

A Cost Analysis of the American Board of Internal Medicine's Maintenance-of-Certification Program

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Background: In 2014, the American Board of Internal Medicine (ABIM) substantially increased the requirements and fees for its maintenance-of-certification (MOC) program. Faced with mounting criticism, the ABIM suspended certain content requirements in February 2015 but retained the increased fees and number of modules. An objective appraisal of the cost of MOC would help inform upcoming consultations about MOC reform.

Objective: To estimate the total cost of the 2015 version of the MOC program ("2015 MOC") and the incremental cost relative to the 2013 version ("2013 MOC").

Design: Decision analytic model.

Data Sources: Published literature.

Target Population: All ABIM-certified U.S. physicians.

Time Horizon: 10 years (2015 to 2024).

Perspective: Societal.

Intervention: 2015 MOC.

Outcome Measures: Testing costs (ABIM fees) and time costs (monetary value of physician time).

Results of Base-Case Analysis: Internists will incur an average of \$23 607 (95% CI, \$5380 to \$66 383) in MOC costs over 10

years, ranging from \$16 725 for general internists to \$40 495 for hematologists-oncologists. Time costs account for 90% of MOC costs. Cumulatively, 2015 MOC will cost \$5.7 billion over 10 years, \$1.2 billion more than 2013 MOC. This includes \$5.1 billion in time costs (resulting from 32.7 million physician-hours spent on MOC) and \$561 million in testing costs.

Results of Sensitivity Analysis: Costs are sensitive to time spent on MOC and MOC credits obtainable from current continuing education activities.

Limitation: Precise estimates of time required for MOC are not available.

Conclusion: The ABIM MOC program will generate considerable costs, predominantly due to demands on physician time. A rigorous evaluation of its effect on clinical and economic outcomes is warranted to balance potential gains in health care quality and efficiency against the high costs identified in this study.

Primary Funding Source: University of California, San Francisco, and the U.S. Department of Veterans Affairs.

Ann Intern Med. 2015;163:401-408. doi:10.7326/M15-1011 www.annals.org

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This article was published online first at www.annals.org on 28 July 2015.

In 2014, the American Board of Internal Medicine (ABIM) substantially expanded its maintenance-of-certification (MOC) requirements for the more than 250 000 board-certified internists, hospitalists, and internal medicine subspecialists in the United States (Table 1) (1). The revised MOC program required physicians to obtain 100 MOC "points" every 5 years—a substantial increase from the prior program—and perform at least 1 MOC activity every 2 years. The objective was to improve physician knowledge through self-assessment and continuous learning; before these more frequent reporting requirements, 73% of enrolled physicians waited until the ninth year of their certification before completing any MOC activity (2). Under the new program, the board certification of physicians with time-limited certificates who did not participate in MOC would lapse, and those with time-unlimited certificates ("grandparents") who chose not to enroll would be listed on the ABIM Web site as "not meeting MOC requirements." The expanded program ignited an intense debate about the societal value of MOC (3, 4). Faced with mounting criticism from physicians and specialty societies (4-7), a lawsuit against the American Board of Medical Specialties (of which ABIM is a member) alleging unfair trade practices (8), and an online anti-MOC petition that garnered more than 19 000 signatures (4, 9), the ABIM temporarily suspended some

of the new requirements in February 2015: Diplomates were no longer required to complete "practice assessment," "patient voice," and "patient safety" modules (10). It announced that the language on its Web site would be updated to be more conciliatory (plans to classify physicians choosing not to participate in MOC as "not meeting MOC requirements" were abandoned) and that it would offer MOC points for continuing medical education (CME) activities that most physicians were already undertaking to meet state licensure requirements (10). However, the ABIM retained the total number of MOC points required and the increased fee structure of the 2014 MOC program (1).

The ABIM's offer to work closely with the physician community "to co-create an MOC program that reflects the medical community's shared values" represents a historic opportunity to redesign how physicians regulate themselves (10). A systematic appraisal of the total costs of the MOC program would help inform upcoming consultations with physicians and professional soci-

See also:

Web-Only
Supplement

EDITORS' NOTES**Context**

The American Board of Internal Medicine (ABIM) has changed its requirements for maintenance of certification (MOC).

