Family Physicians' Quality Interventions and Performance Improvement for Hypertension through Maintenance of Certification

Lars E. Peterson, Brenna Blackburn, James C. Puffer, Robert L. Phillips Jr.

Abstract **Purpose:** Hypertension is a cause of considerable morbidity and mortality. Our objective was to describe the quality outcomes associated with physicians' completion of hypertension Performance in Practice Modules (PPMs) as part of Maintenance of Certification (MOC).

Methods: Descriptive study of all hypertension PPMs completed by family physicians from July 2006 to 2013. Descriptive statistics characterized physician demographics and quality outcomes; linear regression determined characteristics associated with improvement.

Results: In total, 7,319 hypertension PPMs were completed by family physicians that had a mean age of 47.9 years and 14.2 years of practice experience. Most (52.4%) chose lipid control as their quality improvement (QI) focus. Performance on all quality measures improved except mean low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol values; however, percentage of patients with LDL < 130 mg/dl improved. Improvement was seen in blood pressure control (87.4% to 92.6%, $p < .05$), low sodium diet counseling (74.1% to 92.7%, $p < .05$), and exercise counseling (82.4% to 94.4%, $p < .05$). In regression models, no variable was consistently associated with improvement.

Discussion: Family physicians improved the quality of care for patients with hypertension through MOC. Leveraging MOC across all specialties may become an important support for improving management of conditions that cause considerable morbidity and mortality.

Keywords
hypertension
primary care
quality improvement
quality of care

Purpose

Maintenance of Certification (MOC) was adopted by all American Board of Medical Specialties (ABMS) member boards over a decade ago with the goal of improving health and the quality of healthcare. The American Board of Family Medicine (ABFM) was one of the first certifying boards to implement MOC, and ABFM diplomates must assess the quality of care they provide, report it, plan and execute an intervention, and then remeasure and report their outcomes to meet Part 4 (assessment of performance in practice) requirements for MOC for Family Physicians (MC-FP). Because many practicing physicians may not be familiar with quality improvement (QI), the ABFM developed its Part 4 modules to include a tutorial with a robust array of resources to guide the physician through the QI process. Through MC-FP, family physicians complete a Part 4 activity at least once every 3 years to reinforce their knowledge and routine practice of QI. Since the introduction of the ABFM's web-based Part 4 modules—the Performance in Practice Modules (PPMs)—in 2005, family physicians have completed over 53,000 ABFM-produced Part 4 modules, of which hypertension is the second most frequently completed. Our specific aims were (1) to understand whether MC-FP tools can be used by family physicians to improve the quality of care they provide and (2) to investigate associations between how QI projects are structured and whether they are associated with changes in quality. The objectives of our study were (1) to determine if QI projects carried out as part of the ABFM hypertension PPM improved the quality of care and (2) to determine associations between physician and QI project characteristics and any demonstrated improvement.

Review of the Literature

Hypertension is a major source of morbidity (Cushman, 2003; Ong, Cheung, Man, Lau, & Lam, 2007) and a commonly encountered problem in ambulatory care with 67 million Americans currently afflicted (Centers for Disease Control & Prevention, 2011). The direct costs of treating hypertension were estimated at 69.9 billion dollars in 2010 and are projected to nearly double by 2020 (Heidenreich et al., 2011). Despite well-known treatment guidelines (Chobanian et al., 2003), the quality of care for hypertension (Asch et al., 2005; McGlynn et al., 2003) and the percentage of patients with controlled blood pressure (Egan, Zhao, Axon, Brzezinski, & Ferdinand, 2011) remain surprisingly low. Physicians and healthcare organizations are under increasing pressure to measure and report on the quality of care they provide, including hypertension and related comorbidities and health behaviors that contribute to cardiovascular disease. Performance on these measures and the demonstration of QI are increasingly being used to

Journal for Healthcare Quality
Vol. 00, No. 0, pp. 1–11

adjust payments (Mayes, 2011; Rosenthal, Fernandopulle, Song, & Landon, 2004) and to steer patients to providers who demonstrate high-quality care (Chernew, Mechanic, Landon, & Safran, 2011; Draper, Liebhaber, & Ginsburg, 2007).

