## In Brief

Providing diabetes patients all of the care recommended by current guidelines is a clinical challenge. Geisinger Health System has designed a provider-led, team-based system of care to more consistently and reliably meet this challenge. This system of care uses an all-or-none bundle of diabetes measures and electronic health record tools to improve both process measures and intermediate diabetes outcomes.

# Redesign of a Diabetes System of Care Using an All-or-None Diabetes Bundle to Build Teamwork and Improve Intermediate Outcomes

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There is growing recognition and expectation that electronic health records (EHRs) can be used to facilitate patient care and, in particular, management of patients with multi-morbid conditions. Diabetes, an increasingly common disease among primary care patients, poses many care management challenges. Diabetes among older patients in particular is often associated with numerous other chronic conditions. The American Diabetes Association (ADA) and other organizations have published detailed, evidence-based recommendations for effective management of patient outcomes, including medical care from a physician-coordinated team.[1] However, the provision of state-of-the-art guideline care is rarely achieved.[2] At Geisinger Health System (GHS) in Danville, Pa., we developed a bundled protocol for primary care physicians (PCPs) to facilitate the delivery of such care.

Providing guideline-based care is challenging, especially for PCPs. Each day, PCPs see patients with diverse medical conditions. Although published evidence-based guidelines exist for many of these conditions, it is impossible for PCPs to stay current with all guidelines, to recall the specific guidelines that are relevant to each patient, and to act on all relevant guidelines.

Evidence supports this gap. For example, one study showed that only

54.9% of recommendations actually were provided to adults in the United States.[3] One reason for the gap in care is the time required to fulfill all recommended guidelines. Providing just the recommendations for chronic medical conditions to a panel of 2,500 patients each year would take 10.6 hours of each working day.[4] An additional 7.4 hours per day would be required for preventive recommendations, and 4.6 hours per day would be needed for providing acute care.[5,6] Clearly, this cannot be the work of one physician; a team-based model of care that functions in a reliable and accountable manner is required.

Delivering guideline-based care is especially challenging for patients with multi-morbid conditions, for whom expert knowledge on several conditions and a coordinated team-based approach is recommended.[7] EHRs can be used to facilitate a coordinated approach to care and to embed guideline-based clinical decision support within the care coordination protocol. Bundled care protocols are one EHR-based method that has been devised for primary care.

At GHS, we redesigned the approach to managing patients with diabetes in 2005 to include a nine-component all-or-none diabetes bundle. We describe here our experience in developing and deploying the bundled protocol at the GHS clinics. We describe how the bundling process led to more reliable and accountable team-based service. The all-or-none bundle score and all nine process and mediating measures improved within the first year of implementation and consistently thereafter.[8] Our experience suggests that an all-or-none diabetes bundle can be an effective internal quality improvement tactic, offering a metric for achieving improved team-based care and improvements in intermediate outcomes in diabetes.

## System Overview

GHS is a physician-led, fully integrated health care system with nearly 800 employed physicians (about 200 of whom are PCPs handling 850,000 patient visits in 38 community clinics). The clinics serve a 31-county region with a population base of ~ 2.6 million people. The base population of GHS is stable. Census data indicate that with the exception of two counties, the out migration rate is < 1% per year.

In addition to the multispecialty physician group practice, GHS includes a large quaternary-care teaching hospital, and a hospital with two campuses—one an acute/tertiary/quaternary hospital to care for the most critically ill and injured patients and one that offers a variety of acute-care medical services requiring shorter hospital stays. The system also includes a full-service insurance company, although the percentage of our patient care reimbursed by our own insurance company accounts for ~ 30% of total patient care volumes.

GHS has built on its core competencies in redesigning systems of care by using an electronic registry derived from a fully integrated EHR introduced in ambulatory care in 1996. More than 3 million unique patient records are included in the EHR, along with a patient portal that allows > 150,000 patients to access their online medical records. The patient portal provides a means to communicate with patients, caregivers, and most importantly encourage patient activation and engagement through innovative patient report cards and other tools for chronic disease management.

## Methods

Each year, ADA updates its Standards of Medical Care for Diabetes guidelines.[1] These recommendations cover all aspects of diabetes care, including glucose monitoring, nephropathy screening, glycemic control, blood pressure control, lipid management, and immunizations.

