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Estimating the Attributable Cost of Physician Burnout in the United States

Shasha Han, MS; Tait D. Shanafelt, MD; Christine A. Sinsky, MD; Karim M. Awad, MD; Liselotte N. Dyrbye, MD, MHPE; Lynne C. Fiscus, MD, MPH; Mickey Trockel, MD; and Joel Goh, PhD

Background: Although physician burnout is associated with negative clinical and organizational outcomes, its economic costs are poorly understood. As a result, leaders in health care cannot properly assess the financial benefits of initiatives to remediate physician burnout.

Objective: To estimate burnout-associated costs related to physician turnover and physicians reducing their clinical hours at national (U.S.) and organizational levels.

Design: Cost-consequence analysis using a mathematical model.

Setting: United States.

Participants: Simulated population of U.S. physicians.

Measurements: Model inputs were estimated by using the results of contemporary published research findings and industry reports.

Results: On a national scale, the conservative base-case model estimates that approximately $4.6 billion in costs related to physician turnover and reduced clinical hours is attributable to burnout each year in the United States. This estimate ranged from $2.6 billion to $6.3 billion in multivariate probabilistic sensitivity analyses. At an organizational level, the annual economic cost associated with burnout related to turnover and reduced clinical hours is approximately $7600 per employed physician each year.

Limitations: Possibility of nonresponse bias and incomplete control of confounders in source data. Some parameters were unavailable from data and had to be extrapolated.

Conclusion: Together with previous evidence that burnout can effectively be reduced with moderate levels of investment, these findings suggest substantial economic value for policy and organizational expenditures for burnout reduction programs for physicians.

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Occupational burnout is a syndrome characterized by 3 key dimensions: emotional exhaustion, feelings of cynicism and detachment from work, and a sense of low personal accomplishment (1, 2). The prevalence of burnout among physicians is high relative to the general working population: In a 2014 study, approximately 54% of physicians reported at least 1 symptom of burnout, almost twice the rate of the general U.S. working population (3, 4).

Recent studies have begun to provide a more complete picture of the challenges physician burnout presents to the nation's health care delivery system. Systematic reviews have documented associations between physician burnout and negative clinical outcomes as well as unfavorable productivity-related outcomes (5, 6). For example, studies have found that burned-out physicians have higher rates of self-reported medical errors (7–9) and their patients have poorer clinical outcomes (10, 11). Physicians with burnout are more likely to report an intention to reduce their work hours or to leave medical practice altogether (12–14). They also have higher absenteeism rates (13).

See also:

Editorial comment 807

Web-Only
Supplement

Recent research has uncovered the organizational roots of burnout (15, 16), and health care executives have begun to recognize the urgency of this problem. A group of 10 CEOs of leading U.S. health care organizations "unanimously concluded that physician burnout is a pressing issue of national importance" (17) and called on other leaders to commit to addressing it.

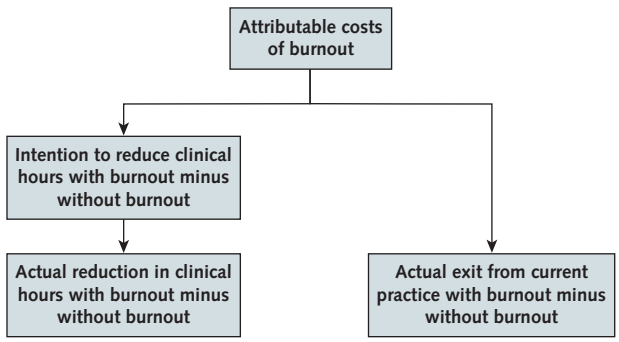
Despite the recent public interest in this subject and literature suggesting that burnout has the potential to be a major problem, only a few studies (18, 19) have attempted to quantify its economic magnitude in the form of easily understandable metrics. As a result, policymakers cannot holistically assess the extent of the burnout problem and develop appropriate policy responses, nor are leaders of health care organizations equipped to make informed decisions when determining whether to invest scarce resources into programs to mitigate burnout.

