Clinical Quality Performance in U.S. Health Centers

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Objective. To describe current clinical quality among the nation's community health centers and to examine health center characteristics associated with performance excellence.

Data Sources. National data from the 2009 Uniform Data System.

Data Collection/Extraction Methods. Health centers reviewed patient records and reported aggregate data to the Uniform Data System.

Study Design. Six measures were examined: first-trimester prenatal care, childhood immunization completion, Pap tests, low birth weight, controlled hypertension, and controlled diabetes. The top 25 percent performing centers were compared with lower performing (bottom 75 percent) centers on these measures. Logistic regressions were utilized to assess the impact of patient, provider, and institutional characteristics on health center performance.

Principal Findings. Clinical care and outcomes among health centers were generally comparable to national averages. For instance, 67 percent of pregnant patients received timely prenatal care (national = 68 percent), 69 percent of children achieved immunization completion (national = 67 percent), and 63 percent of hypertensive patients had blood pressure under control (national = 48 percent). Depending on the measure, centers with more uninsured patients were less likely to do well, while centers with more physicians and enabling service providers were more likely to do well.

Conclusions. Health centers provide quality care at rates comparable to national averages. Performance may be improved by increasing insurance coverage among patients and increasing the ratios of physicians and enabling service providers to patients.

Key Words. Quality of care, primary care, community health, health care delivery

The Bureau of Primary Health Care (BPHC), in the Health Resources and Services Administration (HRSA), funds over 1,100 health centers to provide primary and preventive care to about 19 million underserved patients

throughout the nation (Health Resources and Services Administration). Under Section 330 of the Public Health Service Act, the federal Health Center Program has been serving vulnerable populations since 1965 and has been championed as a model delivery system for improving access to care and reducing disparities (Shi et al. 2001a,b; Shi et al. 2004, 2009; Proser 2005; Hadley, Cunningham, and Hargraves 2006; Shi, Stevens, and Politzer 2007).

The year 2008 marked the beginning of a program-wide clinical quality improvement initiative to measure and demonstrate quality of care across all BPHC-funded health centers (Health Resources and Services Administration). As part of this initiative, the Health Center Program now incorporates an array of performance measures into its annual data reporting activities, emphasizing a combination of indicators measuring both processes of care and health outcomes. The performance measures tracked by HRSA are consistent with those endorsed by the National Quality Forum, AQA Alliance (formerly the Ambulatory Care Quality Alliance), and other national quality organizations; are designed to address priority health conditions of HRSA safety-net populations throughout the life cycle; and are amenable to quality improvement. For instance, quality measures include indicators of screening for cervical cancer, which disproportionately affects vulnerable populations served by HRSA-funded health centers and for which early detection and care can significantly decrease mortality and improve 5-year survival. Other measures include access to prenatal care, low birth weight, age-appropriate immunizations, and chronic disease management indicators for diabetes and hypertension.

In years past, a number of studies have evaluated health centers' performance on quality-related indicators. This prior research found that health centers performed quite well with respect to prenatal care outcomes; specifically, rates of low birth weight in health centers were comparable or lower

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than other provider settings nationwide, despite the fact that health centers serve higher-risk groups (Politzer et al. 2001; Regan et al. 2003; Haq 2007). In addition, cervical cancer screening rates in health centers exceeded national rates, overall and for specific racial/ethnic and insurance groups (Regan, Lefkowitz, and Gaston 1999; Politzer et al. 2001; Regan et al. 2003; Shi and Stevens 2007; Dor et al. 2008; Shin et al. 2008; Shi et al. 2009). Health centers have also generally shown comparable performance in terms of childhood immunization rates (Schempf, Politzer, and Wulu 2003).

However, past research found room for improvement in performance in the management of chronic diseases. Studies of health center patients conducted 10 years ago suggested that only about 50 percent of patients with hypertension, and 40–60 percent of patients with diabetes, received appropriate care (Chin et al. 2000; Hicks et al. 2006). Quality improvement efforts, such as the various Health Disparities Collaboratives implemented within health centers, showed progress in diabetes-related prevention, screening, treatment, and monitoring activities, as well as cancer screening, while the collaboratives were in operation; however, no improvements were demonstrated in hypertension (Chin et al. 2004, 2007; Chien, Walters, and Chin 2007; Landon et al. 2007). There was also mixed evidence regarding the impact of these interventions on longer-term patient outcomes, such as control of glycated hemoglobin levels for diabetes and control of blood pressure for hypertension (Chien, Walters, and Chin 2007; Landon et al. 2007).

While informative, these studies may not serve as the best preface to the current state of clinical quality in health centers. Prior data sources date back at least 5 years, preceding the current quality improvement initiative at HRSA, and previous analyses often included regional rather than national data, possibly limiting the generalizability of the findings. To address this gap in the health center literature, this study sought to provide the most recent national analyses of clinical quality performance across health centers, using 2009 Uniform Data System (UDS) data from HRSA.

