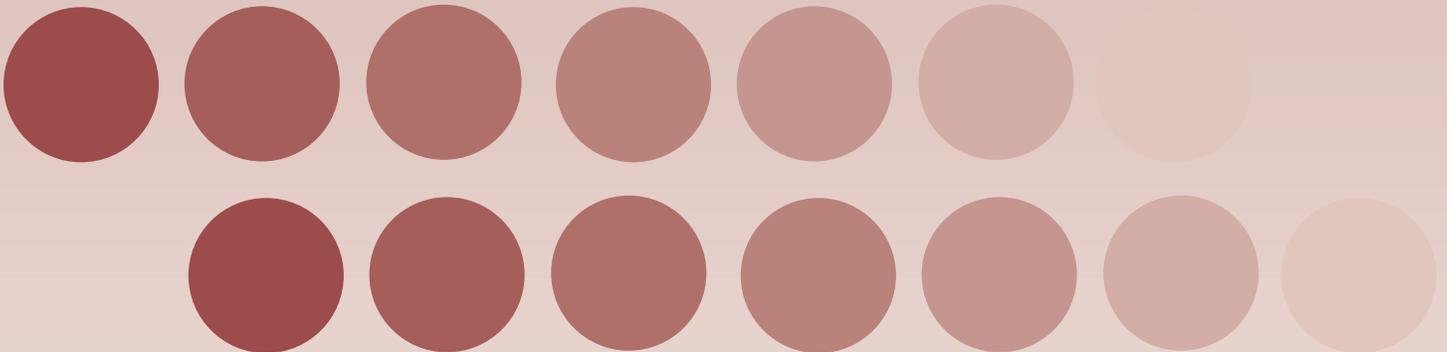
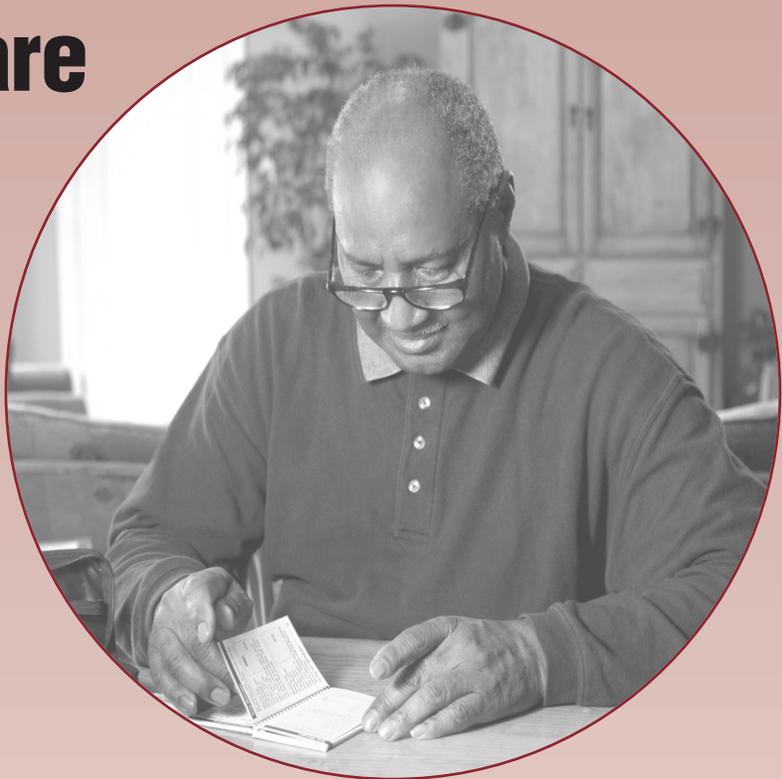


# Assessing the Impact of a Dynamic Chronic Care Registry on the Quality of Care Implementation Handbook



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## Implementation Handbook

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## Preface

This project was funded as an Accelerating Change and Transformation in Organizations and Networks (ACTION) task order contract. ACTION is a 5-year implementation model of field-based research that fosters public–private collaboration in rapid-cycle, applied studies. ACTION promotes innovation in health care delivery by accelerating the development, implementation, diffusion, and uptake of demand-driven and evidence-based products, tools, strategies, and findings. ACTION also develops and diffuses scientific evidence about what does and does not work to improve health care delivery systems. It provides an impressive cadre of delivery-affiliated researchers and sites with a means of testing the application and uptake of research knowledge. With a goal of turning research into practice, ACTION links many of the Nation's largest health care systems with its top health services researchers. For more information about this initiative, go to <http://www.ahrq.gov/research/action.htm>.

This project was one of seven task order contracts awarded under the *Improving Quality through Health IT: Testing the Feasibility and Assessing the Impact of Using Existing Health IT Infrastructure for Better Care Delivery* request for task order (RFTO). The goal of this RFTO was to fund projects that used implemented health IT system functionality to improve care delivery. Of particular interest were projects that demonstrated how health IT can be used to improve decision support, automate quality measurement, improve high-risk transitions across care settings, reduce error or harm, and support system and workflow design, new care models, team-based care, or patient-centered care.

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# Introduction

The implementation handbook describes the design, existing infrastructure, outcomes, lessons learned and recommendations derived from the implementation of a three-pronged intervention plan. This intervention was designed to improve the quality of care provided to adult diabetic patients currently receiving care at Denver Health through the use of information from an integrated diabetes registry. This handbook is intended for use within Denver Health for replication in similar programs using registries and for other institutions to decide whether their organization is suitably positioned for this intervention.

## Defining the Problem

Nonadherence to guidelines for the care of diabetes is pervasive.<sup>1,2,3</sup> Kirkman et al. suggest that Health IT may be a necessary component to increasing adherence: “In busy primary care practices lacking organizational support and computerized tracking systems, sustained improvements in diabetes care are difficult to attain using traditional physician-targeted approaches.”<sup>4</sup>

## Existing Efforts to Address the Problem

A disease registry is one type of clinical information system that has been proven effective in supporting new models for delivering chronic care<sup>5</sup>, and as such is an integral part of the Chronic Care Model (CCM),<sup>6</sup> and important in improving primary care for patients with chronic illness.<sup>7</sup> By tracking patient information, a disease registry helps physicians and other members of the care team to identify and reach out to patients with gaps in care or with suboptimal quality indicators. This has been shown to increase adherence to guideline recommendations for testing of diabetes indicators including HbA1c and LDL testing.<sup>8</sup> These registries can also be used to prompt providers through point-of-care alerts to ensure that appropriate and timely care is provided during patient visits.<sup>9</sup> With the increased sophistication and integration of information systems, computerized disease registries are being used to improve the quality of care both at the point where care is delivered and in between visits.

## Purpose

To improve quality of care provided to adult diabetic patients currently receiving care within an urban safety net system through the use of information from an integrated diabetes registry.

## Background

DH provides care to approximately 145,000 patients, who account for approximately 450,000 primary care visits annually. At the onset of this project in the fall of 2007, about two-thirds of these patients were adults over 18 years of age and over 50 percent of the adult patient

population were uninsured (Table 1). Of the adult patients seen in the DH primary care system, over 7,000 have been diagnosed with diabetes (both Type I and Type II). Diabetic patients are slightly more likely to be uninsured (42.7 percent) than the total population (39.5 percent) and far more likely to be on Medicare (26.4 percent versus 5.5 percent). In addition, nearly 70 percent of patients seen at DH are racial and ethnic minorities (Table 2). The patient population served by the safety net represents a segment of the priority populations identified by AHRQ as being in need of research emphasis.<sup>10</sup>

**Table 1. Denver Health patients (unduplicated), 2006**

	<b>N Total Patients</b>	<b>% Total Patients</b>	<b>N Adult Patients</b>	<b>% Adult Patients</b>	<b>N Diabetic Patients</b>	<b>% Diabetic Patients</b>
Uninsured	57,337	39.5	51,539	51.5	3,141	42.7
Medicaid	45,760	31.5	14,562	14.5	1,352	18.4
Medicare	7,979	5.5	7,978	8	1,943	26.4
Private	12,075	8.3	9,237	9.2	393	5.3
Other	22,023	15.2	16,833	16.8	531	7.2
Total	145,174	100	100,149	100	7,360	100

Note: Payer type was defined at the time of the last visit during 2006.

