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Title: The impact of unit level leadership on physician wellbeing, burnout, professional fulfillment and intent to leave: a multi-center survey study.

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Index, Medical Student Well-being Index, Nurse Well-being Index, Well-being Index). Mayo Clinic holds the copyright to these instruments and has licensed them for use outside of Mayo Clinic. Dr Shanafelt receives a portion of any royalties paid to Mayo Clinic. Dr Shanafelt reported receiving honoraria from grand rounds or keynote lecture presentations and advising for health care organizations outside the submitted work. Other authors report no conflict of interest.

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Summary Box:

- More and more physicians are working in large organization or group practices, increasing the impact of work unit leadership in physician wellness
- Leadership has been identified as a risk factor for burnout and workplace satisfaction in limited previous studies.
- The relationship between leader behavior and physician wellbeing, professional fulfillment and their intent to leave their organizations has not been measured in a multi-center study.

- Physicians who ranked their supervisors in the top tertile of leadership demonstrated 5.8x higher odds of professional fulfillment, 50% less burnout, and 66% lower intention to leave their jobs than those who ranked their supervisors in the lowest tertile.
- Our large multicenter study demonstrates that leadership behavior is strongly associated with physicians' professional fulfillment, burnout and intent to leave their organizations.

Abstract:

Objective: To examine how perceived leadership behaviors affect burnout, professional fulfillment and intent to leave the organization among physicians.

Design: Anonymous cross-sectional survey study from November 2016 to October 2018.

Setting: 12,036 attending and resident physicians at eleven healthcare organizations participating in the Physician Wellness Academic Consortium (PWAC) were surveyed to assess burnout and professional fulfillment and their drivers.

Participants: A sample of 5416 attending physicians with complete data on gender, specialty, leadership, sleep, burnout and professional fulfillment.

Main Outcomes and Measures: The leadership behavior of each physician's supervisor was assessed using the Mayo Clinic Participatory Management Leadership Index and categorized in tertiles. Multivariable logistic regression analyses examined the effect of leadership behavior rating of each physician's supervisor on burnout, professional fulfillment, and intent to leave controlling for sleep impairment, gender, and specialty.

Results: The response rate was 45% across 11 institutions. Half of respondents were female. Professional fulfillment increased with increasing tertiles of leadership behavior rating (19%, 34%, 47% p<0.001). The odds of professional fulfillment were 5.8 times higher (95%CI 5.1-6.59) for physicians in the top tertile compared to those in the lowest tertile. Physicians in the top tertile were also 50% less likely to be burned out (95%CI 0.42-0.60) and reported 66% lower intent to leave (95% CI 0.26-0.44). Individuals who rated their supervisor's leadership in upper tertiles relative to lower tertiles exhibited

lower levels of sleep related impairment (24% vs 38% vs 38% P<0.001), burnout (18% vs 35% vs 47% p<0.001), and intent to leave (16% vs 24% vs 50% p<0.001).

Conclusion: Perceived leadership behaviors have a strong relationship with burnout, professional fulfillment, and intent to leave among physicians. Organizations should consider leadership development as a potential vehicle to improve physician wellness and prevent costly physician departures.

Abstract word count: 290

Keywords: burnout, leadership, gender, professional fulfillment

Strengths and Limitations of this Study:

- First multi-center study to our knowledge of physician well being on professional fulfillment and intention to leave
- Multi-specialty study of physicians from 11 healthcare organizations
- Validated instruments used to assess burnout professional fulfillment, sleep and leadership behavior
- Response rate of 45% with possibility for response and recall bias

INTRODUCTION

As the landscape of modern medicine continues to grow and change, physicians are increasingly becoming employed by large organizations.[1] Solo or small practices are becoming less common, and up to two thirds of physicians are now employed by large practice groups and 20% of physicians employed by a practice of greater than 100 physicians.[2] The trend to group medicine exists beyond the boundaries of academic medicine or private practice, including university hospitals, health maintenance organizations, practice groups, and health systems.

Healthcare organizations have increasingly recognized the impact of occupational burnout and physician well-being on their ability to provide high quality healthcare to their communities.[3] The components of burnout include emotional exhaustion (EE), depersonalization, and decreased personal efficacy in the context of the work environment.[4] Concern for physician burnout has gained increasing attention given its implications for patient and provider health. Burnout has previously been associated with worse quality of care,[5-7] physician attrition,[8-10] patient satisfaction,[11-13] cost of care,[3,14-15] and medical errors.[6,16-17] Institutional factors involved in burnout and professional fulfillment act as modifiable factors that can be targeted by organizations.[18-23]

The impact of leadership effectiveness on burnout and workplace satisfaction for physicians is of importance for healthcare organizations.[24-26] A study of 2800 physicians

at the Mayo Clinic demonstrated that average leadership behavior score of physicians work unit supervisor explained 11% of the variation in burnout and 47% of the variation in workplace satisfaction across 129 work units when adjusted for other factors.[24] The leadership behaviors of physicians immediate supervisor have also been found to have a strong impact on physicians' perception of values alignment with their organization as a whole.[26] Healthcare leaders face many challenges, balancing costs with ever changing reimbursements, managing personnel, and addressing dynamic quality metrics.[27] However, physician training is largely focused on the individual, with an emphasis on clinical care of patients. Developing leadership skills in physician supervisors, organizations can make a large impact in the wellbeing of their clinicians and foster better patient care.[18, 25,28-29] Additionally, by understanding and targeting leadership, organizations can impact a large number of healthcare professionals and teams under each leader's supervision. We sought to further evaluate the factors involved in physician burnout by understanding the relationship between leadership, burnout, profession fulfillment, and intent to leave.

METHODS:

The standardized survey administered to participating institutions included the Professional Fulfillment Index (PFI), the Patient Reported Outcomes Measurement Information System (PROMIS) Sleep-Related Impairment Scale. Data for this analysis was collected between November 2016 and October 2018.The dataset was de-identified by a third-party administrator prior to analysis. The results of the analyses for this study are based on a sample of 5416 physicians from 11 healthcare organizations

participating in the Physician Wellness Academic Consortium (PWAC-https://wellbeingconsortium.org) who provided complete data on gender, specialty, leadership, sleep-related impairment, burnout and professional fulfillment.

Measures

Leadership Evaluation: Participants were asked to evaluate their leader using the organizational leadership subscale based on the revised 9-item Mayo Clinic Participatory Management Leadership Index (used with permission from Mayo Clinic).[25] This instrument was designed to evaluate leadership behaviors associated with team member engagement, including dimensions related to inclusion (treating everyone with respect), keeping people informed, soliciting input, empowering team members, nurturing professional development, and providing feedback and recognition. Each item is scored on a 5-point scale (0-4) and the scores from the individual items are summed to compute an aggregate score (with higher scores indicating more favorable ratings). The total score was then categorized into tertiles to represent groups of participants' leadership scores in increasing order.

Professional Fulfillment Index: The PFI was used to measure professional fulfillment and burnout. The PFI includes 6 items for the assessment of professional fulfillment, 4 items for the assessment of work exhaustion and 6 items to assess interpersonal disengagement. The burnout score represents the mean of 10 work exhaustion and interpersonal disengagement items, scored on a Likert scale from 0 (not at all) to 4 (extremely), where 4 indicates the highest burnout score. The professional fulfillment

scale assesses the degree of intrinsic positive reward the individual derives from their work, including happiness, meaningfulness, contribution, self-worth, satisfaction, and feeling in control when dealing with difficult problems at work. Items are measured on a five-point Likert scale from 0 (not at all true) to 4 (completely true). The mean score represents the mean of all 6 items and ranges between 0 and 4. Burnout score and professional fulfillment scores were rescaled to be between 0 and 10 to make interpretations simpler and consistent with recent reports.[25-26,30] Based on the published validation studies,[31-32] the established thresholds for burnout and professional fulfillment on the 0-10 scales are ≥3.25 and ≥7.5 respectively.

PROMIS Sleep-Related Impairment Scale: PROMIS short-form Sleep-Related Impairment (8a) includes 8 items measured on a 5-point Likert scale on perception of alertness, sleepiness, tiredness and perceived functional impairments during waking hours associated with sleep problems. The total score ranges between 8 and 40 where 40 indicates highest sleep impairment level. Sleep-related impaired status is considered to be present when the total score is equal to or higher than 16.[33-34]

Intent to Leave: Participants were asked if they intended to leave their institution within two years (*What is the likelihood that you will leave your institution within two years?*). The response choices were none, slight, moderate, likely, and definitely. The responses were then collapsed to form a binary variable (0=none, 1 otherwise) indicating that the participants have at least "slight" likelihood of leaving.

Statistical Analyses

Data were summarized for the overall sample (Table 1) and by tertiles of the leadership behavior score using frequencies and percentages for categorical variables (Table 2).

Table 1. Characteristics of the Respondents

Total N=5,416	N (%)
Gender	
Female	2710 (50)
Male	2706 (50)
Specialty	
Anesthesiology	407 (7.5)
Dermatology	71 (1.3)
Emergency Medicine	322 (6.0)
Medicine	1671(30.9)
Neurology	195 (3.6)
OB-GYN	248 (4.6)
Pathology	140 (2.6)
Pediatrics	804 (14.9)
Psychiatry	136 (2.5)
Radiation Oncology	77 (1.4)
Radiology	317 (5.9)
Surgery	630 (11.6)
Missing Specialty	398 (7.3)
Occupational Distress and Well-being	
Sleep related impairment	
Mean score (0-10) (SD)[1]	4.4 (1.7)
Sleep-Related Impairment present (yes)	2619 (48)

Professional fulfillment	
Mean score (0-10) (SD)[2]	6.6 (2.1)
Professional Fulfillment Present (yes)	2280 (42)
Burnout	
Mean score (0-10) (SD)[1]	3.0 (1.9)
Burned Out (yes)	2174 (40)
Intent to Leave Current Organization within Two Years	1694 (32)

[1] higher score unfavorable
[2] higher score favorable

Table 2. Characteristics of the Respondents by the Tertiles of Unit-Level Leadership Ratings

Total N=5,416	Tertile of Leadership Behavior Score[1]			
	Tertile 1 N (row %)	Tertile 2 N (row %)	Tertile 3 N(row %)	p-value (Chi-square)
Sex				
Female	994 (37)	972 (36)	744 (28)	<0.001
Male	824 (31)	987 (37)	895 (33)	
Specialty				
Anesthesiology	156 (38)	154 (38)	97 (24)	
Dermatology	10 (14)	21 (30)	40 (56)	
Emergency Medicine	66 (21)	144 (45)	112 (35)	

Medicine	625 (37)	593 (36)	453 (27)	<0.001
Neurology	51 (26)	72 (37)	72 (37)	
OB-GYN	98 (40)	83 (34)	67 (27)	
Pathology	32 (23)	51 (36)	57 (41)	
Pediatrics	241 (30)	306 (38)	257 (32)	
Psychiatry	43 (32)	44 (32)	49 (36)	
Radiation Oncology	23 (30)	29 (38)	25 (33)	
Radiology	89 (28)	114 (36)	114 (36)	
Surgery	214 (34)	209 (33)	207 (33)	
Missing Specialty	170 (43)	139 (35)	89 (22)	
Sleep-Related Impairment				
Mean score (0-10) (SD)[2]	4.6 (1.8)	4.4 (1.7)	4.0 (1.5)	<0.001
Sleep-Related Impairment present (yes)	997(38)	990 (38)	632 (24)	<0.001
Professional Fulfillment				
Mean score (0-10) (SD) [3]	5.6 (2.1)	6.7 (1.8)	7.7 (1.8)	<0.001
Professional Fulfillment Present (yes)	438 (19)	779 (34)	1063(47)	<0.001
Burned Out				

Mean score (0-10) (SD) [2]	3.7 (2.0)	3.0 (1.7)	2.2 (1.7)	<0.001
Burned Out (yes)	1010(47)	766 (35)	398 (18)	<0.001
Intent to Leave (yes)	851 (50)	578 (34)	265 (16)	<0.001

[1] higher tertile favorable [2] higher score unfavorable
[3] higher score favorable

The association between leadership behavior score and variables of interests were statistically tested using Chi-square and trend tests presented in Table 2. Linear associations between continuous variables and leadership ratings were examined using correlation coefficients. Internal validity of the organizational leadership scale was assessed using Cronbach's alpha. Multivariable logistic regression analyses were conducted to examine the association between the leadership behavior score of each physician's supervisor and burnout and intent to leave controlling for sleep impairment, gender, professional fulfillment and specialty. The correlation within specialty groups was accounted for using clustering at specialty level (logistic command with cluster option in Stata 15). Estimated odds ratios with 95% confidence intervals and p-values were presented in Table 3. Predictive margins over leadership scale tertiles were computed based on the logistic regression models for male and female physicians and presented in Figures 1 and 2. All statistical analyses were conducted in Stata 15. A p-value of <.05 was considered statistically significant.