The purpose of this study was to provide a description of the current status of clinical quality among the nation's health centers, to compare the status with similar national measures, and to examine health center patient, provider, and institutional characteristics associated with performance excellence. We utilized 2009 data from the UDS, to which all health centers are required to submit a variety of aggregated information on an annual basis. Other studies have often included nonrandom and/or regional samples of health centers, but use of the UDS data enables the calculation of national

estimates. Finally, previous studies tended to focus on processes of care as indicators of quality rather than both processes of care and health outcomes.

METHODS

Data Sources

Analyses were conducted utilizing data from the 2009 UDS. The UDS is a tracking system requiring annual reporting from HRSA-funded health centers regarding a variety of information, including patient sociodemographic and diagnostic information, services provided, staffing, clinical indicators and health outcomes, utilization rates, costs, and revenues (Health Resources and Services Administration).

Some health centers submit aggregated center-level data on clinical quality performance measures compiled from manual chart reviews of a random sample of 70 patients (if the number of qualifying patients exceeds 70); if there are fewer than 70 patients who qualify (depending on criteria specified for each measure), data from all patients are aggregated through medical record abstractions. Health centers with electronic health records (EHRs) have the option to submit aggregated data on the universe of their patients for some or all of the performance measures.

In 2008, several quality-related clinical performance measures were introduced into the UDS reports for the first time, including data on hypertension control, diabetes control, and childhood immunization. The 2009 UDS provides recent data on 1,131 health centers serving about 18.8 million patients (Health Resources and Services Administration).

Through the Health Disparities Collaboratives, health centers have already had previous experience in collecting data on clinical quality measures. In addition, BPHC provides very specific instructions to health centers on the data submission requirements for reporting measures to the UDS. The UDS reporting manual also contains specific instructions on how to select a random sample, and health centers are expected to follow this methodology. BPHC also has additional strategies for increasing data validity, including annual data reporting trainings in partnership with Primary Care Associations in all states; a clinical consultation helpline which any health center can access if they require assistance in quality improvement or data collection activities; numerous data checks and screenings to identify and resolve any data discrepancies or outliers; one-on-one communications with health centers to ensure that all outliers are real or

that incorrect data entries are corrected; and sensitivity analyses to determine the impact of any data edits.

For the current study, we included all health centers that received any community health center funding; we excluded any health centers that received funding exclusively through the Health Care for the Homeless, Migrant Health Centers, or Public Housing Primary Care Health Centers programs (future analyses will examine these special population health centers). The final sample included 1,039 community health centers.

Measures

Outcomes. We examined selected clinical performance measures in health centers and assessed the impact of patient, provider, and institutional characteristics on these performance measures. Six quality measures were considered, including both processes of care and outcome measures. Process measures included access to prenatal care, defined as the percentage of pregnant women who began prenatal care in the first trimester; cervical cancer screening, defined as the percentage of women 24–64 years of age who received at least one Pap test in the past 3 years; and childhood immunization completion, defined as the percentage of children 2 years of age who received appropriate immunizations (i.e., seven-vaccine series for diphtheria, tetanus, pertussis, poliomyelitis, measles, hepatitis B, varicella, streptococcus pneumonia, and Haemophilus influenzae type b). Outcome measures included low birth weight, defined as the percentage of births less than 2,500 g; hypertension control, defined as the percentage of adults 18–85 years with diagnosed hypertension whose last blood pressure measurement was less than 140/90; and diabetes control, defined as the percentage of adults 18–75 years diagnosed with type 1 or 2 diabetes with most recent hemoglobin A1c (HbA1c) levels less than or equal to 9.0 percent. Clinical guidelines typically recommend HbA1c levels in the range of 6.5–7.0 percent as an indication of optimal diabetes control (American Diabetes Association 2010); however, a cut-off of 9.0 percent can also be used to indicate poor control. We opted to examine the more liberal threshold, in light of the fact that health center patients are likely to have complex disease and risk factor profiles which may potentially hinder disease management.

Covariates—Patient, Provider, and Institutional Characteristics. We considered various factors in selecting the covariates to be included in our analyses. First,

we considered all the variables that were statistically related to the various clinical performance measures in bivariate analyses. We also reviewed the literature for studies which had analyzed UDS data and identified variables which were found to have a significant impact on clinical quality and outcomes (Shi et al. 1994, 2000, 2001a,b, 2007; Shi, Lebrun, and Tsai 2010). We then considered problems relating to multicollinearity between variables and removed certain variables which were closely related to address this issue. We were also limited by the availability of certain data elements. While it is certainly plausible that specific variables might be relevant to specific models and not others, we were unable to include them if they were not collected in the UDS or if they included a high proportion of missing data elements. Considering all of these factors, we opted for a general model of clinical quality accounting for key patient, provider, and institutional characteristics, which would be relevant regardless of the specific measure and which would be of particular interest and policy relevance to BPHC.

Several patient characteristics were examined, including the proportion of health center patients who were minority patients (any racial/ethnic group other than non-Hispanic white), uninsured, low income (at or below 200 percent of the federal poverty level [FPL]), homeless and migrant and seasonal farmworkers, and who suffered from selected chronic conditions (i.e., primary diagnosis of diabetes, selected heart disease, hypertension, asthma, chronic bronchitis, emphysema, HIV, hepatitis B, or hepatitis C).

