Quality of Care for Chronic Illness in Primary Care: Opportunity for Improvement in Process and Outcome Measures

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Abstract

Objective: **To describe adherence to a number of quality indicators and clinical outcomes for asthma, diabetes mellitus, hypertension, coronary heart disease, atrial fibrillation, and cerebrovascular disease in the primary care practices of the Practice Partner Research Network (PPRNet).**

Study Design: **Cross-sectional epidemiologic design.**

Patients and Methods: **PPRNet is a national research network of ambulatory, mostly primary care practices that use the *Practice Partner Patient Records*™ electronic medical records. Participating practices send anonymous clinical data on patients to the PPRNet data center monthly. Standard database management and statistical software are used to compile practice reports. These reports include measures of adherence to process and outcome measures for chronic illnesses, the subject of this report.**

Results: **Forty-eight PPRNet practices provided data for the first quarter of 1998. A total of 336,401 patients were active in these practices during this quarter. At least 2000 active patients had each of the conditions studied. Wide variation in guideline adherence among PPRNet practices was present for each of the performance measures. Better performance was present for physical examination measures and laboratory monitoring than for treatment interventions. Overall performance was excellent for blood pressure monitoring, poor for lipid monitoring in patients with CHD, and intermediate for glycosylated hemoglobin monitoring in patients with diabetes mellitus.**

Conclusion: **The findings of this study are comparable to others in documenting that most clinical practice guidelines for chronic illness are not followed for a majority of patients and that large majorities do not reach desired clinical outcomes.**

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Deficiencies in the quality of care provided to patients with chronic illness are increasingly being recognized and discussed.[1] Clinical practice guidelines and disease management programs are heralded as tools to improve care for patients with chronic illness. However, evidence exists that it is difficult to incorporate practice guidelines in practice settings.

Studies in the early 1990s revealed that only 15% of diabetic patients received widely recommended glycosylated hemoglobin monitoring.[2,3] ß-blockers reduce mortality after myocardial infarction, yet only 34% of Medicare recipients discharged from the hospital with this diagnosis receive them.[4] Angiotensin-converting enzyme (ACE) inhibitors

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improve survival in patients with congestive heart failure, but they are used suboptimally—in only 41% of eligible patients in one study.[5]

Achieving treatment goals for chronic illness is also difficult. According to the National Health and Nutrition Examination Surveys, in the early 1990s fewer than 30% of Americans with hypertension had controlled blood pressure (<140/90 mm Hg).[6] A study of 603 primary care patients from the midwestern United States with coronary disease, cerebrovascular disease, or peripheral vascular disease found that one third had never had lipid panels done and that only 14% achieved goal low-density lipoprotein cholesterol (LDL-C) levels of less than 100 mg/dL.[7] Similarly, only 9% of women with established coronary disease enrolled in the Heart and Estrogen/Progestin Replacement Study had baseline LDL-C values at this goal level, despite the use of lipid-lowering medication by 47% of the women.[8]

Most studies evaluating adherence to practice guidelines have been done in academic medical centers or a small number of practice settings or have focused on one condition. More information from community-based practice settings across a number of chronic conditions is needed. This information will provide important baseline data needed to design and evaluate strategies to improve adherence in these settings.

In this report, we describe adherence to a number of quality indicators and clinical outcomes for asthma, diabetes mellitus, hypertension, coronary heart disease (CHD), atrial fibrillation, and cerebrovascular disease in the primary care practices of the Practice Partner Research Network (PPRNet).

··· METHODS ···

Formed in May 1995, PPRNet[9] is a national research network of ambulatory, mostly primary care practices that use the *Practice Partner Patient Records*™ electronic medical records (Physician Micro Systems, Inc., Seattle, WA). At the current time, 63 practices in 24 states, with 364 physicians, are PPRNet members.

PPRNet practices enter data in their electronic medical records as a routine part of the care process. Diagnoses and visit notes are entered either directly by physicians or through dictation and transcription. Vital signs are entered by office staff directly or through automatic uploading from the progress notes. Information about medications usually is entered directly through the electronic medical record's prescription module. Laboratory data are either downloaded automatically from affiliated laboratories or directly entered by office staff.