Table 3. Logistic Regression Models of Professional Fulfillment, Burnout and Intent to Leave

		Model 1 Professional Fulfillment (yes) N=5416	Model 2 Burnout Status (yes) N=5416	Model 3 Intent to Leave (yes) N=5374
Variables		Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)
Female vs Male		0.60 (0.52-0.69) (<0.001)	1.55 (1.38-1.74) (<0.001)	0.70 (0.60-0.83) (<0.001)
Leadership Score	Tertile 1	Reference	Reference	Reference
	Tertile 2	2.07 (1.82-2.36) (<0.001)	0.51 (0.43-0.60) (<0.001)	0.56 (0.48-0.65) (<0.001)
	Tertile 3	5.40 (4.72-6.19) (<0.001)	0.29 (0.25-0.33) (<0.001)	0.34 (0.26-0.44) (<0.001)
Sleep-Related Impairment (yes)		0.36 (0.33-0.38) (<0.001)	5.68 (4.76-6.78) (<0.001)	1.14 (0.93-1.39) (0.224)
Professional Fulfillment Present (yes)		-----	-----	0.46 (0.40-0.52) (<0.001)
Burned out vs Not		-----	-----	2.32 (2.10-2.56) (<0.001)
Area under the curve (ROC)		0.75	0.77	0.74

RESULTS

A total of 12036 attending and resident physicians across 11 institutions were surveyed between November 2016 and October 2018 as part of their membership in the Physician Wellness Academic Consortium. Among these, 5795 attendings completed evaluation of their work unit leader using the 9-item version of the Mayo Clinic Participatory Management Leadership Index. The sample size for the present study was based on the number of attending physicians with complete data on gender, specialty, leadership rating scale, sleep-related impairment, burnout and professional fulfillment. The overall attending physician response rate for the PWAC survey was 45%. The personal and professional characteristics of responders are shown in Table 1.

Table 2 presents data on the relationships between specialty distribution, burnout, professional fulfillment, sleep-related impairment, and intent to leave by the tertiles of the scores on the Participatory Management Leadership Index, which showed high internal consistency (Cronbach's alpha=0.95) in this sample.

Female physicians represented 50% (2710/5416) of all participants. The percentage of female physicians who rated their immediate supervisor in the highest tertile of the leaderships scale was significantly lower than male physicians (28% vs 33% $p<0.001$). By specialty, Dermatologists (56%) and Pathologists (41%) had the highest proportion who rated their immediate supervisor in the highest tertile of the leadership behavior. In contrast, Ob-Gyn specialists (40%), Anesthesiologists (38%) and Internal Medicine physicians (31%) were least likely to rate their immediate supervisor in the highest tertile of the leaderships scale.

The leadership behavior rating of each physician's supervisor was negatively associated with burnout score (r=-0.34, p<0.001) and positively associated with professional fulfillment score (r=0.44, p<0.001). There was a significant positive association between professional fulfillment and leadership behavior score. Mean professional fulfillments scores (4.6, 4.4, 4.0,p<0.001) and the percentage of those with professional fulfillment were higher at higher tertiles of leadership behavior scores (lowest tertile: 19%, middle tertile: 34% and highest tertile: 47%, p<0.001). The mean burnout score (3.7, 3.0, 2.2, p<0.001) and percentage of physicians who had a high burnout score decreased with increasing tertiles of leadership behavior score (47%, 35% and 18%, p<0.001). Similarly, the percentage of those who reported an intent to leave their institution in the next two years decreased with increasing tertiles of leadership behavior score (50%, 34% and 16%, p<0.001). Physicians with sleep related impairment were less likely to rate their immediate supervisor in the highest tertile of the leaderships scale (24% vs 38% in lower tertiles, p<0.001).

Table 3 presents multivariable logistic regression models of professional fulfillment (Model 1), burnout status (Model 2) and intent to leave (Model 3) in relation to leadership behavior rating of physician's supervisor. The strong association between professional fulfillment and leadership behavior score is demonstrated in Model 1. Physicians who have more favorable evaluations of their leaders were more likely to be in the professionally fulfilled category. Specifically, the odds of having high professional fulfillment increased by a factor of 2.1 for those who rated their leader in the second tertile compared to those in the lowest tertile (OR:2.07, 95% CI: 1.82-2.36) while the

odds increased by a factor of 5.4 for those who are in the top tertile compared to those in the lowest tertile (OR:5.40, 95% CI:4.72--6.19, AUC 0.75). This model also demonstrates that female physicians were significantly less likely to have high professional fulfillment after adjusting for specialty, sleep-related impairment and supervisor leadership behavior rating (OR:0.60, 95% CI: 0.52-0.69). Figure 1 illustrates the likelihood of having professional fulfillment for leadership behavior tertile of physician's supervisor for female and male physicians based on the predicted probabilities obtained from Model 1. Non-overlapping confidence intervals at each tertile show that the difference between gender groups is maintained across tertiles suggesting that the association between of leadership score on professional fulfillment is not dependent on gender. This is evidenced by non-significant interaction effects between gender and leadership behavior score tertiles in Model 1 when interaction terms are included.

The relationship between organizational leadership and physician burnout is assessed in Model 2, which is adjusted by gender, specialty, sleep-related impairment and professional fulfillment. Physicians who rated the leader behavior of their supervisor in the second tertile were 49% less likely to be burned out compared to those who are in the first tertile (OR:0.51, 95% CI:0.43-0.60); those who are in the top tertile of leadership behavior score were 71% less likely to be burned out compared to those who are in the first tertile (OR:0.29, 95% CI:0.25-0.33). Model 2 also showed that the odds of reporting burnout are 55% higher for female physicians (OR:1.55 95% CI: 1.38-1.74), and approximately 6 times higher for those with sleep-related impairment (OR:5.68, 95% CI:3.4.76-6.78, AUC 0.77). The likelihood of burnout derived from Model 2 by the tertiles

of leadership behavior score of supervisor is illustrated for male and female physicians in behavior score Figure 2. The gender differences in burnout by increasing tertiles of leadership behavior score remained similar across tertiles indicated by non-overlapping confidence intervals at each tertile and non-significant interactions between gender and leadership behavior score tertiles in Model 2.

Model 3 estimates the effect of leadership behavior rating of each physician's supervisor on the likelihood that a physician intent to leave their institution within the next two years. This model is adjusted by gender, specialty, sleep-related impairment, burnout and professional fulfillment status as potential confounders of intent to leave. Physicians who rated the leader behavior of their supervisor in the second tertile were 44% less likely to report an intent to leave compared to those who were in the first tertile (OR:0.56, 95% CI:0.48-0.65); those who were in the top tertile of supervisor leadership behavior score are 66% less likely to intend to leave compared to those who were in the first tertile (OR:0.34, 95% CI:0.26-0.44). Model 3 also shows that the odds of reporting intent to leave were 30% lower for female physicians (OR:0.70 95% CI: 0.60-0.83) and 54% lower for those with high professional fulfillment (OR:0.46, 95% CI:0.40-0.52). The area under the ROC curve for this model is 0.74. The likelihood of having intent to leave for male and female physicians in this model by the tertiles of supervisor leadership behavior score is shown in Figure 3. Fifty percent (95% CI: 47-53) of male physicians and 45% (95% CI: 42-48) of female physicians in the lowest tertile of leadership behavior score reported an intent to leave in two years compared to 17% of male physicians and 16% of female physicians in the top tertile. The difference between the

gender groups in the top tertile is significantly narrower compared to that in the lower tertile evidenced by a statistically significant interaction term (genderXtertile3, OR=0.70, 95% CI: 0.52-0.94, p=0.02) when interaction terms are included.

DISCUSSION

This multi-institution study demonstrates a strong relationship between leadership evaluations and burnout, professional fulfillment and intent to leave current organization among US physicians. These results are consistent with previous single center studies which have demonstrated the significant impact of leadership quality on healthcare professional burnout and professional fulfillment.[24-26,35] The association between leadership and burnout remains strong even when we control for professional fulfillment, which has a well-established strong inverse relationship with burnout.[36] Although the present study looks at the correlation between individuals' rating of the leadership behavior of their supervisor and their own well-being and professional fulfillment, previous studies have also found a strong relationship between the composite leadership behavior score of a leader (as assessed by all individuals reporting to them) and the risk of burnout and professional fulfillment for the members of the team as a whole.[24-26] Leader behavior score also had a strong relationship with intent to leave. These results are consistent with the notion that physicians who are dissatisfied with their supervisor' ability to lead the team are the more likely to consider other opportunities. Prior studies demonstrated physicians who report intent to leave are three times more likely to actually leave their institution in the next two years.[8,9,37] This is

especially important as the cost of replacing physicians is significant, and turnover and burnout can be associated with lower quality and higher cost care for patients.[3, 48-42] Notably, in our study, a lower percentage of female physicians rated the leadership behaviors of their supervisor in the top tertile and a higher percentage rated the behaviors of their supervisor in the lowest tertile. Previous studies have indicated female physicians report greater workplace bullying, harassment, gender discrimination, and feelings of isolation.[43-51] While female physicians are no longer a minority in the profession as a whole, they are often underrepresented in leadership, potentially due to inequality and bias in the opportunity for promotion and reward.[7, 43-46, 52] This also results in fewer female leaders serving as mentors and role models, which may be protective against burnout. [44, 47-49, 52]

Interestingly, in our adjusted analysis controlling for burnout, professional fulfillment, and the behavior score of their leader, female physicians reported less intent to leave than male physicians (OR 0.7 CI 0.59-0.83 p<0.001). This is in contrast to prior studies demonstrating a 8-10% higher attrition rate in female physicians.[37, 45,51] These observations are consistent with the possibility that higher attrition rates among women physicians may be due to lower satisfaction with their leader and higher rates of burnout. Because intention to leave describes a longer-term plan to change jobs, it is also possible that female physicians may leave their jobs more suddenly.