Provider characteristics included the number of physician full-time equivalents (FTE) per 10,000 medical patients, as well as number of enabling service provider FTE per 10,000 medical patients (dental and behavioral health patients were excluded from these calculations). Enabling service providers included case managers, patient/community education specialists, outreach workers, transportation staff, eligibility assistance staff, and language interpretation staff.

Institutional characteristics included net revenue, proportion of total health center revenue from services, health center size (large versus small), health center age (old versus new), data reporting method (EHR versus manual chart review), and number of sites per health center. Revenue from services (as opposed to grants) included payments from Medicaid, Medicare, other public insurance, private insurance, and out-of-pocket payments. Health center size was considered "large" if the number of patients was equal to or greater than the median number of patients per health center, and "small" if the number of patients was less than the median. Using median patient volume as a cut-off threshold afforded adequate

sample sizes in each category. Health centers were categorized as "old" if the health centers had received Section 330 funding from BPHC for 3 years or more and "new" if they had received funding for less than 3 years. The 3-year cutpoint was used because it is HRSA's expectation that newly funded health centers will reach full operational capacity within 2 years of receiving funding, and that the third year of funding will represent full operating capacity for a complete 12-month period. Data reporting method was dichotomized into centers that reported on a clinical measure using their EHR (for the universe of all patients) versus those that reported on a measure using manual chart reviews (on a random sample of patients). Data reporting method was not considered for two clinical measures (i.e., low birth weight, first-trimester prenatal care) because all health centers are required to submit data on the universe of their patients for these measures. Net revenue and number of sites were included as continuous variables.

Analysis

For each quality-related measure, the overall performance across all health centers was calculated, and overall health center performance rates were compared with national averages from various sources, including the National Health and Nutrition Examination Survey, National Health Interview Survey, National Immunization Survey, and National Vital Statistics System, Birth File (Hoerger et al. 2008; Egan, Zhao, and Axon 2010; National Center for Health Statistics 2010). These figures provided some benchmark comparison data to assess whether health center performance was within the range of national outcomes, despite the fact that health centers serve disproportionately more vulnerable patients.

Health centers in the top quartile of performance rates (hereafter referred to as "top performers") were compared with those below the top quartile (hereafter referred to as "lower performers"), with respect to the various patient, provider, and institutional characteristics. This cut-off provided sufficient sample sizes in the two comparison groups and emphasized a focus on the most successful health centers. Since low birth weight was the only negative outcome, it was reverse-coded to facilitate interpretations that would be consistent across all measures (i.e., health centers with the lowest rates of low birth weight were considered top performers). *T*-tests and χ^2 tests were used to determine whether the means or proportions for each variable were significantly different between top performers and lower performers. Logistic

regressions were conducted to examine the associations between these characteristics and performance measures, after adjusting for patient, provider, and institutional characteristics. *SAS* version 9.1 was used for all analyses.

RESULTS

Table 1 describes the patient, provider, and institutional characteristics for the sample of health centers in our analyses. Overall, over 90 percent of patients were low income (≤ 200 percent FPL) among health centers who reported income information, about 40 percent lacked insurance coverage, half were racial/ethnic minorities, and one quarter had at least one of a set of specified chronic conditions. The health centers included here served relatively few homeless and migrant and seasonal farmworker patients because centers that received funding exclusively from the Health Care for the Homeless or Migrant Health Centers programs were excluded from the analyses. On average, there were 5.61 physician FTEs per 10,000 medical patients and 7.77 enabling service provider FTEs per 10,000 medical patients. The mean net revenue was $4.6 million, and two-thirds of health centers' revenues came from payment for services, from various public or private insurance payers or from patients' self-payments (with the remaining third coming from HRSA grants or other grants and contracts). On average, there were about 6 clinic sites per health center. Because the health center size variable was based on median number of patients, half of all centers were by definition considered large and half were small. About 13 percent of health centers had been receiving BPHC funding for less than 3 years. Between 12 and 23 percent of health centers used EHRs to report clinical data to the UDS, depending on the measure of interest.

Table 2 summarizes the overall performance rates and interquartile ranges across all health centers for each performance measure. Performance rates for the top-performing health centers (i.e., top quartile) are also included. For benchmarking comparison purposes, national averages are shown as well. In general, the majority of health center patients received appropriate care. With respect to process of care measures, 69.0 percent of children were up to date on immunizations, 67.3 percent of pregnant patients received prenatal care in the first trimester, and 58.5 percent of female patients had a recent Pap test. Regarding outcome measures, 71.0 percent of diabetic patients had controlled HbA1c levels (<9.0 percent), 63.3 percent of hypertensive patients had blood pressure less than 140/90, and 7.3 percent of all births in health

Table 1: Patient, Provider, and Institutional Characteristics across Health Centers (n = 1,039) UDS 2009

