



# Quality of US Primary Care Delivered by Resident and Staff Physicians

Leah Zallman, MD<sup>1</sup>, Jun Ma, MD, PhD<sup>2</sup>, Lan Xiao, PhD<sup>2</sup>, and Karen E. Lasser, MD, MPH<sup>3</sup>

<sup>1</sup> Department of Medicine, Cambridge Health Alliance and Harvard Medical School, Cambridge, MA, USA; <sup>2</sup>Palo Alto Medical Foundation Research Institute, Palo Alto, CA, USA; <sup>3</sup>Section of General Internal Medicine, Boston Medical Center, Boston, MA, USA.

**BACKGROUND:** Few population-based data are available on the quality of outpatient care provided by resident physicians in the US.

**OBJECTIVE:** To assess the quality of outpatient care delivered by resident and staff physicians.

**DESIGN:** Cross-sectional analysis. We used chi-square tests to compare resident and staff physician performance on 19 quality indicators. Using multivariable logistic regression, we controlled for sex, age, race/ethnicity, insurance, and metropolitan status.

**PARTICIPANTS:** 33,900 hospital-based outpatient visits from the 1997-2004 National Hospital Ambulatory Medical Care Survey (NHAMCS).

**MEASUREMENTS:** Resident and staff physician performance on 19 quality indicators.

**RESULTS:** Resident physicians were more likely to care for younger, non-white, female, urban, and Medicaid-insured patients. In both adjusted and unadjusted analyses, residents outperformed staff on four of 19 measures including angiotensin converting enzyme inhibitor use for congestive heart failure (57.0% vs. 27.6%;  $p < 0.001$ ), diuretic use for hypertension (57.8% vs. 44.0%;  $p < 0.001$ ), statin use for hyperlipidemia (56.3% vs. 40.4%;  $p = 0.001$ ), and routine blood pressure screening (85.3% vs. 79.6%;  $p = 0.02$ ). Residents and staff performed at similar levels for counseling (range 15.7 to 32.0%). Residents and staff performed similarly well on measures capturing inappropriate prescribing or overuse of diagnostic testing (range 48.6 to 100%). Residents and staff performed similarly on measures of appropriate prescribing (range from 30.9% to 69.2%).

**CONCLUSIONS:** Primary care provided by resident physicians is of similar or higher quality than that provided by staff physicians. Significant opportunity remains to improve quality of outpatient care provided by all physicians. Residency training programs should devote attention to improving outpatient quality of care delivered by residents.

**KEY WORDS:** resident; quality of care; primary care.

## Abbreviations

ACE	angiotensin converting enzyme
BB	beta blocker

CAD	coronary artery disease
CBC	complete blood count
CHF	chronic heart failure
ECG	electrocardiography
HTN	hypertension
IC	inhaled corticosteroid
TMP SMX	trimethoprim sulfamethoxazole
URTI	upper respiratory tract infection
UTI	urinary tract infection

J Gen Intern Med 25(11):1193-7

DOI: 10.1007/s11606-010-1456-0

© Society of General Internal Medicine 2010

## BACKGROUND

Despite ongoing efforts to improve the quality of primary care in the United States, deficiencies persist.<sup>1</sup> In recognition of the importance of residency training in ambulatory medicine, the Accreditation Council for Graduate Medical Education (ACGME) increased the required time residents spend in primary care continuity clinics starting in July 2009<sup>2</sup> and has supported involvement of residents in quality improvement efforts. Targeting trainees is prudent, as practice patterns are largely determined during the residency training years. Quality of care delivered by internal medicine residents is particularly important with respect to addressing health care disparities, as residents provide a substantial amount of care to minority and uninsured patients.<sup>3,4</sup>

Studies have shown increased quality of inpatient care delivered in teaching hospitals relative to non-teaching hospitals.<sup>5,6</sup> However, few population-based data are available on the quality of outpatient care provided by resident physicians in the United States. Although prior studies have reported comparable or increased quality of outpatient care delivered by residents, these studies have been limited by their lack of a comparison group<sup>7</sup> or by their focus on specific diseases or geographical areas.<sup>8,9</sup> We analyzed data from the National Hospital Ambulatory Medical Care Survey (NHAMCS). Our objective was to compare the quality of outpatient care delivered by resident physicians and staff physicians in the United States, across a spectrum of previously defined and published quality measures.<sup>10</sup>