Study Design and Methods

Quality Measures

To complete their Part 4 requirement, diplomates gather quality measures from at least 10 patients with hypertension. The ABFM hypertension PPM uses National Quality Forum endorsed measures, including: (1) systolic and diastolic blood pressure measurement, (2) lipids measurement, including both low-density lipoprotein (LDL) and high-density lipoprotein (HDL) levels, (3) low sodium dietary counseling, (4) exercise counseling, (5) smoking cessation counseling, and (6) discussion of an overall plan of care. Additionally, patients complete a questionnaire that included the following items: (1) when you see your doctor, is your blood pressure checked; (2) do you know your goal blood pressure; (3) have you had your cholesterol checked in the last 5 years; (4) has your doctor talked to you about an exercise plan; (5) has your doctor talked to you about a low salt diet; (6) for smokers, whether your doctor asked about quitting; and (7) has your doctor talked to you about a complete plan to keep you healthy.

To assess compliance with guideline recommendations in place during the time period studied, we operationalized physician gathered continuous quality variables into dichotomous variables. We combined blood pressure control intervention choices (diastolic or systolic) into one variable. Blood pressure control was present if systolic <140 mm Hg and diastolic <90 mm Hg (Chobanian et al., 2003). An LDL value of <130 mg/dl indicated control; without data on patient comorbidities, we could not select patient-specific LDL control values; such as <100, <160, or <70 mg/dl (National Cholesterol Education Program Expert Panel on Detection, & Treatment of High Blood Cholesterol in Adults, 2002). Using <130 mg/dl was the conservative choice as <160 mg/dl would misclassify patients with additional cardiovascular risk factors as being in control and <100 or <70 mg/dl would also misclassify those with few or intermediate risk factors as being uncontrolled (National Cholesterol Education Program Expert Panel on Detection, & Treatment of High Blood Cholesterol in Adults, 2002). For the three counseling measures, physicians reported on the presence or absence of recordings of these on the chart.

Completion of PPM

The PPM is completed online and has a separate log in from the physician's secure portfolio, which enables other clinical staff to enter quality data into the PPM without having access to confidential physician information. To protect against legal discoverability of quality data, limited physician demographic information is contained in the ABFM PPM database. Data not available include scope of practice information, examination performance, and other MC-FP activities completed. Once the PPM is complete, the link between the physician and PPM data is broken. This necessary step makes it difficult to study relationships between outcomes and physician and practice characteristics as potentially available data cannot be linked to PPM data.

The PPM structure is based on a Plan-Do-Study-Act (PDSA) cycle. First, the physician, or assigned clinical staff, gathers data on 10 patients with hypertension from the chart and the corresponding patient survey data, and enters them on templates in the web-based PPM. Second, the physician is provided a "quality dashboard" that shows his/her performance on all six chart-derived quality measures compared to the performance of other physicians who previously completed the hypertension PPM. Third, physicians select quality measures for improvement, choosing at least one of the six measures. Fourth, the physician creates a QI plan that includes at least one intervention in at least two of the six Chronic Care Model domains (Wagner, Austin, & Von Korff, 1996). The "QI Wizard" within the PPM provides many options for interventions with examples and links to resources. An example of an intervention is creating a disease registry of all the patients with hypertension within the practice. The registry could then be used to keep track of whether recommended services have been provided (e.g., cholesterol monitoring) and what recent blood pressure measurements have been. After the physician implements their chosen interventions, collection of chart and survey data from the next 10 patients they see with a diagnosis of

hypertension is repeated. After completion of data entry for this set of patients, the physician is provided with pre- and postintervention comparisons as well as comparisons to the mean quality scores for all physicians who have previously completed the PPM.

Physician Demographic Variables

As stated previously, to ensure confidentiality of the quality data, at completion of the module, the link between the physician and the PPM is broken; however, a restricted set of physician demographic variables are retained with PPM data. The retained physician variables are age in years, gender, zip code, date of residency graduation, years in practice, and number of recertifications.

Analytic Strategy

We analyzed data from all hypertension PPMs completed from July 2006 to 2013. Exclusion criteria included physicians with incomplete quality data and those residing outside the United States. Urban, large rural, small rural, and isolated locations were determined by linking the physician's zip code to the Rural-Urban Commuting Area Codes (RUCA) version 2.0 (WWAMI Rural Health Research Center, 2013).

Descriptive statistics characterized physician demographics and calculated the mean or proportion of quality measures, counts of quality measures, Chronic Care Model category, and interventions chosen. Statistical tests for differences between pre- and postinterventions were performed using either t tests or chi-square tests.

