

Physicians' Perceptions, Preparedness for Reporting, and Experiences Related to Impaired and Incompetent Colleagues

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WHILE SYSTEM-LEVEL FACTORS cause many of the medical errors that harm patients, some of these incidents are attributable to the judgment and actions of individual physicians.¹ Various factors can impair physicians' judgment, including mental health conditions, alcoholism, drug use, and failure to maintain technical competence.² Many states have mandatory reporting statutes, requiring physicians and other health care professionals to report to appropriate authorities those physicians whose ability to practice medicine is impaired by alcohol or drug use or by physical or mental illness.³ The American Medical Association (AMA), the Charter on Medical Professionalism, and the European Federation of Internal Medicine go further, stating that physicians have an "ethical obligation to report" and are expected to "participate in the process of self-regulation."^{2,4-6}

For editorial comment see p 210.

Context Peer monitoring and reporting are the primary mechanisms for identifying physicians who are impaired or otherwise incompetent to practice, but data suggest that the rate of such reporting is lower than it should be.

Objective To understand physicians' beliefs, preparedness, and actual experiences related to colleagues who are impaired or incompetent to practice medicine.

Design, Setting, and Participants Nationally representative survey of 2938 eligible physicians practicing in the United States in 2009 in anesthesiology, cardiology, family practice, general surgery, internal medicine, pediatrics, and psychiatry. Overall, 1891 physicians (64.4%) responded.

Main Outcome Measures Beliefs about and preparedness for reporting and experiences with colleagues who practice medicine while impaired or who are incompetent in their medical practice.

Results Sixty-four percent (n=1120) of surveyed physicians agreed with the professional commitment to report physicians who are significantly impaired or otherwise incompetent to practice. Nonetheless, only 69% (n=1208) of physicians reported being prepared to effectively deal with impaired colleagues in their medical practice, and 64% (n=1126) reported being so prepared to deal with incompetent colleagues. Seventeen percent (n=309) of physicians had direct personal knowledge of a physician colleague who was incompetent to practice medicine in their hospital, group, or practice. Of those with this knowledge, 67% (n=204) reported this colleague to the relevant authority. Underrepresented minorities and graduates of non-US medical schools were less likely than their counterparts to report, and physicians working in hospitals or medical schools were most likely to report. The most frequently cited reason for taking no action was the belief that someone else was taking care of the problem (19% [n=58]), followed by the belief that nothing would happen as a result of the report (15% [n=46]) and fear of retribution (12% [n=36]).

Conclusion Overall, physicians support the professional commitment to report all instances of impaired or incompetent colleagues in their medical practice to a relevant authority; however, when faced with these situations, many do not report.

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A 1999 Institute of Medicine report⁷ and periodic media accounts have heightened public awareness of egregious physician behaviors (eg, surgeons leaving midway through operations) and medical

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errors (eg, wrong-site surgery).⁸ Despite increased attention, data suggest that the rate of reporting by physicians is far lower than it should be, given the estimated numbers of physicians who become impaired or who are otherwise incompetent to practice at some point in their careers.⁹⁻¹⁵

In this article, analyses from a large national survey of physicians are presented examining (1) beliefs about the commitment to self-regulation through reporting significantly impaired or incompetent colleagues, (2) preparedness to report, (3) personal experiences with these difficult situations, and (4) actions taken when confronted with impaired or incompetent colleagues.

METHODS

Survey Design and Testing

For this 2009 survey, we revised the professionalism questionnaire that we had administered in 2004.^{9,16} The revisions added items focused specifically on physician behaviors when confronted with a colleague who was impaired or otherwise incompetent to practice. We also revised specific survey items that had not adequately discriminated among respondents (ie, had ceiling effects whereby almost all physicians agreed with a given statement). We based revisions on findings from 4 focus groups involving 40 total physicians and recommendations from an interdisciplinary expert advisory group with 15 members. We conducted a pretest, mailing the survey to 21 physicians to ensure that the survey administration process worked appropriately. The final survey was 7 pages long and contained 110 individual survey items (the survey is available from the authors by request). The Massachusetts General Hospital institutional review board approved the final survey.

