DISEASE MANAGEMENT
Volume 11, Number 3, 2008

DOI: 10.1089/dis.2007.0011

Disease Management Programs for the Underserved

Ronald Horswell, Ph.D.,[1] Michael K. Butler, M.D.,[1] Michael Kaiser, M.D.,[1] Sarah Moody-Thomas, Ph.D.,[2] Shannon McNabb, M.A.,[3] Jay Besse, B.S.,[4] and Amir Abrams[2]

Abstract

Disease management has become an important tool for improving population patient outcomes. The Louisiana State University Health Care Services Division (HCSD) has used this tool to provide care to a largely uninsured population for approximately 10 years. Eight programs currently exist within the HCSD focusing on diabetes, asthma, congestive heart failure, HIV, cancer screening, smoking cessation, chronic kidney disease, and diet, exercise, and weight control. These programs operate at hospital and clinic sites located in 8 population centers throughout southern Louisiana. The programs are structured to be managed at the system level with a clinical expert for each area guiding the scope of the program and defining new goals. Care largely adheres to evidence-based guidelines set forth by professional organizations. To monitor quality of care, indicators are defined within each area and benchmarked to achieve the most effective measures in our population. For example, hemoglobin A1c levels have shown improvements with nearly 54% of the population <7.0%. To support these management efforts, HCSD utilizes an electronic data repository that allows physicians to track patient labs and other tests as well as reminders. To ensure appropriate treatment, patients are able to enroll in the Medication Assistance program. This largely improves adherence to medications for those patients unable to afford them otherwise. (*Disease Management* 2008;11:145–152)

Introduction

Approximately 10 years ago, the Louisiana State University (LSU) Health Care Services Division (HCSD) was created when the LSU System acquired management responsibility for the Louisiana state public hospital and clinic system. Today the HCSD is the largest provider of health care to Louisiana's uninsured citizens and serves a large insured clientele. Among the first actions taken by the HCSD was the inauguration of a disease management (DM) initiative to improve outcomes among patients with chronic illnesses. High-volume, high-cost diseases were the initial targets, and within the first few years of operation, the HCSD launched the following 5 DM programs (shown with current patient population sizes):

1. Adult diabetes (22,624 current patients),
2. Asthma (2,199 current patients),
3. Systolic congestive heart failure (1,767 patients),
4. HIV (3,708 patients),
5. Screening for breast, cervical, and prostate cancers (136,441 total eligible patients).

More recently, the HCSD has added 3 new programs:

6. Smoking cessation,
7. Chronic kidney disease,
8. Diet, exercise, and weight control.

While the term "disease management" often is used to refer to programs whose objectives involve secondary prevention, 2 of the above new programs (smoking cessation and diet, exercise, and weight control) largely target primary prevention and risk factor modification. An additional risk factor modification program targeting blood pressure control is under development.

This paper describes the HCSD approach to operating its

[1]Louisiana State University Health Care Services Division, Baton Rouge, Louisiana 70809.
[2]Louisiana State University Health Sciences Center, School of Public Health, New Orleans, Louisiana.
[3]Pennington Biomedical Research Center, 6400 Perkins Road, Baton Rouge, Louisiana 70808.
[4]Louisiana State University Health Sciences Center, Baton Rouge, Louisiana 70809
Louisiana State University Health Care Services Division Disease Management Leads: Lee Arcement, M.D., John King, M.D., Thomas Ferguson, M.D.,Jolene Johnson, M.D., Mary Abell, M.D., and Lynn Besch, M.D.

DM and risk factor management programs and presents overall results.