Investing in the leadership development of supervising physicians maybe an important strategy to mitigate burnout and promote professional fulfillment in physicians. An integrative model of Wellness-Centered Leadership (WCL) incorporating the critical skills and leadership behaviors that cultivate engagement and professional fulfillment

was recently published.[53] When selecting and developing clinician leaders, the importance of emotional intelligence, social awareness and team communication should be considered.[27] These are skills that can be developed in physicians in training, beginning in medical school and continuing through all phases of training, including communication, mindfulness and reflection.[18, 54-55] Leaders' own well-being impacts their leadership effectiveness. One recent study demonstrated that 9.8% of the variation in a leader's leadership behavior scores as assessed by physicians on their team was related to their own independently assessed degree of burnout.[25] This observation suggests that burnout among leaders may result in sub-optimal leadership behavior which in turn increase the risk of burnout in their team members creating a vicious cycle. This finding suggest that leadership development initiatives should include attention to the well-being of the leader in addition to cultivation of specific leadership skills.[53]

Our study has several limitations. First, although relatively high for a physician survey,[55-58] our response rate was 45% which raises the potential of response bias.[59] Second, all physicians surveyed were from healthcare organizations participating in the PWAC. Although some PWAC institutions are non-academic institutions, most are academic medical centers, which makes the generalizability of the results to non-academic settings unclear. Our study also has a number of strengths. It is a large multi-center study of physicians from 11 healthcare organizations representing all medical specialties with reasonably high response rate, using validated instruments to assess burnout, professional fulfillment, sleep, and leadership behavior.

CONCLUSION

The leadership behaviors of physician supervisors have a strong relationship to their team members' burnout, professional fulfillment, and intent to leave. Female physicians report lower satisfaction with their leaders' leadership behaviors. Greater attention to leader selection, development, and performance evaluation represents a potentially important approach to reducing occupational burnout and promoting professional fulfillment in large healthcare organizations.

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Figure 1. Likelihood (%, 95% CI) of Professional Fulfillment Status by the Tertiles of Unit-Level Leadership Behavior Score for Female and Male Physicians

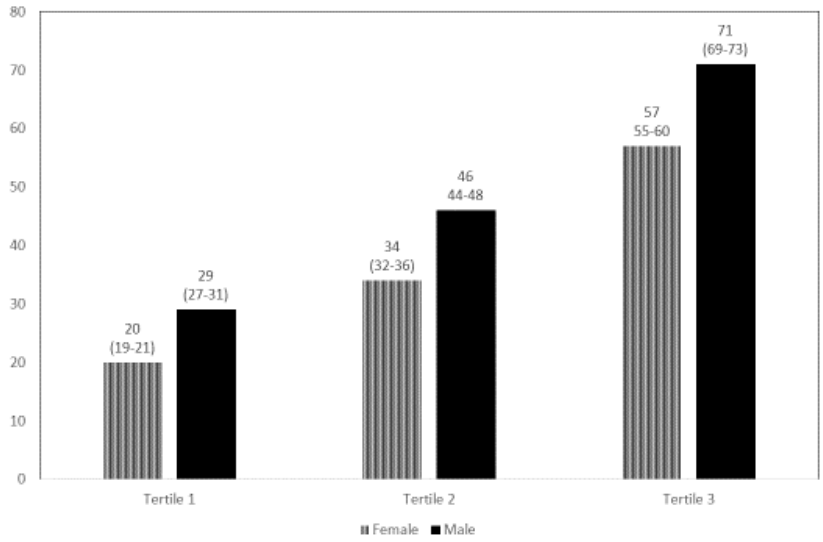


Figure 2. Likelihood (%, 95% CI) of Burnout Status by the Tertiles of Unit-Level Leadership Behavior Score for Female and Male Physicians

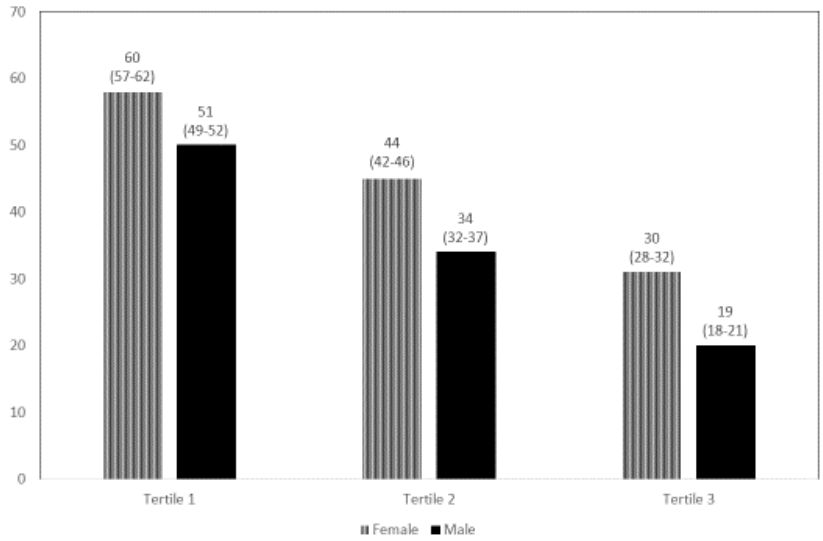
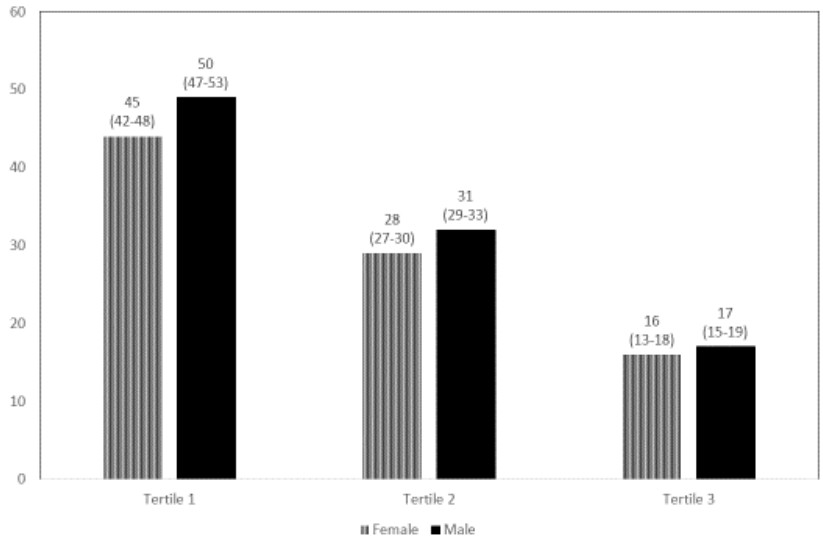


Figure 3. Likelihood (%, 95% CI) of Reporting Intent to Leave by the Tertiles of Unit-Level Leadership Behavior Score for Female and Male Physicians



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Title: The impact of leadership behavior on physician wellbeing, burnout, professional fulfillment and intent to leave: a multi-center cross-sectional survey study

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Drafting of the manuscript: Mete, Goldman

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Index, Medical Student Well-being Index, Nurse Well-being Index, Well-being Index). Mayo Clinic holds the copyright to these instruments and has licensed them for use outside of Mayo Clinic. Dr Shanafelt receives a portion of any royalties paid to Mayo Clinic. Dr Shanafelt reported receiving honoraria from grand rounds or keynote lecture presentations and advising for health care organizations outside the submitted work. Other authors report no conflict of interest.

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Summary Box:

- More and more physicians are working in large organization or group practices, increasing the impact of work unit leadership in physician wellness
- Leadership has been identified as a risk factor for burnout and workplace satisfaction in limited previous studies.
- The relationship between leader behavior and physician wellbeing, professional fulfillment and their intent to leave their organizations has not been measured in a multi-center study.
- Physicians who ranked their supervisors in the top tertile of leadership demonstrated 5.8x higher odds of professional fulfillment, 48% less burnout, and 66% lower intent to leave their jobs than those who ranked their supervisors in the lowest tertile.
- Our large multicenter study demonstrates that leadership behavior is strongly associated with physicians' professional fulfillment, burnout and intent to leave their organizations.

Abstract:

Objective: To examine how perceived leadership behaviors affect burnout, professional fulfillment and intent to leave the organization among physicians.

Design: Anonymous cross-sectional survey study from November 2016 to October 2018.

Setting: 12,036 attending and resident physicians at eleven healthcare organizations participating in the Physician Wellness Academic Consortium (PWAC) were surveyed to assess burnout and professional fulfillment and their drivers.

Participants: A sample of 5416 attending physicians with complete data on gender, specialty, leadership, burnout and professional fulfillment.

Main Outcomes and Measures: The leadership behavior of each physician's supervisor was assessed using the Mayo Clinic Participatory Management Leadership Index and categorized in tertiles. Multivariable logistic regression analyses examined the effect of leadership behavior rating of each physician's supervisor on burnout, professional fulfillment, and intent to leave controlling for gender and specialty.

Results: The response rate was 45% across 11 institutions. Half of respondents were female. Professional fulfillment increased with increasing tertiles of leadership behavior rating (19%, 34%, 47% p<0.001). The odds of professional fulfillment were 5.8 times higher (OR=5.8, 95%CI 5.1-6.59) for physicians in the top tertile compared to those in the lowest tertile. Physicians in the top tertile were also 48% less likely to be burned out (OR=0.52,95%CI 0.45-0.61) and reported 66% lower intent to leave (OR=0.34, 95% CI 0.26-0.44). Individuals who rated their supervisor's leadership in upper tertiles relative to

lower tertiles exhibited lower levels of burnout (18% vs 35% vs 47% p<0.001), and intent to leave (16% vs 24% vs 50% p<0.001).

Conclusion: Perceived leadership behaviors have a strong relationship with burnout, professional fulfillment, and intent to leave among physicians. Organizations should consider leadership development as a potential vehicle to improve physician wellness and prevent costly physician departures.

Abstract word count: 290

Keywords: burnout, leadership, gender, professional fulfillment

Strengths and Limitations of this Study:

- First multi-center survey that analyzed the effect of supervisor leadership behaviors on physician wellbeing, professional fulfillment and intent to leave.
- Leadership was evaluated by 5416 physicians representing at least 12 specialties from eleven healthcare organizations.
- Validated instruments were used to assess burnout, professional fulfillment and leadership behavior.
- Response rate of 45%, although relatively high for a physician survey, may still contribute to selection bias.
- Respondents are from member institutions of the Physician Wellness Academic Consortium (PWAC), which may limit generalizability.

INTRODUCTION

As the landscape of modern medicine continues to grow and change, physicians are increasingly becoming employed by large organizations.[1] Solo or small practices are becoming less common, and up to two thirds of physicians are now employed by large practice groups and 20% of physicians employed by a practice of greater than 100 physicians.[2] The trend to group medicine exists beyond the boundaries of academic medicine or private practice, including university hospitals, health maintenance organizations, practice groups, and health systems.

