

Performance during Internal Medicine Residency Training and Subsequent Disciplinary Action by State Licensing Boards

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Background: Physicians who are disciplined by state licensing boards are more likely to have demonstrated unprofessional behavior in medical school. Information is limited on whether similar performance measures taken during residency can predict performance as practicing physicians.

Objective: To determine whether performance measures during residency predict the likelihood of future disciplinary actions against practicing internists.

Design: Retrospective cohort study.

Setting: State licensing board disciplinary actions against physicians from 1990 to 2006.

Participants: 66 171 physicians who entered internal medicine residency training in the United States from 1990 to 2000 and became diplomates.

Measurements: Predictor variables included components of the Residents' Annual Evaluation Summary ratings and American Board of Internal Medicine (ABIM) certification examination scores.

Results: 2 performance measures independently predicted disciplinary action. A low professionalism rating on the Residents' Annual Evaluation Summary predicted increased risk for disciplinary action

(hazard ratio, 1.7 [95% CI, 1.3 to 2.2]), and high performance on the ABIM certification examination predicted decreased risk for disciplinary action (hazard ratio, 0.7 [CI, 0.60 to 0.70] for American or Canadian medical school graduates and 0.9 [CI, 0.80 to 1.0] for international medical school graduates). Progressively better professionalism ratings and ABIM certification examination scores were associated with less risk for subsequent disciplinary actions; the risk ranged from 4.0% for the lowest professionalism rating to 0.5% for the highest and from 2.5% for the lowest examination scores to 0.0% for the highest.

Limitations: The study was retrospective. Some diplomates may have practiced outside of the United States. Nondiplomates were excluded.

Conclusion: Poor performance on behavioral and cognitive measures during residency are associated with greater risk for state licensing board actions against practicing physicians at every point on a performance continuum. These findings support the Accreditation Council for Graduate Medical Education standards for professionalism and cognitive performance and the development of best practices to remediate these deficiencies.

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The American Board of Internal Medicine (ABIM) sets the standards for, and certifies the competence of, physicians who train in internal medicine and its subspecialties. Residency program directors annually assess medical residents' performance, and medical knowledge is further assessed by the ABIM certification examination. The validity of these assessments for predicting performance in professionalism in practicing physicians is assumed but has not been tested.

The Accreditation Council for Graduate Medical Education (ACGME) has historically accredited residency programs on the basis of their ability to educate residents. In 1999, the ACGME endorsed the measurement of a program's accomplishments by residents' success in attaining educational outcomes. The organization designated 6 competencies as measures of a residency program's effectiveness, one of which was professionalism (1). Much thought has gone into how best to teach and measure professionalism across specialties during graduate medical education (2–12). Once a physician is in clinical practice, the maintenance of certification is a measurement of professionalism (13–15).

In previous studies (16, 17), we have shown that physicians who are disciplined by state licensing boards are more likely to have demonstrated unprofessional behavior in medical school. Thus, for some students, patterns of unprofessional behavior are recognized early and are long-

lived. To investigate whether similar predictors of future problems could be found during residency training, we studied a cohort of all physicians who entered internal medicine residency training in the United States between 1990 and 2000 and subsequently became diplomates. We took advantage of the fact that the same ABIM criteria and instruments are used to assess medical residents' performance throughout the United States and that the ABIM gathers these assessments. In addition, internal medicine residents receive a grade for professionalism, unlike medical students, whose professionalism component may be embedded in the overall grade of their clerkship. A program director's specific assessment of a resident's professionalism imparts confidence that a considered judgment has been made on this competence.

METHODS

We performed a retrospective cohort study of internal medicine residents to determine whether measures of per-

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formance during residency training were associated with disciplinary action by state licensing boards after the residents became diplomates and practicing physicians. Our sample comprised 66 171 residents who were trainees from 1990 to 2000 in any of the approximately 425 ACGME-accredited internal medicine residency programs. We excluded physicians in preliminary or transitional internship programs, 109 physicians who received disciplinary actions by state licensing boards before or during residency training (because disciplinary action would precede the performance indicator variables), and nondiplomates (physicians who entered an internal medicine residency but did not receive specialty certification).