Discussion

The prevalence of chronic disease is growing, with many people having more than 1 chronic condition. Care for chronic illnesses, such as diabetes mellitus, congestive heart failure (CHF), asthma, chronic kidney disease, and hypertension, has come to account for 75% of total annual health expenditures.[1]

In response to the growing prevalence and cost of chronic illnesses, DM programs of various types emerged in the 1990s. Initially, these programs focused primarily on drug therapy and adherence, but over the past decade the concept has expanded. DMAA: The Care Continuum Alliance (DMAA) now defines DM as "a system of coordinated health care interventions and communications for populations with conditions in which patient self-care efforts are significant." Today, DM programs typically include all or several of the following components:

- Population identification processes,
- Evidence-based practice guidelines,
- Collaborative practice models to include physician and support-service providers,
- Patient self-management education (may include primary prevention, behavior modification programs, and compliance/surveillance),
- Process and outcomes measurement, evaluation, and management,
- Routine reporting/feedback loop (may include communication with patient, physician, health plan and ancillary providers, and practice profiling).[2]

In addition, health information technology now greatly influences the structure and operations of DM programs. For example, Kaiser Permanente has developed a Chronic Care Model that provides for electronic patient registries, evidenced-based guidelines, patient self-management support, and decentralized on-site consultation.[3,4]

Ideally, a DM program would improve health outcomes while reducing costs of delivering care (ie, the ideal program would achieve improvements in both health outcomes and cost). When Villagra and Ahmed measured the effectiveness of DM in diabetes mellitus care, they found improved intermediate health outcomes (as evidenced by decreased glycosated hemoglobin A1c [HbA1c] levels) and improved care processes (as evidenced by increased use of angiotensin-converting enzyme inhibitors), as well as a reduction in cost. The cost reduction largely stemmed from a 22% to 30% reduction in patient hospitalizations.[5]

However, programs may be valuable even if only 1 type of improvement is achieved. That is, a successful program might (a) improve health outcomes while holding cost constant or (b) lower costs while maintaining health outcomes at previous levels. For example, Galbreath et al evaluated a CHF program and found improvements in New York Heart Association (NYHA) class and decreased mortality, but with no significant reduction in cost.[6]

Public hospital systems are faced with the task of improving patient health outcomes within limited budgets; therefore, it is not surprising that such systems have gravitated toward DM approaches. Nationally, public hospitals and health care systems provide health care to patients regardless of their ability to pay. While sometimes termed "safety-net" organizations, these facilities provide essential services including primary care, trauma care, and specialty care and educate a substantial proportion of the nation's doctors, nurses, and allied health professionals.

Program structure and management

The LSU HCSD consists of hospital and clinic complexes at 8 population centers in Louisiana (Fig. 1), and is headquartered in Baton Rouge. The DM programs are coordinated at the LSU HCSD system level. Each program has a system-wide clinical lead, an expert clinician who oversees the DM effort, helps identify appropriate clinical indicators and benchmarks against which to measure success, and assists each site to achieve targeted improvements. Most clinical leads also are physicians practicing at one of the HCSD sites.

Each HCSD DM area is supported by systematic measurement that assesses both process performance outcomes and health outcomes. The constructs to be measured are defined by the area's clinical lead. Each construct is then measured by 1 or more defined measures. Table 1 shows constructs currently measured within the HCSD disease management programs and selected related measures.

An HCSD Health Care Effectiveness Team works under the direction of the HCSD Chief Medical Officer to create and support infrastructure needed by the DM programs; such infrastructure needs include development of health information technology applications, development of measurement systems, and assistance in developing and promulgating evidence-based guidelines.

System-wide meetings are held each quarter, usually in Baton Rouge, at which time progress in DM programs is reviewed, the 8 sites report on their successes in improving care, and new goals are defined for the DM programs.

Measurement

As noted earlier, each HCSD DM area is supported by systematic measurement assessing both process performance and outcomes. Many, but not all, of the measures used by the LSU HCSD are versions of standard measures found in nationwide systems, such as the measures used by the National Committee for Quality Assurance's Health Plan Employer Data and Information Set (HEDIS) and the Centers for Medicare and Medicaid Services (CMS). Because it is a provider system, the LSU HCSD cannot define population-based measures of quality and access using exactly the same algorithms as used by HEDIS and CMS, as those algorithms are based on continuous insurance coverage. A provider system such as HCSD does not have sufficient information on patient insurance history to use such algorithms exactly as they are defined. In addition, a majority of the HCSD patient population is uninsured and, therefore, would be overtly excluded from any insurance coverage-based indicator algorithm. As an alternative, the LSU HCSD, like many other provider systems, uses algorithms that estimate population membership rather than define it based on insurance coverage history.