Received March 4, 2010

Revised June 18, 2010

Accepted July 6, 2010

Published online July 20, 2010

## METHODS

### Data Source

We analyzed data from the Outpatient Department component of the NHAMCS collected between 1997 and 2004. The NHAMCS is administered by the National Center for Health Statistics (NCHS). It uses a multistage stratified probability sampling procedure to obtain nationally representative estimates of outpatient visits to hospital-based clinics on an annual basis. Hospital-based physicians (with staff assistance) or hospital staff complete NCHS standard encounter forms, including data on visit diagnoses, over a four-week period. The survey contains items on patient demographics (with the patient's race and ethnicity determined by the physician), up to three reasons for the visit (in the patient's own words), visit diagnoses (primary diagnosis plus two 'other' diagnoses), diagnostic and screening services ordered, counseling and education provided, and up to six medications. Listed medications included prescription and nonprescription medications that the physician prescribed on the day of the visit or prior to the visit and that the physician expected the patient to continue taking. In addition, the physician indicates whether she is the patient's primary care physician and whether she is a staff or resident physician. We did not analyze NHAMCS data after 2004 because the later surveys did not identify resident physicians. Ninety percent of the selected hospitals participated, and item non-response rates were generally 5% or less.

### Description of Quality Indicators

We examined a set of 20 outpatient quality indicators, which was previously described in detail for use in NHAMCS.<sup>10</sup> Briefly, the quality indicators were developed in accordance with the Institute of Medicine's criteria<sup>11</sup> of clinical importance, scientific soundness, and feasibility for indicator selection as well as criteria specific to the limitations of the data source. Limitations of the data source included visit-based data, unreliable data elements and subpopulations, and inconsistent inclusion of variables over years. Indicators were selected if they were meaningful when measured at individual patient visits and did not rely on data elements or subpopulations that are considered unreliable according to NCHS standards. The quality indicators fall into five categories: 1) medical management of chronic diseases (ten measures; e.g. beta blocker use for coronary artery disease); 2) appropriate antibiotic use (two measures; e.g. no antibiotic use for upper respiratory tract infection); 3) preventive counseling (three measures; e.g. exercise counseling in adults at moderate to high risk for coronary heart disease defined as having two or more risk factors including a history of smoking, men >45 years old or women >55 years old, hypercholesterolemia, hypertension, or obesity and excluding those with known CAD or diabetes mellitus); 4) screening tests (four measures; e.g. routine blood pressure screening), and 5) inappropriate prescribing in elderly patients, defined as age  $\geq 65$  (e.g. avoiding use of 33 inappropriate medications such as benzodiazepines). We defined performance on quality indicators as the percentage of eligible visits receiving recommended care (i.e., the higher the percentage the better the performance), based on practice guidelines or, in the absence of authoritative practice guidelines, consensus expert

statements. We excluded visits from both the numerator and denominator of a measure if the patient had clinical contraindications to a recommended treatment. For example, we computed the measure 'angiotensin converting enzyme (ACE) inhibitor use for congestive heart failure (CHF)' as the number of visits by adults with a visit diagnosis of CHF who had a documented prescription of ACE inhibitors or angiotensin receptor blockers divided by the number of visits by adults diagnosed as having CHF. We excluded visits by adults with diagnoses of hyperkalemia or angioedema from both the numerator and the denominator. We could only capture disease conditions and exclusions if the diagnosis in question was listed on the day of the visit, and if the medication in question was listed on the day of the visit. Because this study used publicly available anonymous data, the Institutional Review Board of Boston University Medical Center deemed it exempt from review.

### Statistical Analysis

Using SAS Enterprise Guide 4.2 (SAS Institute, Cary, NC), we performed analyses using the patient visit as the unit of analysis. We calculated standard errors for all results as recommended by the NCHS, which accounts for the sampling weights and the complex multi-stage sampling design of the NHAMCS.<sup>12</sup> According to the NCHS, estimates with greater than a 30% relative standard error (i.e. the standard error divided by the estimate expressed as a percentage of the estimate) or based on fewer than 30 sample cases may be unreliable. In accordance with the NCHS analytical guidelines, we combined data from 1997-2004 in order to generate reliable national estimates. We excluded one quality indicator (antithrombotic therapy for atrial fibrillation), because it had a sample size that was too small to be considered reliable, leaving us with 19 quality indicators.