In this study, we undertook a cost-consequence analysis to investigate the economic burden associated with physician burnout. We used cost as a metric because it is easily understandable by policymakers and organizational leaders and is typically an important data point they can use to make informed decisions, develop organizational strategy, and effect change. We followed a standard approach used by cost-effectiveness studies (20, 21): We constructed a mathematical model linking measureable inputs to the output of interest, estimated values for the input parameters from several data sources, and

ran them through the model to estimate the value of the output.

This study's contributions are 2-fold. First, we introduced a model to estimate the cost associated with burnout in a given population of physicians. Second, we used the model to estimate the annual burnout-attributable costs for the United States as well as for a hypothetical 1000-physician organization whose distribution of age and specialty segments matched the national averages. We used published data sources to estimate the model's input parameters, which reflect our best attempt to synthesize the findings of recent research on the effect and prevalence of physician burnout. Nevertheless, ideal data were not always available, and some parameters had to be extrapolated.

Figure 1. Cost-consequence model used to estimate the cost attributable to physician burnout.



METHODS

Estimation Approach

Our cost-consequence analysis (Figure 1) simulated a hypothetical population of U.S. physicians stratified into 6 segments comprising 2 age groups (<55 years and ≥55 years) and 3 specialty groups (primary care physicians, surgical specialties, and other specialties). The definitions of the segments were chosen to be consistent with previous studies and available data (18, 22); segment sizes were set to match the distribution of U.S. physicians from the 2013 American Medical Association Physician Masterfile (22). In this study, we focused on 2 costly organizational outcomes: turnover and reduction in clinical hours. These were chosen over other productivity metrics because they directly affect the net supply of clinical capacity, which in turn is an important consideration for strategic planning at both a national level (from a health policy perspective) and the level of individual organizations (from a managerial perspective). The model's primary output was the cost attributable to burnout, that is, the difference in costs for these outcomes as observed and the corresponding costs if physicians were not burned out. Further details of the model and input estimation methodology are reported in Supplement 1 (available at Annals.org).

Input Parameters and Data Sources

All costs described in the present study were already inflation adjusted to 2015 dollars by using the medical care component of the Consumer Price Index (23). Although data sources for the inputs were not found through a formal systematic search, we generally prioritized studies that were recent, were published in peer-reviewed journals, directly measured the parameters, and contained segment-specific estimates. Table 1 summarizes the values of selected model parameters.

Burnout Prevalence

Burnout prevalence was estimated from a 2014 national survey of 6880 physicians that assessed level of burnout and short-term career plans. Details of this survey were reported previously (4, 24). Single-specialty studies (25–27) and other less rigorous studies (28) have identified similar prevalence estimates.

Odds Ratios and Outcome Prevalence

The outcome prevalence and odds ratios for intended reduction in professional effort were estimated from the 2014 survey (4, 24). For the outcome of physician turnover, annual turnover statistics were estimated from a 2013 survey conducted by Cejka Search and the American Medical Group Association (29). To the best of our knowledge, only 2 studies have been published that investigated the association between burnout and actual physician turnover: 1 from the Cleveland Clinic (30), and the other from Stanford University (31). Our base analysis used fixed-effects meta-analytic inverse-variance weighting of the odds ratios from these 2 investigations. The estimated I^2 statistic was 44.6%, suggesting moderate heterogeneity between the studies. We note, however, that this statistic is known to be insensitive when only 2 analyses are combined.

Conversion Parameters

For the outcome of reduced clinical hours, we had to estimate conditional probability parameters that mapped from intended to actual reduction in clinical hours. We extrapolated these parameters by assuming that these conditional probabilities were the same as those mapping from intended to actual physician turnover, estimated them from the Stanford study (31), and adjusted them to 1-year probabilities.

Cost Parameters

We accounted for 2 cost components associated with physician turnover. The first component was the cost associated with physician replacement; the second was the lost income from unfilled physician positions.