Healthcare organizations have increasingly recognized the impact of occupational burnout and physician well-being on their ability to provide high quality healthcare to their communities.[3] The components of burnout include emotional exhaustion (EE), depersonalization, and decreased personal efficacy in the context of the work environment.[4] Concern for physician burnout has gained increasing attention given its implications for patient and provider health. Burnout has previously been associated with worse quality of care,[5-7] physician attrition,[8-10] patient satisfaction,[11-13] cost of care,[3,14-15] and medical errors.[6,16-17] Institutional factors involved in burnout and professional fulfillment act as modifiable factors that can be targeted by organizations.[18-23]

The impact of leadership effectiveness on burnout and workplace satisfaction for physicians is of importance for healthcare organizations.[24-26] A study of 2800 physicians

at the Mayo Clinic demonstrated that average leadership behavior score of physicians' work unit supervisor explained 11% of the variation in burnout and 47% of the variation in workplace satisfaction across 129 work units when adjusted for other factors.[24] The leadership behaviors of physicians immediate supervisor have also been found to have a strong impact on physicians' perception of values alignment with their organization as a whole.[26] Healthcare leaders face many challenges, balancing costs with ever changing reimbursements, managing personnel, and addressing dynamic quality metrics.[27] However, physician training is largely focused on the individual, with an emphasis on clinical care of patients. Developing leadership skills in physician supervisors, organizations can make a large impact in the wellbeing of their clinicians and foster better patient care.[18, 25,28-29] Additionally, by understanding and targeting leadership, organizations can impact a large number of healthcare professionals and teams under each leader's supervision. We sought to further evaluate the factors involved in physician burnout by understanding the relationship between leadership, burnout, profession fulfillment, and intent to leave.

METHODS:

A cross sectional study of attending physicians in the United States was performed at eleven healthcare organizations participating in the Physician Wellness Academic Consortium (PWAC-https://wellbeingconsortium.org). A standardized survey was administered at participating institutions to be distributed to physicians from all available departments. A total of 12036 attending and resident physicians across 11 institutions were surveyed between November 2016 and October 2018 as part of their membership

in the Physician Wellness Academic Consortium. Among these, 5795 attendings completed evaluation of their supervisor using the 9-item version of the Mayo Clinic Participatory Management Leadership Index. Resident physician data and incomplete data from attending physicians on gender, specialty, leadership rating scale, burnout or professional fulfillment were excluded. The dataset was de-identified by a third-party administrator prior to analysis.

Patient and Public Involvement

Patients or the public were not involved in the design, conduct or reporting of the study. Given that this was an anonymous deidentified study, the results will be disseminated by publication of this study without direct contact to participants.

Measures

Supervisor Leadership Behavior Score*:* Participants were asked to evaluate their leader using the organizational leadership subscale based on the revised 9-item Mayo Clinic Participatory Management Leadership Index (included in the Appendix, used with permission from Mayo Clinic).[25] This instrument was designed to evaluate leadership behaviors associated with team member engagement, including dimensions related to inclusion (treating everyone with respect), keeping people informed, soliciting input, empowering team members, nurturing professional development, and providing feedback and recognition. Each item is scored on a 5-point scale (0-4) and the scores from the individual items are summed to compute an aggregate score (with higher scores indicating more favorable ratings). The total score was then categorized into

tertiles to represent groups of participants' leadership scores in increasing order towards more favorable evaluations.

Professional Fulfillment Index: The PFI was used to measure professional fulfillment and burnout. The PFI includes 6 items for the assessment of professional fulfillment, 4 items for the assessment of work exhaustion and 6 items to assess interpersonal disengagement. The burnout score represents the mean of 10 work exhaustion and interpersonal disengagement items, scored on a Likert scale from 0 (not at all) to 4 (extremely), where 4 indicates the highest burnout score. The professional fulfillment scale assesses the degree of intrinsic positive reward the individual derives from their work, including happiness, meaningfulness, contribution, self-worth, satisfaction, and feeling in control when dealing with difficult problems at work. Items are measured on a five-point Likert scale from 0 (not at all true) to 4 (completely true). The mean score represents the mean of all 6 items and ranges between 0 and 4. Burnout score and professional fulfillment scores were rescaled to be between 0 and 10 to make interpretations simpler and consistent with recent reports.[25-26,30] Based on the published validation studies,[31-32] the established thresholds for burnout and professional fulfillment on the 0-10 scales are $\geq$3.25 and $\geq$7.5 respectively.

Intent to Leave: Participants were asked if they intended to leave their institution within two years (*What is the likelihood that you will leave your institution within two years?*). The response choices were none, slight, moderate, likely, and definitely. The responses were then collapsed to form a binary variable (0=none, 1 otherwise) indicating that the participants have at least "slight" likelihood of leaving.

Statistical Analyses

Data were summarized for the overall sample (Table 1) and by tertiles of the leadership behavior score using frequencies and percentages for categorical variables (Table 2). The association between leadership behavior score and variables of interests were statistically tested using Chi-square and trend tests presented in Table 2. Kramer's V statistic was included in Table 2 to show the degree of associations between categorical variables. Linear associations between continuous variables and leadership ratings were examined using correlation coefficients. Internal validity of the organizational leadership scale was assessed using Cronbach's alpha. Multivariable logistic regression analyses were conducted to examine the association between the leadership behavior score of each physician's supervisor and burnout and intent to leave controlling for gender, professional fulfillment and specialty. The correlation within specialty groups was accounted for using clustering at specialty level (logistic command with cluster option in Stata 15). Estimated odds ratios with 95% confidence intervals and p-values were presented in Table 3. Predictive margins over leadership scale tertiles were computed based on the logistic regression models for male and female physicians and presented in Figures 1-3. All statistical analyses were conducted in Stata 15. A p-value of <.05 was considered statistically significant.

RESULTS

The overall attending physician response rate for the PWAC survey was 45%. Fully completed surveys from 5416 attending physicians were included in the analysis. The personal and professional characteristics of responders are shown in Table 1.

Table 2 presents data on the relationships between specialty distribution, burnout, professional fulfillment and intent to leave by the tertiles of the scores on the Participatory Management Leadership Index, which showed high internal consistency (Cronbach's alpha=0.95) in this sample.

Female physicians represented 50% (2710/5416) of all participants. The percentage of female physicians who rated their immediate supervisor in the highest tertile of the leaderships scale was significantly lower than male physicians (28% vs 33% p<0.001). Male physicians rated their leaders more favorably compared to female physicians (2.8 (1.0) vs 2.6 (1.0), p<0.001). By specialty, Dermatologists (56%) and Pathologists (41%) had the highest proportion who rated their immediate supervisor in the highest tertile of the leadership behavior. In contrast, Ob-Gyn specialists (40%), Anesthesiologists (38%) and Internal Medicine physicians (31%) were least likely to rate their immediate supervisor in the highest tertile of the leaderships scale.

The leadership behavior rating of each physician's supervisor was negatively associated with burnout score (r=-0.34, p<0.001) and positively associated with professional fulfillment score (r=0.44, p<0.001). There was a significant positive association between professional fulfillment and leadership behavior score. Mean professional fulfillments scores (4.6, 4.4, 4.0, p<0.001) and the percentage of those with professional fulfillment were higher at higher tertiles of leadership behavior scores (lowest tertile: 19%, middle tertile: 34% and highest tertile: 47%, Kramer's V:0.33;

p<0.001). The mean burnout score (3.7, 3.0, 2.2, p<0.001) and percentage of physicians who had a high burnout score decreased with increasing tertiles of leadership behavior score (47%, 35% and 18%, Kramer's V:0.26, p<0.001). Similarly, the percentage of those who reported an intent to leave their institution in the next two years decreased with increasing tertiles of leadership behavior score (50%, 34% and 16%, Kramer's V:0.27, p<0.001).

Table 3 presents multivariable logistic regression models of professional fulfillment (Model 1), burnout status (Model 2) and intent to leave (Model 3) in relation to leadership behavior rating of physician's supervisor. The strong association between professional fulfillment and leadership behavior score is demonstrated in Model 1. Physicians who have more favorable evaluations of their leaders were more likely to be in the professionally fulfilled category. Specifically, the odds of having high professional fulfillment increased by a factor of 2.1 for those who rated their leader in the second tertile compared to those in the lowest tertile (OR:2.10, 95% CI: 1.85-2.37) while the odds increased by a factor of 5.8 for those who are in the top tertile compared to those in the lowest tertile (OR:5.80, 95% CI:5.10-6.59, AUC 0.71). This model also demonstrates that female physicians were significantly less likely to have high professional fulfillment after adjusting for specialty, and supervisor leadership behavior rating (OR:0.58, 95% CI: 0.51-0.66). Figure 1 illustrates the likelihood of having professional fulfillment for each leadership behavior tertile of physician's supervisor for female and male physicians based on the predicted probabilities obtained from Model 1. Non-overlapping confidence intervals at each tertile show that the difference between

gender groups is maintained across tertiles suggesting that the association between of leadership score on professional fulfillment is not dependent on gender. This is evidenced by non-significant interaction effects between gender and leadership behavior score tertiles in Model 1 when interaction terms are included.

The relationship between organizational leadership and physician burnout is assessed in Model 2, which is adjusted by gender, specialty and professional fulfillment. Physicians who rated the leader behavior of their supervisor in the second tertile were 48% less likely to be burned out compared to those who are in the first tertile (OR:0.52, 95% CI:0.45-0.61); those who are in the top tertile of leadership behavior score were 74% less likely to be burned out compared to those who are in the first tertile (OR:0.26, 95% CI:0.23-0.31). Model 2 also showed that the odds of reporting burnout are 57% higher for female physicians (OR:1.57 95% CI: 1.41-1.76, AUC 0.77). The likelihood of burnout derived from Model 2 by the tertiles of leadership behavior score is illustrated for male and female physicians in Figure 2. The gender differences in burnout by increasing tertiles of leadership behavior score remained similar across tertiles indicated by non-overlapping confidence intervals at each tertile and non-significant interactions between gender and leadership behavior score tertiles in Model 2.

Model 3 estimates the effect of leadership behavior rating of each physician's supervisor on the likelihood that a physician intent to leave their institution within the next two years. This model is adjusted by gender, specialty, burnout and professional fulfillment status as potential confounders of intent to leave. Physicians who rated the leader behavior of their supervisor in the second tertile were 44% less likely to report an

intent to leave compared to those who were in the first tertile (OR:0.56, 95% CI:0.48-0.65); those who were in the top tertile of supervisor leadership behavior score are 66% less likely to intend to leave compared to those who were in the first tertile (OR:0.34, 95% CI:0.26-0.44). Model 3 also shows that the odds of reporting intent to leave were 30% lower for female physicians (OR:0.70 95% CI: 0.60-0.83) and 54% lower for those with high professional fulfillment (OR:0.46, 95% CI:0.40-0.52). The area under the ROC curve for this model is 0.74. The likelihood of having intent to leave for male and female physicians in this model by the tertiles of supervisor leadership behavior score is shown in Figure 3. Fifty percent (95% CI: 47-53) of male physicians and 45% (95% CI: 42-48) of female physicians in the lowest tertile of leadership behavior score reported an intent to leave in two years compared to 17% of male physicians and 16% of female physicians in the top tertile. The difference between the gender groups in the top tertile is significantly narrower compared to that in the lower tertile evidenced by a statistically significant interaction term (genderXtertile3, OR=0.70, 95% CI: 0.52-0.94, p=0.02) when interaction terms are included.