Contribution

The authors estimate that the average cost per internist to satisfy requirements over the next 10 years will be \$23 607, with 90% of that cost coming from the amount of time physicians spend satisfying requirements (assuming that 2015 requirements remain unchanged).

Caution

Estimates vary by specialty and are especially sensitive to the amount of time each physician spends to meet requirements, which has not been measured precisely.

Implication

The ABIM should consider the total cost and the sources of that cost as it makes changes to the MOC requirements.

curred had the 2013 version ("2013 MOC") remained unchanged.

METHODS

We developed a discrete-state Markov model of the entire ABIM-certified workforce of internists, hospitalists, and internal medicine subspecialists in the United States, including physicians with time-unlimited certifications (Figure 1 of the Supplement, available at www.annals.org). We adopted the societal perspective (including all costs, regardless of who eventually paid them) to estimate mean costs for individual physicians and aggregated costs by subspecialty in 2015 U.S. dollars (Table 2). We chose a 10-year analytic horizon (2015 to 2024) because the MOC program has a 10-year cycle: A physician typically decides whether to participate in MOC when the relevant recertification examination is due. Furthermore, time spent on MOC varies substantially from year to year, peaking in years when a recertification examination is taken. We discounted future costs at 3% per year to account for the timing of expenditures (11), and we adhered to the recommendations of the Panel on Cost-Effectiveness in Health and Medicine (11).

Model Structure

Our Markov model of the ABIM MOC program had a cycle length of 1 year (Figure 1 of the Supplement). In each year, a physician could attempt a recertification examination or complete MOC modules. We assumed

eties and define priorities for future MOC reform. The objective of this study was to quantify the costs of the 2015 version of the MOC program ("2015 MOC") and compare them with the costs that would have been in-

Table 1. Evolving MOC Requirements of the ABIM*

| Period | Recertification Examination | Training Modules | Costs |
|-------------------------|---|---|---|
| Before 2006 | Every 10 y; physicians bearing time-unlimited certificates ("grandparents") were exempted | Variable number of self-evaluation modules focused on medical knowledge | Cost of board examination(s) varied on the basis of physician specialty and payment plan |
| 2006-2013 | Every 10 y; physicians bearing time-unlimited certificates were exempted | 100 module points every 10 y, including: 20 medical knowledge points 20 practice assessment points | Cost of board examination(s) and ABIM modules:† Internal medicine: \$1675 Hospital medicine: \$2055 Subspecialty: \$1840 Additional examinations: \$775 |
| 2014-2015 | Every 10 y; physicians bearing time-unlimited certificates who did not complete the MOC program (including the recertification examination and modules) would be listed as "not meeting MOC requirements" | 100 module points every 5 y, including: 20 medical knowledge points 20 practice assessment points "Patient safety" and "patient voice" modules Some MOC activity every 2 y§ | Cost of board examination(s) and ABIM modules:† Internal medicine: \$1940 Hospital medicine: \$2060 Subspecialty: \$2560 Subspecialty and internal medicine: \$3530‡§ 2 subspecialties: \$3840‡§ 2 subspecialties and internal medicine: \$4810‡§ Additional examinations: \$400 |
| Announced February 2015 | Every 10 y; physicians bearing time-unlimited certificates who did not complete the MOC program would be listed as "not participating in MOC" | 100 module points every 5 y, including: 20 medical knowledge points Some MOC activity every 2 y§ | Cost of board examination(s) and ABIM modules:† Internal medicine: \$1940 Hospital medicine: \$2060 Subspecialty: \$2560 Subspecialty and internal medicine: \$3530‡ 2 subspecialties: \$3840‡§ 2 subspecialties and internal medicine: \$4810‡ Additional examinations: \$400 |

ABIM = American Board of Internal Medicine; MOC = maintenance of certification.

* From reference 1.

† Can be paid as a 1-time fee every 10 y or in interest-free annual installments.

‡ Cost of the more expensive certification plus half of the cost of additional certifications.

§ The first attempt at a recertification examination yields 20 MOC points.

|| Retests cost \$775 when the revised program was first announced, but the amount was subsequently decreased to \$400.