Measurements

Performance Predictor Variables

We used predictor variables from the longitudinal records maintained by the ABIM to measure residents' performance. These included ratings in 6 components of the ABIM Resident's Evaluation Summary, score on the first attempt of the ABIM internal medicine certification examination, years of residency training, and number of attempts on the ABIM internal medicine certification examination. We obtained information on the residents' sex, age, country of birth, country of medical school, and internal medicine subspecialty certification (for example, gastroenterology or nephrology).

ABIM Resident's Evaluation Summary

The ABIM Resident's Evaluation Summary is a standardized, Web-based, global rating of clinical competence. Program directors must submit this evaluation annually to the ABIM. The components of the form changed during the study interval; however, the following 6 components were present throughout: medical interviewing, physical examination skills, procedural skills, medical knowledge, professionalism, and overall clinical competence. Each component has descriptive anchors that enumerate characteristics of best and worst performance and a 9-point scale in which residents are rated as unsatisfactory (score of 1 to 3), satisfactory (score of 4 to 6), or superior (score of 7 to 9). For example, in the 1997 and 2000 versions of the Resident's Evaluation Summary, the description of the lowest rating of the professionalism component was "lacks altruism, accountability, integrity, commitment to excellence, duty, service, honor; disrespectful to other health care professionals; irresponsible; unreliable; not punctual; ineffective communicator; disruptive; disorganized; records tardy and/or illegible." The description for the highest rating was "aspires to altruism, accountability, excellence, duty, service, honor, integrity and respect for others; is responsive, reliable, punctual, and cooperative; displays initiative; provides effective leadership; maintains legible and timely records."

At the completion of residency, a satisfactory rating in all components is required to take the ABIM certification

examination. The reliability and validity of these ratings correlate with certification examination scores and physician peer ratings (18, 19). Specifically, overall clinical competence ratings from program directors correlate with physician peer ratings of competence ($r = 0.25$; $P < 0.010$). In addition, examinees who did not pass the internal medicine certification examination on their initial attempt received lower ratings of clinical competence, on average, than other examinees. An internal assessment by the ABIM found that although a rating of 4 allowed the examinee to sit for the examination, program directors viewed it as a marginal rather than a satisfactory rating. This process of internal assessment included feedback from the ABIM Visit Program, discussions with Association of Program Directors in Internal Medicine (APDIM) and program directors, joint ABIM/APDIM workshops on problem residents, and comprehensive policy discussions by the ABIM Committee on Evaluation of Clinical Competence. We therefore defined a rating of 4 or less as low for the competencies on the ABIM Resident's Evaluation Summary.

ABIM Certification Examination Score

We made scores on the internal medicine certification examination comparable across examination years by using the Tucker linear equating process, a statistical procedure used in standardized testing to ensure that scores from multiple test administrations can be used interchangeably (20). The equated certification scores were transformed into standardized scores (z scores) and then entered as a continuous variable into the models that predicted future disciplinary action.

Outcome Variable

The outcome variable was disciplinary action by a state medical licensing board (Table 1).

Disciplinary Action and Basis Categories

We examined U.S. state licensing board disciplinary (prejudicial) actions against physicians from 1 January 1990 through 20 November 2006. The study follow-up period for physicians who received disciplinary action began on the date of entry into residency training and ended on the date of the last disciplinary action before 20 November 2006. For those without disciplinary action, the follow-up period began on the date of entry into residency training and extended to 20 November 2006.

Information about disciplined physicians and other public information concerning the disciplinary mandates by state medical boards were supplied to the ABIM by the American Board of Medical Specialties, which obtains its data from the Federation of State Medical Boards. No investigator outside of the ABIM had access to the names of the study physicians.

The reason that a physician is disciplined by a state licensing board is called the *basis for disciplinary action*.