The primary outcomes were mean performance rates on quality indicators analyzed according to physician status (resident vs. staff physician). We compared mean performance rates with chi-square analyses (PROC SURVEYFREQ), followed by multivariable logistic regression analyses (PROC SURVEYLOGISTIC) controlling for patient sex, age, race/ethnicity, medical insurance, and metropolitan status. We selected these variables because they have been shown to be associated with differences in quality of care.<sup>13,14</sup>

## RESULTS

### Patient and Visit Characteristics

Table 1 shows characteristics of patient visits made to resident and staff physicians. Resident physicians were more likely to care for younger, non-white, female, and urban patients, as well as patients with Medicaid. Resident and staff physicians cared for patients with similar numbers of comorbid medical conditions and from similar regions of the United States. The proportion of visits to resident and staff physicians for preventive care versus treatment was similar.

**Table 1. Demographic Characteristics of All Patient Visits to U.S. Resident and Staff Primary Care Physicians as Percentages, 1997-2004**

Variable	Resident Physician	Staff Physician	χ <sup>2</sup> P value
	Visits	Visits	
	n=6322	n=27578	
	%	%	
<b>Patient characteristics</b>			
Sex			
Women	68.5	64.8	0.019
Age			
20-44	46.8	38.7	<0.001
45-64	37.4	35.2	
>=65	15.8	26.2	
Race			
White	52.2	67.8	<0.001
Black/African American	34.5	17.8	
Hispanic	11.4	11.2	
Other	1.9	3.2	
Comorbidity <sup>a</sup>			
Yes	34.7	31.6	NS
Mean number	0.49±0.06	0.42±0.02	NS
<b>Visit characteristics</b>			
Medical insurance			
Private	19.5	38.0	<0.001
Government-sponsored			
Medicaid/SCHIP	31.8	19.8	
Medicare	17.4	24.5	
Other <sup>†</sup>	31.2	17.7	
Visit type			
Preventive care	19.1	16.0	NS
Treatment visit	80.9	84.0	
Geographic region			
Northeast	29.2	27.6	NS
Midwest	33.6	29.0	
South	29.4	33.8	
West	7.8	9.6	
Metropolitan statistical area			
Yes	99.0	79.0	<0.001

<sup>a</sup>Comorbidity defined as coronary heart disease (n=967), diabetes (n=3554), hypertension (n=6469), hypercholesterolemia (n=1504), congestive heart failure (n=507) or stroke (n=207)

<sup>†</sup>“Other” denotes self-pay, no charge/charity, worker’s compensation, other and unknown

**Performance on Quality Indicators**

Table 2 shows mean performance rates on quality indicators for resident and staff physicians. In both unadjusted and adjusted analyses, residents outperformed staff physicians on four measures: ACE inhibitor use for congestive heart failure (57.0% vs. 27.6%; adjusted p=<0.001), diuretic use for hypertension (57.8% vs. 44.0% adjusted p=<0.001), statin use for hyperlipidemia (56.3% vs. 40.4% adjusted p=0.001), and routine blood pressure screening (85.3% vs. 79.6%; adjusted p=0.024). Residents and staff performed at similar levels for counseling on smoking cessation, and for exercise and nutrition counseling among moderate to high-risk adults; performance rates ranged from 15.7 to 32.0%. Residents and staff performed similarly well on measures capturing inappropriate prescribing or overuse of diagnostic testing. These measures included avoiding inappropriate prescribing in elderly