Table 2. Cost of Participation in the 2015 MOC Program Over 10 y (2015–2024)*

| Specialty | MOC Costs for Individual Physicians, \$ | | | MOC Costs Aggregated by Specialty, million \$ | | |
|---|---|---------------------------|----------------------------|---|---------------------------|----------------------------|
| | Mean Testing Costs (95% CI)† | Mean Time Costs (95% CI)‡ | Mean Total Costs (95% CI)§ | Testing Costs† | Mean Time Costs (95% CI)‡ | Mean Total Costs (95% CI)§ |
| All internal medicine physicians | 2349 (1705–4226) | 21 259 (3560–62 840) | 23 607 (5380–66 383) | 561 | 5118 (2482–7714) | 5679 (3043–8275) |
| General internal medicine physicians and hospitalists | 1774 (1705–2093) | 14 950 (2952–32 721) | 16 725 (4720–34 650) | 250 | 2136 (1052–3201) | 2387 (1303–3451) |
| Subspecialists | 3132 (2249–4592) | 29 605 (4986–75 765) | 32 736 (7899–79 361) | 311 | 2982 (1438–4514) | 3293 (1749–4824) |
| Cardiologists | 3166 (2249–4561) | 37 081 (8050–88 939) | 40 247 (10 941–92 719) | 74 | 875 (423–1322) | 949 (496–1396) |
| General cardiologists | 2778 (2249–3490) | 29 985 (7972–63 601) | 32 763 (10 721–66 662) | 38 | 422 (205–633) | 460 (243–671) |
| Interventional cardiologists | 3715 (3374–4614) | 47 822 (10 017–102 360) | 51 537 (13 475–106 423) | 23 | 301 (145–455) | 325 (169–478) |
| Cardiac electrophysiologists | 3737 (3374–4626) | 48 459 (6093–112 242) | 52 196 (9773–115 916) | 9 | 119 (57–179) | 128 (67–189) |
| Advanced heart failure cardiologists | 3722 (3374–4614) | 39 424 (10 831–83 718) | 43 146 (14 420–87 727) | 3 | 34 (16–51) | 37 (19–54) |
| Endocrinologists | 2792 (2249–3490) | 16 282 (3556–36 292) | 19 074 (6188–39 490) | 16 | 95 (46–143) | 111 (62–159) |
| Gastroenterologists and hepatologists | 2788 (2249–3835) | 34 321 (5292–78 595) | 37 109 (7997–81 724) | 35 | 440 (214–663) | 476 (250–698) |
| Gastroenterologists | 2741 (2249–3490) | 34 761 (5369–79 796) | 37 502 (8015–82 940) | 33 | 421 (205–634) | 454 (238–667) |
| Hepatologists | 3802 (3374–4626) | 32 581 (13 735–60 613) | 36 383 (17 196–64 864) | 2 | 19 (9–29) | 21 (11–31) |
| Geriatricians | 3017 (2249–3502) | 16 962 (3617–36 690) | 19 979 (6491–40 009) | 15 | 84 (41–126) | 98 (56–141) |
| Hematologists and oncologists | 3294 (2249–4886) | 37 201 (5448–87 372) | 40 495 (8691–91 423) | 30 | 342 (165–516) | 372 (195–546) |
| Hospice and palliative care physicians | 3243 (3102–3802) | 17 269 (6102–33 982) | 20 512 (9251–37 464) | 14 | 76 (37–114) | 90 (51–128) |
| Infectious disease physicians | 2901 (2249–3502) | 18 402 (3772–40 890) | 21 302 (6569–44 109) | 20 | 127 (62–191) | 147 (82–211) |
| Nephrologists | 2920 (2249–3502) | 25 348 (945–59 472) | 28 268 (4068–62 727) | 24 | 213 (103–321) | 237 (128–345) |
| Pulmonary, critical care, and sleep medicine physicians | 3650 (2249–4898) | 31 541 (7825–69 127) | 35 191 (11 246–73 118) | 59 | 514 (248–776) | 573 (307–835) |
| Rheumatologists | 2809 (2249–3502) | 18 797 (3485–41 859) | 21 606 (6311–44 966) | 11 | 78 (38–117) | 89 (49–128) |
| Other | 3243 (3102–3802) | 22 128 (5403–48 041) | 25 371 (8562–51 425) | 1 | 6 (3–8) | 6 (4–9) |

MOC = maintenance of certification.

* Values may not be exact due to rounding. Costs are in 2015 U.S. dollars, and future costs are discounted at 3% per year.

† All fees payable to the American Board of Internal Medicine for participation in the MOC program, including recertification examinations, retesting after a failed initial examination, and access to MOC modules.