**Table 2. Race/ethnicity of DH patients (unduplicated), 2006**

	<b>N</b>	<b>%</b>
Asian	2,294	1.6
Black	20,485	14.1
Hispanic	77,615	53.5
White	36,573	25.2
Other/Unknown	8,207	5.6
Total	145,174	100

## Intervention Design

This registry was used to address the following objectives, which are more thoroughly explained after this summary:

1. Distribute a patient report card to (i) the patient's home on a quarterly basis and (ii) the patient at the time of each of their primary care visits. The patient report card is tailored to the individual patient and increases the patient's role in managing his/her own care. The final mailout of the report cards occurred in November 2008. The report card was printed at the time of registration of all diabetic patients at the four randomly selected clinic sites.
2. Develop and distribute both standard and enhanced provider report cards on a quarterly basis to the primary care providers regarding the quality of care they are providing to their diabetic patients in eight community health centers. The enhanced provider report card is the same as the standard provider report card but included an additional list of up to 10 patients who meet certain preset criteria. These criteria are explained more fully later in this report. The final of the four enhanced report cards was sent in October 2008.
3. Develop a point-of-care interface to the diabetes registry data, where this interface is to be used by the clinical team at the point of care to improve adherence to guideline-based care.

### Patient Report Cards

Patient report cards were mailed to 2,729 patients in the intervention group on a quarterly basis. Each month, one third of the 2,729 patients were mailed report cards in English and Spanish (Appendix A) so that over a 3-month period all 2,729 patients received a report card. This staggered mailing approach was used so that resource demand could be leveled. During the next quarter, the same mailing process was repeated, with the result that patients received one report card each quarter. In addition to the patient report cards, a self-addressed, postage-paid survey was included with the second and fourth quarter mailings to the 2,729 patients in the intervention group. Some patients were deemed to not be diabetic during the course of the intervention, and were not sent surveys as a result. The final number of surveys sent was 5,359.

Point of care distribution of patient report cards occurred at the four randomly selected clinics. A diabetic patient at these four clinics received their report card every time they registered at a primary care appointment. Table 3 shows how the sites were randomized for the point-of-care patient report cards, as well as for the enhanced provider report cards.

**Table 3. Randomization of enhanced provider report cards and on-site printable report cards**

Clinic Name	Clinic Size	Receive Enhanced Provider Report Cards	On-Site Printable Report Cards
Eastside Family Health Clinic (EFHC)	Large	Yes	Yes
Westside Family Health Clinic (WFHC)	Large	Yes	No
La Casa Quigg Newton (LCQN)	Large	No	Yes
Webb Primary Care (WEBB)	Large	No	No
Montbello Family Health Center (MONT)	Small	Yes	Yes
Westwood Family Health Center (WW)	Small	Yes	No
Parkhill Family Health Center (PH)	Small	No	Yes
Lowery Family Health Center (LOW)	Small	No	No

## Provider-enhanced Report Cards

All providers received either a standard or an enhanced report card as part of the normal process of care. The *standard* report card was generated from the diabetes registry and had been available to all clinicians for two quarters prior to these interventions as part of usual diabetes care; it includes—

- The provider’s performance across his/her patient panel on intermediate outcomes (including average HbA1c, percent with HbA1c < 7.0, percentage with LDL < 100, percentage with blood pressure < 130/80, and percentage with a self-management goal).
- The mean outcome performance across all providers at that clinic site.
- The best provider performance on each of the outcomes at that clinic site.
- The mean outcome performance across all clinic sites.

**Table 4. Provider-enhanced report cards**

Quarter	Date of dissemination	Inclusion Criteria
1	January 10, 2008	HgA1c levels between 7 and 11 and have not been checked within 2 months
2	April 16, 2008	LDL cholesterol more than 99 and not checked in at least 2 months
3	July 23, 2008	Systolic blood pressure greater than 145 <b>OR</b> Diastolic blood pressure greater than 90 and not checked in more than 2 months
4	October 22, 2008	Any of the three previous inclusion criteria for patients who have yet to be included on a provider enhanced report card list.

The standard report card was still available during the intervention, but physicians who received an *enhanced* report card also received an additional list of up to 10 diabetic patients per provider who met certain preset criteria. Criteria assessed to generate the list changed quarterly and are shown in Table 4. Inclusion criteria were based on the most current clinical information at the time of the creation of the enhanced report cards.

As part of the usual process of diabetes care, providers at all eight community health clinics receive a provider report card, which is updated quarterly, published on an internal Website, and presented to providers as an email containing a link. Reports include graphical comparisons of performance between clinics and between providers within a single clinic based on patients’

diabetic control on three separate indicators (H<sub>g</sub>A<sub>1c</sub>, BP, and LDL) as a measure of clinic and provider achievement, and remain available once published.

Intervention and control groups containing four clinics each were established. Providers at clinics in the intervention group were sent a list in the same quarterly email with the link to the provider report card, containing the names of up to ten patients who were not under diabetic control. Discussions with the diabetes champions and at system-wide provider meetings described this intervention and noted the expectation of provider-driven or clinic-driven follow-up. No suggestions were given in the email as to what might be done with the list. Providers at clinics in the control group continued to receive quarterly emails containing the link to the provider report card only.

## **Point-of-Care Reminders**

Since the registry was fully transitioned into the data warehouse, information has been available in real time at the point of care. When a diabetic patient registers for a primary care visit, the data warehouse registry data can be accessed in order to view the patient's clinical information, including a graphical display of medication adherence. Point-of-care reminders were evaluated for the pilot site of Westwood Clinic. The evaluation includes a qualitative analysis based on provider interviews as well as data on how many times the report was accessed at the pilot site.

## Existing Infrastructure

This section provides a background of the existing infrastructure at the time that this project started and how that infrastructure was improved in order to complete all the interventions. This is intended as a resource for outside organizations to gauge whether they are suitably positioned to replicate this intervention or some subset of the intervention.

At the onset of this project in the fall of 2007, the DH diabetes registry included 7,187 patients with recorded visits from December 2005 through April 2007. This number had fluctuated between 7,000 and 7,300 since June of 2006, as patients moved on and off the registry if they became inactive or deceased. Diabetic patients included in the registry are defined as those patients who have been seen in the primary care setting at least once in 18 months and who have been assigned at least one ICD-9 diagnosis code for diabetes (inpatient or outpatient, primary or secondary). Appendix B includes a list of the variables included in the database of the diabetes registry. Using the provider identifier, patient information can be aggregated for the patients seen by each primary care provider. This aggregated provider information includes, but is not limited to—

- Summary of demographics and lab test results.
- Summary of preventive care.
- Number of HbA1c or LDL labs performed within a chosen number of days.
- Last LDL or A1c result over a chosen threshold.
- Number of foot, eye, and dental exams in a chosen time period.

