TOP Project Evaluation Report

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Grant Title: Development of an Information System to Support Collaboration for Population-Based Health Care for Medicaid Beneficiaries

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Background

The goal of this TOP project was to design, develop, implement and evaluate a Web-based information system to promote sharing of information and coordination of care across traditional institutional boundaries for Medicaid beneficiaries in Durham County, North Carolina enrolled in the Carolina Access II (CAII) care management program. This project was conducted over a 4 year period extending from October 1, 1999 through September 30, 2003. Our TOP system, known by the acronym COACH (Community Oriented Approach to Coordinated Healthcare), brought together a care management organization (the Durham Community Health Network), two academically affiliated clinics (Duke Family Medicine Center and Duke Pediatrics), a federally qualified health center (Lincoln Community Health Center), two hospitals (Duke University Hospital and Durham Regional Hospital), three urgent care facilities, and two government agencies (the Durham County Health Department and the Durham County Department of Social Services).

COACH captures a broad array of information that can be categorized into four broad categories. 1. Administrative information: patient demographics, services used, encounter tracking, service utilization, and audit trails. 2. Care management information: health risk assessment, utilization risk assessment, services required, environmental factors, home assessment, special needs (e.g. language), and care management plans. 3. Clinical information: problems, medications, allergies, and disease-specific care plans. 4. Communication: messages, referrals, notices of new information, and care management alerts. This information can be accessed and manipulated through a Web interface, which is constructed on a Lotus Domino platform, by members of partner organizations who have been given accounts to COACH. In addition, a subset of this information can also be loaded on to a Palm-based personal digital assistant (PDA) to allow access to and entry of information in a remote setting (e.g., a patient's home). These data are also transferred on a nightly basis to a relational database (Microsoft SQL Server) for use in report generation and decision support. The system is fully

compliant with both the privacy and security regulations of the Health Insurance Portability and Accountability Act of 1996.

The project was conducted in three phases. In phase 1, the core infrastructure required for information collection and communication was established. This core system has been in active use since October of 2000. In phase 2, COACH was enhanced to import information from other systems. This data import mechanism has been operational since September of 2002 for importing encounter and billing data from the Duke IDX system on a daily basis. Daily data feeds from Durham Regional Hospital (DRH) should be available by the end of the first quarter of 2004, and a data feed from Lincoln Community Health Center (LCHC) should be available by summer 2004. In phase 3, we implemented a clinical decision support system to enable real-time monitoring of care based on data in the COACH database. This decision support system has been operational on a limited scale since fall 2003.

The evaluation of our TOP project was based on four primary hypotheses that sought to assess the impact of our TOP system on various facets of patient care. Table 1 lists each hypothesis along with the specific measures evaluated, the independent and dependent variables associated with each measure, and the data source for each hypothesis.

Methods

For each hypothesis, baseline data was collected during the 7 months prior to implementation of our TOP system (March 2000 to September 2000). Intervention data was then collected monthly over the remaining 36 months of the project, and performance measures were evaluated on a monthly basis. The actual length of the intervention period was dependent on the specifications of each measure. For example, the HEDIS measure for mammography specified that a full 2 years should be allotted for assessing compliance; therefore, we needed to allow 2 years before we could observe the full impact of the intervention, so that only 13 months were available for evaluating the impact of this measure.

We modeled the monthly fraction of responses using a generalized logistic model. We assumed that the impact of the TOP System would increase approximately linearly (in the log-odds of the fraction responding). We also assumed that there would be a seasonal effect, and we chose to model this effect with adjustment terms for the calendar month of the study. We realized that there may have been many other forces which had an effect on the response rate for any given month, but we had no way of measuring these unpredictable factors. The result is that there will be greater variation than expected in the monthly rates, a problem known as over-dispersion. To correct for this, adjustments for over-dispersion were made using GEE methods (see SAS/Stat.