To test for associations between characteristics of QI projects and improvement in quality measures, we performed separate multiple regression analyses for blood pressure control, LDL control, whether smoking cessation counseling, low sodium diet counseling, or exercise counseling were individually provided. For each of these measures, the percentage of patients meeting a quality goal was calculated for both pre- and postintervention, physician-reported quality measures and the change in percentage (between 0 and 1) was used as the outcome in linear regression models. Regression models included all available physician characteristics and days to PPM completion. The variable days to PPM completion was categorized into 7–14 days, 15–30 days, 31–60 days, 61–90 days, and 90+ days to investigate associations between time to complete the PPM and outcomes. Physicians cannot enter postintervention data earlier than 7 days after the intervention is started. All six Chronic Care Model domains were included in the models, with self-management support as the reference. To determine if choosing the measure was associated with improvement, we included a variable for each quality measure, indicating if that measure was chosen for improvement. Specific interventions were included if they were chosen in at least 5% of the PPMs for that specific quality measure. To account for differences in baseline performance, we included in each regression, the mean value of the regressed, preintervention quality measure. We also included dummy variables, indicating the number of outcomes selected for improvement and the number of interventions chosen. All analyses were conducted in SAS Version 9.2 (Cary, NC).

Institutional Review Board Approval

The American Academy of Family Physicians Institutional Review Board determined that this study did not constitute human subjects research, and did not require review, based on the use of previously deidentified data.

Results

We identified 8,028 completed hypertension PPMs, reflecting quality measures for between 80,000 and 160,000 patients. After excluding modules completed by physicians not residing in the United States ($n = 93$), those with missing demographic information ($n = 1$), those with zip codes that could not be linked to a RUCA code ($n = 47$), and those with incomplete quality data ($n = 568$), our final sample was 7,319 PPMs (Table 1). The mean age of physicians completing the modules was 47.9 years, 59.8% were male, mean time in practice was 14.2 years, and 78.9% were located in urban areas. The mean time to complete the module was 134.9 days; 9.2% completed the PPM in 7–14 days, 55.3% in 90 or more days with the range among the top 1% being 780–2770 days.

In slightly over half of the PPMs (52.4%), physicians selected lipid control for improvement, followed by counseling for exercise (39.1%) and diet (17.4%). Systolic and diastolic blood pressures were chosen for improvement

Table 1. Demographics of Physicians Completing the American Board of Family Medicine Hypertension Performance in Practice Modules, June 2006 to 2013

Variable ($n = 7,319$, Completed Modules)	Percentage or Mean (*SD*)
Age in years	47.9 (9.2)
Gender (% male)	59.8
Years in practice	14.2 (9.1)
Number of recertifications	1.4 (1.4)
Days to complete Performance in Practice Modules (PPM)	
7–14	9.2
15–30	11.7
31–60	14.3
61–90	9.5
91+	55.3
Urban[a]	78.9
Large rural	10.6
Small rural	6.9
Isolated	3.6

[a]Geographic location adapted from the Rural-Urban Commuting Area Codes version 2.0.

Table 2. Hypertension Quality Measures Selected by Physicians for Improvement When Completing the American Board of Family Medicine Hypertension Performance in Practice Modules, June 2006 to 2013

$n = 7,319$, Completed Modules	Percentage
Lipids	52.4
Exercise counseling	39.1
Blood pressure (either SBP or DBP)	19.6
Systolic blood pressure (SBP)	17.5
Diastolic blood pressure (DBP)	8.4
Low sodium diet counseling	17.4
Smoking cessation	7.8

Note. Physicians may choose more than one indicator for improvement.

by 17.5% and 8.4%, respectively, and 19.6% of physicians chose to improve at least one of the blood pressure measurements (Table 2). In a majority of PPMs, physicians selected self-management support as their Chronic Care Model category for intervention (Table 3). Interventions chosen in over 30% of PPMs were patient education (57.4%), standing orders (39.0%), and flow sheets (33.0%).

With the exception of mean LDL and HDL cholesterol values, all chart-derived hypertension quality measures demonstrated statistically significant improvement after completion of the PPM (Table 4). Mean systolic and diastolic blood pressures decreased from 2.3 to 1.2 mm Hg, respectively, and the percentage of patients with their blood pressure in control increased from 87.4% to 92.6%. Although no significant differences were seen with mean LDL and HDL cholesterol levels pre- and postintervention, the percentage of patients with an LDL <130 mg/dl increased from 75.9% to 77.9% ($p < .05$). Rates of physician-reported counseling for low sodium diet, exercise, and smoking cessation were all above 90% postintervention. Changes in the responses to the questions in the patient questionnaire corroborated chart-derived outcomes data for each of the quality indicators in both magnitude and in reported improvement (Table 5). For example, patient-reported exercise counseling increased from 78.1% to 89.5% and low salt diet counseling