**Table 2. Quality of Outpatient Care Among All Patient Visits to U.S. Resident and Staff Physicians, 1997-2004**

	Resident Physician	Staff Physician	χ <sup>2</sup> P value
	Visits	Visits	
	% (95% CI)	% (95% CI)	
<b>Medical Management of Common Diseases (N=number of visits associated with issue)</b>			
ACE inhibitor use for CHF (N=506)	57.0 (39.6,74.4)	27.6 (19.2,36.0)	<0.001 <sup>a</sup>
Aspirin use for CAD (N=944)	48.4 (25.1,71.7)	35.8 (27.3,44.2)	NS
BB for CAD (N=903)	31.9 (20.4,43.4)	30.9 (23.38.9)	NS
Diuretic use for HTN (N=3020)	57.8 (51.5, 64.1)	44.0 (40.5,47.6)	<0.001 <sup>a</sup>
IC use for asthma in adults (N=945)	38.2 (26.5, 49.8)	32.3 (24.7, 39.6)	NS
Statin use for hyperlipidemia (N=1269)	56.3 (48.3, 64.2)	40.4 (34.9, 45.8)	0.001 <sup>a</sup>
Treatment of depression <sup>†</sup> (N=1783)	65.2 (52.6, 77.9)	69.2 (63.8, 74.6)	NS
No benzodiazepine use for depression (N=1783)	100 (100, 100)	100 (99.9,100)	NS
Hemoglobin A1C checked for diabetes <sup>§</sup> (N=922)	23.3 (10.2, 36.4)	22.0 (13.1-30.9)	NS
<b>Preventive Counseling</b>			
Smoking cessation (N=493)	20.7 (8.7,32.6)	25.6 (17.7,33.4)	NS
Diet/nutrition in high-risk adults <sup>‡</sup> (N=732)	32.0 (20.7,43.2)	28.3 (21.7,34.9)	NS
Exercise in high-risk adults <sup>‡</sup> (N=732)	16.3 (7.1,25.5)	15.7 (9.6,21.9)	NS
<b>Screening Tests</b>			
Blood pressure screen (N=8061)	85.3 (81.1,89.5)	79.6 (76.4,82.8)	0.024 <sup>a</sup>
No routine ECG (N=1335)	95.3 (91.6,99.0)	91.5 (87.6,95.3)	NS
No routine urinalysis (N=3026)	48.6 (38.5,58.7)	53.7 (47.0,60.3)	NS
No routine CBC (N=551)	88.0 (74.5,100)	81.5 (74.0,89.1)	NS
<b>Appropriate Antibiotic Use</b>			
TMP-SMX or quinolone use for UTI (N=345)	62.2 (45.8,78.6)	60.3 (49.9,70.7)	NS
No antibiotic use for URTI (N=348)	81.5 (69.0,94.0)	78.0 (69.5, 86.7)	NS
<b>Inappropriate Prescribing in Elderly Patients</b>			
Avoiding potentially inappropriate prescribing in elderly patients (N=7372)	93.8 (91.4, 96.1)	93.2 (91.9,94.6)	NS

<sup>a</sup>denotes that significance remains after adjusting for sex, age, race, insurance, and urban location

<sup>†</sup>treatment of depression is defined as: prescribing antidepressants, psychotherapy or mental health counseling

<sup>‡</sup>high risk adults is defined as having two or more of the following risk factors for coronary heart disease: a history of smoking, men >45 years old or women >55 years old, hypercholesterolemia, hypertension, or obesity and excluding those with known CAD or diabetes mellitus

<sup>§</sup>Data only available for 2003 and 2004

patients, benzodiazepine use for the treatment of depression, antibiotic use for upper respiratory tract infections, and ordering routine complete blood counts, urinalyses and electrocardiograms; performance rates varied from 48.6% to 100%. Residents

and staff performed similarly on measures of appropriate prescribing including: treatment of depression (prescribing antidepressants, psychotherapy or mental health counseling), trimethoprim-sulfamethoxazole or quinolone use for urinary tract infections, aspirin and beta blocker use for coronary artery disease, and inhaled corticosteroid use for asthma. Performance rates on these measures of appropriate prescribing were between 30.9% and 69.2%.

## COMMENT

Compared with staff physicians, resident physicians provide primary care that is of similar or higher quality. Residents outperformed staff physicians on four of nineteen quality indicators including ACE inhibitor use for congestive heart failure, diuretic use for hypertension, statin use for hyperlipidemia and routine blood pressure screening. Residents and staff perform similarly on preventive counseling, measures of avoiding inappropriate prescribing or overuse of diagnostic testing, and on measures of appropriate prescribing.

Our results are congruent with previous studies that have demonstrated increased quality of care provided by resident physicians on specific measures or at single sites.<sup>8,9</sup> As in previous studies, we found that resident physicians are less likely than staff physicians to prescribe antibiotics for respiratory conditions where antibiotics are rarely indicated.<sup>8</sup> Both resident and staff physician performance revealed deficits in quality of care. This confirms previously identified gaps in compliance with evidence-based guidelines for blood pressure screening,<sup>15</sup> diet and exercise counseling,<sup>16</sup> statin use for moderate to high risk patients,<sup>17</sup> and aspirin use for primary and secondary prevention of cardiovascular disease.<sup>1,18,19</sup>

Resident physicians provide a disproportionate amount of care for vulnerable populations. In our study, residents were more likely than staff physicians to care for non-white and Medicaid patients, which is consistent with prior studies.<sup>3,4</sup> This finding suggests that improving the quality of resident outpatient care might improve the quality of care delivered to underserved populations and hence potentially reduce disparities in care.