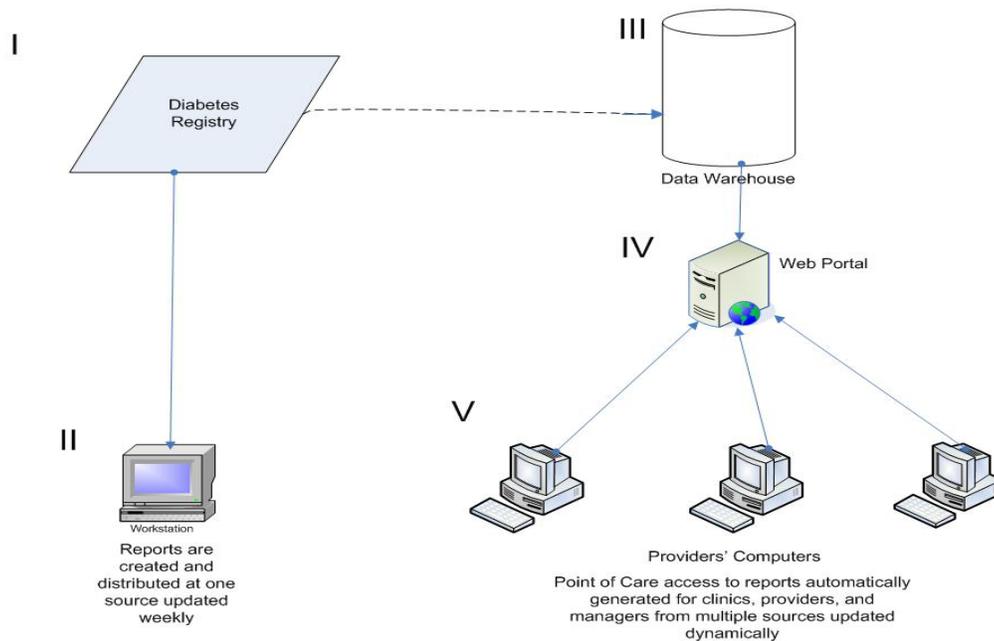
Prior to this project, the registry resided as a stand-alone Microsoft® Access database, allowing for the creation of summary reports based on a range of values selected by the user. Appendix B also depicts the screens by which reports could be generated from the registry at the summary clinic level, the single-clinic level, and the provider level. Reports could also be generated that included lists of patients who met criteria such as having key lab results above a certain threshold value. The registry was “quasi-dynamic” in that the patient list and patient data were refreshed weekly. Each week patients who last had a DH visit more than 18 months ago were removed from the registry while new diabetic patients and existing patients with new diagnoses of diabetes in the previous week were added to the registry. At the time each new patient was added to the registry, all the relevant information related to that patient was also transferred into the registry, including items such as laboratory results, recorded vital signs, and encounter-level data. This merging of information is possible at DH since all patient data can be linked through a unique patient identifier. Reports were generated based on outcomes defined by the National Health Disparities Collaborative and the Bureau of Primary Health Care<sup>11</sup> as “areas of focus” and as recommendations for care by the American Diabetes Association.<sup>12</sup>

The diabetes registry was checked and updated for quality purposes on a weekly basis. This process included data quality checks generated by database queries as well as visual confirmation to make sure the update process had finished completely and successfully. Clinic staff also identified invalid information in the diabetes registry when contacting the patient using registry records or when reviewing the medical record through the diabetes registry. Clinic staff also reviewed patient lists and identify deceased patients, incorrectly-diagnosed patients, and patients that no longer seek care at DH. The clinics then notified the data manager of the registry to remove the patient from the registry. While this mechanism for housing, updating, and

querying the diabetes registry was robust and of a high quality, it did have some limitations. The ability to most effectively identify patients and track relevant outcomes often required the manipulation of multiple data sources and detailed, on-demand reporting for care providers. Even though the patient information could be retrieved from these multiple sources using a unique patient identifier, it was “hands-on” and could be labor intensive, especially when creating customized reports.

In order to improve the quality, efficiency, performance and patient-centeredness of querying and reporting from registries within DH, as part of this project the Information Technology (IT) department transitioned the diabetes registry to the data warehouse. An overview of the old and new plan for utilizing the diabetes registry is illustrated in Figure 1. The diabetes registry (I) in its pre-project form was robust, of high quality and secure, updated weekly, but resident on a single computer (II) at each clinic site and subject to the limitations that result from less-than-full integration. Updating and migrating the diabetes registry to the data warehouse (III) allows for physicians to directly access customized reports that are automatically generated and refreshed into Portable Document Format (PDF) on a secure Web Portal (IV), using their own password-protected computers (V). Multiple levels of security ensure that patient records continue to be safe and private. Other advantages to accessing and updating the registry through the data warehouse include automated creation of mailing labels for patient report cards, more automated updating of the clinical data, and a centralized location for patient data. Lastly, with further enhancement, housing the registry in the data warehouse will allow for the creation of composite data elements from multiple sources (e.g. a flag that represents poor medication adherence AND poor blood pressure control over multiple visits).

**Figure 1. Old mechanism (II) and New (III-V) for utilizing the Diabetes Registry**



DH’s data warehouse includes a dynamic patient registry of all primary care patients, with integrated administrative and clinical data from more than eight data sources, enabling patient

identification and outcome tracking within a stable, secure environment (SQL 2000 tables). Additionally, DH had experience in moving stand-alone database registries into the data warehouse and adding them into the comprehensive information system prior to this project, such as the colorectal screening registry. Current colorectal screening status is now based off of procedure codes for an endoscopy, laboratory data for fecal occult blood testing, and electronic medical encounter data documenting the dates of any relevant off-site procedures. A hypertension registry was also in the process of being added to the data warehouse at the inception of this project, allowing for the development of additional specific process-based experience in translating an existing disease registry into the data warehouse. With the transfer of these registries to the data warehouse, the resource-intensive monthly updating of the stand-alone databases has also been greatly reduced through the utilization of extensive SQL coding and the automated scheduling features available through the data warehouse.

The DH data warehouse was launched in 1997 with an installation of a Siemens Medical System (Appendix C). The many ancillary services housed in this single location include lab, radiology, pharmacy, scheduling, and pathology. The database has been designed and built to accommodate rapid growth over the next few years and currently consumes approximately 500 Gb of the 2 terabytes of disk space allocated. The server utilizes 8 Hyper-Threaded processors (for a logical processor count of 16) along with 8 Gb of RAM. Along with the Web Portal, information in the data warehouse can be accessed through Crystal Reports, Executive View, and MS Analysis Services, as well as by using other tools.

While the transition of the diabetes registry to the data warehouse was not necessary for the DH IT system to be used to support the delivery of high quality health care, it will further improve the quality of care in the same ways that have been realized with the successful migration of the colorectal screening registry to the data warehouse. The combined IT and quality team at DH determined that the movement of the diabetes registry was one of many operational priorities. The diabetes registry migrated to the data warehouse in April 2008.

## Analyses and Outcomes

The clinical and process outcomes were quantitatively and qualitatively assessed for each of the three interventions. Table 5 describes the clinical outcomes to be assessed for each intervention, and Appendix D (patient report card surveys) and E (provider interview guide) are the survey and interview instruments used in the qualitative assessment. The results from the patient report card survey were used in the qualitative assessment of the first intervention. The provider guide was used in the qualitative, interview-based assessment of the second intervention. A second and separate set of unstructured interviews in a focus group setting was conducted as part of the qualitative assessment of the point-of-care reminders.

**Table 5. Overview of evaluation plan for clinical outcomes**

Intervention prong	Intervention group Description	Intervention group N	Intervention Period	Clinical and Process outcomes being assessed
1. Patient Report Cards	A. Mailings: One-half of all diabetics on registry that fulfill inclusion criteria across all clinics. B: Point of Care distribution: Diabetic patients at Eastside, La Casa, Montbello, and Park Hill clinics.	A. Mailings 2,729 B. Point of care 2,316	Quarterly for a year beginning in December 2007	1. Average HbA1c 2. HbA1c < 7% 3. HbA1c Testing 4. Lipid Profile Testing 5. LDL < 100 mg/dl 6. BP Testing 7. Last Blood Pressure < 130/80 mm HG
2. on-site printable and Enhanced Provider Report Cards	Patients who fit inclusion criteria at Westside Clinic, Eastside Clinic, Westwood and Montbello		Quarterly for a year beginning in January 2008	Same as above
3. Point-of-service Interface	Patients at a single pilot site	TBD	August 2008 through January 2009	1. Frequency of use of point-of-care interface

### Mailed Patient Report Cards

The number of patients actually mailed the report cards slightly decreased each quarter as people dropped off the registry because they had “moved or gone elsewhere” (MOGE). Reasons for categorizing patients as MOGE included verification by their primary care provider that they were deceased or were no longer patients at Denver Health.

The mailed patient report cards were expected to affect process outcomes by triggering visits while the report cards distributed at the point-of-care were expected to improve intermediate health outcomes.

The demographics of the intervention and control groups for this prong of the intervention are provided in Table 6. The mean age of the group is just over 54 years old. Almost three-fifths (59.3 percent) of the patients are female and just over three-fifths (61.5 percent) are Hispanic. While the differences between intervention and control group in ages are significantly different ( $p$ -value = 0.05) and gender trends toward significantly different ( $p$ -value = 0.09) these differences are adjusted for in subsequent analyses.