Each month, participating practices run a computer program to extract patient activity in the previous month from *Patient Records*™. To protect patient confidentiality, the extract program assigns a unique, anonymous numerical identifier to each patient. The data are copied to a diskette and mailed to PPRNet's data management partner (IMS America, Plymouth Meeting, PA). The data management center performs rigorous quality control, bridges coded data elements to standard data dictionaries, and appends new data to the existing longitudinal database. Data tapes are sent quarterly to the PPRNet offices at the Medical University of South Carolina Center for Health Care Research, where they are converted to SAS (Statistical Analysis System, Cary, NC) data sets on a UNIX computer. PPRNet staff use microcomputers and standard database and statistical software to perform all subsequent analyses.

Currently, the PPRNet database has information on more than 380,000 patients, including 2.3 million patient visits, 6.6 million diagnoses, 2.7 million prescriptions, 370,000 allergies, 7.8 million vital signs, 8.6 million laboratory records, and 771,000 preventive services. Participating practices are aware that the PPRNet database is used for a variety of research projects.[10] Interested members participate on project teams, usually through planning discussions at annual member meetings. Approximately one third of the sites send physician representatives to these meetings.

The quality indicators and clinical outcomes selected for this report were derived from several sources. Widely accepted, largely evidence-based guidelines feasible in primary care settings were chosen from published sources. Availability of suitable data for analysis in the PPRNet database was another selection criterion. For asthma, we assessed the proportion of patients receiving antiinflammatory medication. For diabetes mellitus, we assessed monitoring and control of glycosylated hemoglobin and monitoring of serum creatinine. For hypertension, we evaluated the extent to which blood pressure measurements were done, whether a diagnosis of hypertension was made in patients with elevated blood pressure, and the proportion of all patients and those diagnosed with hypertension whose blood pressure was within standard blood pressure stages. In patients with CHD, we assessed the degree to which cholesterol and LDL-C measurements were

made, whether hyperlipidemia was diagnosed and treated in patients with elevated levels of lipids, and whether treatment goals were met. We also evaluated whether patients with CHD or cerebrovascular disease were prescribed antiplatelet agents and whether patients with a history of myocardial infarction were prescribed a ß-blocker. For patients with a diagnosis of heart failure, the prescription of ACE inhibitors was assessed, as was the prescription of oral anticoagulants for those with atrial fibrillation.

Some PPRNet practices had incomplete laboratory data in their electronic medical records. For each measure that included laboratory data, only practices with complete data were included in the analyses.

··· RESULTS ···

Forty-eight PPRNet practices from 23 states were active in PPRNet during the first quarter of 1998. Practice specialties were as follows: 29 family practice, 9 general internal medicine, 6 academic family practices, and 4 others. A total of 310 physicians were members of the 48 practices. Seventeen practices had 1 physician, 16 had 2 or 3 physicians, 7 had 4 to 9 physicians, and 8 had 10 or more physicians. The largest practice was a 58-physician academic family practice. A total of 336,401 patients had a chart update within the previous 3 years and were considered as active in these practices during this quarter. The smallest practice had 727 patients; the largest had 34,965 patients. A total of 77,954 patients had a contact during the quarter (range among practices, 20-10,084 patients). Table 1 shows the number of patients with each of the conditions studied. At least 2000 active patients had each of the conditions studied.

Specific process measures for the studied conditions, along with PPRNet patient adherence rates, are shown in Table 2. Physical examination measures and results of laboratory monitoring were reported for the first quarter of 1998. Because chronic medication prescriptions are often written for up to a year's duration, a current prescription was deemed to be one written within 1 year from the end of the first quarter of 1998.