All-or-none care measures that bundle a host of related care processes and outcomes offer a new approach to clinical process improvement. The all-or-none bundle measures the percentage of patients who achieve all of the recommended measures, rather than an average or composite of the individual measures. According to Nolan and Berwick[9] the all-or-none measurement improves performance by:

- More closely reflecting the interests and likely desires of patients
- Fostering a systems perspective encouraging concern with all aspects of the team care
- Offering a more sensitive scale for assessing improvements

An all-or-none bundle of measures for diabetes has been publicly

reported in Minnesota since 2004.[10] This bundle of measures, initially called Optimal Diabetes Care, is now also called the "D5" for the five measures included. The Wisconsin Collaborative for Healthcare Quality announced public reporting of a three-measure diabetes bundle in 2009.[11]

These bundle measures show how difficult it is to achieve multiple recommendations in individual patients. The Minnesota Optimal Diabetes Care measure averaged 16% of patients achieving all five measures for the reported medical groups in 2009 but had started at only 4% in 2004.[10] The Veterans Administration also reported that only 4% of 80,207 patients with diabetes had simultaneous control of A1C to < 7%, blood pressure to < 130/80 mmHg, and LDL cholesterol to < 100 mg/dl in 1999–2000.[12]

In 2005, GHS assembled a multispecialty, multidisciplinary work group to redesign the system of care for patients with diabetes. The work group defined nine measures that comprised the all-or-none diabetes bundle (Table 1).

In addition to this bundle, four other measures (yearly foot exam, yearly retinal exam, ACE inhibitor/angiotensin II receptor blocker [ARB] use in nephropathy, and ACE inhibitor/ARB use in hypertension) were considered but implemented at a later time given challenges with reporting outcomes in discrete EHR fields. These measures are now incorporated into our system of care for diabetes, but the diabetes bundle measure was kept at the original nine metrics. Aspirin use in patients with diabetes was not included as a bundle measure because it was reserved for integration with a cardiovascular risk management protocol to be implemented later.

The nine-measure all-or-none bundle is applied to all adults with diabetes (type 1 or type 2) and includes measures that will probably not be successfully fulfilled on every patient (such as the percentage of patients with diabetes who do not smoke). The bundle also includes outcome measures that may not be the goal for all patients, such as an A1C < 7%.

The pre-launch percentage of patients with diabetes ($n = 20,178$) with success on all bundle elements was surprisingly low (only 2.4%). This low level of success helped to motivate the physician group practice to redesign the system of care from a pro-

## Table 1. Components of the Geisinger All-or-None Diabetes Bundle

| Measures | Quality Standard |
|---|---|
| A1C measurement | Every 6 months |
| A1C control | < 7% |
| LDL measurement | Yearly |
| LDL control | < 100 mg/dl |
| Blood pressure control | < 130/80 mmHg |
| Urine protein testing | Yearly |
| Influenza immunization | Yearly |
| Pneumococcal immunization | Once before age 65, once after age 65 |
| Smoking status | Nonsmoker |
| Patients who receive/achieve ALL of the above | Diabetes bundle percentage |

vider-centric model to a team-based model with delegated, accountable responsibilities for all aspects of care. Tools and reminders were then created in the EHR to "hard wire" these improvements into place.

Specifically, we directed a cross-functional clinician-EHR optimization team to design care processes focused on EHR automation, team-based care, and patient engagement. An additional requirement of our redesign included the development of workflows that were measurable, scalable, reliable, and not dependent on the diligence of individual providers.

Today, our diabetes system of care includes automated patient registries, auto-generated patient report cards, and EHR decision support at the patient portal, clinic nurse, and provider levels. Patients may view and act on their own diabetes care between visits through the EHR patient portal. Care that can be provided outside the office is driven by reports from the registry to our call center to schedule needed tests, immunizations, and examinations. At office visits, clinic nurses and medical assistants are presented with decision support for all process-related diabetes care and act on alerts for influenza and pneumococcal immunizations, diabetes lab work, eye exam referrals, and diabetic foot screenings. Providers are presented with decision support for only those elements of diabetes bundle care that require complex medical decision making, including medication and lab result management.

Patient report cards are generated at office visits and can be used as a teaching tool. The individual metrics and all-or-none bundle result for each GHS office-based team and for each provider individually are reported monthly and shared transparently on our internal Infoweb.

Financial incentives were developed for all health care team members. Our initial goal for improvement was that each team would improve its own office all-or-none bundle by 1%. Financial incentives were given to all providers, nurses, and front office personnel whose teams met their all-or-none bundle goal. All site members had their bonus based on the same measure—the all-or-none bundle score.