FIG. 1. Louisiana State University Health Care Service Division hospital and clinic sites.

HCSD calculates and reports measures quarterly, so as to allow close tracking of changes. Fig. 2 shows a concise way of presenting results for 1 measure (in this case, the fraction of diabetes patients with HbA1c <7%.) The graph shows the values for this measure over 7 years (28 quarters), from the first quarter of 2000 through the fourth quarter of 2006. Results are shown for each of the 8 HCSD sites individually, and for the system as a whole.

Although not a formal analysis, the graph visually portrays several key types of information about HbA1c status for the diabetes patient population, including current HbA1c levels, temporal trends, and degree of variation across sites. This particular measure shows considerable improvement over time (higher levels are better) for the HCSD system as a whole and across most facilities. The facilities that show little improvement are those that had relatively high performance levels initially (and still are among the higher sites.) The horizontal line drawn across the graph at .58 is a form of internal benchmark/target. Specifically, it is a "pared mean"[8] whose approximate interpretation is that of a performance level presumed achievable because it has been achieved by HCSD sites that serve at least 10% of the diabetes patient population.

Many of the targeted DM performance measures are either at a high level or show improvement over time. However, this is not uniformly the case. Fig. 3, for example, depicts the fraction of diabetes patients with blood pressure lower than 130/80 mmHg. Blood pressure control remains an elusive goal among diabetes patients and more generally in the HCSD patient population, creating the motivation for the blood pressure control program now under development.

While Figs. 2 and 3 show results by site and for the entire HCSD system, the measures also can be summarized by clinic and by physician, if appropriate. Also, while the figures show results of measures calculated for the entire HCSD diabetes patient population, the measures also are routinely calculated for subgroups of interest, such as the subgroup of diabetes patients who had primary clinic encounters in the most recent 3 months.

Information technology

The LSU HCSD uses an internally-developed electronic data repository called CLIQ (for clinical inquiry), a Web-based result reporting application and clinical user interface. CLIQ provides clinicians with an easily used entry point to patient data. CLIQ's Web-based deployment allows clinician interface from most Web-enabled computers.

CLIQ organizes data from multiple systems into a clinically intuitive, patient-centric format (Fig. 4). Altogether, CLIQ maintains a total of 16 real-time data interfaces from clinical and administrative feeder systems. In addition, CLIQ accepts information entered by clinicians and clinics, including progress notes, blood pressure, height, weight, and confirmation of diagnoses relevant to DM programs. The interface network has streamlined the clinician's ability to access data, improve continuity of care, and facilitate preventive care.