**Table 6. Demographics of the mailed patient report card groups**

Demographics	All patients (n=5,457)	Intervention (n = 2,728)	Control (n = 2,729)	p-value
Mean Age (SD)	54.1	54.4 (11.9)	53.8 (12.0)	0.05
Gender				0.09
Gender: Female	59.3	58.1	60.4	
Gender: Male	40.7	41.9	39.6	
Gender: Total	100.0	100.0	100.0	
Race/Ethnicity				0.46
Race/Ethnicity: Asian	0.7	0.7	0.6	
Race/Ethnicity: African American	15.9	15.3	16.5	
Race/Ethnicity: Hispanic	61.5	61.6	61.4	
Race/Ethnicity: White	16.9	17.0	16.9	
Race/Ethnicity: Unknown ethnicity	5.0	5.4	4.6	
Race/Ethnicity: Total	100.0	100.0	100.0	

## Process Outcomes

The patient report cards were mailed to the address listed for the most recent visit. Due to the high mobility of the safety net patient population we were expecting a relatively high mail return rate. Process measures for this intervention include # Mailed and Mail return rate and are included in Table 7. Fewer than 10 percent (9.8 percent) of the report cards were returned for having an incorrect address.

**Table 7. Mail return rate for the mailed patient report cards**

Month	# of Report Cards Mailed	# of Report Cards Returned	Return Rate
December,2007	909	80	0.088
January	910	80	0.088
February	909	80	0.088
March	897	87	0.097
April	896	84	0.094
May	893	83	0.093
June	895	88	0.098
July	892	93	0.104
Aug	893	89	0.100
Sep	893	98	0.110
Oct	887	103	0.116
Nov	893	93	0.104
TOTAL	10,767	1,058	0.098

## Clinical Analyses and Outcomes

The process outcomes for HbA1c, BP, and Lipids are the percentage of patients who have had at least one test in the previous year. The intermediate outcome for HbA1c is the percentage of patients with an HbA1c less than seven and is limited to those patients who had an HbA1c checked in the previous year. The intermediate outcome for LDL is the percentage of patients with an LDL below 100 and is limited to patients tested in the previous year. The intermediate outcome for blood pressure is < 130 systolic blood pressure and less than 80 diastolic blood pressure and is limited to patients tested in the previous year.

The baseline analyses account for differences in age, race/ethnicity, gender and degree of illness between control and intervention groups. The Chronic Illness and Disability Payment System (CDPS) was used for the risk adjustment. CDPS uses a diversity of ICD-9-CM codes to group and weight diagnoses for chronic and disabling diseases. The study period analyses were adjusted to account for differences in age, race/ethnicity, gender, and baseline levels for each outcome variable, and included generalized estimated equations (GEE) to account for the within-subject correlation of repeated measures by individual patients. MOGE patients were analyzed according to an intention-to-treat threshold, as if they received the patient report cards and were still active patients at Denver Health. All analyses were performed using SAS Enterprise Guide software version 9.1 (Cary, NC).

Table 8 and 9 provide the baseline and study period outcomes for both the intervention and the control groups for the mailed patient report cards. Intermediate clinical outcomes improved in both the intervention and the control groups; however, as expected, the quarterly patient mailings did not have an impact. Patients in the control group were significantly more likely to continue having their HbA1c and their blood pressure tested than those in the intervention group ( $p < 0.01$  for both). The study period analyses were adjusted to account for differences in age, race/ethnicity, gender, degree of illness, and baseline levels for each outcome variable, and included generalized estimated equations (GEE) to account for the within-subject correlation of repeated measures by individual patients.

**Table 8. Clinical and utilization outcomes, mailed patient report cards, mean HgA1c (SD)**

Outcome	Baseline Intervention	Baseline Control	Baseline p-value	Study Period Intervention	Study Period Control	Study Period p-value*
Mean HgA1c (SD)	8.3 (2.2)	8.4 (2.3)	0.34	8.2 (2.3)	8.2 (2.3)	0.31

**Table 9. Clinical and utilization outcomes, mailed patient report cards**

Outcome	Baseline Intervention Yes (%)	Baseline Intervention Total N	Baseline Control Yes (%)	Baseline Control Total N	Baseline p-value	Study Period Intervention Yes (%)	Study Period Intervention Total N	Study Period Control Yes(%)	Study Period Control Total N	Study Period p-value*
HgA1c < 7	664 (30.3)	2,191	681 (30.1)	2,262	0.88	645 (35.5)	1,816	671 (35.3)	1,900	0.77
HgA1c Testing	2,191 (80.3)	2,728	2,262 (82.9)	2,729	0.21	1,816 (66.6)	2,728	1,900 (69.6)	2,729	<0.01
Lipid Profile Testing	1,740 (63.8)	2,728	1,779 (65.2)	2,729	0.28	1,540 (56.5)	2,728	1,575 (57.7)	2,729	0.10
LDL < 100 mg/dl	1,123 (64.5)	1,740	1,144 (64.3)	1,779	0.89	1,100 (71.4)	1,540	1,149 (72.9)	1,575	0.45
BP Testing	2,402 (88.0)	2,728	2,457 (90.0)	2,729	0.34	1,965 (72.0)	2,728	2,026 (74.2)	2,729	<0.01
Last BP < 130/80 mmHg	985 (41.0)	2,402	1,011 (41.2)	2,457	0.93	896 (45.6)	1,965	924 (45.6)	2,026	0.98

\*Comparison clinical outcomes between the intervention and control group over time, adjusting for differences in demographics, degree of illness and baseline utilization.

## Qualitative Analysis-Patient Report Card Survey

In order to evaluate patient satisfaction with the mailed report cards and to qualitatively assess intervention effectiveness, the second and fourth report card mailings also included a one-page survey, developed by the project team and approved by COMIRB (Appendix D). Surveys were designed to be self-administered, included both fixed-response and unstructured questions, and were printed in both English and Spanish.

A self-addressed, postage-paid envelope was included to facilitate response; however, neither reminders such as follow-up mailings or telephone calls nor additional incentives for participation were offered. This approach was selected in order to most reliably represent results from patient satisfaction assessments if conducted on an ongoing basis in a sustainable fashion in a safety net system with limited financial resources.

Survey data was recorded in a Microsoft® Access database designed for the project, with each survey response comprising one database record. The database was stored on a server to which access was secured by network user account-assigned permissions. Each survey response was assigned a unique ID based on the order in which the response was received in the mail. Survey responses were entered into the database on a daily basis, on the same day that they were received by the project team. Any identifying data written by the respondent on the survey was redacted with a permanent black marker, after which the received surveys were stored in a secure filing cabinet.

Spanish-language unstructured responses received were professionally translated. Translations were recorded together with the original Spanish-language responses in the database record for each survey response.

Unstructured responses were generated as a results set from the database and subjected to content analysis. An open coding process was used to develop heuristic codes from themes and

patterns that emerged during analysis. The initial codes were then reexamined in context and refined into an objective code set, which was used in a final inductive analysis of the survey responses.

**Table 10. Patient survey**

	<b>Surveys Distributed</b>	<b>Responses Received</b>	<b>Response Rate (%)</b>
March	897	60	6.69
April	896	72	8.04
May	893	66	7.39
<b>2nd Quarter</b>	<b>2,686</b>	<b>198</b>	<b>7.37</b>
September	893	38	4.26
October	887	52	5.86
November	893	61	6.83
<b>4th Quarter</b>	<b>2,673</b>	<b>151</b>	<b>5.65</b>
<b>Total</b>	<b>5,359</b>	<b>349</b>	<b>6.51</b>

The low response rate is in line with our expectations for a survey that included neither incentives for participation nor reminders such as telephone calls or additional mailings. As such, qualitative analysis of survey responses was planned and conducted in order to identify common themes, patterns, and issues to be addressed among respondents’ reactions to the patient report card intervention. Future studies which include followup reminders and participant incentives might secure results which could be generalized in a broader fashion.