Our analyses are limited because physicians were only able to list a limited number of diagnoses (up to three) and medications (up to six). Thus, some diagnoses and medications may not have been captured on the day of the NHAMCS study visit. The six-medication limit would cause us to underestimate quality for indicators that call for use of a specific drug, but overestimate quality when the measure suggests drug avoidance. Hence, we would expect measures capturing inappropriate prescribing (avoiding inappropriate prescribing in elderly patients, benzodiazepine use for the treatment of depression, and antibiotic use for upper respiratory tract infections) to be somewhat overestimated in our comparisons, while measures of appropriate prescribing (treatment of depression, trimethoprim-sulfamethoxazole or quinolone use for urinary tract infections, aspirin and beta blocker use for coronary artery disease, and inhaled corticosteroid use for asthma) would be underestimated. Similarly, lack of complete diagnostic information might cause us to underestimate valid contraindications to otherwise indicated drugs. This problem seems most likely for ACE inhibitor in CHF, beta-blocker for CAD, diuretic use for HTN, and statin use for hyperlipidemia.

However, these problems would only affect our conclusions regarding the relative quality of care by the two groups of physicians if these limitations applied differentially to residents or staff physicians. We know of no a priori reason to believe this is so and in fact believe that patients cared for by resident physicians have a similar burden of illness as those cared for by staff physicians, as evidenced by our finding that patients in each group were as likely to have a comorbid condition and had a similar number of comorbid conditions. Thus, we doubt that the absence of data on additional diagnoses and medications has introduced bias.

Our analyses are also limited by underreporting of preventive counseling behaviors in physician-report-based studies such as the NHAMCS, in which counseling behaviors are underreported for two reasons: 1) physicians underreport counseling behavior as compared to procedural behaviors,<sup>20</sup> and 2) visit-based data are unable to capture counseling behaviors that did not occur at the index visit. We doubt that staff physicians are more likely than residents to underreport counseling behaviors; however, because staff physicians have most likely seen their patients over a longer period of time, counseling is more likely to have occurred at a prior visit. One of the quality measures, blood pressure screening, is often carried out by medical assistants and may therefore reflect a difference in practice performance rather than individual physician performance. However, as it is incumbent upon the physician to ensure that screening tests be performed, the difference in blood pressure screening may still reflect a difference in physician attention to this screening test. Our study data were limited to hospital-based clinics and do not include visits to community-based clinics. Thus our findings may not be generalizable to those settings. Finally, because our study period preceded the ACGME-mandated increased ambulatory requirements, we have not captured any improvements in quality of care that may have resulted from this change.

Why are there differences in the quality of outpatient care provided by resident and staff physicians? Resident physicians are in the midst of training, thereby increasing the likelihood that they have learned current evidence-based guidelines. Residents are also closely precepted by faculty, who may be more likely than non-teaching staff physicians to practice according to current guidelines. Residents performed particularly well on measures that are reinforced by their inpatient training, such as ACE inhibitor use for CHF and statin use for hyperlipidemia. Finally, since we were unable to control for the type of institution (academic vs. non-academic), the higher quality of care delivered by residents may reflect differences in systems of care provided at academic versus non-academic institutions.

This study highlights the significant opportunity that remains to improve quality of outpatient care in the United States, including within residency training programs. While ongoing quality improvement projects aimed at staff physicians target the majority of care delivered in the US, quality improvement programs targeting residency training sites are an important area for future interventions. Despite the fact that the majority of care is delivered in ambulatory settings, residents spend the majority of their training years in inpatient settings. Residency training programs should devote attention not only to augmenting time spent in the ambulatory setting as mandated by the ACGME but also on improving outpatient quality of care delivered by residents. Residents might participate in quality improvement projects in order to learn more about quality measurement and process improvement. Such efforts could be



guided by the development of a standard curriculum. As more emphasis is being placed on performance-based compensation, this is an increasingly important area to which residency programs should devote attention. Quality improvement interventions that address specific barriers at the system, provider, and patient level are necessary in order to reduce the discrepancy between clinical practice and best evidence.<sup>21,22</sup> Research on factors contributing to deficiencies and disparities in quality of care will inform the design of tailored interventions.