Since CLIQ was first deployed on March 26, 2003, it has

Table 1. Current LSU HCSD Disease Management Indicators

	Construct	*Measure*
Diabetes	Frequency of HbA1c testing	% with HbA1c test in past 6 months
	Frequency of lipid testing	% with lipid profile in past year
	Frequency of eye exams	% with dilated eye exam in past year
	Frequency of renal assessment	% with microalbumin test (or creatinine if on ACE) in past year
	HbA1c control	% with HbA1c < 7%
	Lipid levels	% with LDL < 120 mg/dl
	Appropriate use of aspirin	% on aspirin
	Frequency of foot exams	% with foot exam in past year
	Blood pressure control	% with blood pressure less than 130/85
	Regular clinic visits	% with primary care clinic visit in past 3 months
Congestive Heart Failure	Appropriate use of ACE inhibitors	% on ACE inhibitor
	Appropriate use of beta-blockers	% on either Carvedilol or Metoprolol
	Avoid inappropriate use of Ca channel blockers	% on an inappropriate Ca channel blocker
	Avoid inappropriate use of NSAIDS	% on NSAIDS
	Hospital admission rate	# of admissions per 1000 patients over past 3 months
	Blood pressure control	% with blood pressure less than 130/80
	Avoid inappropriate use of antiarhythmics	% on an inappropriate antirrhythmic medication
	Use of emergency department (ED)	# of ED visits per 1000 patients over past 3 months
	Regular primary care (or cardiology) visits	% with primary care (or cardiology) visit in past 3 months
Asthma	Hospital admission rate	# of admissions for respiratory diagnoses per 1000 patients over past 3 months
	Use of ED	# of ED visits for respiratory diagnoses per 1000 patients over past 3 months
	Appropriate use of corticosteroids	% of patients on a corticosteroid
	Use of action plans for patients	% of patients with an action plan
	Appropriate use of beta-agonists	% of patients on a beta agonist
	Assessment by peak flow testing	% of patients with a peak flow test in past 2 years
	Regular assessment of severity	% with severity assessed in past 3 months
HIV	Regular HIV clinic visits	% with HIV clinic visit in past 3 months
	Hospital admission rate	# of hospital admissions per 1000 patients over past 3 months
	Appropriate PCP prophylaxis	% on PCP prophylaxis medication among those with CD4 count < 200
	Appropriate MAC prophylaxis	% on MAC prophylaxis medication among those with CD4 count < 50
	Frequency of viral testing	% with viral load test in past 6 months
	Frequency of CD4 testing	% with CD4 test in past 6 months
	CD4 level	% with CD4 > 200
	Screening for tuberculosis	% with PPD placed and read in past year
	Appropriate medication	% on 3+ antiretroviral medications among those with CD4 < 200
Cancer Screening	Screening for breast cancer	% of women age 40+ with screening mammogram in past year
	Screening for cervical cancer	% of women age 18+ with PAP test in past year
	Screening for prostate cancer	% of men age 40+ with PSA test in past year
Tobacco	Identification of smokers	% of adults clinic visitors who are smokers
	Referral of smokers	% of smokers referred to Tobacco Control Program

LSU, Louisiana State University; HCSD: Health Care Services Division; PCP, pneumocystis pneumonia; MAC, mycrobacterium avium complex; ACE, angiotensin-converting enzyme; NSAID, nonsteroidal anti-inflammatory drug.

expanded to cover all 8 LSU HCSD sites, as well as 6 prison sites, 3 community clinics and wellness centers, as well as numerous public health clinics throughout the state of Louisiana. The network serves approximately 1,000 users daily, providing them with access to over 8 million results for over 300,000 unique patients. Over 3,500 log-ins occur daily with over 8,500 records accessed.

One of the newer additions to CLIQ is a "prevention page display" which summarizes a patient's risk factors and DM related information for easy clinician appraisal. The "prevention page display" appears on screen when a clinician first accesses a patient's information on CLIQ, and it is organized to serve as a reminder system for various indicated tests. The features and information on the prevention page continually evolve; the current version of the prevention page includes information such as:

- Latest blood pressure (with an ability to graph blood pressure history),
- Latest weight and body mass index (BMI; with an ability to graph BMI history),
- Date of last mammogram (for women age 40+),

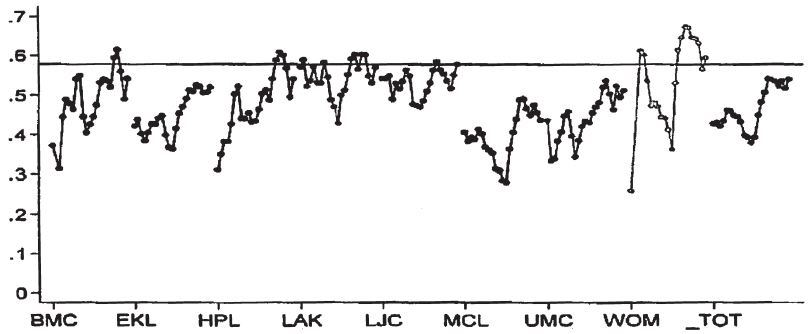

FIG. 2. Fraction of adult diabetes patients with HbA1c < 7% by site over time.

- Date of last prostate-specific antigen (PSA) test (for men age 40+),
- Dates of last HbA1c tests and lipid tests, and
- Current smoking status.

Fig. 5 shows an example of the patient summary for a hypothetical female patient with CHF and diabetes mellitus. The prevention page also serves as a means by which clinicians can confirm diagnoses of chronic diseases (eg, diabetes, CHF) and thereby confirm identification of patients in LSU HCSD DM patient populations. Clinicians can access additional detailed information and patient history from the prevention page display (see menu items on left side and along top of Fig. 5).