	Mean	*SE*
Patient characteristics		
% of minority patients	49.37	0.99
% of uninsured patients	38.61	0.58
% of patients $\leq$ 200% FPL*	91.39	0.35
% of homeless patients	2.88	0.23
% of migrant and seasonal farmworker patients	2.91	0.30
% of patients with chronic conditions[†]	24.07	0.33
Provider characteristics		
Physician FTE per 10,000 medical patients[‡]	5.61	0.10
Enabling service provider FTE per 10,000 medical patients[‡,§]	7.77	0.31
Institutional characteristics		
Net revenue ($ in millions)	4.60	0.32
% of total revenue from services[¶]	65.94	0.46
Number of clinic sites	6.49	0.22
	n	*%*
Size		
Large (# patients $\geq$ median # patients per health center)	520	50.05
Small (# patients < median)	519	49.95
Age		
New (< 3 years of BPHC funding)	140	13.47
Old ($\geq$ 3 years)	899	86.53
Data reporting method for clinical measures		
Childhood immunization completion		
EHR	129	12.42
Manual chart review	910	87.58
Cervical cancer screening		
EHR	185	17.81
Manual chart review	854	82.19
Hypertension control		
EHR	206	19.83
Manual chart review	833	80.17
Diabetes control		
EHR	236	22.71
Manual chart review	803	77.29

*Almost 25 percent of the health centers had missing income information in their UDS reports; income relative to FPL is based on the 75 percent of the sample that reported income.
[†]Chronic conditions include diabetes, selected heart disease, hypertension, asthma, chronic bronchitis, emphysema, HIV, hepatitis B, or hepatitis C.
[‡]Medical patients include individuals who had at least one visit for medical care services during the reporting year.
[§]Enabling service providers include case managers, patient/community education specialists, outreach workers, transportation staff, eligibility assistance staff, and language interpretation staff.
[¶]Revenue from services includes payments from Medicaid, Medicare, other public insurance, private insurance, and out-of-pocket payments.
BPHC, Bureau of Primary Health Care; EHR, electronic health records; FPL, federal poverty line; FTE, full-time equivalent; SE, standard error.

Table 2:   Clinical Performance among Health Centers, UDS 2009

Performance Measure	Measure Definition	Overall Health Center Performance Rate* (Mean, Interquartile Range)	Performance Rate among Top Performers[‡]	National Average
Processes of care				
Prenatal care	Pregnant women receiving care in first trimester	67.3 (20.5)	85.4	68.3[‡]
Child immunization completion	Children with seven-vaccine series at 2 years of age	69.0 (30.0)	88.7	67.0[§,¶]
Cervical cancer screening	Women 24–64 years with at least one Pap test in past 3 years	58.5 (30.8)	80.5	75.1[**,††]
Outcomes				
Low birth weight	Births <2,500 g	7.3 (5.5)	3.2	8.3[‡‡]
Hypertension control	Adults 18–85 years with diagnosed hypertension and blood pressure <140/90	63.3 (16.3)	78.3	50.1[§§,¶¶]
Diabetes control	Adults 18–75 years with diagnosed diabetes and HbA1c $\leq 9\%$	71.0 (15.7)	84.9	87.6[¶¶,***]

Note. Values are expressed in percentage.
* *Source:* 2009 Uniform Data System.
[†]Top performers are health centers that report the top 25 percent performance rates.
[‡] *Source:* National Vital Statistics System, Birth File, 2006 (National Center for Health Statistics 2010).
[§] *Source:* National Immunization Survey, 2007 (National Center for Health Statistics 2010).
[¶]National average includes children 19–35 months.
[**] *Source:* National Health Interview Survey, 2008 (National Center for Health Statistics 2010).
[††]National average includes women 18 years and older.
[‡‡] *Source:* National Vital Statistics System, Birth File, 2006 (National Center for Health Statistics 2010).
[§§] *Source:* National Health and Nutrition Examination Survey, 2007–2008 (Egan, Zhao, and Axon 2010).
[¶¶]National average includes adults 18 years and older.
[***] *Source:* National Health and Nutrition Examination Survey, 2003–2004 (Hoerger et al. 2008).

centers were low birth weight. Health center performance rates were comparable to national rates for prenatal care, childhood immunizations, and low birth weight; higher for hypertension control; and lower for Pap tests and diabetes control.

Table 3 presents comparisons between top-performing health centers and lower performing health centers for the various clinical quality indicators. Patient, provider, and institutional characteristics differed significantly between these two groups, depending on the indicator of interest. For three indicators (prenatal care, hypertension control, diabetes control), larger proportions of uninsured patients and low-income patients were found in the lower performing health centers, compared with top-performing centers. Health centers with lower performance in diabetes control also had larger proportions of homeless patients and patients with chronic conditions relative to top performers. Results were mixed regarding racial/ethnic composition: health centers with a larger proportion of minorities were lower performers for prenatal care, low birth weight, and diabetes control, but health centers with a larger proportion of minorities were top performers for cervical cancer screening and childhood immunizations.

Top-performing health centers for all three processes of care (i.e., prenatal care, cervical cancer screening, and childhood immunizations) had higher physician FTE per 10,000 patients than lower performing centers. In addition, for cervical cancer screening, top-performing health centers had higher enabling service provider FTE per 10,000 patients, compared with lower performing centers.

Top-performing health centers in prenatal care and diabetes control also received a larger proportion of their total revenue from payments for services (as opposed to grants), compared with lower performers. On the other hand, top performers for low birth weight (i.e., lowest rates of low birth weight) as well as for diabetes control had smaller net revenues than lower performers for those indicators. Smaller revenues are likely linked to smaller center size, which was also associated with better performance on these measures.