Table 1. Summary of TOP Project Hypotheses and Measures

#	Original Hypotheses	Specific Measure	Independent Variables	Dependent Variables	Data Source
1	Implementation of the proposed system will significantly decrease the amount of time from the trigger events to initiation of care management	Percentage of patients for whom care management is initiated within 90 days of a trigger event (3 ED visits in 90 days, ED visit for asthma, ED visit for diabetes)	Date of 3rd ED visit in 90 days Date of ED visit for asthma Date of ED visit for diabetes	Date care management is initiated	State CAII enrollment file Encounter data from Duke (IDX) and DRH
2	Availability of the proposed system will reduce the time between enrollment in the Medicaid program to the completion of a complete physical examination on the new enrollee by the designated PCP	Percentage of patients for whom a visit at their assigned site occurs within 90 days following enrollment in the CAII program	Date of enrollment into the CAII program	Date of first occurrence of an appointment at beneficiary's assigned site after enrollment	State CAII enrollment file Encounter data from Duke (IDX) and LCHC
3	Implementation of the proposed system will decrease ED utilization and hospitalization for ambulatory care sensitive conditions (e.g. asthma and diabetes mellitus)	Percent of CAII patients with asthma or diabetes with an emergency room visit or hospitalization for asthma or diabetes	Number of CAII patients with asthma or diabetes	Number of ED visits and hospitalizations for asthma or diabetes	ED and admission data from Duke (IDX), Duke Hospital, and DRH
4	Availability of the proposed system will improve selected HEDIS measures	HEDIS scores	Number of CAII patients eligible for HEDIS-defined services	Immunization rates, access to primary care visits, access to well child visits, Chlamydia screening rates, mammography rates, Pap testing rates, and diabetes management measures (annual glycated hemoglobin, annual LDL cholesterol, annual urine microalbumin, and annual retinal exam)	State CAII enrollment file Encounter data from Duke (IDX) and LCHC

Software: Changes and Enhancements through Release 6.12, SAS Institute Inc., Cary, North Carolina, 1997, pp. 284-285). All analyses were done using SAS® PROC GENMOD

The coefficients derived from these models were converted to adjusted odds ratios by the following formula: OR = Exp[# Intervention Months * ß$_1$]. The baseline compliance rate was estimated as 1/(1 + Exp[-

$ß_0$]), where $ß_0$ is the intercept coefficient. The endpoint compliance rate was estimated as $1/(1 + Exp[-ß_0 - ß_1*(\#\ intervention\ months)])$. Sample size was calculated as the mean of the denominator for each measure during the entire evaluation period (pre-intervention + intervention).

The test for treatment (project) effect was made by testing the coefficient $ß_1$ using a Wald Chi Square test. 95% confidence intervals for the odds ratios were calculated from the asymptotic standard errors of $ß_1$ and the number of intervention months. These values are provided below.

Results

Hypothesis #1. Initiation of Care Management Following a Sentinel Event.

Description. We hypothesized that over time with the availability of the COACH system, the percentage of individuals who were enrolled in care management within 90 days following a sentinel event would increase. For this hypothesis, sentinel events were defined as the occurrence of a third emergency department (ED) encounter within 90 days, an ED encounter for diabetes, or an ED encounter for asthma.

Findings. We found no significant change in the initiation of care management following an ED encounter for asthma or for diabetes and a statistically significant decrease in the percentage of patients enrolled in care management following a third ED visit in 90 days (Table 2).

Table 2. Hypothesis #1 Results

Measure: Care Management Following Sentinel Event	Adjusted Odds Ratio	95% Confidence Interval	P-Value*	Months of Intervention	Average Monthly Sample Size	Baseline Compliance (%)	Projected Endpoint Compliance (%)
Care Management within 90 Days of ED Visit for Asthma	1.44	0.48-4.31	0.52	33	23	3.78	5.35
Care Management within 90 Days of ED Visit for Diabetes	0.26	0.06-1.06	0.061	33	6	24.23	7.61
Care Management within 90 Days of **Third ED Visit in 90 Days**	**0.11**	0.04-0.27	**<0.0001**	33	70	**13.25**	**1.59**