‡ Value of physician time dedicated to meeting MOC requirements. In the base case, this was assumed to equal the hourly wage plus the cost of fringe benefits.

§ Testing costs plus time costs.

|| Includes adolescent and sports medicine.

that current specialty-specific pass rates for recertification examinations would continue (12) and that physicians who failed an initial attempt at the recertification examination would retake and pass the examination the following year. In light of the more frequent reporting requirements of 2015 MOC, we assumed that physicians would distribute their MOC modules equally across all nonexamination years. Over the 10-year period, physicians would fulfill all MOC requirements for the board certifications they held at the start of the study.

Input Parameters

We used ABIM publications to estimate the number and specialty distribution of board-certified physicians in 2015 and the number of subspecialists recertifying in internal medicine (13, 14) (Table 1 of the Supplement). The ABIM does not publish the number of physicians with time-unlimited certificates; we based our estimates on the year before which time-unlimited certificates were last issued (for example, 1990 for internal medicine) (15, 16) and an average clinical career of 35 years. In the base case, we assumed that all physicians holding 1 or more active time-limited certificates would enroll in the program (because failure to participate in MOC would eventually result in a lapse in

certification), as would physicians with time-unlimited certificates who had 5 or more years of clinical practice before retirement. We modeled the increase in the physician workforce over the coming decade on the basis of projections by the Health Resources and Services Administration (17) and assumed that expanded MOC requirements would not alter physicians' decisions on maintaining certification or retiring early.

We assumed that a physician would spend 12.5 hours each year (midpoint of the range of 5 to 20 hours estimated by the ABIM) (18, 19) to complete modules equivalent to 20 MOC points and an additional 1.5 hours per year completing MOC-related documentation. We assumed that the time outlay would triple (to a total of 42 hours) in a year in which the physician took a recertification examination. Because these estimates are uncertain, we performed extensive sensitivity analyses to examine their effect on total cost of MOC. We assumed that 25% of CME activities that physicians currently complete to meet state requirements would earn MOC credit (20–22), and we varied this parameter in sensitivity analyses from 0% (equivalent to the 2014 MOC program) to 50%.

Additional modeling details are provided in the Supplement.

Outcome Measures

The primary outcome was the total 10-year cost of the 2015 MOC program. The secondary outcome was the incremental cost of 2015 MOC compared with 2013 MOC. We estimated MOC costs incurred by individual physicians and aggregated by specialty as follows:

Total costs = Testing costs + Time costs

Testing Costs

Testing costs included 2 components: annual fees payable to ABIM (adjusted for the number of board certifications held by an individual physician), which included access to online ABIM modules, and retesting fees for physicians who failed their first attempt at a recertification examination (1).

Time Costs

Time costs captured the market value of the time physicians spent completing MOC and related documentation. The alternative use of this time—whether it would have otherwise been spent on additional clinical work or leisure—is not theoretically relevant to determining its economic value, which is assumed to be at least equal to the wage rate plus benefits. (In economics argot, neoclassical labor theory suggests that the marginal value of leisure time is at least equal to the market value of work time [23]). We valued physician time by using nationally representative, specialty-specific wages and a benefits rate of 34% (24–27). In the base case, we assumed no real (that is, inflation-adjusted) change in physician compensation over the coming decade, but we varied this assumption in sensitivity analyses.

Base-Case Analysis

To examine individual variability in MOC-related costs due to differences in physician wage and number of hours spent on MOC, we performed 10 000 Monte Carlo simulations through the model for each type of certification. In these simulations, we assumed truncated normal distributions for wages and annual hours needed for MOC (28). Cumulative costs of MOC by specialty (for example, for all of cardiology) were estimated using a probabilistic analysis that accounted for uncertainty in the mean wage for that specialty as well as the number of hours required for MOC.