Table 1. Basis for Disciplinary Actions Taken by State Licensing Boards

Basis for Disciplinary Action	Physicians Disciplined, n (%) [*]	Category of Action [†]		
		A	B	C
Unprofessional behavior				
Failure to meet educational requirement (e.g., continuing medical education)	138 (21.6)	2	26	110
Fraud/billing/tax irregularities (e.g., Medicare/Medicaid)	58 (9.1)	23	34	0
Controlled substance violation [‡] (e.g., inappropriate/excessive prescribing)	52 (8.2)	14	38	0
Examination/license irregularities (e.g., misinterpretation of credentials)	47 (7.4)	6	39	2
Substance use (e.g., self-use of drugs/alcohol)	41 (6.4)	24	17	0
Sexual misconduct [‡]	31 (4.9)	21	10	0
Failure to report/comply with order of the board	31 (4.9)	4	22	5
Professional conduct [‡]	29 (4.5)	4	25	0
Negligence [‡]	26 (4.1)	5	21	0
Convicted of a crime	24 (3.8)	14	10	0
Quality [‡] (e.g., excessive treatment not warranted by patient's condition)	21 (3.3)	1	20	0
Records [‡] (e.g., failure to maintain adequate records/misrepresentation of documents)	17 (2.7)	0	17	0
Failure to conform to minimal standards of acceptable medical practice [‡]	12 (1.9)	1	11	0
Failure to adequately supervise [‡] (e.g., allowing staff to perform procedures without adequate supervision)	3 (0.5)	0	3	0
Total	530 (83.3)			
Incompetence				
Impairment [‡]	11 (1.1)	8	3	0
Neither unprofessional behavior nor incompetence/undeterminable				
General	97 (15.2)	31	66	0
Total	638 (100)	158	362	118

* Percentage of all disciplined physicians.

[†] Disciplinary action categories: A = loss of medical license; B = restriction of medical license (e.g., probation, reprimand); C = monetary fine.

[‡] Violation directly related to substandard quality or safety of patient care.

Common examples include inappropriate prescribing of controlled substances, fraudulent billing practices, or failure to meet continuing medical education requirements. State licensing boards may impose penalties of varying degrees of severity. Category A, the most severe type of disciplinary action, is loss of the physician's license (21). Category B actions are restrictions of the physician's medical license—for example, in the form of probation. Category C actions are usually monetary fines, such as for failure to comply with continuing medical education requirements.

Two investigators who were familiar with the designations of the state licensing boards and were blinded to each diplomate's predictor variables reviewed the information on each physician's disciplinary action and designated whether it demonstrated unprofessional behavior, incompetence, or neither/undeterminable (Table 1) (17). If a physician had only 1 disciplinary action, we designated the basis for that action as unprofessional behavior, incompetence, or neither/undeterminable. If a physician had more than 1 disciplinary action, we reviewed the basis for the action in the most severe category and made the designation. For physicians who received more than 1 action in the most severe category, we designated the most representative basis for action in that category. We further categorized whether the bases for disciplinary action reflected diminished quality of patient care or affected patient safety, such as inappropriate prescribing, negligence, or sexual misconduct. The κ statistic for these judgments showed a

high level of agreement between investigators (0.96 [CI, 0.95 to 0.96]). An independent expert in patient safety adjudicated designation disagreements.

Statistical Analysis

We first compared characteristics of internal medicine diplomates with and without disciplinary actions by using chi-square tests for proportions, Cochran–Armitage trend tests, *t* tests, and Kendall–Tau tests where appropriate. For multivariate analyses, our analytic plan included all variables from Table 2 as candidate covariates. The stepwise selection procedure allowed a variable to enter the model if its *P* value was less than 0.25 and retained the variable if the *P* value was less than 0.050. To ensure that covariate selection was not unduly influenced by the large sample size, we used a resampling Cox regression procedure to identify the variables that would consistently predict disciplinary action (22). We evaluated all possible 2-way interactions and found one that seemed consistent (ABIM certification examination score by medical school location).