* P-values are not adjusted for multiple comparisons

Discussion. We postulate that two factors explain why we did not see a significant increase in the initiation of care management in response to sentinel events. First, as described in detail in the final report, the major shortcoming of our project was a lengthy delay in obtaining data from partner sites other than Duke. As a consequence, we did not have the data upon which to run our decision support system, which was designed to notify care managers when a sentinel event occurred. Thus, the intervention designed to impact the initiation of care management (i.e., hypothesis #1) was never fully in effect during the course of the project. Second, during

the TOP grant period, the number of enrollees in the Medicaid program increased by 50%, while the care management staff remained constant. As a consequence, with more work to do and no decision support available to help with the care process, the ability of the care managers to respond to sentinel events actually deteriorated over the course of the project. Fortunately, our efforts to obtain the necessary data from non-Duke sites are continuing, and we anticipate that we will be able to support care management in response to sentinel events in the future.

Hypothesis #2. New Enrollees Obtaining Timely Initial Visits at their Primary Care Sites.

Description. When the Durham Medicaid care management program known as Carolina Access II (CAII) was first established, one of the early goals of the program was that each enrollee obtains a comprehensive physical examination by his/her designated primary care provider within 3 months of enrollment. We anticipated that the decision support component of the COACH system could facilitate these appointments by notifying care managers of deficiencies prior to the 90-day target, e.g., if the appointment had not happened within 60 days. Specifically, we hypothesized that there would be an increase over time with respect to the percentage of enrollees who completed a visit at their PCP site within 90 days of initial enrollment into the CAII program.

Findings. We found that there was a statistically significant increase in the percentage of enrollees who had a visit at their PCP site within the 90 days following enrollment in the CAII program. (Table 3).

Table 3. Hypothesis #2 Results

Measure: Care Provision	Adjusted Odds Ratio	95% Confidence Interval	P-Value*	Months of Intervention	Average Monthly Sample Size	Baseline Compliance (%)	Projected Endpoint Compliance (%)
Visit at PCP Site within 90 Days of CAII Enrollment	**1.42**	1.20-1.69	**<0.0001**	33	395	**29.47**	**37.29**

* P-values are not adjusted for multiple comparisons

Discussion. We recognize that several factors in addition to the COACH system likely contributed to the statistically significant result for hypothesis #2. While the system increased general awareness of the collaborative community care program that promoted patient contact with their PCP site, as described above, the specific decision support system that was designed to impact this hypothesis was delayed in its implementation. As discussed above, once we establish the data import mechanism for all provider sites, we anticipate that the COACH decision support tool will be able to further increase the proportion of new enrollees who attain the goal of completing a visit at their PCP site within 90 days of enrollment.

Hypothesis #3. Emergency Department Utilization and Hospital Admission.

Description. Hypothesis #3 was developed to assess the impact of the COACH system on inappropriate utilization of care services by Medicaid enrollees. Specifically, we hypothesized that the availability of the system would lower ED utilization and hospitalizations for ambulatory care sensitive conditions. For the population in our program, we elected to focus specifically on diabetes and asthma.

Findings. Our results for this hypothesis showed a statistically significant decrease in ED utilization for asthma over time, but a statistically significant increase in ED utilization for diabetes. No statistically significant impact on hospitalization was found for either asthma or diabetes. (Table 4).