For most measures (except cervical cancer screening and hypertension control), top-performing centers had fewer average numbers of clinic sites than lower performers. In addition, a greater proportion of small health centers than large health centers were top performers for prenatal care, low birth weight, and diabetes control. However, large health centers were more frequently top performers for cervical cancer screening. Newer health centers were more frequently in the top performers for prenatal care than older centers. Finally, centers that used manual chart reviews to report their data were

Table 3: Bivariate Analyses of Clinical Performance Measures: Patient, Provider, and Institutional Characteristics among Top versus Lower Performing Health Centers, UDS 2009[†]

	First-Trimester Prenatal Care		Low Birth Weight		Childhood Immunization Completion		Cervical Cancer Screening		Hypertension Control		Diabetes Control	
	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)
Sample size	174	523	171	511	251	776	261	773	258	775	286	746
Patient characteristics												
% of minority patients	44.8 (2.82)***	59.9 (1.22)***	50.8 (2.51)**	58.6 (1.33)**	59.1 (1.97)***	46.2 (1.13)***	60.5 (2.01)***	45.4 (1.11)***	50.5 (2.13)	48.8 (1.12)	36.0 (1.97)***	54.1 (1.09)***
% of uninsured patients	31.2 (1.29)***	40.2 (0.77)***	38.7 (1.47)	37.8 (0.77)	38.1 (1.20)	38.7 (0.66)	38.3 (1.25)	38.7 (0.66)	36.0 (1.17)*	39.4 (0.67)*	31.7 (1.01)***	41.2 (0.68)***
% of homeless patients	2.3 (0.40)	3.3 (0.32)	3.0 (0.46)	3.1 (0.32)	3.5 (0.63)	2.7 (0.22)	3.1 (0.59)	2.8 (0.23)	3.0 (0.52)	2.9 (0.25)	1.7 (0.33)**	3.3 (0.28)**
% of patients ≤200% FPL	89.9 (0.88)***	93.0 (0.42)***	91.0 (0.88)	92.8 (0.43)	92.3 (0.66)	91.2 (0.4)	92.3 (0.7)	91.1 (0.40)	91.2 (0.67)	91.4 (0.41)	88.7 (0.75)***	92.4 (0.38)***
% of farmworker patients	4.4 (1.11)	3.4 (0.43)	4.3 (0.94)	3.4 (0.47)	3.7 (0.73)	2.6 (0.31)	3.6 (0.79)	2.6 (0.29)	2.9 (0.57)	2.9 (0.35)	2.0 (0.44)	3.2 (0.37)
% of patients with chronic conditions	23.2 (0.73)	22.5 (0.4)	21.7 (0.73)	22.8 (0.4)	24.6 (0.71)	23.8 (0.37)	23.8 (0.64)	24.2 (0.38)	24.3 (0.66)	24.0 (0.38)	25.4 (0.61)*	23.6 (0.38)*
Provider characteristics												
Physician FTE per 10,000 medical patients	6.2 (0.22)*	5.6 (0.11)*	6.1 (0.22)	5.7 (0.11)	6.0 (0.17)***	5.4 (0.09)***	6.0 (0.17)*	5.50 (0.13)*	5.8 (0.16)	5.6 (0.13)	5.8 (0.17)	5.6 (0.13)

continued

Table 3. *Continued*

	First-Trimester Prenatal Care		Low Birth Weight		Childhood Immunization Completion		Cervical Cancer Screening		Hypertension Control		Diabetes Control	
	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)	Top Performers Mean (SE)	Lower Performers Mean (SE)
Enabling service provider FTE per 10,000 medical patients	8.4 (0.96)	8.1 (0.34)	8.3 (0.79)	8.2 (0.39)	7.7 (0.64)	7.5 (0.29)	9.5 (0.69) ***	7.2 (0.34) ***	7.4 (0.49)	7.9 (0.38)	7.2 (0.66)	8.0 (0.35)
Institutional characteristics												
Net revenue ($, in millions)	5.2 (1.02)	6.2 (0.51)	3.8 (0.31)**	6.8 (0.62) **	4.1 (0.28)	4.8 (0.41)	5.6 (0.79)	4.30 (0.33)	5.0 (0.70)	4.5 (0.36)	3.5 (0.42) *	5.1 (0.41) *
% of total revenue from services	69.8 (1.20)*	66.9 (0.61)*	66.6 (1.21)	68.3 (0.60)	67.0 (0.86)	65.9 (0.53)	65.7 (0.97)	66.16 (0.51)	66.8 (0.86)	65.8 (0.53)	69.0 (0.82) ***	65.0 (0.54) ***
Number of clinic sites	6.1 (0.49)**	8.1 (0.35)**	6.1 (0.45)***	8.3 (0.37)***	5.6 (0.34)**	6.8 (0.27)**	6.4 (0.45)	6.5 (0.25)	7.0 (0.48)	6.4 (0.25)	5.5 (0.35)**	6.9 (0.27)**
	% Top Performers		% Top Performers		% Top Performers		% Top Performers		% Top Performers		% Top Performers	
Size												
Large	22.4*		19.7***		27.0		29.8***		26.8		24.5*	
Small	29.6*		35.2***		21.9		20.6***		23.2		31.0*	