Sample

Using the AMA 2008 Masterfile, all US physicians in primary care (family practice, internal medicine, and pediatrics) and 4 non-primary care special-

ties (anesthesiology, cardiology, general surgery, and psychiatry) were identified. Excluded were all osteopathic physicians, resident physicians, and physicians in federally owned hospitals; those with no address; those who requested not to be contacted; and those who were retired. From this pool of eligible participants, we randomly selected 500 physicians within each of the 7 specialties (total sample, 3500).

Survey Administration

The questionnaire was administered by the Center for Survey Research at the University of Massachusetts-Boston. The center sent the initial survey packet by Priority Mail in May 2009 and included a cover letter, fact sheet, questionnaire with a sticker on the back containing the random participant identification number, postage-paid return envelope, and a \$20 incentive. The center made telephone calls to all nonrespondents to solicit participation, and 2 additional mailings were sent to all nonrespondents.

Dependent Variables

Physicians' beliefs about reporting were assessed using the question, "Please rate the extent to which you agree with the following statement . . . Physicians should report all instances of significantly impaired or incompetent colleagues to their professional society, hospital, clinic, and/or other relevant authorities." Response categories were "completely agree," "somewhat agree," "somewhat disagree," or "completely disagree." For the multivariable analysis described below, a new dichotomous variable was created that compared physicians who "completely agree" with physicians who gave any other response. We focused on the "completely agree" response because the AMA Code of Ethics, the Charter on Medical Professionalism, and many state mandates require physicians to report all instances of colleagues whose practice of medicine is significantly impaired or incompetent.

Two survey items were used to assess physicians' preparedness for deal-

ing with impaired or incompetent colleagues. Physicians were asked to rate the extent to which "you feel prepared to deal with colleagues who practice medicine while they are impaired" and "you feel prepared to deal with colleagues who are incompetent in their medical practice." Response categories were "very prepared," "somewhat prepared," "very unprepared," and "somewhat unprepared." For the multivariable analysis described herein, a new dichotomous variable was created that combined "very prepared" and "somewhat prepared" into one group and "very unprepared" and "somewhat unprepared" into another.

Two survey items were used to examine physician behavior about reporting colleagues: "In the last three years, have you had direct, personal knowledge of a physician who was impaired or incompetent to practice medicine in your hospital, group, or practice?" and "In the most recent case, did you report that physician to a hospital clinic, professional society, or other relevant authority?" Response categories were "yes" and "no."

The survey further asked physicians with direct, personal knowledge of an impaired or incompetent colleague to report whether there had been a time in the past 3 years when they did not report because of any of the following reasons or beliefs: "someone else was taking care of the problem," "nothing would happen as a result of the report," "the physician would be excessively punished," "it could easily happen to you," and "it was not your responsibility." The survey also asked if physicians did not report because of fear of retribution or lack of knowledge about how to report. All physicians were asked to respond "yes" or "no" for each of the items.

Independent Variables

The study hypothesis was that the dependent variables described above could be affected by the following physician and practice characteristics: physician sex, race/ethnicity (self-reported as African American [non-

Hispanic], Asian, Hispanic, Native American, Pacific Islander, white [non-Hispanic], or other, with white and Asian combined into a “not underrepresented minority” category, other categorized on a case-by-case basis, and the remainder combined into an “underrepresented minority” category), specialty, graduate of a US medical school (yes/no), number of years in practice (<10, 10-19, 20-29, ≥30), and practice organization (hospital or clinic, university or medical school, group practice, solo or 2-person practice, other).