Table 4. Hypothesis #3 Results

Measure: Service Utilization	Adjusted Odds Ratio	95% Confidence Interval	P-Value*	Months of Intervention	Average Monthly Sample Size	Baseline Compliance (%)	Projected Endpoint Compliance (%)
ED Utilization for Asthma (% Monthly Use Among CAII Patients with Asthma)	**0.65**	0.51-0.84	**0.0011**	36	685	**4.55**	**3.02**
ED Utilization for Diabetes (% Monthly Use Among Diabetic CAII Patients)	**1.52**	1.10-2.12	**0.012**	36	205	**5.01**	**7.44**
Hospitalization for Asthma (% Monthly Use Among CAII Patients with Asthma)	1.43	0.74-2.75	0.29	36	685	0.54	0.77
Hospitalization for Diabetes (% Monthly Use Among Diabetic CAII Patients)	1.45	0.81-2.62	0.21	36	205	1.60	2.30

* P-values are not adjusted for multiple comparisons

Discussion. The significant decrease in ED utilization for asthma over the course of the project is potentially due to the COACH system, but also presumably reflects other factors as well. In the final months of the project, we operationalized the decision support system in COACH to send alerts to care managers when a Carolina Access II patient was seen in the Duke Hospital ED for asthma or for diabetes. While these alerts were very useful for identifying individuals who would benefit from care management, it is unlikely that the COACH system alone can be credited for the decrease in ED utilization for asthma, because the alerting system was not operational until the final months of the project. Additionally, we failed to see a similar favorable effect for diabetes, even though alerts were also sent for ED utilization for diabetes. Asthma was a major focus of the care management activities for the Carolina Access II program. It is likely that the educational and care management interventions targeted at asthma account for this decrease in ED utilization. The COACH decision

support tool is an ideal adjunct to these other efforts. The failure to see any impact on hospital admissions likely reflects the fact that no specific intervention was in place to impact this measure.

Hypothesis #4. HEDIS Measures of Care Quality.

Description. Hypothesis #4 was aimed at assessing the impact of the COACH system on the quality of care delivered to the patients enrolled in the Carolina Access II program. We elected to employ HEDIS measures as they are standard quality indicators used widely across the healthcare industry. Moreover, HEDIS measures could be evaluated using the electronic administrative data that were available to us. We elected to evaluate 4 metrics for diabetes (glycated hemoglobin, LDL cholesterol, urine microalbumin, and eye examination), 3 metrics for preventive care (Chlamydia screening, mammography, and cervical cancer screening), 5 metrics for access to care (PCP visits for patients aged 1 year, 2 to 6 years, and 7 to 11 years; well child visits for 15 month-olds; and well child visits for patients aged 3 to 6 years), and 6 metrics for immunizations (DTP, IPV, MMR, HIB, Hepatitis B, and VZV vaccinations for patients 2 years old).

Findings. For all of the HEDIS measures pertaining to diabetes, there was a statistically significant decrease in the rate of compliance over the course of the project (Table 5). Among the preventive care services, we observed a statistically significant increase in the rate of compliance with mammography, but not a significant change in the rate of Chlamydia screening. There was insufficient data for assessing our intervention's effect on Pap testing, as this metric required a full 3 years for assessing compliance. For access to services, 2 of the measures improved significantly over time (proportion of 1-year old patients who had at least 1 PCP visit in the past year and the proportion of 7-to-11 year olds who had at least one PCP visit in the past 2 years). One of the access to care measures (proportion of 3-to-6 year olds who had at least one well child visit in the previous year) declined over time. Finally, because of changes in how immunization data was captured electronically at the Duke-affiliated sites, reliable immunization data was not available at the 2 Duke clinics. Thus, the assessment of immunization rates was limited to the federally qualified health center in the partnership, and applied to only a small number of enrollees (average monthly sample size = 25). Consequently, no significant changes were detected in immunization rates.

Discussion. As was the case in the other evaluations, factors external to the COACH information system likely contributed to improved HEDIS measures, since alerts and reminders targeted to these measures were delayed to beyond the end of the project. The worsening performance with regards to diabetes care across all measures probably reflects additional stress on the care system through the influx of significantly more enrollees in the absence of a concomitant increase in the number of care managers. In the future, we plan to send reminders

Table 5. Hypothesis #4 Results.