Sensitivity Analysis

We performed extensive deterministic, probabilistic, and scenario-based sensitivity analyses to examine the effect of uncertainty in the input parameters. In 1-way analyses, we varied the following: 1) the annual time required to complete MOC modules worth 20 points (base case, 12.5 hours; range, 5 to 40 hours); 2) the total time required to prepare for and take a certification examination (base case, 37.5 hours; range, 18.75 to 56.25 hours); 3) the proportion of current CME activities that also earn MOC points (base case, 25%; range, 0% to 50%); 4) the proportion of grandparents who enroll in MOC (base case, 53%; range, 21% to

100%); 5) the annual change in real (inflation-adjusted) wage over the study period (base case, 0%; range, –3% to 3%); 6) the benefits rate (base case, 34%; range, 0% to 50%); 7) ABIM fees (base case, 2015 rates; range, 50% to 150% of 2015 rates); 8) valuation of physician MOC time (base case, equal to wage and benefits; range, 75% to 125% of wage and benefits); and 9) the discount factor for future costs (base case, 3%; range, 0% to 5%). In a 3-way sensitivity analysis, we examined the effect of the number of certificates, hours spent on MOC modules each year, and physician wage on total MOC costs. In a probabilistic analysis, we evaluated the individual variability in MOC-related costs by simultaneously varying key input parameters along pre-specified distributions (28). Finally, in a scenario analysis, we estimated the savings per physician per year that the program would have to generate to be cost-neutral from a societal perspective.

Statistical Analysis

We compared the projected costs of 2015 MOC with those of 2013 MOC by using the Wilcoxon signed-rank test. We report 2-sided *P* values with a significance level of 0.05 for all statistical tests. We used TreeAge Pro 2014 (TreeAge Software) and Excel 2011 (Microsoft) to perform the modeling and Stata 13 (Stata-Corp) to perform statistical analyses.

Role of the Funding Source

This study was funded in part by the University of California, San Francisco, and the Department of Veterans Affairs. The funding sources had no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

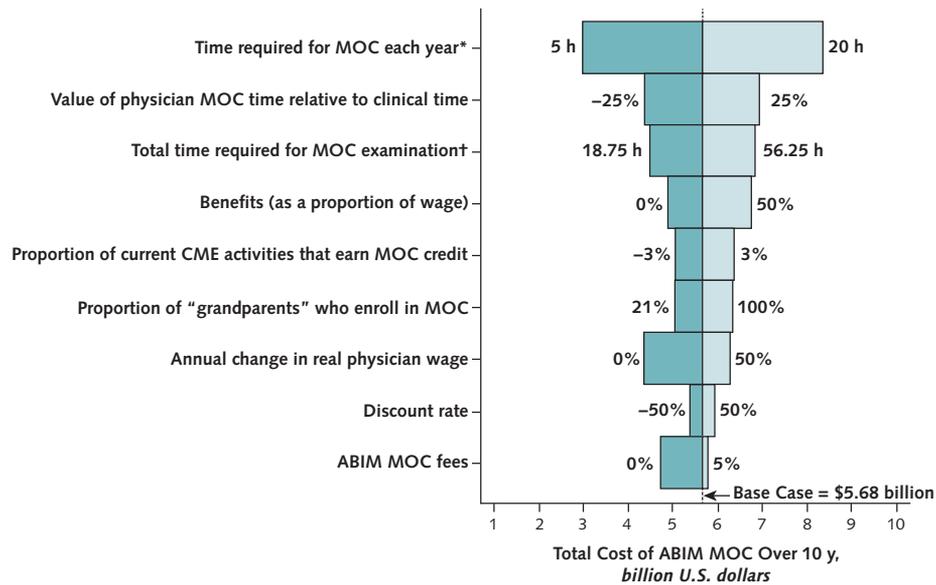
RESULTS

Base-Case Analysis

The ABIM's 2015 MOC requirements will cost board-certified internal medicine physicians an average of \$23 607 (95% CI, \$5380 to \$66 383) (Table 2) over 10 years, including \$2349 (CI, \$1705 to \$4226) in fees to the ABIM and \$21 259 (CI, \$3560 to \$62 840) in time costs. Costs of MOC vary substantially by physician specialty, ranging from \$16 725 for general internists to \$40 495 for hematologists-oncologists. In general, subspecialists will face greater costs than general internists or hospitalists (*P* < 0.001 for comparison).

The 2015 MOC is projected to cost \$5.7 billion (CI, \$3.0 billion to \$8.3 billion) over the coming decade (Table 2), an increase of \$1.2 billion over the costs that would have been incurred if the 2013 MOC program had remained unchanged (Table 4 of the Supplement). Total MOC costs include \$561 million (10%) in ABIM fees and \$5.1 billion (90%) in time costs resulting from 32.7 million physician-hours (CI, 15.8 million to 49.4 million physician-hours; 37.1 million undiscounted hours) required to complete MOC. This represents 6.8 million additional hours (CI, 3.6 million to 10.0 million hours) compared with 2013 MOC (*P* < 0.001 for pairwise comparisons with the 2013 program).