Most respondents expressed overall satisfaction with the design, usability, and content of the mailed report cards and indicated a wish to continue receiving them. Regardless of the fact that only one-third of respondents (33.2 percent) reported taking the report card to their next clinic visit, respondents also felt that their health care providers had helped them both understand and use the diabetes report card. Over three-quarters of respondents indicated that the report card had helped them to set diabetes self-management goals (77.4 percent), over half (52.7 percent) reported that their diabetes had improved since beginning to receive report cards, and two-thirds (67.6 percent) indicated that they can control their diabetes, as shown in Table 11:

**Table 11. Patient satisfaction with mailed report cards**

<b>Content, assistance, and control</b>	<b>Strongly Agree N</b>	<b>Strongly Agree %</b>	<b>Agree N</b>	<b>Agree %</b>	<b>Neutral N</b>	<b>Neutral %</b>	<b>Disagree N</b>	<b>Disagree %</b>	<b>Strongly Disagree N</b>	<b>Strongly Disagree %</b>	<b>No Response N</b>	<b>No Response %</b>
The report card was clear and easy to understand.	219	62.75	94	26.93	17	4.87	7	2.01	1	0.29	11	3.15
The information on the report card was correct.	193	55.30	99	28.37	23	6.59	12	3.44	5	1.43	17	4.87
The information on the report card was helpful.	202	57.88	104	29.80	19	5.44	5	1.43	4	1.15	15	4.30
I would like to keep receiving report cards.	220	63.04	73	20.92	14	4.01	14	4.01	14	4.01	14	4.01
My health care provider helped me understand the report card.	121	34.67	71	20.34	39	11.17	24	6.88	12	3.44	82	23.50
My health care provider helped me use the report card.	100	28.65	77	22.06	43	12.32	23	6.59	14	4.01	92	26.36
My health care provider should take more time to review my report card with me.	65	18.62	67	19.20	62	17.77	37	10.60	23	6.59	95	27.22
The report card helped me set goals to improve my diabetes.	157	44.99	113	32.38	33	9.46	9	2.58	4	1.15	33	9.46
My diabetes has gotten better since receiving report cards.	105	30.09	79	22.64	85	24.36	24	6.88	8	2.29	48	13.75
I can control my diabetes.	123	35.24	113	32.38	48	13.75	14	4.01	11	3.15	40	11.46

Respondents who did not take the report card to a primary care visit were invited to share their reasons, and all respondents were offered the opportunity to provide additional comments and suggestions about the report card in an unstructured fashion. Of the 349 respondents, 199 offered remarks elaborating on reasons for not bringing the report card to their providers, and 195 elected to provide one or more additional comments.

Examination of the reasons for not taking the report card to a visit resulted in the emergence of six core themes:

- I have not seen my provider yet / since receiving the report card (48 responses).
- I forgot to bring it (41 responses).
- My provider already knows / has this information (26 responses).
- I did not know I was supposed to bring it (22 responses).
- This is the first card I have received (15 responses).
- I did not have the report card (11 responses).

Additional general reaction to the report cards was found to be positive overall, with 45 respondents offering some indication of approval and 26 expressing specific thanks. Some opportunities for improvement were identified as well, with a number of respondents pointing out incorrect diagnoses or information (13 responses) or expressing other disapproval (9 responses). Respondents also actively engaged with the intervention by offering suggestions for report card improvement or additional approaches that might be taken (21 responses).

Respondents valued receiving information about diabetes and diabetes-related topics, as indicated by requests for additional information (23 responses), more explanation of what information was provided on the report cards (13 responses), or remarks on their own clinical information (18 responses). Of particular note is that several respondents took the opportunity to freely indicate perceived improvement in their own self-efficacy (22 responses).

## **Enhanced Provider Report Cards**

### **Clinical Analyses and Outcomes**

Since the patient and providers' enhanced report card interventions were implemented simultaneously, advantages in one intervention could affect advantages in the other. In order to differentiate advantages of care associated with the patient report card versus those advantages associated with the providers' enhanced report card, analyses were done separating the patients into the four possible categories of intervention and control group. Since it was expected that patient report cards distributed at the clinics were more likely to impact intermediate health outcomes than those mailed, these analyses looking at the interaction of the patient report cards and the provider-enhanced report cards focused on the patient report cards distributed at the clinics. The four categories include:

1. Patients whose report cards **were not** available at the point of care and **were not** on a provider's enhanced report card.
2. Patients whose report cards **were** available at the point of care and **were not** on a provider's enhanced report card.
3. Patients whose report cards **were not** available at the point of care and **were** on a provider's enhanced report card.
4. Patients whose report cards **were available** at the point of care and **were on** a provider's enhanced report card

Table 12 provides the clinical and utilization outcomes for these four categories. All p-values are derived by comparing each other group to the "Neither" group over time, adjusting for differences in demographics, degree of illness and baseline utilization.

**Table 12. Clinical and utilization outcomes, printed patient report cards and provider report cards**

Outcome	Neither Report Card Yes (%)	Neither Report Card Total N	Printed Report Cards Only, Yes (%)	Printed Report Cards Only, Total N	p-value *	Pro-vider Report Cards Only Yes (%)	Pro-vider Report Cards Only Total N	p-value *	Both Report Cards Yes (%)	Both Report Cards Total N	p-value *
HbA1c < 7%					0.93			<0.01			<0.01
HbA1c < 7%: Study period	632 (37.8)	1,672	468 (35.6)	1,314		131 (29.6)	442		85 (29.5)	288	
HbA1c < 7%: Baseline	652 (32.6)	2,002	508 (33.2)	1,529		103 (19.4)	531		82 (21.0)	391	
HbA1c < 7%: Absolute % change	5.2		2.4			10.2			8.5		
HbA1c Testing					0.3			0.73			<0.01
HbA1c Testing: Study period	1,672 (68.1)	2,454	1,314 (70.2)	1,872		442 (68.4)	646		288 (59.4)	485	
HbA1c Testing: Baseline	2002 (81.6)	2,454	1,529 (81.7)	1,872		531 (82.2)	646		391 (80.6)	485	
HbA1c Testing: Absolute % change	-13.5		-11.5			-13.8			-21.2		
Lipid Profile Testing					0.14			0.29			0.03
Lipid Profile Testing: Study period	1,398 (57.0)	2,454	1,089 (58.2)	1,872		382 (59.1)	646		246 (50.7)	485	
Lipid Profile Testing: Baseline	1,620 (66.0)	2,454	1,154 (61.7)	1,872		427 (66.1)	646		318 (65.6)	485	
Lipid Profile Testing: Absolute % change	-9		-3.5			-7			-14.9		
LDL < 100 mg/dl					<0.01			<0.01			<0.01
LDL < 100 mg/dl: Study period	1,081 (77.3)	1,398	775 (71.2)	1,089		246 (64.4)	382		147 (59.8)	246	
LDL < 100 mg/dl: Baseline	1,164 (71.9)	1,620	750 (65.0)	1,154		197 (46.1)	427		156 (49.1)	318	
LDL < 100 mg/dl: Absolute % change	5.4		6.2			18.3			10.7		

**Table 12. Clinical and utilization outcomes, printed patient report cards and provider report cards (continued)**

Outcome	Neither Report Card Yes (%)	Neither Report Card Total N	Printed Report Cards Only, Yes (%)	Printed Report Cards Only, Total N	p-value *	Pro-vider Report Cards Only Yes (%)	Pro-vider Report Cards Only Total N	p-value *	Both Report Cards Yes (%)	Both Report Cards Total N	p-value *
BP Testing					0.45			0.8			<0.01
BP Testing: Study period	1,810 (73.7)	2,454	1,406 (75.1)	1,872		465 (72.0)	646		310 (63.9)	485	
BP Testing: Baseline	2,197 (89.5)	2,454	1,672 (89.3)	1,872		579 (89.6)	646		411 (84.7)	485	
BP Testing: Absolute % change	-15.8		-14.2			-17.6			-20.8		
Last BP < 130/80 mm HG					<0.01			<0.01			<0.01
Last BP < 130/80 mm HG: Study period	938 (51.8)	1,810	571 (40.6)	1,406		202 (43.4)	465		109 (35.2)	310	
Last BP < 130/80 mm HG: Baseline	1,008 (45.9)	2,197	656 (39.2)	1,672		190 (32.8)	579		142 (34.6)	411	
Last BP < 130/80 mm HG: Absolute % change	5.9		0.8			10.6			0.6		

\*p-value is derived by using the "Neither" group as the referent and adjust for differences in demographics, degree of illness and baseline utilization