Measure: Quality of Care as HEDIS Indicators	Adjusted Odds Ratio	95% Confidence Interval	P-Value*	Months of Intervention	Average Monthly Sample Size	Baseline Compliance (%)	Projected Endpoint Compliance (%)
Diabetes - HgbA1c Exam (1/yr)	**0.48**	0.38-0.61	**< 0.0001**	25	147	**64.14**	**46.17**
Diabetes - Eye Exam (1/yr)	**0.80**	0.75-0.86	**< 0.0001**	25	147	**18.71**	**15.56**
Diabetes - LDL Cholesterol Exam (1/yr)	**0.83**	0.70-1.00	**0.046**	25	147	**58.56**	**54.08**
Diabetes - Urine Microalbumin Exam (1/yr)	**0.81**	0.78-0.85	**< 0.0001**	25	147	**29.25**	**25.20**
Chlamydia Exam (1/yr)	1.02	0.89-1.16	0.77	25	774	11.40	11.60
Mammography (1/2yrs)	2.00	1.82-2.21	**< 0.0001**	13	149	**20.73**	**34.39**
Pap Testing (1/3yrs)	Insufficient data available						
PCP Visit - 1 yo (1/yr)	**1.40**	1.15-1.69	**0.0006**	25	974	**81.08**	**85.70**
PCP Visit - 2 to 6 yo (1/yr)	0.95	0.91-1.01	0.077	25	2795	69.50	68.48
PCP Visit - 7 to 11 yo (1/2yrs)	**1.53**	1.41-1.66	**< 0.0001**	13	1389	**89.51**	**92.88**
Well Child Visit - 15 mo (3/15mo)	0.72	0.50-1.04	0.077	22	87	44.09	36.23
Well Child Visit - 3 to 6 yo (1/yr)	**0.72**	0.67-0.78	**< 0.0001**	25	2057	**34.20**	**27.30**
Immunization - DTP for 2 yo (4 by 2nd birthday)+	1.23	0.46-3.32	0.68	13	25	11.98	14.37
Immunization - IPV for 2 yo (3 by 2nd birthday) +	2.18	0.62-7.65	0.22	13	25	18.02	32.43
Immunization - MMR for 2 yo (1 between 1st and 2nd birthdays) +	1.19	0.45-3.16	0.73	13	25	61.56	65.54
Immunization - HIB for 2 yo (2 by 2nd birthday) +	2.00	0.96-4.18	0.063	13	25	63.01	77.35
Immunization - Hep B for 2 yo (3 by 2nd birthday) +	0.29	0.04-2.32	0.24	13	25	0.00	0.00
Immunization - VZV for 2 yo (1 between 1st and 2nd birthdays) +	1.13	0.46-2.77	0.78	13	25	36.83	39.78

* P-values are not adjusted for multiple comparisons

+ Immunization rates based only on Lincoln Community Health Center patients turning 2 years old during analysis month

from the COACH decision support system to the care managers and primary care practice sites when enrollees are found to be deficient on their care quality indicators. We also anticipate an increase in the number of care providers available to assist with this care quality initiative, as we are attempting to directly involve providers at the individual primary care sites by providing them with relevant care alerts and reminders.

Conclusions

Through this evaluation, we have demonstrated our ability to assess measures of care service, utilization and quality. Unfortunately, significant delays in obtaining data from partner sites delayed the implementation

of the alerts and reminders that were aimed at directly impacting these care metrics. As a consequence, the COACH system was unable to affect a consistently positive impact on care services, utilization and quality. However, we are actively working toward establishing data import mechanisms with the remaining partner sites, and we still plan to activate the necessary reminders and alerts when the data are available. The impact of our COACH system was also limited because our technology-based interventions depended primarily on the care managers in order to be effective. The growth in the number enrollees without a parallel grow in the number of care managers overwhelmed the care management system and presumably contributed to the findings of this study with a negative trend. Due in part to these findings, processes are now being initiated to address these work overload issues. We feel confident that we will be able to demonstrate improvements across the board in terms of care service, utilization and quality as we move forward, as we are currently in the process of making necessary staffing changes and obtaining the partner data necessary for fully operationalizing our system's decision support capabilities.