The prevention page is constantly evolving. First added to CLIQ in June 2006, the page now contains smoking status and may soon incorporate influenza immunization status as well.

Medication assistance program

For low-income, uninsured patients the lack of resources to purchase medications creates noncompliance, relapse, and worsening conditions, ultimately leading to increased emergency department visits and, on some occasions, hospitalization. For this reason, the HCSD created a medication assistance program that facilitates the linking of qualifying patients to pharmaceutical company programs which provided free or discounted medications. (For most pharmaceutical programs, qualifying patients are those with incomes below 200% of the poverty level.) This service has led to improved clinical outcomes, such as improved HbA1c levels for diabetes patients.[9]

Results

Table 2 shows results over time for the major process and outcomes measures used by the HCSD's initial 5 DM programs (diabetes, CHF, HIV, asthma, and cancer screening.) For each measure, the table shows the average level of the measure in the first year of program operation and in the most recent ("last") year of program operation. These results are shown for the entire DM population, and separately for that portion of the population that is uninsured. All results have been adjusted for age, race, and (if applicable) gender; specifically, results are adjusted by direct standardization to the demographic composition of the patient population over the most recent year of operation.

The results in Table 2 show improvement across many measures and across all disease areas, and the improvements have occurred among uninsured patients as well as in the population more generally. Among the notable improvements within the diabetes patient population are the increases in the percentage of patients with HbA1c levels <7% (from 44% to 54%), the percentage of patients with LDL <120 mg/dl (38% to 54%), and the increased used of aspirin (39% to 58%.)

Within the CHF population, use of carvedilol or metoprolol rose (58% to 89%), while quarterly inpatient admissions fell (from 257 to 124 per 1000 patients) as did quarterly ED visits (from 457 to 265 per 1000 patients). It should be noted, however, that HCSD's measures of admissions and

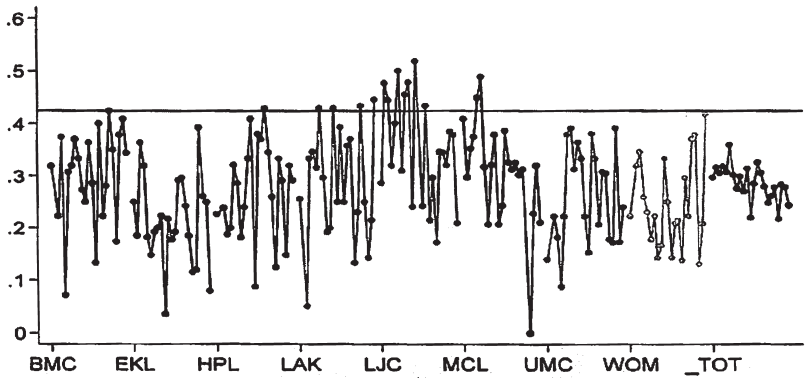

FIG. 3. Fraction of adult diabetes patients with blood pressure < 130/80 mmHg by site over time.

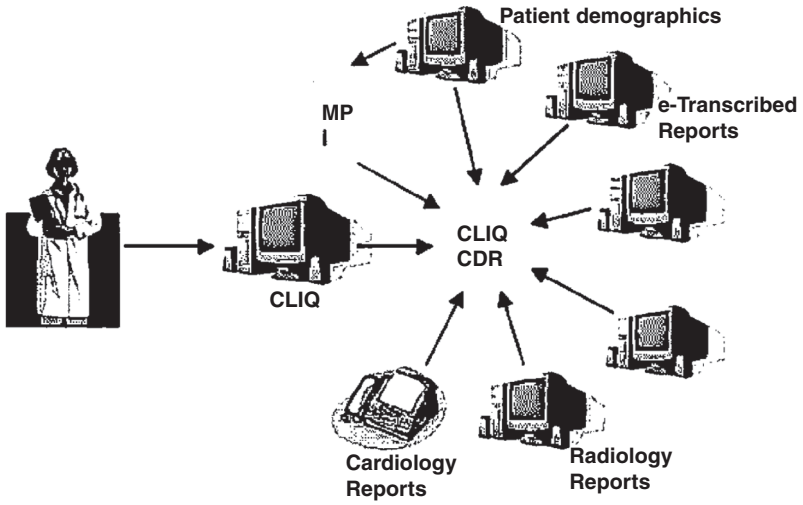

FIG. 4. CLIQ date acquisition layout.