Table 3. Chronic Care Model Category of Intervention and Practice Changes Implemented during Hypertension Performance in Practice Modules of the American Board of Family Medicine, June 2006 to 2013

n = 7,319, completed modules	Percentage
Overall Chronic Care Model Categories	
Self-management support	82.5
Delivery system design	39.8
Decision support	33.7
Health system	19.3
Community resources and policies	17.9
Clinical information systems	12.4
Interventions	
Patient education	57.4
Standing order	39.0
Flow sheets	33.0
Patient care card	23.0
Exercise prescription	20.8
Diet prescription	18.0
Referral to services	14.1
Patient and physician communication aids	13.5
Reminder systems (low and high tech)	11.0
Physician/staff education	8.4
Registry	3.6
Group visits	3.6
Plan of care cards	3.2
Medication/treatment assistance	2.9
Staff in-service training on blood pressure checks	2.6
Referral to counseling/services	2.5
Counseling tools	2.1
Community services and organizations	1.6
Community action resources	1.1
Support groups	0.9

from 71.9% to 87.1%. Small increases were seen for quality measures that were already at high levels prior to the intervention with the percentage of patients who reported receiving smoking cessation counseling increasing from 92.5% to 96.1% and having their cholesterol checked in the last 5 years from 94.4% to 96.9%.

In regression analyses, we found no variable was consistently associated with improvement across quality measures, despite all measures improving (Table 6). Large rural and isolated RUCA status were both associated with small magnitude improvements in LDL control and exercise counseling. Shorter PPM completion time was associated with increased improvement with 7–14 days being significant and 15–30 days being significant in three of five regressions compared to >90 days completion time. For example, PPMs completed in 7–14 days were associated with a 3.3% increase in low sodium diet counseling, those completed in 15–30 days with a 2.9% increase, and those completed in 31–60 days with a 1.8% increase compared to PPMs completed in greater than 90 days.

Discussion

Family physicians who chose hypertension as the focus of their QI activity to meet MC-FP requirements had significant and meaningful improvements in blood pressure control and related quality measures. Patient questionnaire responses supported improvements reported in chart-derived quality measures in both hypertension-related counseling and changes in physician/clinic behaviors. Reports from other studies suggest that blood pressure for upwards of half of patients with hypertension is not adequately controlled (Egan & Laken, 2011). This contrasts starkly with our finding that 87.4% of patients in our study had

Table 4. Pre- and Postintervention Chart-Derived Quality Measures from American Board of Family Medicine Hypertension Performance in Practice Modules, June 2006 to 2013

	Percentage or mean (*SD*)	
Variable ($n = 7,319$, Completed Modules)	**Pre**	**Post**
Systolic blood pressure (SBP) in mm Hg,	132.8 (7.8)	130.5 (6.9)*
Diastolic blood pressure (DBP) in mm Hg,	79.0 (5.4)	77.8 (4.7)*
Blood pressure controlled SBP <140 mm Hg and DBP <90 mm Hg	87.4	92.6*
Low-density lipoprotein (LDL) in mg/dl	108.3 (16.1)	108.0 (15.6)
High-density lipoprotein (HDL) in mg/dl	49.1 (7.0)	49.2 (6.9)
LDL <130 mg/dl	75.9	77.9*
Low sodium diet counseling	75.1	92.7*
Exercise counseling	82.4	94.4*

*p-value for t test or chi-square <.05.

Table 5. Patient Reported Pre- and Postintervention Quality Measures from American Board of Family Medicine Hypertension Performance in Practice Modules, June 2006 to 2013

	(Percent answering yes)	
Variable ($n = 7,319$, Completed Modules)	**Pre**	**Post**
When you see your doctor, is your blood pressure checked?	99.7	99.8*
Do you know your goal blood pressure (the blood pressure you should have for good health)?	82.5	90.9*
Have you had your cholesterol checked in the last 5 years?	94.4	96.9*
Has your doctor talked to you about an exercise plan?	78.1	89.5*
Has your doctor talked to you about a low salt diet?	71.9	87.1*
For smokers: has your doctor talked to you about quitting?	92.5	96.1*
Has your doctor talked to you about a complete plan to keep you healthy?	72.9	85.1*

*p-value chi-square <.05.

adequate blood pressure control at baseline; however, our findings are within range for the baseline control reported in a recent trial to improve hypertension care (Petersen et al., 2013). We were also surprised to find that QI projects of the shortest duration had significantly better outcomes. This finding may suggest that a conscious effort to institute rapid cycle change may be associated with better improvement. It may also be an indication that QI is difficult to sustain if not integrated into the culture and systems of care. This finding reinforces the need for MOC activities to be a continuous and recurring effort.