Another hypothesis was that the malpractice environment in which physicians practice may affect beliefs, preparedness, and reporting behaviors. As a proxy for this, data from the 2009 National Practitioner Database were used to calculate the total malpractice claims paid per physician per state. These data were grouped into tertiles (eg, low, medium, and high) for the multivariable analysis.¹⁷

Analyses

Univariate and bivariate relationships in the data were examined. To test for significant differences between groups, 2-sided *t* tests (continuous variables) or χ^2 tests (categorical variables) were used as appropriate. A multivariable model was constructed based on the bivariate analysis.

Separate multivariable logistic regression models were fitted to evaluate the association of outcomes (beliefs about reporting; preparedness to deal with, knowledge of, and reporting of impaired or incompetent colleagues) with the independent variables described above. Adjusted percentages and standard errors were obtained from these models.¹⁸

Further examination included the reasons for not reporting an impaired or incompetent colleague to relevant authorities among those who said they did not report. Multivariable analysis of reasons for not reporting were not conducted, owing to small sample sizes. All analyses used weights that accounted for the sampling design and

nonresponse and were conducted in SAS version 9.2 (SAS institute Inc, Cary, North Carolina) and SUDAAN version 10.0.1 (RTI International, Research Triangle Park, North Carolina).

RESULTS

Of the 3500 sampled physicians, 562 were ineligible because they were deceased, out of the country, practicing a nonsampled specialty, on leave, or not currently providing patient care. Of the remaining 2938 eligible physicians, 1891 completed the survey, yielding an overall response rate of 64.4%. Response rates by physician specialty were

72.7% (pediatrics), 67.5% (family practice), 65.1% (surgery), 64.6% (anesthesiology), 64.0% (psychiatry), 60.8% (internal medicine), and 50.6% (cardiology).

TABLE 1 shows characteristics of the survey respondents. Based on weighted data, 67% of respondents were men, and 10% were underrepresented minorities. Twelve percent of respondents had been in practice for less than 10 years, 28% for 10 to 19 years, 31% for 20 to 29 years, and 29% for 30 years or longer. In terms of primary practice type, 40% worked in group practices (more than 2 persons), 22% in solo or 2-person practices, 19% in hospitals or

Table 1. Characteristics of Respondents (N=1891)^a

Characteristic	No.	%	
		Unweighted	Weighted ^b
Sex			
Men	1284	70	67
Women	539	30	33
Race/ethnicity ^c			
Not underrepresented minority	1648	91	90
Underrepresented minority	168	9	10
Specialty			
Anesthesiology	259	14	11
Cardiology	218	12	6
Family practice	269	15	22
General surgery	263	14	7
Internal medicine	249	14	29
Pediatrics	297	16	15
Psychiatry	255	14	10
Type of medical school graduate			
US	1331	73	72
International	494	27	28
Years in practice			
<10	210	11	12
10-19	464	25	28
20-29	569	31	31
≥30	579	32	29
Practice organization			
Hospital or clinic	343	19	19
University or medical school	117	6	5
Group	744	41	40
Solo or 2-person	401	22	22
Other	223	12	13
Total malpractice claims paid per practicing physician in state in which physician practices			
Low (0.003-≤0.007)	629	34	35
Medium (0.008-<0.011)	582	32	33
High (≥0.011)	619	34	32

^aNot all respondents answered all questions.

^bEstimates obtained using weights that account for sampling design and nonresponse.

^cSee “Methods.”

clinics, and 5% in a university faculty practice plan or medical school.

Beliefs About the Commitment to Report Impaired or Incompetent Colleagues

TABLE 2 presents regression-adjusted percentages of physicians who completely agree with the statement “physicians should report all instances of significantly impaired or incompetent colleagues to their professional society, hospital, clinic and/or other relevant authority.” Overall, 64% of physicians completely agreed with this statement. Women physicians were

significantly more likely than men to completely agree, as were graduates of US medical schools compared with those graduating from non-US medical schools. Years in practice were significantly associated with beliefs; however, this association was not linear. Rather, the trend was S-shaped, with those in practice for 10 to 19 years and those in practice for more than 30 years being less likely than other physicians to completely support reporting.