DISCUSSION

This multi-institution study demonstrates a strong relationship between leadership evaluations and burnout, professional fulfillment and intent to leave current organization among US physicians. These results are consistent with previous single center studies which have demonstrated the significant impact of leadership quality on healthcare professional burnout and professional fulfillment.[24-26,33] The association between leadership and burnout remains strong even when we control for professional fulfillment,

which has a well-established strong inverse relationship with burnout.[34] Although the present study looks at the correlation between individuals' rating of the leadership behavior of their supervisor and their own well-being and professional fulfillment, previous studies have also found a strong relationship between the composite leadership behavior score of a leader (as assessed by all individuals reporting to them) and the risk of burnout and professional fulfillment for the members of the team as a whole.[24-26] Leader behavior score also had a strong relationship with intent to leave. These results are consistent with the notion that physicians who are dissatisfied with their supervisor' ability to lead the team are the more likely to consider other opportunities. Prior studies demonstrated physicians who report intent to leave are three times more likely to leave their institution in the next two years.[8,9,35] This is especially important as the cost of replacing physicians is significant, and turnover and burnout can be associated with lower quality and higher cost care for patients.[3, 46-40]

Notably, in our study, a lower percentage of female physicians rated the leadership behaviors of their supervisor in the top tertile and a higher percentage rated the behaviors of their supervisor in the lowest tertile. Previous studies have indicated female physicians report greater workplace bullying, harassment, gender discrimination, and feelings of isolation.[41-49] While female physicians are no longer a minority in the profession, they are often underrepresented in leadership, potentially due to inequality and bias in the opportunity for promotion and reward.[7, 41-44, 50] This also results in fewer female leaders serving as mentors and role models, which may be protective against burnout. [42, 45-47, 50]

Interestingly, in our adjusted analysis controlling for burnout, professional fulfillment, and the behavior score of their leader, female physicians reported less intent to leave than male physicians (OR 0.7 CI 0.59-0.83 p<0.001). This is in contrast to prior studies demonstrating a 8-10% higher attrition rate in female physicians.[35, 43,49] These observations are consistent with the possibility that higher attrition rates among women physicians may be due to lower satisfaction with their leader and higher rates of burnout. Because intent to leave describes a longer-term plan to change jobs, it is also possible that female physicians may leave their jobs more suddenly.

Investing in the leadership development of supervising physicians maybe an important strategy to mitigate burnout and promote professional fulfillment in physicians. An integrative model of Wellness-Centered Leadership (WCL) incorporating the critical skills and leadership behaviors that cultivate engagement and professional fulfillment was recently published.[51] When selecting and developing clinician leaders, the importance of emotional intelligence, social awareness and team communication should be considered.[27] These are skills that can be developed in physicians in training, beginning in medical school and continuing through all phases of training, including communication, mindfulness and reflection.[18, 52-53] Leaders' own well-being impacts their leadership effectiveness. One recent study demonstrated that 9.8% of the variation in a leader's leadership behavior scores as assessed by physicians on their team was related to their own independently assessed degree of burnout.[25] This observation suggests that burnout among leaders may result in sub-optimal leadership behavior which in turn increase the risk of burnout in their team members creating a vicious cycle. This finding suggest that leadership development initiatives should include

attention to the well-being of the leader in addition to cultivation of specific leadership skills.[51]

Our study has several limitations. First, although relatively high for a physician survey,[53-56] our response rate was 45%, which raises the potential for selection bias.[57] Second, the cross-sectional and survey-based design of the study allows us only to assess associations between leadership evaluations and the outcomes. Third, all physicians surveyed were from healthcare organizations participating in the PWAC. Although some PWAC institutions are non-academic institutions, most are academic medical centers, which makes the generalizability of the results to non-academic settings unclear. Finally, since the age of the respondent along with gender can help reveal the identity of the physicians in small specialties, it was not made available for the analyses and remains a limitation of the study. Our study has several strengths. It is a large multi-center study of physicians from 11 healthcare organizations representing all medical specialties with reasonably high response rate, using validated instruments to assess burnout, professional fulfillment, and leadership behavior.

CONCLUSION

The leadership behaviors of physician supervisors have a strong relationship to their team members' burnout, professional fulfillment, and intent to leave. Female physicians report lower satisfaction with their leaders' leadership behaviors. Greater attention to

leader selection, development, and performance evaluation represents a potentially important approach to reducing occupational burnout and promoting professional fulfillment in large healthcare organizations.

Tables and Figures:

Table 1. Characteristics of the Respondents

Total N=5,416	N (%)
Gender	
Female	2710 (50)
Male	2706 (50)
Specialty	
Anesthesiology	407 (7.5)
Dermatology	71 (1.3)
Emergency Medicine	322 (6.0)
Medicine	1671(30.9)
Neurology	195 (3.6)
OB-GYN	248 (4.6)
Pathology	140 (2.6)
Pediatrics	804 (14.9)
Psychiatry	136 (2.5)
Radiation Oncology	77 (1.4)
Radiology	317 (5.9)
Surgery	630 (11.6)
Missing Specialty	398 (7.3)
Leadership Behavior Mean Score (0-4) (SD)	2.7 (0.7)
Occupational Distress and Well-being	
Professional fulfillment	
Mean score (0-10) (SD)[2]	6.6 (2.1)
Professional Fulfillment Present (yes)	2280 (42)

Burnout	
Mean score (0-10) (SD)[1]	3.0 (1.9)
Burned Out (yes)	2174 (40)
Intent to Leave Current Organization within Two Years	1694 (32)

[1] higher score unfavorable
[2] higher score favorable

Table 2. Characteristics of the Respondents by the Tertiles of Supervisor Leadership Behavior Score (Scores ranked from lowest to highest)

Total N=5,416	Tertiles of Leadership Behavior Score[1]			
	Lowest 1/3 (Low Scores: (0-2.3) N (row %)	Middle 1/3 Medium Scores: (2.4-3.2) N (row %)	Highest 1/3 High Scores: (3.3-4.0) N (row %)	(Kramer's V) Chi-square-p-value
Sex				
Female	994 (37)	972 (36)	744 (28)	(0.07) (<0.001)
Male	824 (31)	987 (37)	895 (33)	
Specialty				
Anesthesiology	156 (38)	154 (38)	97 (24)	(0.11) (<0.001)
Dermatology	10 (14)	21 (30)	40 (56)	
Emergency Medicine	66 (21)	144 (45)	112 (35)	
Medicine	625 (37)	593 (36)	453 (27)	

Neurology	51 (26)	72 (37)	72 (37)	
OB-GYN	98 (40)	83 (34)	67 (27)	
Pathology	32 (23)	51 (36)	57 (41)	
Pediatrics	241 (30)	306 (38)	257 (32)	
Psychiatry	43 (32)	44 (32)	49 (36)	
Radiation Oncology	23 (30)	29 (38)	25 (33)	
Radiology	89 (28)	114 (36)	114 (36)	
Surgery	214 (34)	209 (33)	207 (33)	
Missing Specialty	170 (43)	139 (35)	89 (22)	
Professional Fulfillment				
Mean score (0-10) (SD) [3]	5.6 (2.1)	6.7 (1.8)	7.7 (1.8)	<0.001
Professional Fulfillment Present (yes)	438 (19)	779 (34)	1063(47)	(0.33) (<0.001)
Burned Out				
Mean score (0-10) (SD) [2]	3.7 (2.0)	3.0 (1.7)	2.2 (1.7)	<0.001
Burned Out (yes)	1010(47)	766 (35)	398 (18)	(0.26) (<0.001)
Intent to Leave (yes)	851 (50)	578 (34)	265 (16)	(0.27) (<0.001)

[1] higher tertile favorable [2] higher score unfavorable
[3] higher score favorable

Table 3. Logistic Regression Models of Professional Fulfillment, Burnout and Intent to Leave

	Model 1 Professional Fulfillment (yes) N=5416	Model 2 Burnout Status (yes) N=5416	Model 3 Intent to Leave (yes) N=5374
Variables	Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)
Female vs Male	0.58 (0.51-0.66) (<0.001)	1.57 (1.41-1.76) (<0.001)	0.70 (0.60-0.83) (<0.001)
Leadership Score Tertile 1 (Lowest 1/3 of All Scores)	Reference	Reference	Reference
Tertile 2 (Middle 1/3 of All Scores)	2.10 (1.85-2.37) (<0.001)	0.52 (0.45-0.61) (<0.001)	0.56 (0.48-0.65) (<0.001)
Tertile 3 (Highest 1/3 of All scores)	5.80 (5.10-6.59) (<0.001)	0.26 (0.23-0.31) (<0.001)	0.34 (0.26-0.44) (<0.001)
Professional Fulfillment Present (yes)	-----	-----	0.45 (0.40-0.52) (<0.001)
Burned out vs Not	-----	-----	2.43 (2.17-2.71) (<0.001)
Area under the curve (ROC)	0.71	0.66	0.74

Figure 1. Likelihood (%, 95% CI) of Professional Fulfillment Status by the Tertiles of Supervisor Leadership Behavior Score for Female and Male Physicians

Figure 2. Likelihood (%, 95% CI) of Burnout Status by the Tertiles of Supervisor Leadership Behavior Score for Female and Male Physicians

Figure 3. Likelihood (%, 95% CI) of Reporting Intent to Leave by the Tertiles Supervisor Leadership Behavior Score for Female and Male Physicians

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Figure 1. Predicted Percentage of Physicians (%, 95% CI) with High Professional Fulfillment by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians

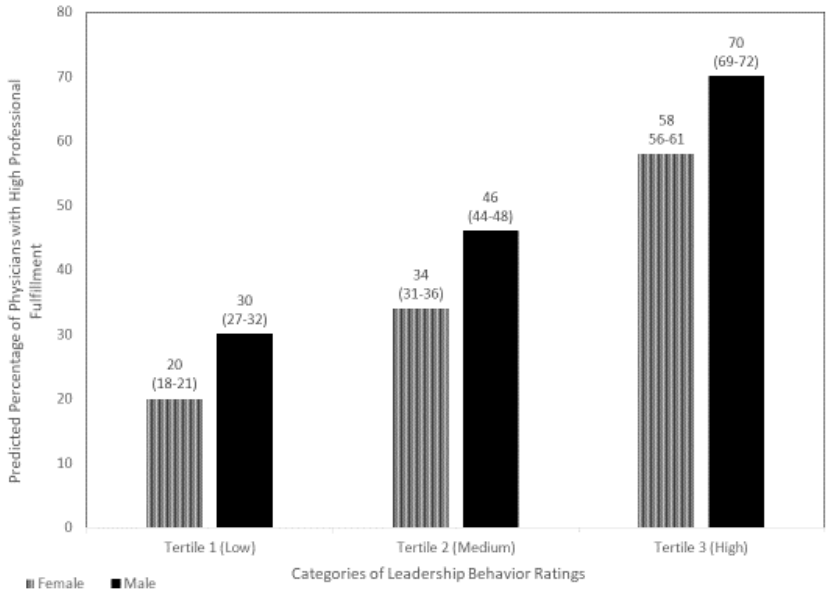


Figure 2. Predicted Percentage of Physicians (%, 95% CI) with Burnout by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians

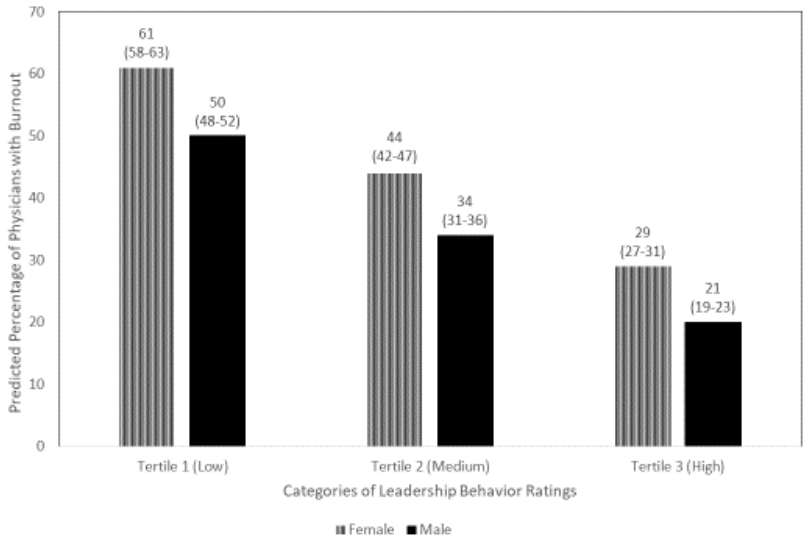
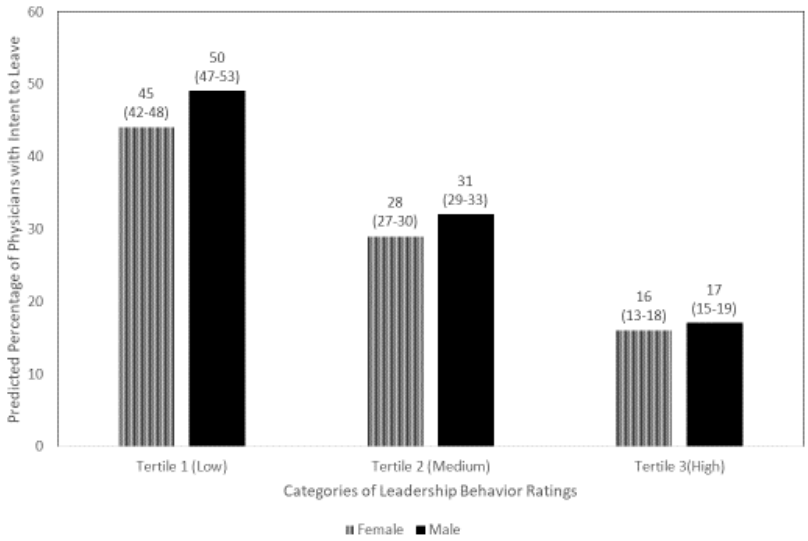


Figure 3. Predicted Percentage of Physicians (%, 95% CI) Reporting Intent to Leave by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians



STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	5	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7	
Objectives	3	State specific objectives, including any prespecified hypotheses	8	
Methods				
Study design	4	Present key elements of study design early in the paper	8	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-9	
Participants	6	(9) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10	
Bias	9	Describe any efforts to address potential sources of bias	10-11, 16-18	
Study size	10	Explain how the study size was arrived at	8-9, 11	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy (Not applicable)	N/A No sampling
		(*e*) Describe any sensitivity analyses (Not applicable)	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9,11
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	19-20 (table 1)
		(b) Indicate number of participants with missing data for each variable of interest	N/A, not included in the study
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*N/A*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	*N/A*
		Cross-sectional study—Report numbers of outcome events or summary measures	*20*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	20-22 (Table 2)
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Figures 1-3 (attached

	separately)

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The impact of leadership behavior on physician wellbeing, burnout, professional fulfillment and intent to leave: a multi-center cross-sectional survey study

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Title: The impact of leadership behavior on physician wellbeing, burnout, professional fulfillment and intent to leave: a multi-center cross-sectional survey study

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Abstract:

Objective: To examine how perceived leadership behaviors affect burnout, professional fulfillment and intent to leave the organization among physicians.

Design: Anonymous cross-sectional survey study from November 2016 to October 2018.

Setting: 12,036 attending and resident physicians at eleven healthcare organizations participating in the Physician Wellness Academic Consortium (PWAC) were surveyed to assess burnout and professional fulfillment and their drivers.

Participants: A sample of 5416 attending physicians with complete data on gender, specialty, leadership, burnout and professional fulfillment.

Main Outcomes and Measures: The leadership behavior of each physician's supervisor was assessed using the Mayo Clinic Participatory Management Leadership Index and categorized in tertiles. Multivariable logistic regression analyses examined the effect of leadership behavior rating of each physician's supervisor on burnout, professional fulfillment, and intent to leave controlling for gender and specialty.

Results: The response rate was 45% across 11 institutions. Half of respondents were female. Professional fulfillment increased with increasing tertiles of leadership behavior rating (19%, 34%, 47% p<0.001). The odds of professional fulfillment were 5.8 times higher (OR=5.8, 95%CI 5.1-6.59) for physicians in the top tertile compared to those in the lowest tertile. Physicians in the top tertile were also 48% less likely to be burned out (OR=0.52,95%CI 0.45-0.61) and reported 66% lower intent to leave (OR=0.34, 95% CI 0.26-0.44). Individuals who rated their supervisor's leadership in upper tertiles relative to

lower tertiles exhibited lower levels of burnout (18% vs 35% vs 47% p<0.001), and intent to leave (16% vs 24% vs 50% p<0.001).

Conclusion: Perceived leadership behaviors have a strong relationship with burnout, professional fulfillment, and intent to leave among physicians. Organizations should consider leadership development as a potential vehicle to improve physician wellness and prevent costly physician departures.

Abstract word count: 290

Keywords: burnout, leadership, gender, professional fulfillment

Strengths and Limitations of this Study:

- First multi-center survey that analyzed the effect of supervisor leadership behaviors on physician wellbeing, professional fulfillment and intent to leave.
- Leadership was evaluated by 5416 physicians representing at least 12 specialties from eleven healthcare organizations.
- Validated instruments were used to assess burnout, professional fulfillment and leadership behavior.
- Response rate of 45%, although relatively high for a physician survey, may still contribute to selection bias.
- Respondents are from member institutions of the Physician Wellness Academic Consortium (PWAC), which may limit generalizability.

INTRODUCTION

As the landscape of modern medicine continues to grow and change, physicians are increasingly becoming employed by large organizations.[1] Solo or small practices are becoming less common, and up to two thirds of physicians are now employed by large practice groups and 20% of physicians employed by a practice of greater than 100 physicians.[2] The trend to group medicine exists beyond the boundaries of academic medicine or private practice, including university hospitals, health maintenance organizations, practice groups, and health systems.

Healthcare organizations have increasingly recognized the impact of occupational burnout and physician well-being on their ability to provide high quality healthcare to their communities.[3] The components of burnout include emotional exhaustion (EE), depersonalization, and decreased personal efficacy in the context of the work environment.[4] Concern for physician burnout has gained increasing attention given its implications for patient and provider health. Burnout has previously been associated with worse quality of care,[5-7] physician attrition,[8-10] patient satisfaction,[11-13] cost of care,[3,14-15] and medical errors.[6,16-17] Institutional factors involved in burnout and professional fulfillment act as modifiable factors that can be targeted by organizations.[18-23]

The impact of leadership effectiveness on burnout and workplace satisfaction for physicians is of importance for healthcare organizations.[24-26] A study of 2800 physicians

at the Mayo Clinic demonstrated that average leadership behavior score of physicians' work unit supervisor explained 11% of the variation in burnout and 47% of the variation in workplace satisfaction across 129 work units when adjusted for other factors.[24] The leadership behaviors of physicians immediate supervisor have also been found to have a strong impact on physicians' perception of values alignment with their organization as a whole.[26] Healthcare leaders face many challenges, balancing costs with ever changing reimbursements, managing personnel, and addressing dynamic quality metrics.[27] However, physician training is largely focused on the individual, with an emphasis on clinical care of patients. Developing leadership skills in physician supervisors, organizations can make a large impact in the wellbeing of their clinicians and foster better patient care.[18, 25,28-29] Additionally, by understanding and targeting leadership, organizations can impact a large number of healthcare professionals and teams under each leader's supervision. We sought to further evaluate the factors involved in physician burnout by understanding the relationship between leadership, burnout, profession fulfillment, and intent to leave.

METHODS:

A cross sectional study of attending physicians in the United States was performed at eleven healthcare organizations participating in the Physician Wellness Academic Consortium (PWAC-https://wellbeingconsortium.org). A standardized survey was administered at participating institutions to be distributed to physicians from all available departments. A total of 12036 attending and resident physicians across 11 institutions were surveyed between November 2016 and October 2018 as part of their membership

in the Physician Wellness Academic Consortium. Among these, 5795 attendings completed evaluation of their supervisor using the 9-item version of the Mayo Clinic Participatory Management Leadership Index. Resident physician data and incomplete data from attending physicians on gender, specialty, leadership rating scale, burnout or professional fulfillment were excluded. The dataset was de-identified by a third-party administrator prior to analysis.

Patient and Public Involvement

Patients or the public were not involved in the design, conduct or reporting of the study. Given that this was an anonymous deidentified study, the results will be disseminated by publication of this study without direct contact to participants.

Measures

Supervisor Leadership Behavior Score*:* Participants were asked to evaluate their leader using the organizational leadership subscale based on the revised 9-item Mayo Clinic Participatory Management Leadership Index (included in the Appendix, used with permission from Mayo Clinic).[25] This instrument was designed to evaluate leadership behaviors associated with team member engagement, including dimensions related to inclusion (treating everyone with respect), keeping people informed, soliciting input, empowering team members, nurturing professional development, and providing feedback and recognition. Each item is scored on a 5-point scale (0-4) and the scores from the individual items are summed to compute an aggregate score (with higher scores indicating more favorable ratings). The total score was then categorized into

tertiles to represent groups of participants' leadership scores in increasing order towards more favorable evaluations.

Professional Fulfillment Index: The PFI was used to measure professional fulfillment and burnout. The PFI includes 6 items for the assessment of professional fulfillment, 4 items for the assessment of work exhaustion and 6 items to assess interpersonal disengagement. The burnout score represents the mean of 10 work exhaustion and interpersonal disengagement items, scored on a Likert scale from 0 (not at all) to 4 (extremely), where 4 indicates the highest burnout score. The professional fulfillment scale assesses the degree of intrinsic positive reward the individual derives from their work, including happiness, meaningfulness, contribution, self-worth, satisfaction, and feeling in control when dealing with difficult problems at work. Items are measured on a five-point Likert scale from 0 (not at all true) to 4 (completely true). The mean score represents the mean of all 6 items and ranges between 0 and 4. Burnout score and professional fulfillment scores were rescaled to be between 0 and 10 to make interpretations simpler and consistent with recent reports.[25-26,30] Based on the published validation studies,[31-32] the established thresholds for burnout and professional fulfillment on the 0-10 scales are $\geq$3.25 and $\geq$7.5 respectively.

Intent to Leave: Participants were asked if they intended to leave their institution within two years (*What is the likelihood that you will leave your institution within two years?*). The response choices were none, slight, moderate, likely, and definitely. The responses were then collapsed to form a binary variable (0=none, 1 otherwise) indicating that the participants have at least "slight" likelihood of leaving.