Having selected the covariates, we conducted the multivariate analyses for disciplinary action by using a derivation and validation procedure. We performed the Cox regression analysis initially on 57 461 of the physicians (the derivation sample) after having first randomly selected a validation sample of 8710 physicians from the total sample of 66 171 physicians. By using the set of covariates obtained in the derivation samples, we observed an equivalent fit (*P* = 0.49) in the

Table 2. Performance and Demographic Characteristics of Internal Medicine Diplomates*

Characteristic	Physicians Not Disciplined (n = 65 533)	Physicians Disciplined† (n = 638)
Performance measures		
Internal medicine residency training‡, n (%)		
1 y	21 (0.0)	0
2 y	1480 (2.3)	9 (1.4)
3 y	59 945 (91.5)	588 (92.2)
4 y	3789 (5.8)	40 (6.3)
≥5 y	298 (0.5)	1 (0.3)
ABIM Resident's Annual Evaluation Summary rating, n (%)		
At completion of first year of residency training		
Professionalism ≤4	1127 (2.0)	27 (5.6)
Medical interviewing ≤4	1637 (3.0)	33 (6.8)
Physical examination ≤4	1403 (2.5)	28 (5.8)
Procedural skills ≤4	1695 (3.1)	26 (5.6)
Medical knowledge ≤4	3776 (6.8)	59 (12.1)
Across all years of residency training		
Professionalism ≤4	3116 (4.8)	68 (10.7)
Medical interviewing ≤4	2842 (4.3)	55 (8.6)
Physical examination ≤4	2529 (3.9)	49 (7.7)
Procedural skills ≤4	3611 (5.5)	67 (10.5)
Medical knowledge ≤4	7345 (11.2)	122 (19.1)
Overall clinical competence ≤4	1247 (1.9)	28 (4.4)
Mean performance on initial ABIM Internal Medicine Certification Examination (SD)§	0.1 (0.9)	-0.3 (1.0)
Attempts at ABIM certification examination, n (%)		
1 attempt	56 758 (86.6)	477 (74.8)
2-3 attempts	8775 (13.4)	161 (25.2)
No subspecialty certification , n (%)	39 752 (60.7)	458 (71.8)
Demographic characteristics		
Men, n (%)	41 821 (63.8)	501 (78.5)
Mean age when began residency (SD), y	29.1 (4.2)	30.0 (4.2)
Born outside of United States or Canada, n (%)	32 961 (50.4)	369 (58.0)
International medical school graduate, n (%)	28 746 (43.9)	349 (54.7)

* ABIM = American Board of Internal Medicine.

† As of 20 November 2006.

‡ Physicians must complete an equivalency of 3 years of residency training to become certified. Two percent of diplomates with <3 years' residency were granted an equivalency of 3 years' training.

§ Scale of performance = equated z score of initial ABIM internal medicine certification examination.

|| No internal medicine subspecialty certification (e.g., cardiovascular disease, infectious disease).

validation sample. Therefore, we present the results based on the sample of 66 171 physicians.

All analyses were performed by using SAS, version 9.1 (SAS Institute, Cary, North Carolina). The institutional review board of UCSF approved this study and did not require informed consent from the physicians. All statistical analyses were performed by investigators who were blinded to the physicians' identities.

Role of the Funding Source

The project was funded in part by the ABIM Foundation. Investigators employed by the ABIM Foundation were involved in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation of the manuscript; and the decision to submit the study for publication.