Figure 1. One-way sensitivity analyses.



These analyses—performed by varying 1 input parameter at a time while holding all others constant—suggest that the total cost of MOC is sensitive to the amount of time required to complete MOC modules each year and to prepare for and take the MOC examination in examination years. Increasing the proportion of CME activities that also earn MOC points would decrease demands on physician time and costs. Because time costs are the primary driver of MOC, the valuation of physician time spent on MOC is another source of uncertainty. If physician MOC time were valued 25% lower than clinical time, it would decrease MOC costs to \$4.4 billion. ABIM = American Board of Internal Medicine; CME = continuing medical education; MOC = maintenance of certification.

* Base case assumes 12.5 h to complete 20 MOC points.

† Base case assumes 37.5 h per examination.

Sensitivity Analysis

Costs were sensitive to the physician time required to fulfill MOC requirements each year (Figures 1 and 2). For example, if the time required to complete MOC modules were to increase to 20 hours per year, MOC costs would increase by 47% over 10 years, to \$8.4 billion (Figure 2). If MOC time were 25% less valuable than clinical time, costs would be reduced by 23%, to \$4.4 billion. A scenario in which CME activities provided no MOC credit (akin to the 2014 version of MOC) increased costs by \$1.1 billion. Costs decreased by \$764 million (14%) when we assumed that half of all CME activities earned MOC credit. The program would have to generate savings of \$2692 (CI, \$1442 to \$3922) per physician per year to be cost-neutral over the period studied.