Physician replacement cost was broken down further into 3 subcomponents, which were estimated separately: search costs, hiring costs, and physician startup costs (termed *friction costs* by economists). These were estimated from, respectively, a 2015 report from the Association of Staff Recruiters (ASPR) (32), a 2016 report by a search firm (33), and a 2004 study of physician turnover in a U.S. academic medical center (34).

Table 1. Summary of Input Parameters and Estimated 95% CIs

Parameter	Primary Care Physicians		Surgical Specialties	
	Age <55 y	Age ≥55 y	Age <55 y	Age ≥55 y
Physicians, *n*	240 271	121 702	107 674	64 180
Prevalence and OR (95% CI)				
Burnout prevalence, %*	62.1 (58.7–65.5)	49.4 (45.9–52.8)	62.7 (58.6–66.7)	49.7 (46.1–53.2)
Physicians who actually turned over during 12 mo, %†‡	5.9 (5.4–6.4)		8.3 (7.4–9.2)	
Physicians who intended to reduce clinical hours in the next 12 mo, %	26.4 (23.4–29.6)	39.4 (36.1–42.9)	23.9 (19.7–27.9)	40.2 (37.0–44.7)
OR of burnout				
Associated with actual turnover†	1.76 (1.28–2.40)			
Associated with intention to reduce work hours	3.53 (2.08–4.98)	1.93 (1.32–2.54)	3.19 (1.55–4.83)	2.14 (1.42–2.85)
Conditional probabilities of actual reduced effort, %†§				
Given intention to reduce effort	13.7 (7.7–19.8)			
Given no intention to reduce effort	3.9 (1.9–6.0)			
Cost (95% CI)				
Physician replacement cost, *$ per physician (thousand)*†‖	254.7 (235.0–276.1)			
Average vacancy-adjusted revenue loss, *$ per physician (thousand)*	111.9 (111.4–112.4)	109.8 (109.5–110.1)	144.7 (144.2–145.3)	151.9 (151.3–152.2)
Average reduction in clinical hours associated with burnout, %†	11.7 (3.3–20.1)	13.5 (1.2–25.7)	19.0 (6.5–31.4)	18.0 (5.4–30.6)

OR = odds ratio; PSA = multivariate probabilistic sensitivity analysis.
* Burnout is defined as having ≥1 burnout symptoms according to the Maslach Burnout Inventory.
† Pooled estimates used.
‡ SEs estimated under the assumption that distribution of physicians in the sample in the Cejka report (29) were equal to national averages (22).
§ Extrapolated from conditional probabilities of actual turnover given no intention/intention.
‖ SEs estimated by adjusting the range of physician replacement costs from the Stanford study (31), assuming that this adjusted range represented 95% coverage of a log-normal distribution, and using the most conservative (smallest) sample size in the data for our estimates (32–34).

Lost income from unfilled positions was included only in the organizational-level analysis. We excluded this component from the national-level analysis because at that level the lost income from physicians leaving 1 organization is gained by the new organization they join, unless the physician leaves medical practice permanently. In the latter scenario, this estimate would be conservative. We estimated this component as the difference between physicians' collections and compensation by using industry benchmarking data collected by the Medical Group Management Association (35), adjusting this difference for the average duration of vacancy obtained from the ASPR report (32).

To estimate the cost of physicians reducing their clinical hours, we adjusted the net cost of turnover by a fraction that represented the average percentage difference in weekly work hours between burned-out and non–burned-out physicians. This fraction was estimated by analyzing primary data from the 2014 physician survey (24).

Sensitivity Analysis

We conducted 3 groups of sensitivity analyses: a rerun of the model using alternate modeling assumptions, univariate sensitivity analyses, and multivariate probabilistic sensitivity analyses. In the first group, we focused on assessing the effect of using alternative data sources for our estimates for some model parameters and varying implicit model assumptions. In particular, for the odds ratio of burnout and actual turnover, we assessed the effect of using only results from either the Cleveland Clinic or the Stanford study. The second and third groups of analyses aimed to assess the model's robustness to perturbations in the inputs within their ranges of uncertainty (reported in Table 1). In the latter group, we used 100 000 random draws with standard distributional assumptions (Table 1). Additional details and results are reported in Supplement 1.