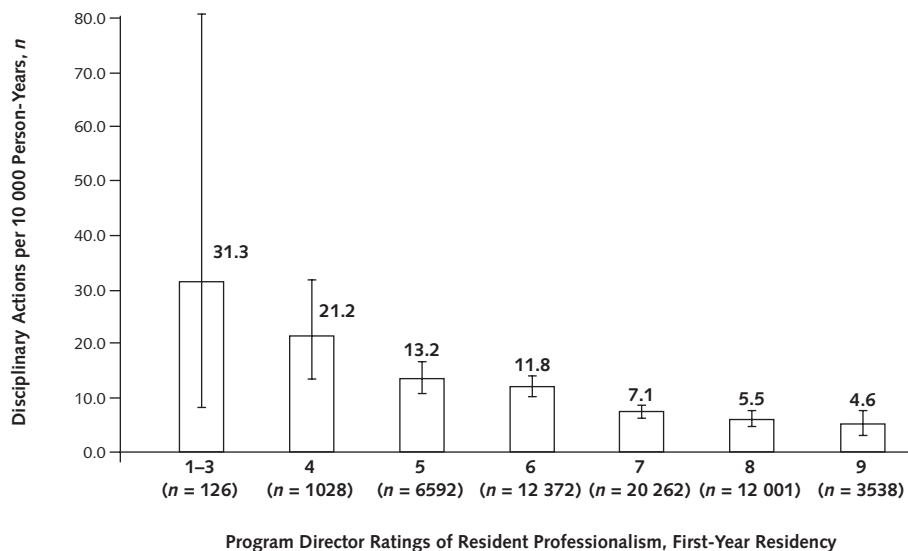
RESULTS

We located records for 66 171 internal medicine diplomates. One of 638 records (0.2%) was missing among the physicians who received disciplinary action and 101 of

65 533 records (0.2%) were missing among the physicians who did not.

Table 2 shows measures of performance and demographic characteristics for the residents. State licensing boards disciplined 1% of the diplomates during the 17-year study interval (median years to first disciplinary action, 11.0; range, 3.0 to 16.0 years). On average, physicians who were disciplined received 4.1 (SD, 5.0) disciplinary actions (range, 1 to 48 actions).

Most (83.3%) of the disciplinary actions were for unprofessional behavior, and nearly one third (31.2%) were for violations that directly related to substandard quality of patient care, such as inappropriate or excessive prescribing of controlled substances (Table 1). Compared with non-disciplined diplomates, diplomates who were disciplined had lower ratings on their ABIM Resident's Evaluation Summary, had more unsuccessful attempts and lower scores on the internal medicine certification examination, and were less likely to be certified in an internal medicine subspecialty (Table 2).

Figure 1. Incidence of disciplinary actions, by program director rating.

Incidence of disciplinary actions per 10 000 person-years over 16 years for 66 171 internal medicine diplomates, based on professionalism rating by the program director after the first year of residency. Ratings range from 1 (lowest) to 9 (highest). Error bars indicate 95% CIs.

Professionalism

Unadjusted analyses of diplomates showed that progressively better professionalism ratings during residency were associated with progressively less risk for subsequent disciplinary actions (Figure 1). Diplomates with low professionalism ratings (ratings ≤ 4) had the highest risk for disciplinary action, whereas diplomates with high professionalism ratings had the lowest risk. Multivariate Cox proportional hazard analysis demonstrated that a low professionalism rating (< 4) independently predicted disciplinary action (hazard ratio, 1.7 [CI, 1.3 to 2.2]) (Table 3).

ABIM Certification Examination Performance

Unadjusted analyses showed that progressively higher scores on the ABIM certification examination were associ-

ated with decreasing risks for subsequent disciplinary actions (Figure 2). Multivariate Cox proportional hazard analysis revealed that better performance on the internal medicine certification examination independently reduced the likelihood for disciplinary action (hazard ratio, 0.7 [CI, 0.6 to 0.7] for American or Canadian medical school graduates and 0.9 [CI, 0.8 to 1.0] for international graduates) (Table 3). The analysis revealed an interaction between performance on the internal medicine certification examination and graduation from an international medical school: For every SD unit of increase in performance scale, international medical graduates had a 9% reduction in subsequent disciplinary action, whereas American or Canadian medical graduates had a 35% reduction. We examined the

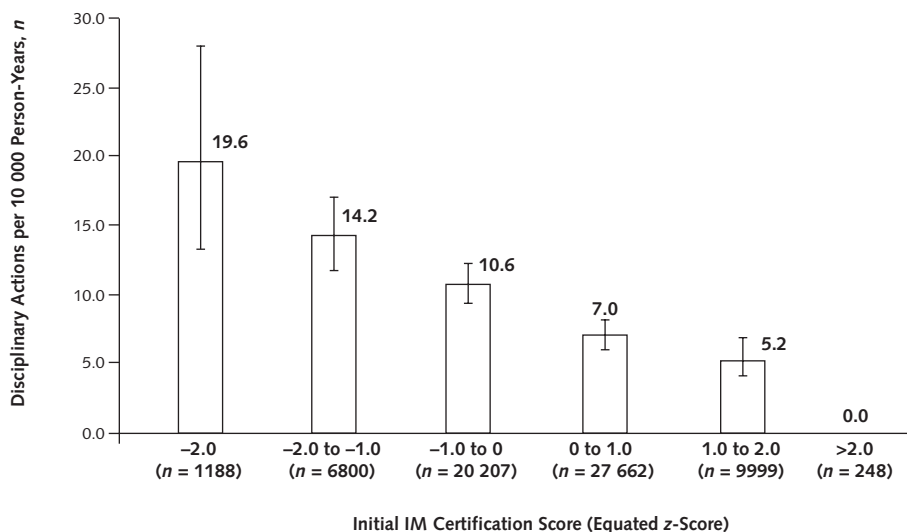
Table 3. Cox Proportional Hazards Regression Models for Risk for Disciplinary Action*