Clinical results indicate that patients randomized to both the point-of-care report card and provider performance report card interventions had significantly improved rates of HbA1c levels lower than 7 ( $p < 0.01$ ) from baseline and rates of LDL levels less than 100 mg/dl ( $p < 0.01$ ) from baseline than patients randomized to neither group. While the raw numbers suggest an advantage of being in neither intervention, the differences at baseline were even more pronounced. At baseline, the rate of people in the “Both” group who had an HbA1c lower than 7 was 21 percent, which improved to 29.5 percent (absolute change of 8.5), while the rate of people in the “Neither” group was 32.6 percent which improved to 37.8 percent (absolute change of 5.2). Similarly, the rate of people in the Both group who had LDL levels below 100 was 49.1 percent which improved to 59.8 percent (absolute change of 10.7) and the percentage of people in the Neither group was 71.9 percent, which improved to 77.3 percent (absolute change of 5.4). The advantages in HbA1c rates are found in the provider report card intervention ( $p < 0.01$ ) as there is not a significant difference between those in the “Neither” group and those in the “Printed Report Cards Only” group ( $p = 0.3$ ). The advantages in the rates of LDL levels are found in each of the printed report card and provider report card interventions separately ( $p < 0.01$ )

Patients were significantly more likely to improve their BP if they are in “Neither” the printable report card group NOR the Provider report card group than if they are in “Both” groups ( $p < 0.01$ ). These disadvantages are found in each of the printed report card and provider report card interventions separately ( $p < 0.01$ )

The provider report cards and the printed report cards seem to have a combined affect associated with improved utilization outcomes ( $p < 0.01$  for HbA1c and BP testing,  $p = 0.03$  for

lipid testing.) for those in the “Neither” group when comparing change from baseline. This is not seen with either intervention separately for any of the utilization categories.

## Qualitative Analyses and Outcomes

Key informants at each of the eight intervention and control clinics were asked to identify one health care provider for each site, to be considered “diabetes champion” (DC). The established DC at each clinic was then contacted and asked to consent to in-person interviews with the investigator, with all interview responses to be treated confidentially. All eight identified DCs agreed to participate.

Interviews were conducted with the eight DCs twice each, at the middle of the project period and after the intervention was completed. All interviews were conducted in a semi-structured format, according to an interview guide developed by the project team and approved by COMIRB (Appendix E) while also allowing for the in-depth exploration of additional topics and areas of interest which might emerge and be identified during the interview. Interview topics included ways a provider might help patients manage diabetes, provider-level and clinic-level initiatives to improve diabetes care and intermediate diabetes health outcomes, the patient report card interventions (both mailed and on-site printed versions), and the provider report card program.

One DC was unable to participate in the postintervention sessions, resulting in a total of 15 interviews conducted. Fourteen interviews were audio recorded; 1 interview was recorded only through interviewer notes made during the session, at the request of the participating DC. All audio recordings and written notes were reviewed and transcribed by the conducting interviewer, with the participating DC identified in the transcripts by interviewer-assigned ID instead of by name.

Interview data were subjected to inductive analysis through both review of written transcripts and audio recordings. An open, heuristic coding process was used to identify emergent themes and patterns. The identified themes and patterns were then reexamined in context and incorporated into a synthesis of results.

**Provider Interviews.** All providers interviewed indicated familiarity with the provider report cards, but were generally uncertain as to how often they were updated or made available. Most providers were uncertain of how to access the provider report cards aside from the emailed link; in the two interview sessions where access was immediately attempted, one was unable to locate them at all, and the other was successful only after time spent searching.

Time was repeatedly noted as a factor, with emphasis placed on the short length of patient visits, the increasing numbers of patients to be seen, and the ever-increasing number of things to accomplish both during patient visits and in the course of a clinical day. As a result, a tool which is perceived as requiring excess time is extremely unlikely to be utilized.

Sustained provider report card usage is evidently rare. Providers indicated a general pattern of looking at the report card when it was published, then setting it aside and not doing anything else with it. Some utility was found in that the report card was indicated to be helpful in identifying trends and raising awareness; however, it was also suggested that while information is useful, information with guidance or assistance would be better. Interviewees reported a common reaction among providers of “I know this, but what can I do to change it?” as well as a perception that providers are already aware of the issues but lack resources to address them.

Specific examples of desired resources include additional personnel for education and case management as well as the equipment and materials needed to conduct A1c testing at the point of care.

The provider report card was also seen to promote a sense of competition among providers and among clinics. Reactions to such competition were mixed, with more than one provider noting that while it might be useful for motivation among physicians, who are perceived as being generally more competitive or used to competition, it might be less well received among other members of a clinic team. Provider frustration with a perceived inability to affect change was mentioned as a concern and possible negative consequence; it was also noted that a focus on provider performance related to diabetes excluded mention of successes or issues in other areas of care.

Perception among those who received the enhanced report card was that the list of patient names contained too few items and was not sent frequently enough. Concurrent initiatives were identified at two of the intervention clinics that involved generating separate, more frequent, and more inclusive lists of patients and distributing them to providers for action—efforts that may have affected the results of the enhanced report card intervention. Other concurrent initiatives reported during interviews that may have influenced study outcomes include telephone nurse case management initiatives, programs to promote establishing diabetes self-management goals, a focused clinic-level program to improve cholesterol levels, and a system-wide medication reconciliation program.

Design suggestions included making the provider report card easier to read without scrolling up and down on the computer screen, including a within-clinic comparison of provider performance to that of the clinic as a whole, and altering the number of data points or the duration of the reporting period to make it easier to observe changes in diabetic indicators as well as trends over time. Distribution suggestions included making the provider report card easier to find on the system, distributing it more frequently, and giving a copy directly to providers rather than requiring them to locate it on the system.

## Point-of-Care Reminders

### Quantitative Outcomes

**Clinical Outcomes.** Point-of-care reminders were not expected to drive clinical indicators as the period of performance being assessed is too short. The quantitative assessment of this intervention is limited to the providers' utilization of the report in the process outcomes section.

**Process Outcomes.** Point-of-care reminders were evaluated for a single pilot site in August 2008 through December 2008. We were able to automatically track how many point-of-care report cards were generated by providers. The information system was used to tabulate the number of report cards viewed.

Table 13 provides the number of providers who accessed the report and how many times the report was accessed at the pilot site by month for the analysis period. No providers at the pilot site accessed the report prior to additional education in September. September was the most highly accessed month, with half of the providers accessing the report and a total of six views of the point-of-care reports. Subsequently, utilization diminished, until it was again not accessed by any providers in December, the final month of analysis. Utilization of point-of-care reminders

was far less than anticipated. Providers at the pilot site accessed the reminders only nine total times. The qualitative assessment provides some insight as to why they were not utilized.

**Table 13. Utilization of the point-of-care reminders at pilot site**

Month	Number of providers who accessed*	Number of times accessed
August	0	0
September	3	6
October	2	2
November	1	1
December	0	0

\*There are six total providers at the pilot site.

## Qualitative Outcomes

The DC at the pilot site for the point-of-care report established the point-of-care intervention as a topic to be discussed during a regularly scheduled health care provider team meeting, and also facilitated the attendance of the focus group interviewer at the meeting. Out of six health care providers at the pilot site, three were available to participate in the team meeting. The interviewer explained the purpose of the focus group session to meeting attendees, secured participants' consent, and subsequently involved them in discussion.

The topical structure of the guided group conversation was based on the interview guide developed for individual provider interviews, but with questions retailored to include details applicable to the point-of-care intervention rather than the provider performance feedback report. The session was audio recorded with the permission of all participants, and the recording was reviewed and transcribed by the focus group interviewer.

The point-of-care reminder tool was perceived as an efficient means for collecting diabetes-related patient information together in one place, thus potentially providing easier access to the collected data for the provider. However, access to the report itself was found to be much more problematic. One focus group participant had attended a training session on how to use it, but was unable to locate it again upon later attempts to do so, while another participant, having missed the initial training session, was not aware of the existence of the reminder at all.

Additional misgivings were expressed about the usefulness of the reminder at the point of care itself. For example, while the reminder is computer-based, not all providers use a computer during the patient encounter. There was also concern that the reminder as designed might be too advanced for patient understanding; in addition, the lack of translation into languages besides English was noted. It was suggested that the reminder might have greater utility as a chart review mechanism tailored to providers alone than as a point-of-care tool intended for use by the provider together with the patient.