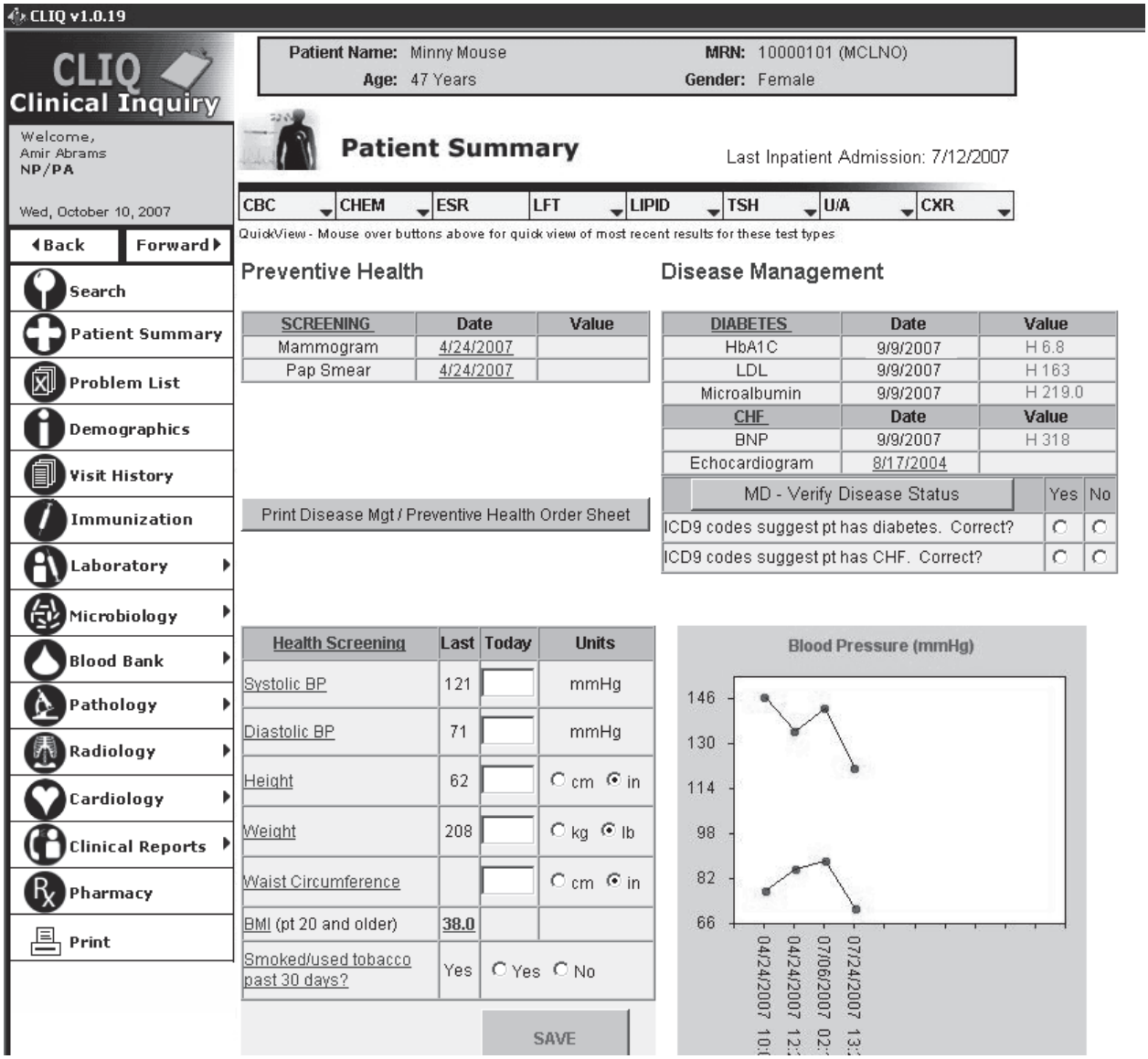

FIG. 5. CLIQ patient summary page.