The mean reductions of systolic blood pressure (SBP) by 2.3 mm Hg and diastolic blood pressure (DBP) by 1.2 mm Hg across all PPMs seem small but are in line with those found in a meta-analysis of hypertension QI interventions: SBP 4.2 mm Hg (95% CI, 1.8–6.6)

Table 6. Adjusted Beta Coefficients in Linear Regression between Physician and Quality Improvement (QI) Module Characteristics with Chart-Derived Quality Measures from American Board of Family Medicine Hypertension Performance in Practice Modules, June 2006 to 2013

Variable	Category	Percentage of Patients with Blood Pressure in Control (<140/90 mm Hg)	Percentage of Patients with LDL Under Control (<130 mg/dl)	Percentage of Smokers Counseled on Smoking Cessation	Percentage of Patients Counseled on Low Sodium Diet	Percentage of Patients Counseled on Exercise Plan
Intercept		0.7167*	0.4214*	0.8756*	0.6900*	0.7066*
Gender	Female	Reference	Reference	Reference	Reference	Reference
	Male	−0.0020	−0.0017	0.0008	0.0007	−0.0027
Location	Urban	Reference	Reference	Reference	Reference	Reference
	Large rural	−0.0054	0.0182*	0.0037	0.0020	−0.0050
	Small rural	−0.0003	0.0049	0.0052	−0.0085	−0.0179*
	Isolated	0.0028	−0.0020	−0.0028	−0.0046	−0.0043
Age in years		0.0002	0.0012*	−0.0003	0.0009	0.0009*
Days to complete	(7, 14)	0.0160*	−0.0011	0.0019	0.0330*	0.0209*
Performance in	(15,30)	0.0019	0.0012	0.0134*	0.0286*	0.0169*
Practice Modules	(31,60)	0.0016	0.0042	0.0016	0.0188*	0.0053
(PPM)	(61,90)	0.0037	−0.0001	0.0072	0.0096	0.0072
	(91,2,770)	Reference	Reference	Reference	Reference	Reference
Number of recertifications		0.0012	0.0001	−0.0028	−0.0060*	−0.0044*
Years practicing		0.0001	0.0001	0.0006	0.0001	−0.0001
Chronic care model category	Self-management support	Reference	Reference	Reference	Reference	Reference
	Clinical information systems	−0.0001	0.0098	−0.0032	−0.0108	−0.0112*
	Community resources and policies	0.0016	0.0093	0.0094	−0.0054	0.0106
	Decision support	−0.0005	−0.0008	0.0022	−0.0072	−0.0014
	Delivery system design	−0.0035	0.0028	0.0010	−0.0040	−0.0015
	Health system	−0.0002	−0.0068	0.0042	−0.0070	−0.0095*
Indicator chosen for improvement	Diet	Reference	Reference	Reference	Reference	Reference

Continued

Table 6. Continued

Variable	Category	Percentage of Patients with Blood Pressure in Control (<140/90 mm Hg)	Percentage of Patients with LDL Under Control (<130 mg/dl)	Percentage of Smokers Counseled on Smoking Cessation	Percentage of Patients Counseled on Low Sodium Diet	Percentage of Patients Counseled on Exercise Plan
	Blood pressure	−0.0024	0.0106	0.0012	0.0022	0.0086*
	Lipids	0.0041	0.0081	0.0070	0.0077	0.0081*
	Exercise	0.0044	0.0020	−0.0040	−0.0119*	0.0018
	Smoking counseling	−0.0113	−0.0048	−0.0074	−0.0141	−0.0099
Number of indicators chosen for improvement		−0.0013	−0.0028*	0.0004	0.0010	−0.0007
Number of indicator interventions		0.0105*	0.0040	−0.0331	0.0194*	0.0109*
Baseline control of regressed outcome		−0.7761*	−0.6049*	−0.9072*	−0.7527*	−0.7642*
Intervention chosen	Standing order	0.0040	−0.0020		0.0098	0.0035
	Flow sheets	−0.0014	−0.0015	0.0620	−0.0104	−0.0032
	Reminder system	−0.0056	−0.0098	0.0494	−0.0003	−0.0200*
	Patient education	0.0009	−0.0013	0.0460	−0.0057	−0.0053
	Patient and physicians communication aids	−0.0099	0.0105	0.0548		
	Plan of care cards	−0.0028				
	Patient care cards		−0.068	0.0423	−0.0124	−0.0153
	Staff in-service training on blood pressure checks	−0.0232				
	Physician/staff education		0.0069			
	Group visits			0.0399		
	Counseling tools			0.0262		
	Referral to counseling/services			0.0178		
	Exercise prescription					0.0057
	Diet prescription				−0.0088	