---

**Acknowledgements:** We thank Dr Stephanie Woolhandler for her editorial comments, and Meredith Manze for her assistance with manuscript preparation.

**Conflict of Interest:** There are no financial conflicts of interest for any of the authors.

**Corresponding Author:** Karen E. Lasser, MD, MPH, Section of General Internal Medicine, Boston Medical Center, 801 Massachusetts Avenue, Crosstown #2091, Boston, MA 02118, USA (e-mail: Karen.lasser@bmc.org).

## REFERENCES

1. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *N Engl J Med*. 2003;348(26):2635–45.
2. ACGME. [http://www.acgme.org/acWebsite/downloads/RRC\\_progReq/140\\_internal\\_medicine\\_07012009\\_TCC.pdf](http://www.acgme.org/acWebsite/downloads/RRC_progReq/140_internal_medicine_07012009_TCC.pdf). Accessed 7/6/10.
3. Charlson ME, Karnik J, Wong M, McCulloch CE, Hollenberg JP. Does experience matter? A comparison of the practice of attendings and residents. *J Gen Intern Med*. 2005;20(6):497–503.
4. Serwint JR, Thoma KA, Dabrow SM, et al. Comparing patients seen in pediatric resident continuity clinics and national ambulatory medical care survey practices: a study from the continuity research network. *Pediatrics*. 2006;118(3):e849–858.
5. Kupersmith J. Quality of care in teaching hospitals: a literature review. *Acad Med*. 2005;80(5):458–66.
6. Ayanian JZ, Weissman JS. Teaching hospitals and quality of care: a review of the literature. *Milbank Q*. 2002;80(3):569–93. v.
7. Mladenovic J, Shea JA, Duffy FD, Lynn LA, Holmboe ES, Lipner RS. Variation in internal medicine residency clinic practices: assessing practice environments and quality of care. *J Gen Intern Med*. 2008;23(7):914–20.
8. Rounie CL, Halasa NB, Edwards KM, Zhu Y, Dittus RS, Griffin MR. Differences in antibiotic prescribing among physicians, residents, and nonphysician clinicians. *Am J Med*. 2005;118(6):641–8.
9. Tsui JI, Dodson K, Jacobson TA. Cardiovascular disease prevention counseling in residency: resident and attending physician attitudes and practices. *J Natl Med Assoc*. 2004;96(8):1080–3. 1088–1091.
10. Ma J, Stafford RS. Quality of US outpatient care: temporal changes and racial/ethnic disparities. *Arch Intern Med*. 2005;165(12):1354–61.
11. Hurtado MPSE, Corrigan JM. Committee on the National Quality Report on Health Care Delivery, Board on Health Care Services. *Envisioning the National Health Care Quality Report*. Washington: National Academy Press; 2001.
12. CDC. <http://www.cdc.gov/nchs/ahcd.htm> Accessed 7/6/10.
13. Asch SM, Kerr EA, Keeseey J, et al. Who is at greatest risk for receiving poor-quality health care? *N Engl J Med*. 2006;354(11):1147–56.
14. Zaslavsky AM, Hochheimer JN, Schneider EC, et al. Impact of sociodemographic case mix on the HEDIS measures of health plan quality. *Med Care*. 2000;38(10):981–92.
15. Ma J, Stafford RS. Screening, treatment, and control of hypertension in US private physician offices, 2003–2004. *Hypertension*. 2008;51(5):1275–81.
16. Ma J, Xiao L, Stafford RS. Adult obesity and office-based quality of care in the United States. *Obesity*. 2009;17(5):1077–85.
17. Ma J, Sehgal NL, Ayanian JZ, Stafford RS. National trends in statin use by coronary heart disease risk category. *PLoS Med*. 2005;2(5):e123.
18. Stafford RS, Monti V, Ma J. Underutilization of aspirin persists in US ambulatory care for the secondary and primary prevention of cardiovascular disease. *PLoS Med*. 2005;2(12):e353.
19. Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? *Milbank Q*. 1998;76(4):517–63. 509.
20. Gilchrist VJ, Stange KC, Flocke SA, McCord G, Bourguet CC. A comparison of the National Ambulatory Medical Care Survey (NAMCS) measurement approach with direct observation of outpatient visits. *Med Care*. 2004;42(3):276–80.
21. Bergeson SC, Dean JD. A systems approach to patient-centered care. *Jama*. 2006;296(23):2848–51.
22. Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*. 2001;20(6):64–78.