TABLE 2. DISEASE MANAGEMENT MEASURES: CHANGES FROM FIRST YEAR OF PROGRAM IMPLEMENTATION TO MOST RECENT YEAR

	Total population		*Uninsured*	
	First year	*Last year*	*First year*	*Last year*
Diabetes-related measures				
% with HbA1c test in past six months	0.56	0.55	0.59	0.57
% with lipid profile in past year	0.6	0.65*	0.63	0.66*
% with dilated eye exam in past year	0.31	0.37*	0.34	0.39*
% with renal assessment in past year	0.52	0.74*	0.54	0.74*
% with HbA1c < 7%	0.44	0.54*	0.39	0.49*
% with LDL < 120 mg/dl	0.38	0.54*	0.36	0.50*
% on aspirin	0.39	0.58*	0.37	0.61*
% with foot exam in past year	0.24	0.48*	0.23	0.50*
% with blood pressure less than 130/85	0.33	0.29	0.3	0.29
CHF-related measures				
% on ACE inhibitor	0.89	0.93*	0.91	0.94
% on either Carvedilol or Metoprotol	0.58	0.89*	0.57	0.90*
% on Ca channel blocker other than	0.02	0.02	0.03	0.02
% on NSAIDS	0.05	0.03	0.04	0.02
# of admissions per 1000 patients over past 3 months	257	124*	232	126*
% on blood pressure less than 130/85	0.53	0.41**	0.49	0.38**
# of ER visits per 1000 patients over past 3 months	457	265*	490	299*
Asthma-related measures				
# of admissions for respiratory diagnoses per 1000 patients over past 3 months	18	11*	15	7*
# of ER visits for respiratory diagnoses per 1000 patients over past 3 months	191	187	201	174
% of patients on a corticosteroid	0.73	0.81*	0.78	0.81
% of clinic visitors in past 3 months with current action plan	0.6	0.84*	0.66	0.92*
% of patients on a beta agonist	0.79	0.92*	0.81	0.91*
% of patients with a peak flow test in past 2 years	0.4	0.43	0.51	0.49
% of patients on a leukotrene modifier	0	0.45*	0	0.44*
% of clinic visitors in past 3 months with current severity assessment	0.71	0.89*	0.74	0.92*
HIV-related measures				
% with HIV clinic visit in past 3 months	0.65	0.66	0.67	0.66
# of hospital admissions per 1000 patients over past 3 months	79	69	62	52
% on PCP prophylaxis medication among those with CD4 count < XXX	0.73	0.76	0.76	0.82
% on MAC prophylaxis medication among those with CD4 count < XXX	0.6	0.66	0.6	0.77*
% with viral load test in past 6 months	0.62	0.59	0.62	0.6
% with viral load undetectable	0.37	0.50*	0.4	0.50*
% with CD4 test in past 6 months	0.66	0.65	0.64	0.67*
% with CD4 > 200	0.74	0.75	0.79	0.79
% women with PAP test in past year	0.02	0.39*	0.02	0.45*
% on 3+ antiretroviral medications	0.49	0.68*	0.46	0.70*
Cancer screening measures				
% of women age 40+ with screening mammogram in past year	0.31	0.37*	0.32	0.39*
% of women age 18+ with PAP test in past year	0.13	0.36*	0.13	0.38*
% of men age 40+ with PSA test in past year	0.19	0.25*	0.17	0.21*

*Statistically significant improvement from first to last year ($p < 0.05$); **Statistically significant deterioration from first to last year ($p < 0.05$).

ED visits include only events occurring at HCSD hospitals, so that those measures underestimate actual inpatient and ED activity to some degree.

