177(12):1826-1832.
- Shanafelt TD, Gorringer G, Menaker R, et al. Impact of organizational leadership on physician burnout and satisfaction. *Mayo Clin Proc.* 2015;90(4):432-440.
- Harms PD, Credé M, Tynan M, Leon M, Jeung W. Leadership and stress: A meta-analytic review. *Leadership Quarterly.* 2017; 28(1):178-194.
- Dyrbye LN, Major-Elechi B, Hays JT, Fraser CH, Buskirk SJ, West CP. Relationship between organizational leadership and health care employee burnout and satisfaction. *Mayo Clinic Proc.* 2020;95(4):698-708.
- West C, Shanafelt T, Kolars J. Quality of life, burnout, educational debt, and medical knowledge among internal medicine residents. *JAMA.* 2011;306(9):952-960.
- Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in burnout and satisfaction with work-life balance in physicians and the general US working population between 2011 and 2014. [Erratum appears in *Mayo Clin Proc.* 2016;91(2):276]. *Mayo Clin Proc.* 2015;90(12):1600-1613.
- Shanafelt TD, Boone S, Tan L, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med.* 2012;172(18): 1377-1385.
- Dyrbye LN, Burke SE, Hardeman RR, et al. Association of clinical specialty with symptoms of burnout and career choice regret among us resident physicians. *JAMA.* 2018;320(11):1114-1130.
- West CP, Dyrbye LN, Satele D, Sloan J, Shanafelt TD. Concurrent validity of single-item measures of emotional exhaustion and depersonalization in burnout assessment. *J Gen Intern Med.* 2012;27(11):1445-1452.
- West CP, Dyrbye LN, Sloan JA, Shanafelt TD. Single item measures of emotional exhaustion and depersonalization are useful for assessing burnout in medical professionals. *J Gen Intern Med.* 2009;24(12):1318-1321.
- Norman GR, Sloan JA, Wyrwich KW. The truly remarkable universality of half a standard deviation: confirmation through another look. *Expert Rev Pharmacoecon Outcomes Res.* 2004; 4(5):515-519.
- Balch CM, Oreskovich MR, Dyrbye LN, et al. Personal consequences of malpractice lawsuits on American surgeons. *J Am Coll Surg.* 2011;213(5):657-667.
- Shanafelt TD, Balch CM, Bechamps G, et al. Burnout and medical errors among American surgeons. *Ann Surg.* 2010;251(6): 995-1000.
- Schwartz RW, Pogge CR, Gillis SA, Holsinger JW. Programs for the development of physician leaders: a curricular process in its infancy. *Acad Med.* 2000;75(2):133-140.
- Straus SE, Soobiah C, Levinson W. The impact of leadership training programs on physicians in academic medical centers: a systematic review. *Acad Med.* 2013;88(5):710-723.
- Frich JC, Brewster AL, Cherlin EJ, Bradley EH. Leadership development programs for physicians: a systematic review. *J Gen Intern Med.* 2015;30(5):656-674.
- Lucas R, Goldman EF, Scott AR, Dandar V. Leadership development programs at academic health centers: results of a national survey. *Acad Med.* 2018;93(2):229-236.
- Shanafelt T, Dyrbye LN, Sinsky C, et al. Relationship between clerical burden and characteristics of the electronic environment with physician burnout and professional satisfaction. *Mayo Clin Proc.* 2016;91(7):836-848.
- West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *Lancet.* 2016;388(10057):2272-2281.
- Panagioti M, Panagopoulou E, Bower P, et al. Controlled interventions to reduce burnout in physicians: a systematic review and meta-analysis. *JAMA Intern Med.* 2017;177(2):195-205.
- Shanafelt TD, Noseworthy JH. Executive leadership and physician well-being: nine organizational strategies to promote engagement and reduce burnout. *Mayo Clinic Proc.* 2017; 92(1):129-146.