Table 3. Continued

	% Top Performers	% Top Performers	% Top Performers	% Top Performers	% Top Performers	% Top Performers
Age						
New	37.5*	29.4	24.8	23.0	22.6	22.5
Old	23.9*	24.7	24.4	25.6	25.3	28.5
Data reporting method						
EHR	N/A	N/A	19.4	15.7***	18.0**	22.5*
Manual chart review	N/A	N/A	25.2	27.3***	26.7**	29.3*

†Top performers are health centers that report the top 25 percent performance rates; lower performers are health centers below this threshold.
* $p < .05$;
** $p < .01$;
*** $p < .001$ for chi-square test or t-test.
EHR, electronic health records; FPL, federal poverty level; FTE, full-time equivalent; SE, standard error.

more frequently top performers than those that used EHRs, for cervical cancer screening, hypertension control, and diabetes control.

Table 4 presents the odds ratios (ORs) and 95 percent confidence intervals (CI) for the adjusted associations between performance on quality indicators and patient, provider, and institutional characteristics. For each performance measure, the outcome was coded as 1 = health center is a top performer versus 0 = health center is a lower performer (with lower performers serving as the reference group). The associations varied by clinical measure and independent variable, and no consistent patterns emerged across all quality indicators. In adjusted analyses, several patient characteristics were associated with top clinical performance among health centers: health centers with greater proportions of uninsured patients had lower odds of being top performers for prenatal care, hypertension control, and diabetes control. Centers with greater proportions of minority patients had higher odds of being top performers for childhood immunization and cervical cancer screening but also lower odds of timely prenatal care and diabetes control. In addition, a greater percentage of low-income patients was associated with lower odds of top performance for low birth weight.

Provider characteristics were also related to high performance. Specifically, higher physician FTE was associated with higher odds of performing well on childhood immunizations, and higher enabling service FTE was associated with higher odds of performing well on prenatal care, cervical cancer screening, and diabetes control. Finally, institutional characteristics were also significantly associated with top performance: having more sites per health center was associated with lower odds of top performance in prenatal care, childhood immunizations, and cervical cancer screening. Larger health centers had higher odds of performing well on childhood immunizations compared with small health centers. New centers had higher odds of performing well regarding timely prenatal care, but lower odds of performing well for diabetes control, relative to more established centers. Centers that reported data using manual chart reviews had higher odds of top performance than those that used EHRs, for cervical cancer screening, hypertension control, and diabetes control.

DISCUSSION

This study provides some insight into current performance on selected clinical quality measures for a critical component of the nation's safety-net system and

Table 4: Multivariate Logistic Regressions—Characteristics Associated with Top Clinical Performance among Health Centers, UDS 2009[†]

	Relative Odds of Being a Top-Performing Health Center, OR (95% CI)					
	First-Trimester Prenatal Care	Low Birth Weight	Childhood Immunization Completion	Cervical Cancer Screening	Hypertension Control	Diabetes Control
Patient characteristics						
% of minority patients (per 5%)[‡]	0.94*** (0.90–0.97)	0.97 (0.93–1.003)	1.07*** (1.04–1.11)	1.07*** (1.04–1.10)	1.02 (0.995–1.06)	0.92*** (0.90–0.95)
% of uninsured patients (per 5%)	0.88** (0.82–0.95)	1.05 (0.98–1.13)	0.99 (0.94–1.05)	0.97 (0.92–1.02)	0.94* (0.89–0.99)	0.90*** (0.85–0.95)
% of homeless patients (per 5%)	1.02 (0.86–1.20)	1.01 (0.88–1.16)	1.13* (1.02–1.26)	1.02 (0.91–1.14)	1.03 (0.92–1.15)	0.87 (0.73–1.04)
% of patients ≤ 200% FPL (per 5%)	0.91 (0.83–1.01)	0.90* (0.81–0.99)	0.98 (0.90–1.06)	1.01 (0.93–1.10)	0.99 (0.92–1.07)	0.95 (0.89–1.02)
% of farmworker patients (per 5%)	1.14** (1.04–1.24)	1.08 (0.99–1.18)	1.04 (0.95–1.13)	1.03 (0.95–1.12)	0.99 (0.91–1.08)	1.00 (0.90–1.11)
% of patients with chronic conditions (per 5%)	1.02 (0.92–1.15)	0.93 (0.83–1.04)	1.01 (0.93–1.09)	0.97 (0.90–1.05)	0.99 (0.92–1.07)	1.05 (0.96–1.13)
Provider characteristics						
Physician FTE per 10,000 medical patients	1.06 (0.98–1.16)	1.08 (0.997–1.18)	1.11** (1.04–1.19)	1.02 (0.97–1.06)	1.00 (0.95–1.04)	1.00 (0.95–1.05)
Enabling service provider FTE per 10,000 medical patients	1.03* (1.005–1.05)	1.00 (0.97–1.02)	0.99 (0.97–1.01)	1.02* (1.001–1.03)	0.99 (0.97–1.01)	1.02** (1.01–1.04)