Statistical Analyses

Data were summarized for the overall sample (Table 1) and by tertiles of the leadership behavior score using frequencies and percentages for categorical variables (Table 2). The association between leadership behavior score and variables of interests were statistically tested using Chi-square and trend tests presented in Table 2. Kramer's V statistic was included in Table 2 to show the degree of associations between categorical variables. Linear associations between continuous variables and leadership ratings were examined using correlation coefficients. Internal validity of the organizational leadership scale was assessed using Cronbach's alpha. Multivariable logistic regression analyses were conducted to examine the association between the leadership behavior score of each physician's supervisor and burnout and intent to leave controlling for gender, professional fulfillment and specialty. The correlation within specialty groups was accounted for using clustering at specialty level (logistic command with cluster option in Stata 15). Estimated odds ratios with 95% confidence intervals and p-values were presented in Table 3. Predictive margins over leadership scale tertiles were computed based on the logistic regression models for male and female physicians and presented in Figures 1-3. All statistical analyses were conducted in Stata 15. A p-value of <.05 was considered statistically significant.

RESULTS

The overall attending physician response rate for the PWAC survey was 45%. Fully completed surveys from 5416 attending physicians were included in the analysis. The personal and professional characteristics of responders are shown in Table 1.

Table 2 presents data on the relationships between specialty distribution, burnout, professional fulfillment and intent to leave by the tertiles of the scores on the Participatory Management Leadership Index, which showed high internal consistency (Cronbach's alpha=0.95) in this sample.

Female physicians represented 50% (2710/5416) of all participants. The percentage of female physicians who rated their immediate supervisor in the highest tertile of the leaderships scale was significantly lower than male physicians (28% vs 33% p<0.001). Male physicians rated their leaders more favorably compared to female physicians (2.8 (1.0) vs 2.6 (1.0), p<0.001). By specialty, Dermatologists (56%) and Pathologists (41%) had the highest proportion who rated their immediate supervisor in the highest tertile of the leadership behavior. In contrast, Ob-Gyn specialists (40%), Anesthesiologists (38%) and Internal Medicine physicians (31%) were least likely to rate their immediate supervisor in the highest tertile of the leaderships scale.

The leadership behavior rating of each physician's supervisor was negatively associated with burnout score (r=-0.34, p<0.001) and positively associated with professional fulfillment score (r=0.44, p<0.001). There was a significant positive association between professional fulfillment and leadership behavior score. Mean professional fulfillments scores (4.6, 4.4, 4.0, p<0.001) and the percentage of those with professional fulfillment were higher at higher tertiles of leadership behavior scores (lowest tertile: 19%, middle tertile: 34% and highest tertile: 47%, Kramer's V:0.33; p<0.001). The mean burnout score (3.7, 3.0, 2.2, p<0.001) and percentage of physicians who had a high burnout score decreased with increasing tertiles of leadership behavior score (47%, 35% and 18%, Kramer's V:0.26, p<0.001). Similarly,

the percentage of those who reported an intent to leave their institution in the next two years decreased with increasing tertiles of leadership behavior score (50%, 34% and 16%, Kramer's V:0.27, p<0.001).

Table 3 presents multivariable logistic regression models of professional fulfillment (Model 1), burnout status (Model 2) and intent to leave (Model 3) in relation to leadership behavior rating of physician's supervisor. The strong association between professional fulfillment and leadership behavior score is demonstrated in Model 1. Physicians who have more favorable evaluations of their leaders were more likely to be in the professionally fulfilled category. Specifically, the odds of having high professional fulfillment increased by a factor of 2.1 for those who rated their leader in the second tertile compared to those in the lowest tertile (OR:2.10, 95% CI: 1.85-2.37) while the odds increased by a factor of 5.8 for those who are in the top tertile compared to those in the lowest tertile (OR:5.80, 95% CI:5.10-6.59, AUC 0.71). This model also demonstrates that female physicians were significantly less likely to have high professional fulfillment after adjusting for specialty, and supervisor leadership behavior rating (OR:0.58, 95% CI: 0.51-0.66). Figure 1 illustrates the likelihood of having professional fulfillment for each leadership behavior tertile of physician's supervisor for female and male physicians based on the predicted probabilities obtained from Model 1. Non-overlapping confidence intervals at each tertile show that the difference between gender groups is maintained across tertiles suggesting that the association between of leadership score on professional fulfillment is not dependent on gender. This is

evidenced by non-significant interaction effects between gender and leadership behavior score tertiles in Model 1 when interaction terms are included.

The relationship between organizational leadership and physician burnout is assessed in Model 2, which is adjusted by gender, specialty and professional fulfillment. Physicians who rated the leader behavior of their supervisor in the second tertile were 48% less likely to be burned out compared to those who are in the first tertile (OR:0.52, 95% CI:0.45-0.61); those who are in the top tertile of leadership behavior score were 74% less likely to be burned out compared to those who are in the first tertile (OR:0.26, 95% CI:0.23-0.31). Model 2 also showed that the odds of reporting burnout are 57% higher for female physicians (OR:1.57 95% CI: 1.41-1.76, AUC 0.77). The likelihood of burnout derived from Model 2 by the tertiles of leadership behavior score is illustrated for male and female physicians in Figure 2. The gender differences in burnout by increasing tertiles of leadership behavior score remained similar across tertiles indicated by non-overlapping confidence intervals at each tertile and non-significant interactions between gender and leadership behavior score tertiles in Model 2.

Model 3 estimates the effect of leadership behavior rating of each physician's supervisor on the likelihood that a physician intent to leave their institution within the next two years. This model is adjusted by gender, specialty, burnout and professional fulfillment status as potential confounders of intent to leave. Physicians who rated the leader behavior of their supervisor in the second tertile were 44% less likely to report an intent to leave compared to those who were in the first tertile (OR:0.56, 95% CI:0.48-0.65); those who were in the top tertile of supervisor leadership behavior score are 66%

less likely to intend to leave compared to those who were in the first tertile (OR:0.34, 95% CI:0.26-0.44). Model 3 also shows that the odds of reporting intent to leave were 30% lower for female physicians (OR:0.70 95% CI: 0.60-0.83) and 54% lower for those with high professional fulfillment (OR:0.46, 95% CI:0.40-0.52). The area under the ROC curve for this model is 0.74. The likelihood of having intent to leave for male and female physicians in this model by the tertiles of supervisor leadership behavior score is shown in Figure 3. Fifty percent (95% CI: 47-53) of male physicians and 45% (95% CI: 42-48) of female physicians in the lowest tertile of leadership behavior score reported an intent to leave in two years compared to 17% of male physicians and 16% of female physicians in the top tertile. The difference between the gender groups in the top tertile is significantly narrower compared to that in the lower tertile evidenced by a statistically significant interaction term (genderXtertile3, OR=0.70, 95% CI: 0.52-0.94, p=0.02) when interaction terms are included.

DISCUSSION

This multi-institution study demonstrates a strong relationship between leadership evaluations and burnout, professional fulfillment and intent to leave current organization among US physicians. These results are consistent with previous single center studies which have demonstrated the significant impact of leadership quality on healthcare professional burnout and professional fulfillment.[24-26,33] The association between leadership and burnout remains strong even when we control for professional fulfillment, which has a well-established strong inverse relationship with burnout.[34] Although the present study looks at the correlation between individuals' rating of the leadership

behavior of their supervisor and their own well-being and professional fulfillment, previous studies have also found a strong relationship between the composite leadership behavior score of a leader (as assessed by all individuals reporting to them) and the risk of burnout and professional fulfillment for the members of the team as a whole.[24-26] Leader behavior score also had a strong relationship with intent to leave. These results are consistent with the notion that physicians who are dissatisfied with their supervisor' ability to lead the team are the more likely to consider other opportunities. Prior studies demonstrated physicians who report intent to leave are three times more likely to leave their institution in the next two years.[8,9,35] This is especially important as the cost of replacing physicians is significant, and turnover and burnout can be associated with lower quality and higher cost care for patients.[3,36-40]

Notably, in our study, a lower percentage of female physicians rated the leadership behaviors of their supervisor in the top tertile and a higher percentage rated the behaviors of their supervisor in the lowest tertile. Previous studies have indicated female physicians report greater workplace bullying, harassment, gender discrimination, and feelings of isolation.[41-49] While female physicians are no longer a minority in the profession, they are often underrepresented in leadership, potentially due to inequality and bias in the opportunity for promotion and reward.[7, 41-44, 50] This also results in fewer female leaders serving as mentors and role models, which may be protective against burnout. [42, 45-47, 50]

Interestingly, in our adjusted analysis controlling for burnout, professional fulfillment, and the behavior score of their leader, female physicians reported less intent to leave than male physicians (OR 0.7 CI 0.59-0.83 p<0.001). This is in contrast to prior studies

demonstrating a 8-10% higher attrition rate in female physicians.[35, 43,49] These observations are consistent with the possibility that higher attrition rates among women physicians may be due to lower satisfaction with their leader and higher rates of burnout. Because intent to leave describes a longer-term plan to change jobs, it is also possible that female physicians may leave their jobs more suddenly.

Investing in the leadership development of supervising physicians maybe an important strategy to mitigate burnout and promote professional fulfillment in physicians. An integrative model of Wellness-Centered Leadership (WCL) incorporating the critical skills and leadership behaviors that cultivate engagement and professional fulfillment was recently published.[51] When selecting and developing clinician leaders, the importance of emotional intelligence, social awareness and team communication should be considered.[27] These are skills that can be developed in physicians in training, beginning in medical school and continuing through all phases of training, including communication, mindfulness and reflection.[18, 52-53] Leaders' own well-being impacts their leadership effectiveness. One recent study demonstrated that 9.8% of the variation in a leader's leadership behavior scores as assessed by physicians on their team was related to their own independently assessed degree of burnout.[25] This observation suggests that burnout among leaders may result in sub-optimal leadership behavior which in turn increase the risk of burnout in their team members creating a vicious cycle. This finding suggest that leadership development initiatives should include attention to the well-being of the leader in addition to cultivation of specific leadership skills.[51]

Our study has several limitations. First, although relatively high for a physician survey,[53-56] our response rate was 45%, which raises the potential for selection bias.[57] Second, the cross-sectional and survey-based design of the study allows us only to assess associations between leadership evaluations and the outcomes. Third, all physicians surveyed were from healthcare organizations participating in the PWAC. Although some PWAC institutions are non-academic institutions, most are academic medical centers, which makes the generalizability of the results to non-academic settings unclear. Finally, since the age of the respondent along with gender can help reveal the identity of the physicians in small specialties, it was not made available for the analyses and remains a limitation of the study. Our study has several strengths. It is a large multi-center study of physicians from 11 healthcare organizations representing all medical specialties with reasonably high response rate, using validated instruments to assess burnout, professional fulfillment, and leadership behavior.

CONCLUSION

The leadership behaviors of physician supervisors have a strong relationship to their team members' burnout, professional fulfillment, and intent to leave. Female physicians report lower satisfaction with their leaders' leadership behaviors. Greater attention to leader selection, development, and performance evaluation represents a potentially important approach to reducing occupational burnout and promoting professional fulfillment in large healthcare organizations.