Predictor	Risk for Disciplinary Action	
	Unadjusted Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI)
Performance measures during residency		
Professionalism rating ≤ 4 on the ABIM Resident's Evaluation Summary†	2.2 (1.7–2.8)	1.7 (1.3–2.2)
First-attempt internal medicine certification z score‡		
American or Canadian medical school graduates	0.6 (0.5–0.7)	0.7 (0.6–0.7)
International medical school graduates	0.9 (0.8–0.9)	0.9 (0.8–1.0)
Other measures		
International medical school graduate	1.5 (1.3–1.8)	1.5 (1.3–1.8)
Male sex	1.9 (1.6–2.3)	2.0 (1.7–2.4)
No subspecialty certification	1.9 (1.6–2.3)	2.0 (1.6–2.3)

* ABIM = American Board of Internal Medicine.

† Ratings on professionalism ≤ 4 across all years of residency training vs. > 4 (9-point scale); higher ratings denote better professional conduct.

‡ Mean (SD), 0 (1).

Figure 2. Incidence of disciplinary actions, by certification on initial examination attempt.

Incidence of disciplinary actions per 10 000 person-years over 16 years for 66 171 internal medicine (IM) diplomates, based on performance on their initial attempt at the IM certification examination. Error bars indicate 95% CIs.

completion of maintenance of certification as a proxy for location of clinical practice in the United States. Among 12 159 international and American- or Canadian-born physicians who were required to complete the maintenance of certification program to maintain a valid certificate, a small but statistically significantly higher percentage of those born in the United States were enrolled in the maintenance of certification program (88% vs. 84%; $P < 0.001$).

DISCUSSION

In this cohort study of internal medicine residents who trained in the United States between 1990 and 2000, we found 2 predictors during residency training of subsequent disciplinary action against practicing physicians: unprofessional behavior and a low score on the internal medicine certification examination. Residents with either risk factor had nearly twice the chance of being subsequently disciplined by a state licensing board.

To test the importance of professional behavior, this study evaluated disciplinary action, the extreme sanction for problematic performance by practicing physicians. Patterns of professional behavior in residents can persist over time, similar to what has been shown for medical students (16, 17). We believe that most residents and practicing physicians cherish professionalism and that professionalism in residents grows with experience, especially when it is both valued and taught by the faculty (23). We focused on performance measures as predictors of disciplinary action, rather than demographic characteristics, because residents may improve on their performance. Because most residents who had a poor performance measure were not subsequently disciplined by a licensing board, unprofessional

behavior is a weak signal for the rare event of disciplinary action. These residency performance measures are predictors but are not adequate screening tests in and of themselves for subsequent disciplinary action and should not be used as such (24). Current evidence also does not support dismissal of residents with low professionalism ratings because of concerns about subsequent disciplinary action against them. Rather, decisions to promote residents should be based on whether residents have met the ACGME standards for advancement, which includes professionalism, and this study indicates that a physician's rating in this area does correlate with subsequent care of patients. Our findings also support previous findings that showed that ABIM diplomate certification is an important predictor of the quality of patient care that a physician provides, as assessed by peers and patients (25). Residents' scores on certification examinations correlate with both global ratings by program directors and scores on licensure examinations (26). A study of Canadian residents showed that certification scores also correlate with the quality of primary care practice and patient complaints against physicians (27, 28).