The data show wide variation among PPRNet practices for each of the performance measures. Better performance is apparent for physical examination measures and laboratory monitoring than for treatment interventions, particularly in light of the different time intervals for assessment of these indicators. Overall performance was excellent for blood pressure monitoring; nearly 4 of 5 active patients had a blood pressure measurement in the quarter. Performance was poor for lipid monitoring in patients with CHD; only 1 patient in 10 had monitoring in the quarter. Glycosylated hemoglobin measurements were done in only 1 of 7 patients with diabetes. Notably though, the 90th percentile for cholesterol, LDL-C, and glycosylated hemoglobin monitoring was 30.9%, 22.2%, and 32.4%, respectively, indicating that some practices have developed systems to better assess these measures. The poor performance of physicians in prescribing antiplatelet agents for patients with CHD or cerebrovascular dis-

Table 1. Diagnostic Codes and Number of Patients for Conditions Evaluated in 48 Reporting Practice Partner Research Network Practices, First Quarter 1998

Condition	ICD-9 Codes	No. of Patients (Range of Patients Among Practices
Asthma	493	11,027 (1–1225)
Diabetes mellitus	250, 648.0, 357.2	11,789 (3–1158)
Hypertension	401–405, 796.2, 997.91	35,237 (8–3786)
Coronary heart disease	410–414, P3606, P3609–P3614, V45.81, V45.8	7004 (1–866)
Myocardial infarction	410–412	1170 (1–163)
Heart failure	402.01, 402.11, 402.91, 404.01, 428	4003 (1–543)
Atrial fibrillation	427.31	2078 (1–390)
Cerebrovascular disease	434–438	3004 (2–449)

ICD-9 = *International Classification of Diseases,* 9th Revision.

Table 2. Process Measures for Studied Conditions, First Quarter 1998

Condition	Practice Guideline Measure	Study Measure	Performance		
			Total No.	Adherence Among All Patients (%)	Adherence Range Among Practices* (%)
Asthma	Antiinflammatory agent for persistent asthma†	Current‡ prescription of antiinflammatory agent	11,027	22.2	11.0–38.5
Diabetes mellitus	Monitor glycosylated hemoglobin	Measurement of glycosylated hemoglobin first quarter 1998	11,789	14.2	1.8–42.4
	Monitor serum creatinine	Measurement of serum creatinine 1st quarter 1998		16.6	2.2–42.3
Hypertension§	BP measurement annually for all patients	Measurement of BP in patients with contact 1st quarter 1998	77,954	78.5	49.2–94.0
	Diagnosis of hypertension for more than three 140/90 mm Hg measurements	Recorded diagnosis of hypertension for most recent systolic BP > 140 mm Hg or diastolic BP > 90 mm Hg	19,412	45.0	21.9–72
CHD	Cholesterol and LDL–C measures in CHD patients‖	Measurement of total cholesterol 1st quarter 1998	7004	11.9	5.2–30.9
		Measurement of LDL–C 1st quarter 1998		8.2	4.1–22.2
	Diagnosis of hyperlipidemia for elevated levels‖	Recorded diagnosis of hyperlipidemia for total cholesterol > 200 mg/dL or LDL–C > 130 mg/dL 1st quarter 1998	407	60.7	41.3–81.6
	Treatment of elevated cholesterol or LDL–C‖	Current medication for hyperlipidemia for total cholesterol > 200 mg/dL or LDL–C > 130 mg/dL 1st quarter 1998		41.5	21.1–96.7
	Antiplatelet agent unless contraindicated¶	Current‡ prescription of antiplatelet agent	7004	1.4	0.8–3.4
	Beta–blocker in patients with history of myocardial infarct if not contraindicated#	Current‡ prescription of ß–blocker	1170	13.3	7.4–36.4
Heart failure	Use ACE inhibitor if not contraindicated**	Current‡ prescription of ACE inhibitor	4003	20.7	10.0–35.3
Atrial fibrillation	Use oral anticoagulants in high-risk patients††	Current‡ prescription of oral anticoagulant	2078	28.7	11.2-52.3
Cerebrovascular disease	Antiplatelet agent unless contraindicated¶	Current‡ prescription of antiplatelet agent	3004	3.6	2.8-13.8