Practice organization was significantly associated with complete agreement about reporting impaired and

incompetent colleagues. Physicians practicing in hospitals or clinics were most likely to completely endorse reporting, followed by those practicing in a university or medical school. Physicians in solo or 2-person practices and in group practices were least likely to completely support reporting.

The malpractice environment was also significantly associated with beliefs about reporting. Physicians practicing in areas with low numbers of malpractice claims were significantly more likely than those practicing in areas with medium or high numbers to com-

Table 2. Beliefs About and Preparedness for Dealing With Impaired or Incompetent Colleagues

Characteristic	Completely Agree Physicians Should Report All Impaired or Incompetent Colleagues		Very or Somewhat Prepared to Deal With Impaired Colleagues		Very or Somewhat Prepared to Deal With Incompetent Colleagues	
	No. (%) [95% CI] ^a	P Value	No. (%) [95% CI] ^a	P Value	No. (%) [95% CI] ^a	P Value
Total	1120 (64)		1208 (69)		1126 (64)	
Sex						
Men	759 (61) [58-64]	.02	894 (69) [66-73]	.07	839 (65) [62-68]	.01
Women	361 (68) [64-73]		314 (64) [59-69]		287 (58) [53-63]	
Race/ethnicity ^b						
Not underrepresented minority	1024 (64) [61-67]	.21	1095 (67) [65-70]	.57	1022 (63) [60-65]	.64
Underrepresented minority	96 (58) [50-67]		113 (70) [62-78]		104 (65) [56-73]	
Specialty						
Anesthesiology	163 (65) [59-71]	.94	191 (76) [70-81]	<.001	193 (77) [71-82]	<.001
Cardiology	121 (63) [56-69]		140 (63) [56-70]		136 (63) [56-70]	
Family practice	163 (63) [57-69]		163 (65) [59-71]		143 (57) [51-63]	
General surgery	165 (65) [59-71]		187 (71) [65-76]		175 (66) [60-72]	
Internal medicine	150 (62) [56-68]		167 (68) [62-74]		157 (6) [58-70]	
Pediatrics	196 (66) [61-72]		167 (59) [54-65]		160 (58) [52-64]	
Psychiatry	162 (63) [57-69]		193 (76) [70-81]		162 (62) [56-69]	
Type of medical school graduate						
US	870 (67) [64-70]	<.001	871 (67) [64-70]	.57	800 (62) [58-64]	.14
International	250 (56) [51-61]		337 (69) [64-74]		326 (66) [61-71]	
Years in practice						
<10	147 (71) [63-78]	.02	134 (69) [62-76]	.009	131 (68) [61-75]	.001
10-19	295 (62) [57-67]		273 (61) [56-66]		248 (55) [50-60]	
20-29	364 (67) [62-71]		381 (67) [63-72]		363 (64) [59-69]	
≥30	314 (59) [54-64]		420 (73) [69-78]		384 (67) [62-72]	
Practice organization						
Hospital or clinic	231 (70) [65-76]	.01	230 (69) [63-74]	.04	215 (63) [57-69]	.13
University or medical school	79 (66) [56-77]		88 (80) [73-88]		82 (72) [63-81]	
Group	450 (61) [57-65]		480 (66) [62-70]		439 (59) [55-64]	
Solo or 2-person	216 (58) [53-64]		273 (69) [63-74]		258 (66) [60-71]	
Other	144 (70) [63-76]		137 (64) [57-71]		132 (64) [57-71]	
Total claims paid per practicing physician						
Low (0.003-≤0.007)	415 (68) [64-72]	.03	402 (67) [62-71]	.82	374 (63) [59-67]	.98
Medium (0.008 < -0.011)	338 (60) [55-64]		393 (68) [64-72]		364 (62) [58-67]	
High (≥0.011)	367 (63) [58-67]		413 (68) [64-73]		388 (63) [58-67]	

Abbreviation: CI, confidence interval.