Note. Numbers reported represent adjusted beta coefficients between the quality outcome of interest and all listed variables in linear regression. To provide an example of interpretation, for LDL <130 mg/dl physician location in a large rural area ($B = 0.0182$*) was associated with a 1.8% increase in the percentage of patients with LDL in control compared to urban-located physicians.
*Beta coefficient is significantly different than 0 with a p-value <.05.

and DBP 1.9 mm Hg (95% CI, 0.7–3.1; Walsh et al., 2006). Small reductions in mean blood pressure across populations may have large impacts on morbidity and mortality. For instance, one study estimated that lowering DBP by even 2 mm Hg may lower the risk of coronary heart disease by 6% and that of stroke or transient ischemic attacks by 15% (Cook, Cohen, Hebert, Taylor, & Hennekens, 1995). Reducing SBP by 2 mm Hg was found to be associated with 7% lower mortality from vascular causes and with 10% lower mortality from stroke (Lewington et al., 2002).

Despite improvement in all quality measures, regression analyses did not find any consistent associations between QI and physician and QI project characteristics. A systematic review of QI efforts to improve blood pressure control found that team changes, such as including nurses or pharmacists in guiding care, were associated with improvement, but similar to our study, no consistent relationships were seen (Walsh et al., 2006). This same study reported that almost half of the trials included patient education or self-management interventions (Walsh et al., 2006). In our study, patient education was the most commonly selected intervention, regardless of the specific quality measure selected for improvement, indicating that the physicians were relying on commonly employed interventions. However, our regression results did not find an association between patient education and improvement in quality outcomes.

Adherence to process of care, quality measures for hypertension has been found to have mixed associations with lowering blood pressure (Wong, Smalarz, Wu, Boulanger, & Wogen, 2011), which supports our findings of no consistent associations between the structure of QI interventions and outcomes. Further research into what specific components of QI interventions are more effective is needed. However, an alternate interpretation of our findings is that simply participating in the QI process may be associated with improvement, regardless of the specific components or interventions used.

With increasing emphasis on quality by both payers and patients, physicians will need to learn and embrace QI strategies, and eventually demonstrate improvement. Engagement in MC-FP is one way in which family physicians can demonstrate participation in QI and subsequent improvement in the quality of care they deliver. Assuring delivery of quality care and commitment to improvement are both important responsibilities of a self-regulated profession, which dates back as far as 1803 (Lesser et al., 2010; Percival, 1803). Participation in MC-FP by family physicians and MOC programs designed by other ABMS boards for their physicians, not only offers regular reporting opportunities as part of this professional responsibility, but also offers tools, benchmarking, and periodicity that support QI that will hopefully make it both a societal and cultural norm in healthcare. As the number of entities monitoring physician outcomes grows, aligning these with MOC can reduce reporting burden and strengthen the incentives to make QI a routine part of care (Conway & Cassel, 2012). Value-based purchasing, Medicare Patient Quality Reporting System requirements, and other quality certifying options could work with certifying boards to better develop alignment and potentially reach agreement to accept each other's activities reciprocally.

Limitations

Certain limitations may affect our findings. First, we used physician reported data and physician administered patient surveys to assess quality of care that raises the possibility of bias. In testing their own Part 4 QI activity, the American Board of Internal Medicine (ABIM) demonstrated that physicians can reliably and accurately abstract and report data from their medical records (Holmboe et al., 2006). We found much higher rates of blood pressure control than what is reported in the literature (Egan et al., 2011), which may suggest that physicians "cherry picked" the patients they reported. However, ABIM found no evidence of such behavior by physicians (Duffy et al., 2008). Second, due to concerns over legal discoverability of quality measures, we were unable to link PPM data to any other physician-specific data, such as additional physician and practice demographics or other MC-FP activities completed. Finally, we used data collected from 10 patients pre- and postintervention to assess quality of care; this limited number of patients may not accurately capture the true quality of care delivered by the physician.