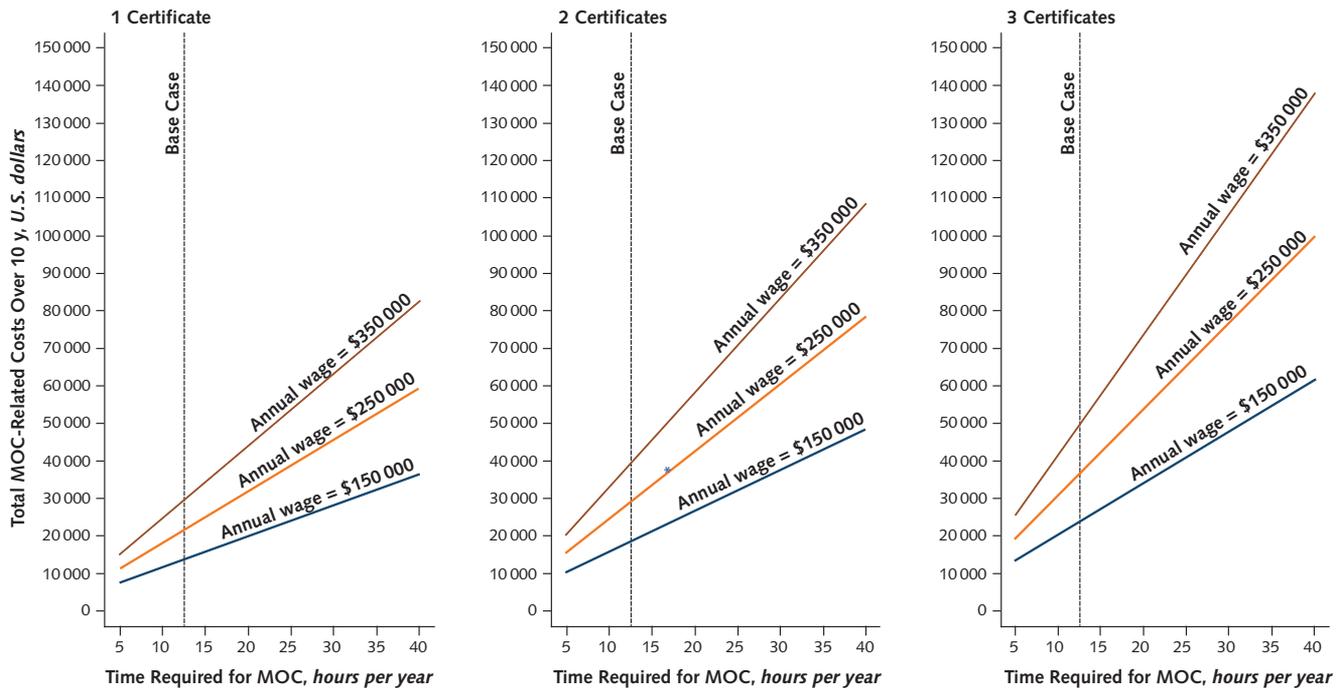
DISCUSSION

This is, to our knowledge, the first study to quantify the cost of the ABIM MOC program. We found that the 2015 MOC will cost \$5.7 billion over 10 years, including \$5.1 billion in time costs resulting from 32.7 million physician-hours spent on completion of MOC. There is significant interphysician variability in MOC-related costs: Subspecialists face higher costs than general internists, primarily because they take additional certification examinations that generate more fees and a greater time outlay. Because time costs vary substantially from year to year, peaking in years in which a

certification examination is taken, physicians estimating personal MOC-related costs should consider specialty-specific costs over the entire 10-year period (Figure 2). Although these costs make up slightly more than 1% of the salary of a typical physician, the aggregate amount represents a large investment in the process of continuing education, and understanding the composition of these costs is critical to future efforts to decrease the cost of MOC and establish its societal value.

Our study highlights that the key driver of MOC costs is the physician time required to complete MOC activities, which accounts for 9 of every 10 dollars spent on MOC. The ABIM has previously suggested that participation in MOC will cost \$200 to \$400 per year; this is a substantial underestimate precisely because it overlooks time costs (19). Efforts to decrease the cost of MOC should therefore focus on reducing demands on physician time.

The changes announced by the ABIM in February 2015 are a step in the right direction. Because medical boards in all but 5 states already require physicians to provide evidence of CME to hold a medical license, counting educational activities toward both CME and MOC would substantially decrease time costs (20). As part of the 2015 overhaul of its MOC program, ABIM has offered MOC credit for “most forms of CME,” with evidence to support that they “drive learning and/or change practice” (1, 20). In a scenario in which a quarter of all CME activities that physicians currently under-

Figure 2. MOC costs for individual physicians.

Costs vary substantially among physicians on the basis of the number of certificates held (i.e., physicians holding 1 certificate [left] have lower costs than those holding 2 [middle] or 3 [right]), the number of hours spent on MOC each year (costs increase with time spent on MOC), and physician wage (annual compensation based on hourly wage and 2080 work hours per year, not including benefits). A physician holding 2 certificates (e.g., internal medicine and cardiology) with an annual income of \$250 000 who spends 20 hours per year would incur approximately \$42 000 in MOC-related costs over 10 years (asterisk). All costs are in 2015 U.S. dollars, and future costs are discounted at 3% per year. MOC = maintenance of certification.

take also earned MOC points, costs decreased by \$1.1 billion compared with a scenario in which no such credits were available. Increasing MOC credits for CME activities would produce additional savings. However, harmonization of MOC and CME requirements is likely to be imperfect for 3 reasons. First, CME requirements vary substantially among states (22), and physicians in states with few or no requirements would not benefit from integration of MOC and CME. Second, providing MOC credit for all CME activities would be inconsistent with ABIM's assessment that current CME processes are inadequate to maintain physician skills, a key stated motivation for expanding the MOC program (29, 30). Finally, physicians may choose to continue to participate in CME activities, such as grand rounds, tumor boards, or manuscript reviews, even if they do not offer MOC points (these activities currently account for more than 75% of physician-hours spent on CME) (Table 2 of the Supplement) (21). Nevertheless, efforts to carefully integrate MOC and CME and eliminate redundant reporting requirements would substantially reduce the time costs of MOC. Allowing the use of existing CME products should also decrease ABIM's costs; these savings should be passed on to physicians in the form of lower annual fees for those who elect to use non-ABIM products.