A weakness in the reminder design was also noted by the focus group, who observed that the color-coding used to indicate a patient's prescribed medications at the top of the page did not match the colored bar at the bottom of the page used to indicate medication compliance by refill information. In addition, it was noted that the medication data were limited to those for prescriptions filled at Denver Health, where a number of patients might fill their prescriptions outside the system in order to achieve a more cost-effective solution.

## Costs of the Project

This section is intended to show the costs in money and time for each arm of this project. These costs do not include time and other resources necessary to analyze the results.

### Mailed Patient Report Cards

Table 14 provides the estimated costs for the health system for program implementation. Mailed report cards cost an estimated \$15,095.48. The hourly rates do not include benefits or indirect costs. The time taken by the providers to review the report cards with patients who brought them in is also not included. A business reply account is required (\$175 annually) to receive replies to the patient surveys. In the event that surveys are not a component of an intervention modeled after this, the business reply account, envelopes and postage will not be necessary. For this intervention, surveys were sent to one-half of the participants two times over the course of the 1-year study period, for 5,359 total surveys sent.

The programmatic costs include the resources used to/for—

- Monitor and control product generated from the diabetes registry for quality.
- Print and prepare mailings.
- Postage.
- IT development specific to the patient report card.

**Table 14. Cost for program implementation for mailed report cards**

Line Item	Number or Hours	Rate	Number x Rate
Postage	10,767	0.394	4,242.20
Returned report cards	1,058	0.5	529.00
Tri-folding machine	1	500	500.00
Envelopes	22 boxes	6.97	153.34
Paper	9 cartons	20.97	188.73
Business reply account	1	175	175.00
Business reply envelopes	2 orders	200	400.00
Postage—business reply	349	1.14	397.86
Translation to Spanish	1653	0.11*	181.83
Monitor/QC for registry	96	23.37	2,243.52
Prep/Stuffing envelopes	162	25	4,050.00
Development/providers	18	85	1,530.00
Development/other	24	21	504.00
IT development	0	0	0.00
<b>Total Estimate</b>			<b>15,095.48</b>

\*Per word for translations of report card, survey instrument, and survey responses.

## Provider-Enhanced Report Cards

The evaluation of programmatic costs of the providers' enhanced report card includes assessment of the resources used to—

- Create the enhanced form, complete with list of patients
- Disseminate provider-enhanced report card
- Evaluate providers' time in contacting patients listed on enhanced report card
- IT development specific to the providers' enhanced form

Table 15 provides the estimated costs associated with the provider-enhanced report cards. The hourly rates do not include benefits or indirect rates. An estimated \$38,382 was spent on the enhanced report cards.

**Table 15. Cost for program implementation for enhanced provider report cards**

Line Item	Number or Hours	Rate	Number x Rate
Development/providers	40	85	3400
Development/other	40	21	840
Provider time contacting patients	320	85	27,200
Salary for prep and distribution	48	30.13	1,446
Salary for prep and distribution cont'd	64	23.37	1,496
IT development specific to enhanced form	40	100	4,000
Total Estimate			38,382

## Point-of-Care Reminders

Table 16 provides the estimated costs associated with the point-of-care reminder reports. The estimated cost for this intervention was \$157,555, with the great majority of the costs associated with IT development. While this development, which constituted putting the registry into the data warehouse will provide benefits outside of the scope of this intervention and project, this intervention was the initial reason for putting it into the warehouse. Approximately \$50,000 of the IT development went into the design phase of the project and approximately \$100,000 was used to construct and convert the template from the hypertension registry into the point-of-care reminders.

**Table 16. Cost for program implementation for point-of-care reminder report**

Line Item	Number or Hours	Rate	Number x Rate
Development/providers	40	85	3,400
Development/other	40	21	840
Provider time accessing reminders*	39	85	3,315
IT development specific to enhanced form	1500	100	150,000
Total Estimate			157,555

\*Includes all providers, not just those at the pilot site.

## Lessons Learned

Several themes and lessons have emerged from the program implementation and analyses:

- Provider buy-in is mandatory for success.
- Concomitant quality improvement efforts make it challenging to isolate the effects of an intervention implemented across a number of outlying clinics.
- Qualitative analysis is key in order to identify noninterventional quality improvement efforts and other factors that have the potential to influence the implementation and outcomes of an intervention in order to incorporate their effects into the final analysis
- One challenge of implementing a control group of providers or clinics is the perception at the nonintervention sites that they are being prevented from using useful intervention tools and that this detracts from the quality of their patient care (like the patient report card).
- However, studying the impact of this type of intervention is invaluable as it provides evidence as to how to best allocate resources. For instance, patient report card (PRC) mailings are fairly resource intensive yet, unexpectedly, did not impact process outcomes. On the other hand, point-of-care PRC distribution generates a useful and effective tool for providers and patients.
- When automating care delivery using a large chronic disease registry, it is key to best ensure the quality of the data of the registry. Our largest concern was dissemination of diabetes report cards to patients incorrectly labeled with diabetes (through an incorrect ICD-9 code). “Cleaning-up” of the registry prior to randomization through provider-level manual review of patient lists was effective.
- Implementing an intervention that involves point-of-care, computer-generated tools (like the PRC) requires frequent contact with the sites to rapidly detect and problem-solve technological glitches (intermittent printing problems in the initial stages in our case).
- Qualitative analysis uncovers important provider and patient attitudes towards the interventions. For instance, providers respond to performance feedback and improve the quality of care they deliver. However, providers note that i) the provider-level performance comparison fosters competition and ii) more support, such as case management, is needed to assist providers with patient-level feedback (the enhanced provider report card).

## Recommendations for Future Implementations

The Lessons Learned and unintended consequences provide for recommendations for future implementations:

- Iterative qualitative assessment in the form of surveys and interviews allow for streamlining, constant improvement, more buy-in, and an increased likelihood of sustained use.
- Use a mixed methods quantitative/qualitative approach to analysis for complete understanding of how well the program is working/not working.
- When migrating a registry into the data warehouse allow for ample time. We allotted 6 months and had previous experience in such transitions. This seemed to be about the correct amount of time.
- For recurring mass mailings, consider getting a tri-folding machine of at least moderate quality (\$500). The time saved in folding will more than make up for the cost.
- Provider time is extremely limited. To the greatest extent possible, make any changes without adding to their time.
- When creating reports with color, consider using universally applied cues, such as a traffic light pattern of red indicating a problem, yellow a warning, and green being good.
- When providing tools intended to improve patient care, try to provide support in the form of suggestions and guidance without orders and mandates.

## References

1. Resnick HE, Foster GL, Bardsley J, et al. Achievement of American Diabetes Association clinical practice recommendations among U.S. adults with diabetes, 1999–2002. *Diabetes Care* 2006;29:531–7.
2. Mehler PS, Esler A, Estacio RO, et al. Lack of improvement in the treatment of hyperlipidemia among patients with type 2 diabetes. *Am J Med* 2003;114:377–82.
3. Rucker D, Johnson JA, Lee TK, et al. The natural history of LDL control in type 2 diabetes: a prospective study of adherence to lipid guidelines. *Diabetes Care* 2006 Nov;29(11):2506–8.
4. Kirkman MS, Williams SR, Caffrey HH, et al. Impact of a program to improve adherence to diabetes guidelines by primary care physicians. *Diabetes Care* 2002 Nov;25(11):1946–51.
5. California Healthcare Foundation. Using Computerized Registries in Chronic Disease Care. February 2004. Available at: <http://www.chcf.org/documents/chronicdisease/ComputerizedRegistriesInChronicDisease.pdf>.
6. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness: the chronic care model, Part 2. *JAMA* 2002;288:1909–14.
7. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. *JAMA* 2002;288:1775–9.
8. Thomas KG, Thomas MR, Stroebel RJ, et al. Use of a registry-generated audit, feedback, and patient reminder intervention in an internal medicine resident clinic—a randomized trial. *J Gen Intern Med* 2007 Dec;22(12):1740–4. Epub 2007 Nov 1.
9. Gabbay RA, Khan L, Peterson KL. Critical features for a successful implementation of a diabetes registry. *Diabetes Technol Ther* 2005;7(6):958–967.
10. Agency for Healthcare Research and Quality. Special Emphasis Notice: Research Priorities for the Agency for Healthcare Research and Quality—Research on Systems and Organizational Interventions for Improving Healthcare Quality for Low-income People Served in Under-resourced Settings and Communities. Notice Number: NOT-HS-07-045; November 22, 2006.
11. Health Disparities Collaborative. Phase 2 Measures of Diabetes Population. Available at: <http://www.healthdisparities.net/hdc/html/collaboratives.topics.diabetes.aspx>. Accessed June 22, 2007.
12. American Diabetes Association. Standards of medical care in diabetes—2007. *Diabetes Care* 2007;30(1):S4–S41

# Appendix A: ABC Patient Report Card

Name:

Joe Patient

123 Mailing address, 4 Tri-fold

Denver, CO 90765

Do you know your diabetes **ABC** numbers?