^aNumbers are unadjusted; all percentages are adjusted. All estimates were obtained using multivariable analysis controlling for all variables shown in the table.

^bSee "Methods."

pletely agree that physicians should report all instances of impaired or incompetent colleagues.

Preparedness to Deal With Impaired or Incompetent Colleagues

Table 2 shows the ratings by physicians of their own preparedness to deal with impaired colleagues. Overall, 69% of physicians said they were very or somewhat prepared. Among the specialties, anesthesiologists and psychiatrists were most likely and pediatricians were the least likely to feel very or somewhat prepared. Physicians practicing in medical school and university settings were significantly more likely to report being prepared than those in other practice settings.

Table 2 also shows ratings by physicians of their own preparedness to deal with incompetent colleagues. Similar to the data concerning impaired colleagues, 64% of physicians overall reported being prepared to deal with colleagues who were incompetent in their medical practice, and preparedness varied by specialty and professional age. However, unlike preparedness to deal with impaired colleagues, for which no significant difference was found between men and women physicians, women were significantly less likely than men to report being prepared to deal with incompetent colleagues.

Experiences With Impaired and Incompetent Colleagues

Seventeen percent (n=309) of physicians reported having direct personal knowledge of an impaired or incompetent physician colleague in their hospital, group, or practice in the last 3 years. Only physician specialty was significantly associated with direct personal knowledge (TABLE 3), with anesthesiologists being the most likely and pediatricians being the least likely to report such knowledge.

As shown in Table 3, 67% of physicians with knowledge of an impaired or incompetent colleague reported that individual to a hospital, clinic, professional society, or other relevant author-

ity. Underrepresented minority physicians were significantly less likely than other physicians to report, as were international medical graduates compared with graduates of US medical schools.

Practice organization was significantly associated with reporting. Seventy-six percent of physicians practicing in hospitals and 77% of those in universities or medical schools who had knowledge of an impaired or incompetent colleague reported that col-

league to the relevant authority. In contrast, only 44% of physicians with such knowledge in solo or 2-person practices reported that colleague.

Reasons for Failing to Report

The FIGURE shows the reasons why physicians did not report an impaired or incompetent colleague at least once in the past 3 years. Among the 309 with such knowledge, the most frequently cited reason for not reporting was the belief that some-

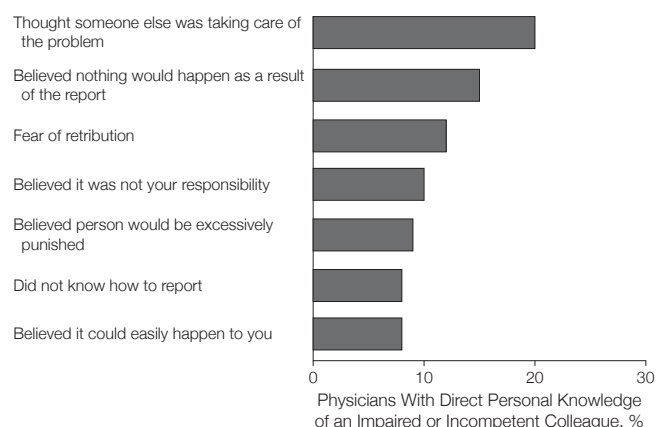
Table 3. Experiences With Impaired or Incompetent Colleagues