A comprehensive economic evaluation of a health policy intervention must include a careful consideration

of both costs and benefits. By focusing on costs of MOC, our analysis informs only one part of the analysis. To the extent that MOC improves the quality or efficiency of care delivered by participating physicians, downstream savings may offset some of the MOC-related costs. We found no high-quality studies examining the effect on clinical or economic outcomes of the increased requirements of 2015 MOC (such as doubling the required number of MOC points) and were therefore unable to model potential benefits. However, a recently published quasi-experimental study examining the 2001 version of the program offers a proof of concept (31). This study compared ambulatory care-sensitive hospitalizations and resource use between Medicare beneficiaries receiving primary care from general internists required to participate in the 2001 version of the MOC program ($n = 956$) and those receiving primary care from internists holding time-unlimited certificates ($n = 974$). Although no differences in ambulatory care-sensitive hospitalizations (the primary outcome of the study) were observed between the groups, patients who received primary care from internists required to participate in the 2001 MOC experienced a smaller increase in annual health care expenditures during follow-up. This translated to savings of \$167 (CI, $-\$270.5$ to $-\$63.5$) per Medicare beneficiary (31). Although these findings should not be directly extrapolated to the evaluation of 2015 MOC be-

cause of substantial differences in the intervention and physician population studied, they suggest that some of the initial expenditure on MOC may be recouped by improved resource use downstream. Our analysis indicates that future studies would need to demonstrate at least \$2692 in savings per physician per year across all internal medicine subspecialties for the 2015 MOC program to pay for itself from a societal perspective.

Whether the costs of MOC ultimately will be borne by physicians or will be passed on to employers, payers, or patients is uncertain. Furthermore, unless balanced by improved efficiency downstream, the increased demand on physician time in a period of anticipated physician workforce shortfalls may have a deleterious effect on access to care, particularly elective care. This may be an important consideration given that the number of insured Americans is estimated to increase by 40 million over the coming decade as a result of demographic changes and implementation of the Patient Protection and Affordable Care Act (32). Our findings highlight the need for well-designed studies that delineate the clinical benefits and economic implications of 2015 MOC. Ideally, MOC should be compared with other policy interventions or health systems interventions to improve the quality and decrease the costs of health care, providing an empirical basis for choosing this approach from available alternatives for quality improvement. The internal medicine community has long embraced the principles of evidence-based medicine in clinical practice. Expensive policy interventions such as MOC should be held to the same high evidentiary standards.

Our analysis has limitations. Physician time required for MOC is an important driver of total costs and should be carefully evaluated in future studies. We assumed that changes in MOC would not affect physicians' career decisions; if these increased requirements encourage physicians to retire early or transition to nonclinical jobs, our analysis will have underestimated the societal costs. Some physicians may decrease costs by selectively dropping 1 or more certifications (for example, cardiologists may drop their internal medicine certification). However, early data from ABIM suggest that 77% of physicians with time-limited certificates who are currently board-certified have enrolled in the revised MOC program (33), which supports our base-case assumptions. Finally, we may have underestimated MOC-related costs because we did not include the cost of "board review" courses, which are popular among physicians taking recertification examinations, as well as any related travel costs, which can add up to several thousand dollars in a 10-year cycle. We also did not model physicians with more than 3 certifications (for example, internal medicine, pulmonary medicine, critical care, and sleep medicine), who incur substantially higher testing and time costs. We assumed a 35-year career, which may have underestimated the number of currently active grandparents. Finally, we modeled only 2 attempts at the recertification examination, thus underestimating testing and time costs for

the small minority of physicians who need 3 or more attempts to pass the MOC examination.

In conclusion, the MOC program generates considerable costs, predominantly due to demands on physician time. Reform of MOC should focus on decreasing the time required to fulfill MOC requirements and increasing integration with existing continuing education activities. A rigorous evaluation of the program's effect on clinical and economic outcomes is warranted to better balance potential gains in the quality and efficiency of clinical care against the high costs identified in this study.

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Disclaimer: The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Department of Veterans Affairs.

Acknowledgment: The authors thank Ann F. Bolger, MD; James G. Kahn, MD, MPH; and Rashmee U. Shah, MD, MS, for their thoughtful comments on the draft manuscript and Meghann Williams, Elizabeth Thew, and LaCretia King for their administrative support.

Financial Support: This study was funded in part by the University of California, San Francisco (Dr. Kazi), and the U.S. Department of Veterans Affairs (Dr. Sandhu).

Disclosures: Authors have disclosed no conflicts of interest. Forms can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M15-1011.

Reproducible Research Statement: *Study protocol:* Not available. *Statistical code:* Available from Dr. Kazi (e-mail, kazi@ucsf.edu). *Data set:* No additional data are available.

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