ACE = angiotensin-converting enzyme; BP = blood pressure; CHD = coronary heart disease; LDL-C = low-density lipoprotein cholesterol.
*The range reflects the 10th to 90th percentiles among 48 practices as of March 1998.
†Guidelines adapted from *Global Strategy for Asthma Management and Prevention,* NHLBI/WHO Workshop Report, January 1995, NIH/NHLBI publication 95-3659.
‡For these analyses a current prescription is one with a date on or after April 1, 1997.
§Adapted from *The Sixth Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC VI).* National Institutes of Health, National Blood Pressure Education Program, November 1997, NIH publication 98-4080.
‖Adapted from summary of the Second Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *JAMA* 1993;269(23):3015-3023.
¶Adapted from Hennekens CH, Dyken ML, Fuster V: Aspirin as a therapeutic agent in cardiovascular disease. *Circulation* 1997;96:2751-2753. American Heart Association Scientific Statement.
#Adapted from Smith SC, Blair SN, Criqui MH, et al. Preventing heart attack and death in patients with coronary disease. *Circulation* 1995;92:2-4. American Heart Association Scientific Statement.
**Adapted from Williams JF, Bristow MR, Fowler MB, et al. Guidelines for the evaluation and management of heart failure. *Circulation* 1995;92:2764-2784. American Heart Association Scientific Statement.
††Adapted from Prystowsky EN, Benson DW, Fuster V, et al. Management of patients with atrial fibrillation. *Circulation* 1996;93:1262-1277. American Heart Association Scientific Statement.

ease may reflect the nonprescription status of aspirin, the most widely used agent in this class. Physicians may recommend aspirin to their patients but not record it as a prescription, or they may do so once and not renew the prescription regularly.

Outcome measures and PPRNet patient outcomes are presented in Table 3. Notable here are (1) the common finding that a majority of patients do not achieve goal levels set by guidelines and (2) the wide variability among practices in the proportion of patients that have reached treatment goals. One third of patients with diabetes had well-controlled glycosylated hemoglobin and one quarter had poor control, with much worse control in some practices. At least 3 out of 5 patients in 10% of practices had glycosylated hemoglobin measurements greater than 9%. Only 38.1% of hypertensive patients' most recent blood pressure readings were in the normotensive range, although 10% of the practices had blood pressure controlled in 58.7% or more of their patients. One third of patients with CHD and a recent LDL-C measurement had reached the goal of less than 100 mg/dL, with twofold variability among practices in the proportion of patients who had achieved goal LDL-C values.

··· DISCUSSION ···

Several limitations of the present study must be acknowledged. First, data were obtained exclusively from the electronic medical records at each practice site. If sites did not record data on the measures studied in the electronic medical records, our findings may be underestimates of true adherence. Although a recent report documents that physical examination findings, laboratory tests, and immunizations are reliably reported in medical records,[11] this finding may not be applicable to electronic medical record systems. However, PPRNet recruitment policies and data analyses for the present study should have minimized the possibility of incomplete reporting bias. Practices are only eligible for PPRNet if they record essentially all patient visits, diagnoses, and medications in their electronic medical records. Practices that had no data on particular laboratory tests (eg, LDL-C) were excluded from practice-level analyses of these measures. In addition, reporting adherence ranges as 10th to 90th percentiles, as is done in Tables 2 and 3, minimizes the impact of practices with incomplete data for a particular measure.

Second, PPRNet sites may not be representative of all primary care physicians. Indeed, they are self-selected groups who choose to use electronic medical records and participate in a research network. However, the 48 primary care sites represented in this study are diverse geographically, in practice specialty, and in the gender of participating physicians. Because of this diversity, the breadth of the measures considered, and the study's timeliness, the present study adds to the existing body of literature on adherence to practice guidelines in primary care

Finally, the choice of a 3-month period of observation for monitoring adherence to several of the process variables presented in Table 2 is arguable. We chose this period because it reflects the usual frequency of PPRNet audits; it is also a commonly recommended interval for some of the process measures (eg, glycosylated hemoglobin monitoring) in diabetic patients. A longer period of observation might change the magnitude of adherence to some of the measures but would not likely change the variability among practices.

The findings of this study are comparable to others in documenting that many clinical practice guidelines for chronic illness are not followed for a majority of patients and that large majorities do not reach desired clinical outcomes. Nonetheless, there were interesting differences between our findings and those of other studies. Nearly 40% of patients with hypertension had normotensive blood pressure measurements, compared with fewer than 30% in earlier studies.[6] Nearly one third of CHD patients had LDL-C measurements lower than 100 mg/dL, more than twice the percentage found in other studies.[7,8] Control of glycosylated hemoglobin was better for patients in this study than in other reports.[12,13] On the other hand, the use of ACE inhibitors in patients with heart failure is lower in the current study than in previous reports.[5] Whether observed differences between our findings and those of previous studies are due to differences in the patient population, measurement issues, or true differences in clinical practice is uncertain.