Both professionalism during training and scores on ABIM certification examinations show continuous relationships with disciplinary actions across the spectrum of performance: Better scores correlate with fewer disciplinary actions. Disciplinary actions were taken for problems directly involving patient care and safety, and although our study did not directly assess patient care, receiving fewer disciplinary actions is probably a proxy for better patient care; this speculation bears further study. We also do not know the relationship between professionalism violations

in medical school and residency. Our study does not test the effect of education on professionalism but supports the enhanced emphasis on professionalism in residency training, regardless of one's place on the performance continuum (29–31).

What are the implications of these findings? It is reassuring that most physicians will not get into trouble with their state licensing boards, and it is probable that many residents who received lower professionalism ratings subsequently resolved these lapses. However, licensing actions taken by state medical boards mostly detect egregious behavior. Thus, this disciplinary action is probably an insensitive measure of poor patient care. Our results raise concern, given that other studies show a relationship between cognitive skill and quality among practicing physicians (15, 27, 28), because many physicians have performance problems that do not reach the attention of the state medical boards. Because the public has the right to expect that practicing physicians will participate in performance assessments, the medical profession has imposed requirements for maintenance of certification and maintenance of licensure. Assessment of professionalism, 1 of the 6 core ACGME competencies, should be an explicit part of these ongoing programs.

What are the next steps? Our study covered a 10-year period during which professionalism was officially designated as a competency by the ACGME and, subsequently, the American Board of Medical Specialties. This designation enhanced the legitimacy of professionalism as a standard, one that had already been established by ABIM certification. The ACGME Common Program Requirements and Institutional Requirements have also required greater accountability by program directors in the past several years and designated institutional officials to address resident competency in the domains of professionalism, including problematic behavior, intervention and remediation, performance improvement, and outcome (32, 33). This regulation was not in place during the course of our study. However, program directors and medical educators continue to struggle with how to deal with residents who demonstrate problematic behavior (34). One institution has recently published a systems approach to unprofessional behavior (35). This framework, which incorporates clear expectations for and assessment of behavior by medical students, residents, and faculty, could serve as a model to be adapted throughout the continuum of medical education. As a worthy next step, the academic community should mandate the development of best practices for remediation of unprofessional behavior. We hope that improved remediation outcomes will improve patient care.

Many of the disciplinary actions stemmed from delivery of substandard patient care in terms of quality or safety. Although the drive to improve patient safety has rightly focused on faulty systems as the cause of injuries, it would be wrong to dismiss poor performance by physicians as a factor when trying to improve quality of patient care and

patient safety (36, 37). According to the Federation of State Medical Boards, approximately one half of physicians who are disciplined receive subsequent disciplinary actions (Knettler T. Personal communication). The APDIM is calling for the redesign of residency education, in large part to improve the link between the educational system and efforts to improve patient safety (29). We hope that our findings will help expand the conversation about patient safety to include problematic behavior and low achievement by the individual provider (36).

Our study has limitations. First, we could not control for the quality of the observations or standardize thresholds for disciplinary actions across different states. Second, our data are retrospective. Third, we could not determine whether our findings are generalizable to other specialties because disciplinary action rates differ by specialty (38). Fourth, we excluded nondiplomates. It is likely that some of these individuals had to change specialties because of difficulties during internal medicine training, but we did not include data on their performance in this study because the data were incomplete. Finally, trainees who came to the United States for residency training may have returned to practice in their home country and would therefore not be at risk for disciplinary action in the U.S. medical licensure system. However, this probably represents a small number of diplomates because at least 84% of graduating internal medicine diplomates participate in the maintenance of certification program. These limitations may bias against finding an effect; therefore, because we found effects, the risks we determined may underestimate the true risks.

We have shown that both behavioral and cognitive performance measures during residency training can predict problematic performance in practicing physicians and that there is a continuum of performance. Our findings support the ACGME standard for successful performance in both residency and practice and support the development of best practices for helping residents address deficiencies in these standards. Our data also support the ACGME's decision to broaden the components of competence to include professionalism and its goal to promote continued professional growth for all residents.

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Note: Dr. Lipner from the ABIM had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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