RESULTS

Using the base-case model, we estimated that approximately $4.6 billion a year related to physician turnover and reduced productivity is attributable to physician burnout in the United States. As Figure 2 shows, estimated turnover costs were generally higher than costs of reduced productivity across all segments. Burnout-attributable costs tended to be greater in the younger segment of physicians (those aged <55 years).

The results of univariate sensitivity analyses (Figure 3) revealed that the odds ratio associating burnout with turnover was the input driving most of the uncertainty in the cost estimates. As this input parameter was varied, the estimated annual burnout-attributable cost ranged from $2.2 billion to $6.7 billion. When only the Stanford study (31) was used to estimate the odds ratio, estimated costs increased to $6.6 billion ($2.8 billion to $9.6 billion in univariate sensitivity analyses); when only the Cleveland Clinic study (30) was used, estimated costs decreased to $3.5 billion ($0.6 billion to $6.1 billion).

At an organizational level, the annual cost attributable to burnout in the base-case model was estimated at $7600 per physician (Table 2), varying from $3700 to $11 000 per physician in univariate sensitivity analyses.

Table 1–Continued

Other Specialties		PSA Distribution	References
Age <55 y	**Age ≥55 y**		
198 224	122 647	–	22
64.0 (61.6–66.3)	46.5 (44.3–48.8)	Beta	24
7.4 (6.8–8.0)		Beta	29
23.7 (21.8–25.9)	36.2 (34.2–38.4)	Beta	24
		Log-normal	30, 31
3.11 (2.19–4.03)	1.82 (1.44–2.21)	Log-normal	24
		Beta	31
		Beta	31
		Log-normal	32–34
77.7 (77.3–78.1)	69.6 (69.2–70.0)	Log-normal	32–35
7.7 (1.6–13.8)	12.5 (6.7–18.3)	Beta	24

Multivariate sensitivity analysis of the base case revealed that annual burnout-attributable costs ranged from $2.6 billion to $6.3 billion at the national level, with 95% of cases ranging from $3.7 billion to $5.3 billion. At an organizational level, these costs ranged from a minimum of $4100 to a maximum of $10 200 per physician, with 95% of cases ranging from $6100 to $8700 per physician.

DISCUSSION

These results suggest that the economic costs attributable to physician burnout in the United States are substantial. Our analysis is conservative, omitting other burnout-related costs that are difficult to quantify. First, physician burnout has been associated with poorer overall quality of patient care, lower patient satisfaction, and malpractice lawsuits (36–40). These may contribute both direct economic and indirect reputational costs. Second, the model does not capture all the friction costs involved with physician replacement, such as disruptions in continuity of patient care (41), the effects on other members of the care team (42), and costs associated with reduced patient access as departing physicians wind down their practices and replacement physicians build up theirs (43).

The results of our organizational-level analysis may be adapted to calculate burnout-attributable costs for individual health care organizations by modifying the inputs in Table 2. A more detailed calculation also may be done by substituting organization-specific input parameters that are available (such as burnout prevalence or replacement costs) into the model and repeating the full analysis. We provide a spreadsheet to facilitate such calculations in Supplement 2 (available at Annals.org).

On an organizational level, these burnout-attributable cost estimates are conservative for other reasons. Physicians who leave a practice may cause their patients to seek an alternate practice for their care, thus incurring further revenue losses. This factor is particularly salient for large urban medical centers facing strong competition. Our analysis captures only direct revenue losses for physician services during a physician vacancy but does not account for indirect lost revenue, such as that derived from facility fees or from tests and procedures, during the vacancy. In addition, as patient satisfaction diminishes with reduced quality

Figure 2. Estimated annual cost (in 2015 dollars) attributable to physician burnout in the United States.