Table 4. *Continued*

			Relative Odds of Being a Top-Performing Health Center, OR (95% CI)			
	First-Trimester Prenatal Care	*Low Birth Weight*	*Childhood Immunization Completion*	*Cervical Cancer Screening*	*Hypertension Control*	*Diabetes Control*
Institutional characteristics						
Net revenue ($, in millions)	0.99 (0.96–1.02)	0.97 (0.93–1.02)	0.98 (0.95–1.01)	1.01 (0.99–1.03)	0.99 (0.97–1.01)	1.00 (0.98–1.02)
% of total revenue from services	1.01 (0.99–1.03)	1.00 (0.98–1.02)	1.01 (0.998–1.03)	1.00 (0.98–1.01)	1.00 (0.98–1.01)	1.01 (0.99–1.02)
Number of clinic sites	0.96* (0.92–0.995)	0.98 (0.95–1.02)	0.96** (0.92–0.99)	0.97* (0.94–1.00)	1.02 (0.99–1.04)	0.97 (0.94–1.003)
Large (versus small)	1.13 (0.68–1.88)	0.62 (0.39–1.002)	1.56* (1.04–2.36)	1.42 (0.95–2.11)	1.11 (0.75–1.63)	0.91 (0.61–1.36)
New (versus old)	2.43* (1.18–4.99)	1.13 (0.56–2.30)	1.52 (0.92–2.52)	1.07 (0.64–1.80)	1.22 (0.75–1.99)	0.52* (0.31–0.87)
Manual chart review (versus EHR)	N/A	N/A	1.66 (0.98–2.82)	2.35*** (1.45–3.81)	1.54* (1.01–2.33)	1.82** (1.21–2.72)

†Comparing the odds of health center being a top performer (top 25 percent) versus lower performer (bottom 75 percent). Reference group is the lower performers.
‡Represents the increase (or decrease) in relative odds of a given performance measure, for every 5 percent increase in the proportion of health center patients who are minorities.
*p < .05;
**p < .01;
***p < .001.
CI, confidence interval; EHR, electronic health records; FPL, federal poverty level; FTE, full-time equivalent; OR, odds ratio.

highlights characteristics associated with better performance on those measures. In general, health centers performed relatively well in achieving national clinical quality benchmarks. Evaluated against national averages, health centers performed similarly on most performance indicators, and in some cases even better. For instance, health centers had comparable rates to national averages for childhood immunization completion (69 percent versus 67 percent), first-trimester prenatal care (67 percent versus 68 percent), and low birth weight (7.3 percent versus 8.3 percent) (National Center for Health Statistics 2010). Health centers also had higher rates of hypertension control compared with national rates (63 percent versus 50 percent) (Egan, Zhao, and Axon 2010). Considering that health centers serve a disproportionate number of the nation's uninsured, low-income, and minority populations, performance on these indicators suggests that health centers are effective primary care providers for the vulnerable populations they are mandated to serve. Furthermore, health centers' performance provides further support for the proposition that they could function as health care delivery models during health care reform, particularly for providers in other primary care settings who may see an increasing number of underserved patients.

Other health center quality measures were below national averages, including timely cervical cancer screening and diabetes control. In the current study, about 59 percent of health center patients received at least one Pap test in the past 3 years, compared with 75 percent of women nationally (National Center for Health Statistics 2010). The lower rates of cervical cancer screening among health center patients may result from many of their patients electing to go to other sources for their Pap tests (e.g., local health departments, STD clinics), where such services are provided free of charge. This may be particularly true for the large proportion of health center patients who are uninsured and expected to pay for the services out-of-pocket. Health centers may attempt to obtain documentation of Pap tests received elsewhere to ensure complete medical records, but this is not always feasible. Therefore, a patient who received a Pap test outside the health center may not be recorded as having received the screening if the health center cannot confirm the procedure. It is likely that the true Pap test rates among health center patients are in fact higher than indicated in the current analyses.

While rates of controlled diabetes were lower in health centers (71 percent) than the national rates (88 percent; Hoerger et al. 2008), positive diabetes outcomes are notoriously difficult to achieve, particularly among high-risk populations such as the patients served by health centers. Research in Veterans Affairs and managed care settings indicates that even with good clinical

processes, glycemic control may not necessarily follow because clinicians often have little influence over what their patients do outside the health care setting regarding diet, exercise, medication adherence, and self-care (Mangione et al. 2006; Trivedi et al. 2011). More intensive outreach and support efforts may be needed to improve diabetic patients' outcomes.

The study findings also indicate that certain patient, provider, and institutional characteristics are associated with better clinical performance. Some of these factors are amenable to intervention, thus offering potential avenues for further improvement in clinical quality within the health center program. For example, increasing the ratios of physician and enabling service provider FTEs to patients could potentially increase health centers' performance on childhood immunizations, prenatal care, cervical cancer screening, and diabetes control, by increasing clinical capacity to provide processes of care as well as increasing support for outreach efforts. In addition, increasing the proportions of patients who have insurance (perhaps through Medicaid expansions) could positively impact health centers' performance on prenatal care, hypertension control, and diabetes control. Of course, simply increasing insurance coverage may not suffice to overcome other socioeconomic factors that serve as barriers to quality health care and positive health outcomes.