Directions for Future Research

Future work will need to use larger patient samples, perhaps whole-panel measures, to further

test for associations between MC-FP participation and quality of care. Achieving this fuller capacity to assess and reward quality will require IT-supported solutions and legal protections for certifying boards that hold and analyze identified quality measures. Additionally, longer study periods covering multiple QI cycles are needed to study sustained practice change.

Implications for Practice

Our study of over 7,000 hypertension QI projects done by family physicians, as a part of MC-FP, found success in improving the quality of care and adds to the evidence base for integration of QI into practice. MC-FP is one way for family physicians to build QI skills in order to continuously monitor quality and further improve the care they provide. Payers and federal agencies should become fully engaged partners with certifying boards in aligning QI efforts to better support physicians and reduce reporting burden. Leveraging MC-FP to improve the quality of care family physicians provide to patients with hypertension may be one pathway to reduce the considerable burden and costs of treating hypertension.

Acknowledgments

The study received no external funding. The authors have no conflicts of interest to disclose.

References

Asch, S. M., McGlynn, E. A., Hiatt, L., Adams, J., Hicks, J., DeCristofaro, A., et al. (2005). Quality of care for hypertension in the United States. *BMC Cardiovascular Disorders*, *5*, 1. doi:10.1186/1471-2261-5-1.

Centers for Disease Control & Prevention. (2011). Vital signs: Prevalence, treatment, and control of hypertension—United States, 1999–2002 and 2005–2008. *MMWR. Morbidity and Mortality Weekly Report*, *60*, 103–108.

Chernew, M. E., Mechanic, R. E., Landon, B. E., & Safran, D. G. (2011). Private-payer innovation in Massachusetts: The "alternative quality contract." *Health Affairs*, *30*, 51–61. doi:10.1377/hlthaff.2010.0980

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., Jr., et al. (2003). The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: The jnc 7 report. *Journal of the American Medical Association*, *289*, 2560–2572. doi:10.1001/jama.289.19.2560

Conway P. H, & Cassel. C. K. (2012). Engaging physicians and leveraging professionalism: A key to success for quality measurement and improvement. *Journal of the American Medical Association*, *308*, 979–980. doi:10.1001/jama.2012.9844

Cook, N. R., Cohen, J., Hebert, P. R., Taylor, J. O., & Hennekens, C. H. (1995). Implications of small reductions in diastolic blood pressure for primary prevention. *Archives of Internal Medicine*, *155*, 701–709.

Cushman, W. C. (2003). The burden of uncontrolled hypertension: Morbidity and mortality associated with disease progression. *Journal of Clinical Hypertension (Greenwich)*, *5*(3 Suppl 2), 14–22.

Draper, D., Liebhaber, A., & Ginsburg, P. (2007). High-performance health plan networks: Early experiences—Center for Studying Health System Change. Issue Brief No. 111. Retrieved July 17, 2014 from http://www.hschange.com/CONTENT/929/.

Duffy, F. D., Lynn, L. A., Didura, H., Hess, B., Caverzagie, K., Grosso, L., et al. (2008). Self-assessment of practice performance: Development of the ABIM Practice Improvement Module (PIM). *Journal of Continuing Education in the Health Professions*, *28*, 38–46. doi:10.1002/chp.154

Egan, B. M., & Laken, M. A. (2011). Is blood pressure control to less than 140/less than 90 mm Hg in 50% of all hypertensive patients as good as we can do in the USA: Or is this as good as it gets? *Current Opinion in Cardiology*, *26*, 300–307. doi:10.1097/HCO.0b013e3283474c20

Egan, B. M., Zhao, Y., Axon, R. N., Brzezinski, W. A., & Ferdinand, K. C. (2011). Uncontrolled and apparent treatment resistant hypertension in the United States, 1988 to 2008. *Circulation*, *124*, 1046–1058. doi:10.1161/CIRCULATIONAHA.111.030189

Heidenreich, P. A., Trogdon, J. G., Khavjou, O. A., Butler, J., Dracup, K., Ezekowitz, M. D., et al. (2011). Forecasting the future of cardiovascular disease in the United States: A policy statement from the American Heart Association. *Circulation*, *123*, 933–944. doi:10.1161/CIR.0b013e31820a55f5