Characteristic	Had Direct Personal Knowledge of a Physician Who Was Impaired or Incompetent to Practice Medicine in Hospital, Group, or Practice		Reported Impaired or Incompetent Colleague to a Hospital, Clinic, Professional Society, or Other Relevant Authority	
	No. (%) [95% CI] ^a	P Value	No. (%) [95% CI] ^a	P Value
Total	309 (17)		204 (67)	
Sex				
Men	240 (17) [15-19]	.40	156 (66) [59-73]	.84
Women	69 (15) [12-19]		48 (67) [55-80]	
Race/ethnicity ^b				
Not underrepresented minority	282 (16) [14-18]	.85	190 (68) [62-74]	.02
Underrepresented minority	27 (17) [10-24]		14 (47) [28-66]	
Specialty				
Anesthesiology	72 (26) [20-31]	<.001	52 (67) [56-79]	.32
Cardiology	37 (17) [11-22]		21 (68) [53-83]	
Family practice	43 (17) [12-21]		32 (71) [59-83]	
General surgery	51 (19) [14-24]		33 (71) [56-85]	
Internal medicine	37 (16) [11-20]		21 (59) [44-73]	
Pediatrics	25 (9) [6-12]		13 (54) [35-73]	
Psychiatry	44 (18) [13-23]		32 (77) [66-87]	
Type of medical school graduate				
US	236 (18) [15-20]	.13	175 (73) [66-79]	<.001
International	73 (14) [10-18]		29 (45) [32-58]	
Years in practice				
<10	29 (14) [9-20]	.14	25 (79) [61-96]	.14
10-19	60 (15) [11-19]		38 (66) [53-78]	
20-29	127 (20) [16-23]		88 (70) [61-79]	
≥30	93 (15) [12-18]		53 (57) [46-69]	
Practice organization				
Hospital or clinic	65 (19) [14-24]	.24	49 (76) [63-88]	.002
University or medical school	24 (20) [12-29]		18 (77) [59-94]	
Group	131 (17) [14-20]		90 (71) [63-80]	
Solo or 2-person	63 (16) [11-20]		29 (44) [30-57]	
Other	26 (11) [7-16]		18 (62) [42-82]	
Total claims paid per practicing physician				
Low (0.003-≤0.007)	113 (18) [15-22]	.37	80 (67) [58-77]	.91
Medium (0.008-0 < .011)	98 (16) [12-19]		63 (64) [54-75]	
High (≥0.011)	98 (15) [12-19]		61 (66) [57-76]	

Abbreviation: CI, confidence interval.

^aNumbers are unadjusted; all percentages are adjusted. All estimates were obtained using multivariable analysis controlling for all variables shown in the table.

^bSee "Methods."

Figure. Reasons for Failing to Report an Impaired or Incompetent Colleague in Last 3 Years

Percentages are unadjusted. All physicians reporting direct personal knowledge of an impaired or incompetent colleague (n=309) were asked to respond "yes" or "no" to each item; percentages will not sum to 100%.

one else was taking care of the problem (19% [n=58]), followed by the belief that nothing would happen as a result of the report (15% [n=46]). Other reasons for failing to report included fear of retribution (12% [n=36]), the belief that reporting was not their responsibility (10% [n=30]), or that the physician would be excessively punished (9% [n=27]).

COMMENT

These national data regarding physicians' beliefs, preparedness, and actual experiences related to impaired and incompetent colleagues raise important questions about the ability of medicine to self-regulate. More than one-third of physicians do not completely support the fundamental belief that physicians should report colleagues who are impaired or incompetent in their medical practice. This finding is troubling, because peer monitoring and reporting are the prime mechanisms for identifying physicians whose knowledge, skills, or attitudes are compromised. Similar to suspected cases of child or spousal abuse, in which physicians are legally mandated to alert relevant authorities, physicians are required by the AMA Code of Ethics to report colleagues whom they suspect are unable to

practice medicine safely because of impairment or incompetence. Clearly, additional efforts on the part of medical societies, specialty and accrediting organizations, and hospitals are needed to reinforce the responsibilities of the medical community and to prepare physicians to deal with these difficult situations.