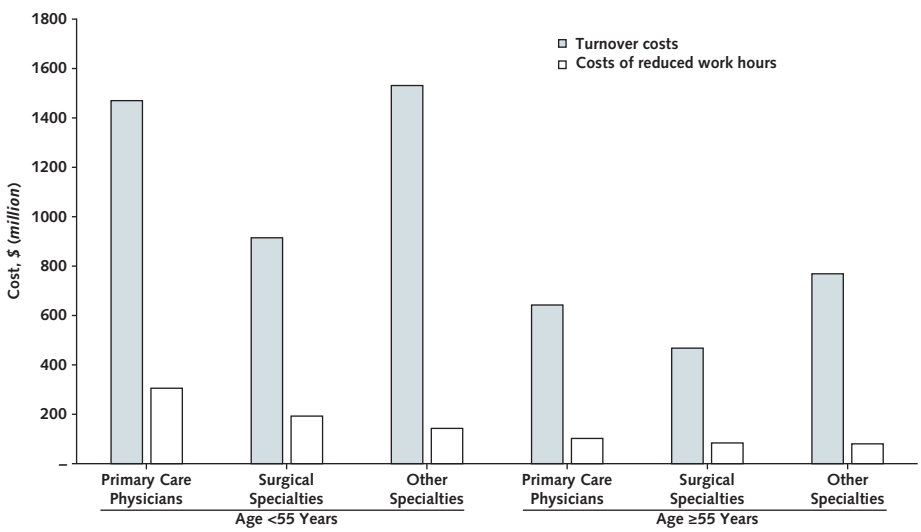
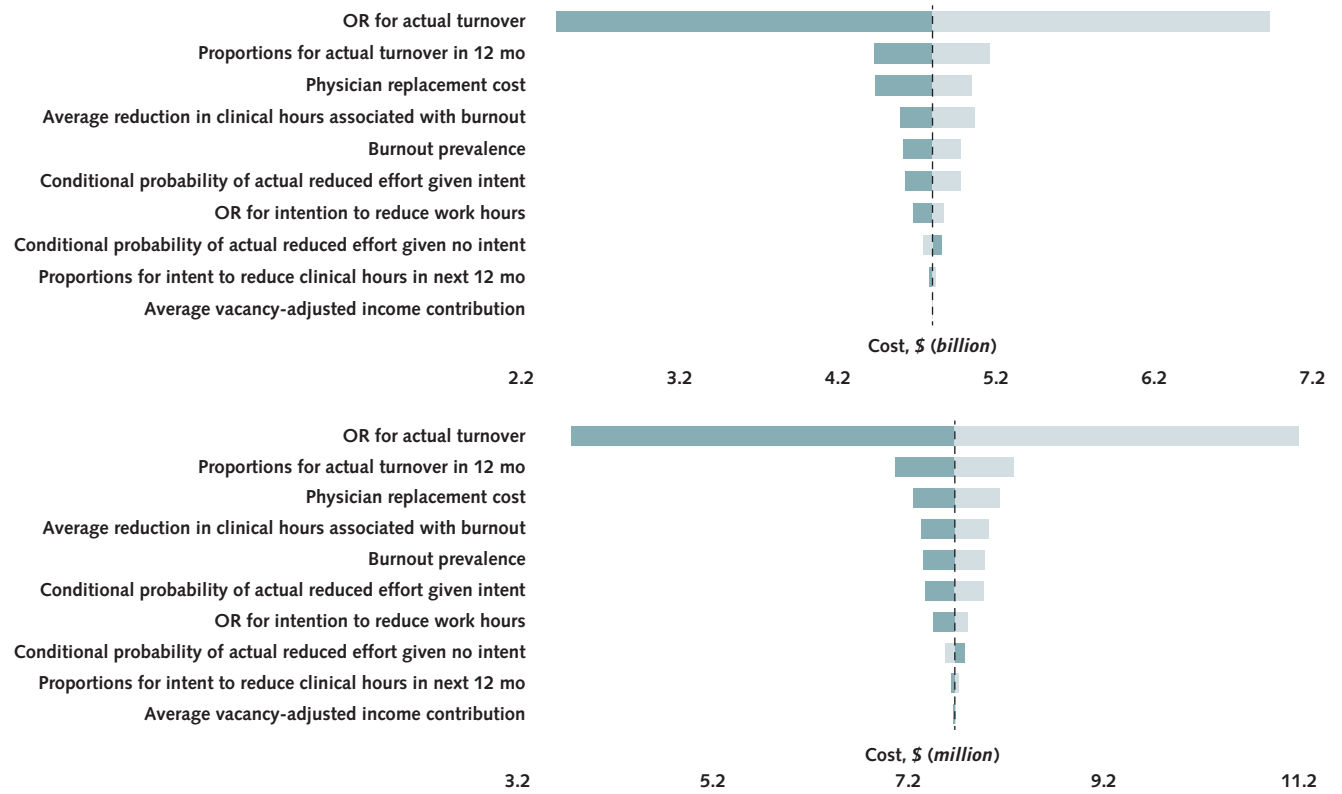