## Results

In the first year of the diabetes bundle initiative, the percentage of patients with success on all nine measures who achieved the all-or-none diabetes bundle improved from 2.4 to 6.5%. There were statistically significant improvements in all individual metrics, including the intermediate outcomes of A1C, LDL, and blood pressure control, in the first year compared to the previous baseline year.[8] After the first year, the improvements on the process measures of lab specimen collection and immunization were sustained. The improvement in smoking status was likely a function of better documentation (since no documentation was considered the same as current smoking), and this was sustained. The three intermediate outcome measures (A1C < 7%, LDL < 100 mg/dl, and blood pressure < 130/80 mmHg) have continued to improve, causing the diabetes bundle percentage to rise to 13.1% (Table 2).

The all-or-none bundle does not offer information about how patients perform when they are not completely successful with all nine measures. We measured the percentage of patients who achieved from none to all nine of the bundle measures in each year. Although the diabetes bundle percentage rose < 5% in the first year, there was a dramatic shift in the curve, with many more patients achieving a greater number of bundle components. (Figure 1). This dramatic shift

## Table 2. Percentages of Adult Patients With Diabetes Who Had Success With All Elements of the Diabetes Bundle and Specific Bundle Processes From 2006 to 2010

| Diabetes Bundle Measure | March 2006 | March 2007 | January 2009 | January 2010 |
|---|---|---|---|---|
| All nine measures (all-or-none bundle) (%) | 2.4 | 7.2 | 11.3 | 13.1 |
| Influenza vaccination (%) | 57 | 73 | 73 | 74 |
| Pneumococcal vaccination (%) | 59 | 83 | 84 | 84 |
| Microalbumin test order (%) | 58 | 87 | 87 | 93 |
| A1C < 7% (%) | 33 | 37 | 45 | 47 |
| LDL < 100 mg/dl (%) | 50 | 52 | 59 | 62 |
| Blood pressure < 130/80 mmHg (%) | 39 | 44 | 48 | 51 |
| Documented nonsmokers (%) | 74 | 84 | 85 | 85 |
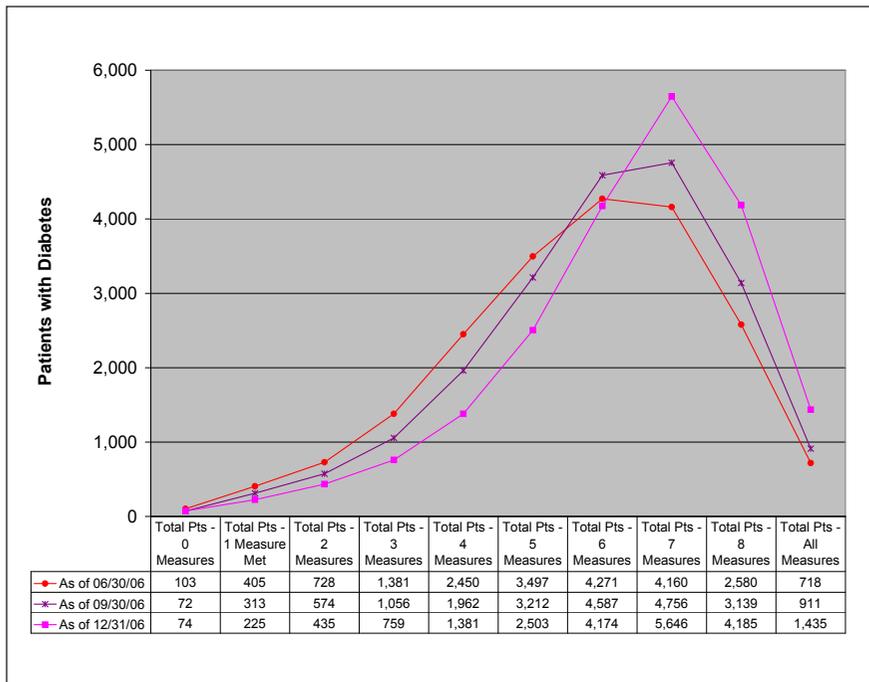
Figure 1. Diabetes bundle improvement in 1 year.

| | Total Pts - 0 Measures | Total Pts - 1 Measure Met | Total Pts - 2 Measures | Total Pts - 3 Measures | Total Pts - 4 Measures | Total Pts - 5 Measures | Total Pts - 6 Measures | Total Pts - 7 Measures | Total Pts - 8 Measures | Total Pts - All Measures |
|---|---|---|---|---|---|---|---|---|---|---|
| As of 06/30/06 | 103 | 405 | 728 | 1,381 | 2,450 | 3,497 | 4,271 | 4,160 | 2,580 | 718 |
| As of 09/30/06 | 72 | 313 | 574 | 1,056 | 1,962 | 3,212 | 4,587 | 4,756 | 3,139 | 911 |
| As of 12/31/06 | 74 | 225 | 435 | 759 | 1,381 | 2,503 | 4,174 | 5,646 | 4,185 | 1,435 |