Holmboe, E. S., Meehan, T. P., Lynn, L., Doyle, P., Sherwin, T., & Duffy, F. D. (2006). Promoting physicians' self-assessment and quality improvement: The ABIM diabetes practice improvement module. *Journal of Continuing Education in the Health Professions*, *26*, 109–119. doi:10.1002/chp.59

Lesser, C. S., Lucey, C. R., Egener, B., Braddock, C. H., 3rd, Linas, S. L., & Levinson, W. (2010). A behavioral and systems view of professionalism. *Journal of the American Medical Association*, *304*, 2732–2737. doi:10.1001/jama.2010.1864

Lewington, S., Clarke, R., Qizilbash, N., Peto, R., Collins, R., & Prospective Studies, C. (2002). Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*, *360*, 1903–1913.

Mayes, R. (2011). Moving (realistically) from volume-based to value-based health care payment in the USA: Starting with Medicare payment policy. *Journal of Health Services Research & Policy*, *16*, 249–251. doi:10.1258/jhsrp.2011.010151

McGlynn, E. A., Asch, S. M., Adams, J., Keesey, J., Hicks, J., DeCristofaro, A., et al. (2003). The quality of health care delivered to adults in the United States. *New England Journal of Medicine*, *348*, 2635–2645. doi:10.1056/NEJMsa022615

National Cholesterol Education Program Expert Panel on Detection, E., & Treatment of High Blood Cholesterol in Adults. (2002). Third report of the national cholesterol education program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (adult treatment panel iii) final report. *Circulation*, *106*, 3143–3421.

Ong, K. L., Cheung, B. M., Man, Y. B., Lau, C. P., & Lam, K. S. (2007). Prevalence, awareness, treatment, and control of hypertension among United States adults 1999–2004. *Hypertension*, *49*, 69–75. doi:10.1161/01.HYP.0000252676.46043.18

Percival, T. (1803). *Medical ethics: Or a code of institutes and precepts adapted to the professional conduct of physicians and surgeons*. Manchester, England: J Johnson.

Petersen, L. A., Simpson, K., Pietz, K., Urech, T. H., Hysong, S. J., Profit, J., et al. (2013). Effects of individual

physician-level and practice-level financial incentives on hypertension care: A randomized trial. *Journal of the American Medical Association*, *310*, 1042–1050. doi:10.1001/jama.2013.276303

Rosenthal, M. B., Fernandopulle, R., Song, H. R., & Landon, B. (2004). Paying for quality: Providers' incentives for quality improvement. *Health Affairs*, *23*, 127–141. doi:10.1377/hlthaff.23.2.127

Wagner, E. H., Austin, B. T., & Von Korff, M. (1996). Organizing care for patients with chronic illness. *Milbank Quarterly*, *74*, 511–544.

Walsh, J. M., McDonald, K. M., Shojania, K. G., Sundaram, V., Nayak, S., Lewis, R., et al. (2006). Quality improvement strategies for hypertension management: A systematic review. *Medical Care*, *44*, 646–657. doi:10.1097/01.mlr.0000220260.30768.32

Wong, K., Smalarz, A., Wu, N., Boulanger, L., & Wogen, J. (2011). The association between hypertension-specific care management processes and blood pressure outcomes in US-based physician organizations. *Journal of the American Society of Hypertension*, *5*, 505–512. doi:10.1016/j.jash.2011.08.002

WWAMI Rural Health Research Center. (2013). Rural-Urban Commuting Area Codes (RUCAs). WWAMI Rural Health Research Center. Retrieved December 11, 2013, from http://depts.washington.edu/uwruca/.

Authors' Biographies

Lars E. Peterson, MD, PhD, is the Research Director at The American Board of Family Medicine (ABFM), Lexington, KY, and an Assistant Professor in the Department of Family and Community Medicine, University of Kentucky, Lexington, KY. Dr. Peterson conducts and oversees research activities at the ABFM.

Brenna Blackburn, MPH, is a Research Assistant at the ABFM, Lexington, KY. Blackburn performs statistical analyses and data management.

James C. Puffer, MD, is the President and Chief Executive Officer of the ABFM, Lexington, KY. Dr. Puffer is responsible for the all activities of the ABFM, including the continuing development of its Maintenance of Certification program.

Robert L. Phillips Jr., MD, MSPH, is the Vice President of Research and Policy of the ABFM, Washington, DC. Dr. Phillips is responsible for policy analysis and development and the research portfolio of the ABFM.

For more information on this article, contact Lars E. Peterson at lpeterson@theabfm.org.