In the asthma population, there have been increases in the use of corticosteroids (73% to 81%), beta-agonists (79% to 92%), and leukotriene modifiers (0% to 45%). The percentage of patients visiting clinics who were given action plans increased (60% to 84%) as did the percentage with current severity assessments (71% to 89%). Meanwhile, quarterly admissions for respiratory diagnoses fell (from 18 to 11 per 1000 patients.)

Among HIV patients, the percentage of patients with CD4

<50 who were on 3 or more antiretroviral medications increased from 49% to 68%, and the percentage of patients with undetectable viral loads increased from 37% to 50%. Also, the percentage of patients with CD4 <50 on mycrobacterium avium complex (MAC) and pneumocystis pneumonia (PCP) prophylaxis appears to have increased, especially among uninsured patients.

With regard to cancer screening, there were statistically significant increases in the percentage of women age 40+ who had a mammography in the past year (from 31% to 37%), the percentage of women age 18+ with a Papanicolaou (PAP) test in the past year (13% to 36%), and the percentage of men age 40+ with a PSA test in the past year (19% to 25%).

Certainly, the improvements shown in Table 2 cannot be unambiguously attributed to HCSD's DM programs. Undoubtedly other factors were involved as well. And, as evidenced by the levels of the measures, as well as by variation across HCSD sites and clinics (not shown in Table 2), considerable room for improvement remains in most measures. Indeed, not all the results shown in Table 2 are positive. In particular, the percentages of CHF and diabetes patients with blood pressure lower than 130/85 has either decreased or, at best, remained stable at fairly low levels.

Overall, however, Table 2 illustrates the generally positive direction of process and outcomes measures. In the future, the number of measures within each area will expand to provide coverage of more process and outcomes constructs, and the measurement activity will expand to include new HCSD programs.

Conclusion

Disease management and evidence-based clinical programs can be successfully implemented within public hospital/clinic systems (so-called "safety-net" institutions). Comprehensive measurement of processes and outcomes, aggressive development of health information technology systems, and an integrated approach to management of the programs contributes to their success. At the HCSD, the concept of "disease management" is expanding to include programs designed to address major risk factors, such as tobacco use and hypertension.

Author Disclosures

The authors disclosed no conflicts of interest.

References

1. Hoffman C, Rice D, Sung HY. Persons with chronic conditions. Their prevalence and costs. *JAMA*. 1996;276:1473–1479.
2. DMAA: The Care Continuum Alliance. Definition of disease management. Available at: http://www.dmaa.org/dm_definition.asp. Accessed June 21, 2007.
3. Wagner EH, Austin BT, Von Koriff M. Organizing care for patients with chronic illness. *Milbank Q*. 1996;74:511–544.
4. McCulloch D, Price M, Hindmarsh M, Wagner E. Improvement in diabetes care using an integrated population-based approach in a primary care setting. *Dis Manag*. 2000;3:75–82.
5. Villagra VG, Ahmed T. Effectiveness of a disease management program for patients with diabetes. *Health Aff (Millwood)*. 2004;23:255–266.
6. Galbreath AD, Krasuski RA, Smith B, Stajhuhar KC, Kwan MD, Ellis R, Freeman GL. Long-term healthcare and cost outcomes of disease management in a large, randomized, community-based population with heart failure. *Circulation*. 2004; 110:3518–3526.
7. Zaman O, Lukens E, Cummins L. *America's Public Hospitals and Health Systems, 2004: Results of the Annual NAPH Hospital Characteristics Survey*. Washington, DC: National Association of Public Hospitals and Health Systems; 2006.
8. Kiefe CI, Weissman NW, Allison JJ, Farmer RM, Weaver M, Williams OD. Identifying achievable benchmarks of care: concepts and methodology. *Int J Qual Health Care*. 1998;10:443–447.
9. Horswell RL, Johnson JK, Wascom CK, Cerise FP. Diabetes mellitus medication assistance program: Relationship of effectiveness to adherence. *Journal for Healthcare in the Poor and Underserved*. In press.

Address reprint requests to:
Ronald Horswell, Ph.D.
LSU Health Care Services Division
P.O. Box 91308
Baton Rouge, LA 70821-1308

E-mail: rhorsw@lsuhsc.edu