Figure 3. Annual burnout-attributable cost in the United States (*top*) and in a hypothetical 1000-physician organization (*bottom*).



The *dashed line* represents the estimated cost from the base-case model in both cases. OR = odds ratio.

of care from physician burnout, the organization may enjoy less favorable contracting with payers or see reduced annual reimbursements drop because of low patient satisfaction scores.

The present study adds to the literature in several ways. First, although a national-level study was published estimating burnout-attributable costs due to early retirement and reduced work hours among Canadian physicians (18), to the best of our knowledge our study is the first to analyze such costs for the U.S. health care delivery system. Second, a recent article by some of this study's authors (19) contains a simpler version of the calculation used in this work. In contrast, the present study uses a more precise structural model and more rigorous estimation approaches for its inputs.

Another contribution of this research lies in the methods and data used to estimate turnover-related costs. Some of the most commonly cited estimates for the cost of turnover per U.S. physician have been based on internal data from specific organizations (17, 44). These estimates were difficult to validate and generalize. Therefore, in this study we estimated these costs ourselves by using primary and publicly available data sources when possible to maximize the transparency of our approach. Our estimation strategy paralleled that of a 1999 study that focused on calculating the turnover costs for primary care providers (45).

Our study has limitations, which we hope future work will address. In general, although we report and analyze the effect of parameter uncertainty in our mo-

Table 2. Annual Cost Attributable to Physician Burnout in a Hypothetical Organization With 1000 Physicians

Parameter/Model Output	Primary Care Physicians		Surgical Specialties		Other Specialties		Total
	Age <55 y	Age ≥55 y	Age <55 y	Age ≥55 y	Age <55 y	Age ≥55 y	
U.S. physicians, %	28.1	14.2	12.6	7.5	23.2	14.4	100
Physicians in hypothetical organization, *n**	281	142	126	75	232	144	1000
Estimated average cost per employed physician, *2015 USD*	7100	5900	10 800	9100	7800	6100	–
Total cost, *2015 USD*	2 000 000	840 000	1 400 000	690 000	1 800 000	870 000	7 600 000

* Assuming physicians are distributed across segments according to national averages.

del's inputs, this reflects only statistical imprecision primarily driven by sampling (46), and the possibility of bias from other sources remains (47). For example, although our estimates of burnout prevalence were drawn from a large, recent survey of physicians in the United States (12, 24), they may not represent the general physician population for reasons including nonresponse bias. In addition, the odds ratio estimates were obtained from multivariate regressions on observational data by using several studies and do not carry a causal interpretation. The possibility exists that confounding was not fully controlled for, particularly because the regressions controlled for different covariates across the studies. Furthermore, some input parameter estimates had to be obtained by extrapolation or were assumed to hold across subspecialties and age subgroups, possibly contributing to imprecision in the results. Lastly, the cost-consequence model assumes that eliminating burnout would eradicate the excess burnout-associated risk (reducing it to the risk in the absence of burnout) for physicians leaving an organization and intending to reduce work hours.