Physician education around reporting may be most needed among physicians in solo and dual practices, in which more than 40% of respondents did not completely agree with the professional responsibility to report impaired or incompetent colleagues. Moreover, whereas physicians in this group were no less likely than those in other practice organizations to have direct knowledge of an impaired colleague, fewer than half reported that colleague to an authority. The isolation of solo or dual practice may make it difficult for physicians in such practices to know about reporting procedures. Another possibility is that these physicians are heavily dependent on referrals and fear either retribution or a loss of reputation. Further study is needed to understand how this practice dynamic affects physicians' beliefs about self-regulation and the best methods for ensuring that physicians in small practices can access reporting mechanisms when necessary.

The findings also support and extend prior research concerning physicians who are outside the majority (ie, underrepresented minorities and international medical school graduates). For these physicians, reporting an impaired or incompetent colleague may pose particular challenges. Underrepresented minority physicians are equally likely to endorse the commitment to report, to feel prepared to deal with impaired or incompetent colleagues, or to have encountered such colleagues—yet more than half of these physicians did not report. International medical graduates demonstrated a similar pattern, although they are also less likely than US graduates to endorse reporting. Further research should examine whether these physicians feel particularly vulnerable to retribution or loss of reputation because of their "outsider" status.

These data on why physicians do not report colleagues have practical implications for improving physician reporting systems. First, it is clear that a reliance on self-regulation is not sufficient to ensure that reporting will occur. This suggests the need for stronger external regulation. Organizations that might play a much more significant role in managing reporting and remediation may include professional societies, licensing groups, hospitals, and patient groups. Second, reporting systems must be designed and maintained to protect the confidentiality of the reporting physicians. Given that physicians outside the majority or heavily dependent on referrals are less likely to report, it is critical that their fears of retaliation be adequately addressed to increase the likelihood that they will feel able to report when necessary. Third, some underreporting appears related to physicians' beliefs that nothing will happen as a result of the report. One way to address this is to provide physician reporters with confidential feedback about the outcomes of any actions taken based on the report. These changes would likely address several

of the more frequent reasons for non-reporting.

This study has several limitations. First, because of reliance on voluntary disclosure of failure to report impaired and incompetent colleagues, these failures may be viewed as negative, and the results likely represent a lower-bound estimate of the actual frequency of nonreporting. Second, although the response rate was relatively high for a physician survey, non-response bias might exist. Attempts were made to adjust for the possible bias through weighting, but such adjustments are imperfect. Third, the accuracy of the respondents' beliefs about whether their colleagues were, in fact, impaired or incompetent cannot be verified. Physicians may have made erroneous judgments about their colleagues' functioning and competence. It is possible that what a physician reported as incompetence may have been, for example, a difference of opinion regarding a diagnosis or treatment plan. Survey methods do not allow determination of exactly how often this misclassification happens.

Overall, this study calls into question the willingness and ability of physicians to identify and report colleagues whose ability to practice medicine is impaired by alcohol or drug use or by physical or mental illness, as well as those incompetent to practice because of deficits in knowledge and skills. These findings further suggest that a large number of practicing physicians do not support the current process of self-regulation: it is underused and appears to have several major shortcomings, including a perceived lack of anonymity and efficacy. All health care professionals, from administrative leaders to those providing clinical care, must understand the urgency of preventing impaired or incompetent colleagues from injuring patients and the need to help these physicians confront and resolve their problems. The system of reporting must facilitate, rather than impede, this process. Reliance on the current process results in patients being exposed to unacceptable levels of risk and in impaired and incompetent physicians

possibly not receiving the help they need.

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Study concept and design: DesRoches, Fromson, Birnbaum, Iezzoni, Campbell.

Acquisition of data: DesRoches, Campbell.

Analysis and interpretation of data: DesRoches, Rao, Fromson, Birnbaum, Iezzoni, Vogeli, Campbell.

Drafting of the manuscript: DesRoches, Fromson, Birnbaum, Campbell.

Critical revision of the manuscript for important intellectual content: DesRoches, Rao, Fromson, Birnbaum, Iezzoni, Vogeli, Campbell.

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