Tables and Figures:

Table 1. Characteristics of the Respondents

Total N=5,416	N (%)
Gender	
Female	2710 (50)
Male	2706 (50)
Specialty	
Anesthesiology	407 (7.5)
Dermatology	71 (1.3)
Emergency Medicine	322 (6.0)
Medicine	1671(30.9)
Neurology	195 (3.6)
OB-GYN	248 (4.6)
Pathology	140 (2.6)
Pediatrics	804 (14.9)
Psychiatry	136 (2.5)
Radiation Oncology	77 (1.4)
Radiology	317 (5.9)
Surgery	630 (11.6)
Missing Specialty	398 (7.3)
Leadership Behavior Mean Score (0-4) (SD)	2.7 (0.7)
Occupational Distress and Well-being	
Professional fulfillment	
Mean score (0-10) (SD)[2]	6.6 (2.1)
Professional Fulfillment Present (yes)	2280 (42)

Burnout	
Mean score (0-10) (SD)[1]	3.0 (1.9)
Burned Out (yes)	2174 (40)
Intent to Leave Current Organization within Two Years	1694 (32)

[1] higher score unfavorable
[2] higher score favorable

Table 2. Characteristics of the Respondents by the Tertiles of Supervisor Leadership Behavior Score (Scores ranked from lowest to highest)

Total N=5,416	Tertiles of Leadership Behavior Score[1]			
	Lowest 1/3 (Low Scores: (0-2.3) N (row %)	Middle 1/3 Medium Scores: (2.4-3.2) N (row %)	Highest 1/3 High Scores: (3.3-4.0) N (row %)	(Kramer's V) Chi-square-p-value
Sex				
Female	994 (37)	972 (36)	744 (28)	(0.07) (<0.001)
Male	824 (31)	987 (37)	895 (33)	
Specialty				
Anesthesiology	156 (38)	154 (38)	97 (24)	(0.11) (<0.001)
Dermatology	10 (14)	21 (30)	40 (56)	
Emergency Medicine	66 (21)	144 (45)	112 (35)	
Medicine	625 (37)	593 (36)	453 (27)	
Neurology	51 (26)	72 (37)	72 (37)	
OB-GYN	98 (40)	83 (34)	67 (27)	
Pathology	32 (23)	51 (36)	57 (41)	
Pediatrics	241 (30)	306 (38)	257 (32)	
Psychiatry	43 (32)	44 (32)	49 (36)	

Radiation Oncology	23 (30)	29 (38)	25 (33)	
Radiology	89 (28)	114 (36)	114 (36)	
Surgery	214 (34)	209 (33)	207 (33)	
Missing Specialty	170 (43)	139 (35)	89 (22)	
Professional Fulfillment				
Mean score (0-10) (SD)[3]	5.6 (2.1)	6.7 (1.8)	7.7 (1.8)	<0.001
Professional Fulfillment Present (yes)	438 (19)	779 (34)	1063(47)	(0.33) (<0.001)
Burned Out				
Mean score (0-10) (SD)[2]	3.7 (2.0)	3.0 (1.7)	2.2 (1.7)	<0.001
Burned Out (yes)	1010(47)	766 (35)	398 (18)	(0.26) (<0.001)
Intent to Leave (yes)	851 (50)	578 (34)	265 (16)	(0.27) (<0.001)

[1] higher tertile favorable [2] higher score unfavorable
[3] higher score favorable

Table 3. Logistic Regression Models of Professional Fulfillment, Burnout and Intent to Leave

	Model 1 Professional Fulfillment (yes) N=5416	Model 2 Burnout Status (yes) N=5416	Model 3 Intent to Leave (yes) N=5374
Variables	Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)	Odds Ratio (95% CI) (p-val)
Female vs Male	0.58 (0.51-0.66) (<0.001)	1.57 (1.41-1.76) (<0.001)	0.70 (0.60-0.83) (<0.001)
Leadership Score Tertile 1 (Lowest 1/3 of All Scores)	Reference	Reference	Reference
Tertile 2 (Middle 1/3 of All Scores)	2.10 (1.85-2.37) (<0.001)	0.52 (0.45-0.61) (<0.001)	0.56 (0.48-0.65) (<0.001)
Tertile 3 (Highest 1/3 of All scores)	5.80 (5.10-6.59) (<0.001)	0.26 (0.23-0.31) (<0.001)	0.34 (0.26-0.44) (<0.001)
Professional Fulfillment Present (yes)	-----	-----	0.45 (0.40-0.52) (<0.001)
Burned out vs Not	-----	-----	2.43 (2.17-2.71) (<0.001)
Area under the curve (ROC)	0.71	0.66	0.74

Figure 1. Likelihood (%, 95% CI) of Professional Fulfillment Status by the Tertiles of Supervisor Leadership Behavior Score for Female and Male Physicians

Figure 2. Likelihood (%, 95% CI) of Burnout Status by the Tertiles of Supervisor Leadership Behavior Score for Female and Male Physicians

Figure 3. Likelihood (%, 95% CI) of Reporting Intent to Leave by the Tertiles Supervisor Leadership Behavior Score for Female and Male Physicians

Author Contributions: Dr. Mete had full access to all of the study data provided by PWAC and take responsibility for the integrity and the accuracy of the data analysis.

Concept and design: Marchalik, Mete and Shanafelt.

Acquisition, analysis, or interpretation of data: Mete, Marchalik and Shanafelt

Drafting of the manuscript: Mete, Goldman

Critical revision of the manuscript for important intellectual content: Shanafelt, Marchalik, Goldman

Statistical analysis: Mete.

Administrative, technical, or material support: Marchalik, Mete

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Ethical Approval: MedStar Health Research Institute Institutional Review Board approved the study (MHRI-IRB 2028:149)

Transparency statement: Mihriye Mete affirms this manuscript is an honest, accurate and transparent account of the study reports; no aspects have been omitted and all discrepancies have been explained.

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Conflict of Interests: Dr. Shanafelt is coinventor of the Mayo Clinic Participatory Management Leadership Index and Well-being Index Instruments (Physician Well-being Index, Medical Student Well-being Index, Nurse Well-being Index, Well-being Index). Mayo Clinic holds the copyright to these instruments and has licensed them for use outside of Mayo Clinic. Dr Shanafelt receives a portion of any royalties paid to Mayo Clinic. Dr Shanafelt reported receiving honoraria from grand rounds or keynote lecture presentations and advising for health care organizations outside the submitted work. Other authors report no conflict of interest.

Data availability: No additional data related to the analyses of this study are available.

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Figure 1. Predicted Percentage of Physicians (%, 95% CI) with High Professional Fulfillment by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians

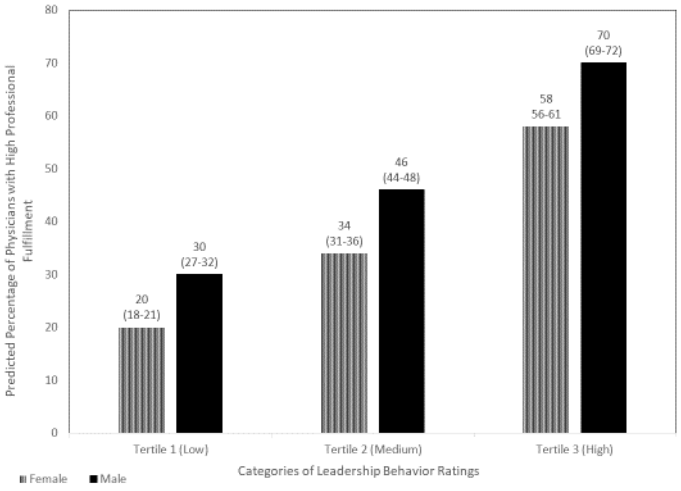


Figure 2. Predicted Percentage of Physicians (%, 95% CI) with Burnout by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians

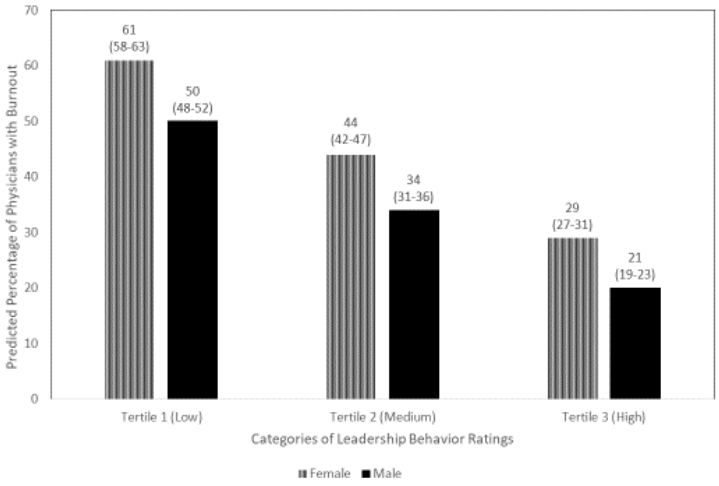
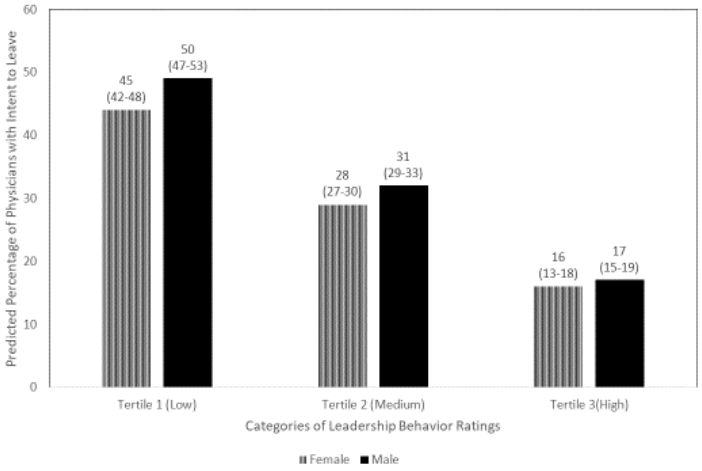


Figure 3. Predicted Percentage of Physicians (%, 95% CI) Reporting Intent to Leave by the Tertiles of Supervisor Leadership Behavior Ratings for Female and Male Physicians



Appendix

Revised 9-item Mayo Clinic Participatory Management Leadership Index[1]

Please answer the following questions about your experience with the supervisor who is most directly responsible for providing you administrative guidance, feedback, and support.
My supervisor...

1. Holds career development conversations with me
2. Empowers me to do my job
3. Encourages me to suggest ideas for improvement
4. Treats me with respect and dignity
5. Provides helpful feedback and coaching on my performance
6. Recognizes me for a job well done
7. Keeps me informed about changes taking place at (Institution)
8. Encourages me to develop my talents and skills
9. Overall, how satisfied are you with your supervisor?

Response options:
Items 1-8: 4-strongly agree, 3-agree, 2-neither agree nor disagree, 1-disagree, 0-strongly disagree
Item 9: 4-very satisfied, 3-satisfied, 2-neither satisfied nor dissatisfied, 1-dissatisfied, 0-very dissatisfied.

Scoring: Each item is scored on a 5-point scale (0-4) and the scores from the individual items are summed to compute an aggregate score (with higher scores indicating more favorable ratings)

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	5	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7	
Objectives	3	State specific objectives, including any prespecified hypotheses	8	
Methods				
Study design	4	Present key elements of study design early in the paper	8	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-9	
Participants	6	(9) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10	
Bias	9	Describe any efforts to address potential sources of bias	10-11, 16-18	
Study size	10	Explain how the study size was arrived at	8-9, 11	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy (Not applicable)	N/A No sampling
		(*e*) Describe any sensitivity analyses (Not applicable)	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9,11
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	19-20 (table 1)
		(b) Indicate number of participants with missing data for each variable of interest	N/A, not included in the study
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*N/A*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	*N/A*
		Cross-sectional study—Report numbers of outcome events or summary measures	*20*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	20-22 (Table 2)
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Figures 1-3 (attached

	separately)

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.