Burnout is a problem that extends beyond physicians to nurses and other health care staff. Future work holistically investigating the costs associated with burnout in health care organizations would be valuable. Studies focusing on differences in burnout-attributable costs across provider segments other than the ones investigated in this study, including academic versus private settings, or across a finer segmentation of physician specialties also might be fruitful. Finally, future research might adapt our methods to study other costly burnout-related outcomes, such as reduced quality of care, medical errors, and malpractice suits.

Our estimates are not meant to be the last word on this subject. As new research sharpens our collective understanding of the effects and prevalence of burnout, our model can be reapplied with updated input parameters to reflect the new data. Nonetheless, using data informed by the current state of research, our conservative analyses suggest that on a national scale, a substantial economic burden is associated with physician burnout in the United States.

Traditionally, the case for ameliorating physician burnout has been made primarily on ethical grounds. Our study provides tools to evaluate the economic dimension of this problem. Together with previous evidence that burnout can be reduced effectively with moderate levels of investment (48), our results suggest that a strong financial basis exists for organizations to invest in remediating physician burnout.

From National University of Singapore, Singapore (S.H.); Stanford University School of Medicine, Palo Alto, California (T.D.S., M.T.); American Medical Association, Chicago, Illinois (C.A.S.); Atrius Health, Boston, Massachusetts (K.M.A.); Mayo Clinic, Rochester, Minnesota (L.N.D.); University of North Carolina Physicians Network, Morrisville, North Carolina (L.C.F.); and National University of Singapore, Singapore, and Harvard Business School, Boston, Massachusetts (J.G.).

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Corresponding Author: Joel Goh, PhD, National University of Singapore Business School, 15 Kent Ridge Drive, #08-04, Singapore 119245, Singapore; e-mail, joelgoh@nus.edu.sg.

Current author addresses and author contributions are available at Annals.org.

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Current Author Addresses: Ms. Han: National University of Singapore Business School, 15 Kent Ridge Drive, #08-69, Singapore 119245, Singapore.
Dr. Shanafelt: 300 Pasteur Drive, Suite 3215, Stanford, CA 94305.
Dr. Sinsky: American Medical Association, 330 North Wabash Avenue, Chicago, IL 60611.
Dr. Awad: 133 Brookline Avenue, Boston, MA 02215.
Dr. Dyrbye: Mayo Clinic, 200 First Street Southwest, Rochester, MN 55905.
Dr. Fiscus: 613 Sugarberry Road, Chapel Hill, NC 27514.
Dr. Trockel: Psychiatry Clinic, 401 Quarry Road, Room 2303, Stanford, CA 94305.
Dr. Goh: National University of Singapore Business School, 15 Kent Ridge Drive, #08-04, Singapore 119245, Singapore.

Author Contributions: Conception and design: S. Han, T.D. Shanafelt, C.A. Sinsky, K.M. Awad, L.N. Dyrbye, L.C. Fiscus, M. Trockel, J. Goh.
Analysis and interpretation of the data: S. Han, T.D. Shanafelt, L.N. Dyrbye, J. Goh.
Drafting of the article: S. Han, K.M. Awad, J. Goh.
Critical revision for important intellectual content: S. Han, T.D. Shanafelt, C.A. Sinsky, L.N. Dyrbye, M. Trockel, J. Goh.
Final approval of the article: S. Han, T.D. Shanafelt, C.A. Sinsky, K.M. Awad, L.N. Dyrbye, L.C. Fiscus, M. Trockel, J. Goh.
Statistical expertise: S. Han, J. Goh.
Administrative, technical, or logistic support: T.D. Shanafelt, L.N. Dyrbye.
Collection and assembly of data: S. Han, T.D. Shanafelt, L.C. Fiscus, J. Goh.