What is clear is the great variability between PPRNet practices in adherence to practice guideline process measures and achievement of clinical outcomes. Some of the variability no doubt relates to differences between practices with respect to socioeconomic factors and disease severity among patients. For example, the distribution of patients with persistent versus intermittent asthma may differ among practices. Because antiinflammatory agents are indicated only for persistent asthma, the variability found in the use of these agents may be

due to this factor. However, it is unlikely that biases of this kind account for all the differences observed. Certain physicians may work harder at adhering to practice guidelines because of belief in the value of these guidelines or knowledge that their behavior is being measured. Future work is needed to determine what accounts for variability in guideline adherence among practices and what factors characteristic of "best practices" can be disseminated.

Research on how to bridge the gap between known ways to improve health and delivery of this care to patients is a crucial element of primary care

Table 3. Outcome Measures for Studied Conditions, First Quarter 1998

Condition	Practice Guideline Measure	Study Measure	Performance		
			Total No.	Outcome for All Patients	Range Among Practices*
Diabetes mellitus	Glycosylated hemoglobin level	Proportion of most recent measurements with glycosylated hemoglobin level < 7%	1673	32.6%	17.6–51.5%
		Proportion of most recent measurements with glycosylated hemoglobin level > 9%		26.5%	13.3–61.2%
Hypertension	Systolic BP and diastolic BP	Mean of most recent systolic BP and diastolic BP in all patients	62,368	127/77 mm Hg	121–137/ 72–80 mm Hg
		Mean of most recent systolic BP and diastolic BP in patients with a diagnosis of hypertension	14,119	142/82 mm Hg	135–147/78–86 mm Hg
	JNC VI BP stages† for all patients	Normotensive Stage 1 Stage 2 Stage 3	62,368	68.9% 21.8% 7.2% 2.1%	52.1–84.5% 13.2–30.8% 3.6–13.3% 0.7–4.2%
	JNC VI BP stages for patients with hypertension	Normotensive Stage 1 Stage 2 Stage 3	14,119	38.1% 37.7% 17.9% 6.3%	29.0–58.7% 30.8–43.5% 9.6–23.8% 2.3–10.0%
Hyperlipidemia in CHD‡	Total cholesterol level in CHD patients	Mean total cholesterol for most recent measurement	831	201 mg/dL	185–236 mg/dL
		Proportion of most recent measurements with total cholesterol < 160 mg/dL		15.6%	7.8–25 %
	LDL-C level in CHD patients	Mean LDL-C for most recent measurement (mg/dL)	571	119 mg/dL	107–154 mg/dL
		Proportion of most recent measurements with LDL-C < 100 mg/dL		32.4%	21.3–45.0%

BP = blood pressure; CHD = coronary heart disease; LDL-C = low-density lipoprotein cholesterol.
*The range reflects the 10th to 90th percentiles among practices.
†*The Sixth Report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC VI).* National Institutes of Health, National Blood Pressure Education Program, November 1997, NIH publication 98-4080.
‡Adapted from summary of the Second Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *JAMA* 1993;269(23):3015-3023.

research.[14] Different approaches using educational sessions, prompts, structured team care, and peer review have had variable success in improving several measures of care for diabetes[15,16] and hypertension.[17] Continuous quality improvement methods have been successful in improving clinical outcomes for diabetes[18] and other conditions, particularly when electronic medical records are used as improvement tools.[19,20] Information from this report can be used to illustrate areas requiring improvement. Ongoing monitoring of process measures and clinical outcomes can illustrate whether interventions designed to improve adherence with guidelines for chronic illness are effective.

··· CONCLUSION ···

Currently, PPRNet practices receive quarterly reports that include their individual practice data and summary data as provided here. At annual meetings and through ongoing communication with sites, the practice reports are modified to reflect physician input. Individual practices are beginning to use these data in their quality improvement efforts, and networkwide projects are contemplated. As a practice-based research laboratory, PPRNet is ideally suited to evaluate strategies designed to change physician behavior.

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