Figure 2. Diabetes bundle improvement after 1 year.

| | Total Pts - 0 Measures | Total Pts - 1 Measure Met | Total Pts - 2 Measures | Total Pts - 3 Measures | Total Pts - 4 Measures | Total Pts - 5 Measures | Total Pts - 6 Measures | Total Pts - 7 Measures | Total Pts - 8 Measures | Total Pts - All Measures |
|---|---|---|---|---|---|---|---|---|---|---|
| As of 12/31/06 | 74 | 225 | 435 | 759 | 1,381 | 2,503 | 4,174 | 5,646 | 4,185 | 1,435 |
| As of 12/31/07 | 46 | 191 | 404 | 674 | 1,305 | 2,364 | 4,213 | 5,482 | 4,794 | 2,186 |
| As of 12/31/08 | 32 | 144 | 358 | 682 | 1,299 | 2,351 | 4,129 | 5,813 | 5,351 | 2,632 |
| As of 12/31/09 | 7 | 30 | 132 | 443 | 1,195 | 2,460 | 4,330 | 6,064 | 5,838 | 2,905 |

was driven by the improvement in all measures in the first year. After the first year, the shift in the curve continued, although more gradually because the improvement was based mainly on improvements in the three intermediate outcomes (Figure 2).

## Discussion

The GHS nine-component all-or-none diabetes bundle shows clearly how a physician group can have individual metrics for diabetes that are at or above national averages and still have a very low all-or-none bundle percentage. Teams who thought they were doing well were given new knowledge that many patients were not receiving all recommended care and were inspired to redesign care to achieve more consistent process results and intermediate outcomes.

A diabetes bundle percentage works well as an internal quality improvement metric but presents difficulties when used outside of an organization. The very low score is difficult to understand by the public and can be misinterpreted as poor diabetes care. This is especially true when there is no statewide or national comparison to use to benchmark performance.

Another reason to use a diabetes bundle as an internal organizational tool is that there is no consensus on the best components for diabetes bundle inclusion. There are at least 146 distinct measures in diabetes care,[13] and the way they are combined can have profound differences on the results.[14] The components that one organization would find most beneficial could be different from the components selected by another organization in a different stage of the improvement process.

Our findings show that our initial year of the program achieved a great deal of improvement in the process measures, and including these in the bundle provided rapid positive feedback to the group. Intermediate outcome improvement was more gradual but did drive the bundle improvements in later years, so that bundle improvement became almost completely related to improvement in intermediate outcomes.

The understanding that the entire population is achieving more consistent and reliable care, despite only small increases in the diabetes bundle percentage, assured providers concerned that the needs of patients who were not achieving the all-or-none bundle were being addressed. This more consistent, reliable care requires an accountable team-based approach. Having metrics in the bundle that reflected the work of all team members provided incentives to each team member and documented their accountability.

A valid criticism of this bundle is that not all the bundle goals apply to all patients. Patients with diabetes often have other medical conditions that might influence their guideline recommendations and goals. We are currently refining our measurement techniques to incorporate patient-specific goals for A1C, LDL, and blood pressure control and to exclude patients who would not benefit from aggressive treatment.

This diabetes bundle is a patient-centric bundle with the goals being the patients' goals rather than a group of process steps performed by team members. This created some initial

criticism about the fairness of the all-or-none diabetes bundle percentage for measuring team performance (i.e., "How can you hold me responsible if a patient will not quit smoking?"). By choosing appropriate, achievable goals for improvement (i.e., a 1% improvement), the patient-centric bundle measure can be used for all team members rather than focusing on individual measures or creating subsections of the bundle for each team member. The use of the single measure reinforces the need to work as a team.

Team-based incentives provide a larger "*n*" for measurement, encourage treatment of patients when cross-covering for another provider, and encourage peers to share best practices within teams. There can be unintended consequences of all-or-none measurement.[15] Team-based incentives can reduce some of these unintended consequences of measurement, such as the shuffling of patients not achieving their goals among team providers.

Studies of diabetes care redesign have shown that it is possible to achieve improvements in processes of care[16] and small to modest improvements in glycemic control.[17] There is also a report of reduced adverse health events (amputations, retinopathy, and myocardial infarction) with a diabetes disease management program.[18]

The redesigned GHS system of care for diabetes reported here has shown that clinical process redesign using a team-based model with optimization of the tools of an EHR and measurement with an all-or-none bundle of diabetes care metrics has resulted in sustained improvement in process measures and intermediate outcomes in our diabetic population.

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