Our analyses included a variable for the proportion of patients who were racial/ethnic minorities, meaning patients from any group other than non-Hispanic white. Given the heterogeneity of this group and the mixed findings of our analyses, it is difficult to draw meaningful conclusions about the effects of race/ethnicity on clinical quality. However, health centers should be mindful that the demographic and socioeconomic composition of their patient populations may have an effect on clinical quality performance and that targeted outreach may help address the needs of these population groups. In the future, analyses similar to these may enable policy decisions based on patient risk profiles and clinical performance.

In this analysis, between 12 and 23 percent of health centers used EHRs to report on the 2009 clinical measures (depending on the measure). This is a reflection of the fact that health centers are currently in the process of implementing and developing their EHRs, and these rates are expected to increase in future years. In fact, more recent data indicate that 65 percent of health centers had an EHR system in place by the end of 2010, and 77 percent of these reported using their EHRs to compile data for at least one UDS measure in 2010 (Wittie, Segebrecht, and Ngai 2011). Health centers that used EHRs to report data to the 2009 UDS performed worse than those that used manual chart reviews. There are several possible explanations for this finding. For

instance, EHRs reflect all patients in the universe, whereas chart reviews represent a sample of patients, which may potentially be biased. Although the UDS instruction manual directs health centers to select a random sample of patients across all their clinical practice sites, selection bias may have occurred if they preferentially sampled patients from better-performing sites. Alternatively, it is possible that health centers in fact performed less well in spite or because of EHR use. Additional research is needed to further explore this finding. For example, future analyses could compare both data reporting methods within the same site to determine whether there are indeed differences in clinical performance due to data collection methods.

There are several limitations to bear in mind when interpreting the results of this study. First, this analysis used health center-level data rather than individual patient-level data; therefore, any associations are subject to ecological fallacy. The inferences drawn from these results are at best suggestive of associations and are not indications of causation. Additional analyses using individual-level patient data would be necessary to draw more conclusive findings.

There was variation in data reporting across health centers. Some health centers reported information on all patients using EHRs, while most reported on a sample of patients using manual record abstraction. Sample selection during chart reviews may not have been consistent or generalizable to the health center population at large. However, the UDS reporting manual also contains specific instructions on how to select a random sample, and health centers are expected to follow this methodology. In addition, while most or all health centers reported on most measures, data on prenatal care and low birth weight were only reported by two-thirds of health centers because the remaining centers did not provide or assume primary responsibility for their patients' prenatal care. Therefore, we do not have information on prenatal measures for patients who visited health centers for certain primary care services but sought prenatal care elsewhere.

For these analyses, we were unable to tease out the mixed performance results for minority subpopulations. Future analyses are planned to examine health center performance among specific racial/ethnic groups, which may help to explain these varied findings. The literature indicates that compared with non-Hispanic whites, non-Hispanic blacks have relatively high rates of cervical cancer screening (Adams, Breen, and Joski 2007; Rakowski et al. 2011), Hispanics have higher rates of childhood immunization (Schempf, Politzer, and Wulu 2003; Kim et al. 2007), and both blacks and Hispanics have lower utilization of prenatal care(Alexander, Kogan, and Nabukera

2002; Gavin et al. 2004; Ruwe et al. 2010), as well as worse outcomes for diabetes control (Egede et al. 2011; Trivedi et al. 2011). The UDS also lacks data on clinical and management leadership within health centers, which may also influence clinical performance and the success (or lack thereof) of quality improvement efforts. Qualitative investigations are needed to identify the management-related factors that promote better performance.

Clinical performance rates among health centers should be compared with national averages with the stipulation that there were some differences in the measurement criteria between the two settings. Specifically, the relevant age groups defined for each measure and data years were slightly different for health centers and for the United States at large, therefore performance rates apply to slightly different populations.

Despite these limitations, the 2009 UDS is the most comprehensive, national description of the health center program. These new clinical quality data provide a unique opportunity to examine clinical performance within a critical component of the safety-net system for medically underserved populations. Data collection on quality measures has only just begun in the Health Center Program. Future data collection cycles will enable trend analyses and confirm the current findings.

Health Resources and Services Administration has a history of pursuing various solutions to improve clinical quality in health centers. In the late 1990s, the agency initiated the Health Disparities Collaboratives to improve chronic disease management throughout the nation's health centers, and by the mid-2000s over 90 percent of health centers were participating in the collaboratives (Chin et al. 2004, 2007; Candib 2007; Chien, Walters, and Chin 2007; Landon et al. 2007). Collaboratives were created to focus on specific conditions which disproportionately affect health center patients, including diabetes, cardiovascular diseases, asthma, cancer, and depression. They incorporated team-based approaches and community partnerships, best practices learning sessions, and health information technology to support rapid quality improvement. This approach is now being applied to new initiatives which address other important health concerns, such as obesity (National Initiative for Children's Healthcare Quality's 2011). More recently, HRSA launched efforts to support health centers in obtaining recognition as patient-centered medical homes, which emphasize a team-based approach to patient care. Continued tracking of clinical outcomes through the UDS will serve to provide some indication of the impacts of these types of efforts on the quality of care in health centers.

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