**A** is for A1C. This measures your average blood glucose (sugar) over the last 3 months.

**B** is for blood pressure. High blood pressure makes your heart work too hard.

**C** is for Cholesterol. Bad cholesterol, or LDL, builds up and clogs your blood vessels.

If you have diabetes, you are at high risk for heart attack, stroke, kidney disease and blindness. Heart disease is more likely to strike you—and at an earlier age—than someone without diabetes.

But, you can fight back; practicing good health behaviors will enable you to take control of the **ABCs** of diabetes and live a long and healthy life!

Here is your **ABC** report card:

	Most Recent Result	Previous Result
<b>A1C</b> Goal less than 7		
<b>Blood Pressure</b> Goal 130/80 or less		
<b>Cholesterol</b> Goal LDL less than 100		

To improve my diabetes, I will:

- Make and keep more regular appointments
- Take my medications exactly as prescribed
- Improve my diet
- Exercise more regularly.

If you are not at goal on any of your **ABCs** you need to be seen every 2 months until you are at goal.

We will send this report card every 3 months to help you monitor your diabetes.

Please bring this form with you to your next visit.

## Boletín de Calificaciones ABC

Nombre:

Joe Patient

123 Mailing address, 4 Tri-fold

Denver, CO 90765

¿Conoce usted sus cifras ABC de diabetes?

**A** corresponde a A1C. Esta cifra indica su promedio de glucosa (azúcar) en la sangre durante los últimos 3 meses.

**B** corresponde a la presión sanguínea (blood pressure). La presión sanguínea alta hace trabajar demasiado al corazón.

**C** corresponde al colesterol. El colesterol malo, o LDL, se acumula y obstruye las arterias del corazón.

Si usted tiene diabetes, usted tiene mayor riesgo de sufrir un ataque al corazón, derrame cerebral, enfermedad del riñón y ceguera. Usted tiene más probabilidades de tener una enfermedad del corazón a una edad temprana que una persona que no tenga diabetes.

¡Pero usted puede combatir la diabetes! ¡Los buenos hábitos de salud le ayudarán a controlar las cifras **ABC** de diabetes y a vivir una vida más larga y saludable!

Aquí está su boletín de calificaciones **ABC**:

	Resultado más reciente	Resultado previo
<b>A1C</b> La meta es menos de 7		
<b>B. Presión sanguínea</b> La meta es 130/80 o menos		
<b>Colesterol</b> La meta de LDL es menos de 100		

Para combatir la diabetes, yo:

- Pediré citas e iré a las citas con el médico con más regularidad.
- Tomaré mis medicamentos exactamente como me los han recetado.
- Mejoraré mi dieta.
- Haré ejercicio con más regularidad.

Si usted no ha llegado a su meta en sus cifras ABC, necesita que lo veamos cada dos meses hasta que alcance su meta.

Le enviaremos este boletín de calificaciones cada tres meses para ayudarle a controlar la diabetes.

Por favor traiga este formulario con usted a su próxima consulta.

# Appendix B: Diabetes Registry Database Fields and Screenshots

## Diabetes Registry Database Field List

Field name in DM Registry	Description	Where data is pulled from
ACE/ARB	Is pt on ACE/ARB	Yes/No qst collected at "Encounter visit"
ASA/Other	Is pt on ASA/Other	Yes/No qst collected at "Encounter visit"
BMI	BMI measurement	Collected through "Encounter visit"
BP_DIASTOLIC	Blood Pressure Diastolic measurement	Collected through "Encounter visit"
BP_SYSTOLIC	Blood Pressure Systolic measurement	Collected through "Encounter visit"
DENTAL_EX	Date of exam	Collected through "Encounter visit" and from visits that have HOSP SVC CODE of "DHY", "DEN", "EDE", and "WDE".
EYE_EX	Date of exam	Collected through "Encounter visit" and from visits that have HOSP SVC CODE of "EYE", "EYG", and "EYR".
FLU	Date of shot	Collected through Vax Trax
FLU_RU	Shot refused/unknown	Collected through Vax Trax
FOOT_EX	Date of exam	Collected through "Encounter visit" and from visits that have HOSP SVC CODE of "EYE", "EYG", and "EYR".
HEARING	Pt hearing status	Collected through "Encounter visit"
HEARING_WNL	Pt hearing status	Collected through "Encounter visit"
HEIGHT_CENT	Pt height in Centimeters	Collected through "Encounter visit"
HEIGHT_FEET	Pt height in Feet	Collected through "Encounter visit"
HEIGHT_IN	Pt height inches	Collected through "Encounter visit"
HEIGHT_TOT_IN	Pt height total inches	Collected through "Encounter visit"
LATEX_ALL	Does pt have latex allergy	Yes/No qst collected at "Encounter visit"
MED_ALL_VER	Med allergies verified	Yes/No qst collected at "Encounter visit"
MEDS	Meds	Yes/No qst collected at "Encounter visit"
NARCOTIC_CON	Narcotic Contract	Yes/No qst collected at "Encounter visit"
O2	If the patient is on oxygen, how many liters	Collected through "Encounter visit"
PHQ9	Depression scale score	Collected through "Encounter visit"
PRIMARY_LANG_CODE	Primary Language code	Collected through "Encounter visit"
PULSE	Pulse	Collected through "Encounter visit"
PVAX	Date of PVAX	Collected through Vax Trax
PVAX_RU	PVAX refused/unknown	Collected through Vax Trax
RESPIRATION	Respiration	Collected through "Encounter visit"
SELF_MAN_GOAL	Pt's Self management goal	Collected through "Encounter visit"
SITE	Site of visit	Collected through "Encounter visit"
STATINS	Is pt on Statins	Yes/No qst collected at "Encounter visit"
STEROID_MDI	Is pt on Steroid MDI	Yes/No qst collected at "Encounter visit"
TD	Date of TD	Collected through Vax Trax
TD_RU	TD refused/unknown	Collected through Vax Trax
TEMP_C	Pt temperature in Celsius	Collected through "Encounter visit"
TEMP_F	Pt temperature in Fahrenheit	Collected through "Encounter visit"
TEMP_METH	Method used to collect temperature	Collected through "Encounter visit"
TOBACCO	Pt's tobacco use history	Collected through "Encounter visit"
VISION	Pt vision status	Collected through "Encounter visit"
VISION_WNL	Pt vision status	Collected through "Encounter visit"
WEIGHT_KILO	Pt weight in kilograms	Collected through "Encounter visit"
WEIGHT_LB	Pt weight in pounds	Collected through "Encounter visit"
WEIGHT_OZ	Pt weight in Ounces	Collected through "Encounter visit"
Protein, Urine, UPR	Lab Test	Collected by Lab
ALBUMIN/CREATININE RATIO, ALBCT	Lab Test	Collected by Lab
ALT	Lab Test	Collected by Lab
AST	Lab Test	Collected by Lab
CHOLESTEROL LEVEL	Lab Test	Collected by Lab
CREATINE KINASE MB	Lab Test	Collected by Lab
Hgb A1C	Lab Test	Collected by Lab
HDL Cholesterol	Lab Test	Collected by Lab
LDL, Calculated	Lab Test	Collected by Lab
Triglyceride, TRIG	Lab Test	Collected by Lab

# Diabetes Registry Database Screenshots

## Diabetes Registry Main Menu Screen

Please Select Type of Report:

Clinic

All Clinics

PCP

Lipid Management Panel

Record: 1 of 1

## Diabetes Registry Clinic Report Selection Screen

Clinic Report

Please Select Clinic: DAVIS

**Summary**

Demographics and Labs

Preventive Care

Learning/Physical/Cognitive

**Registry Information**

List of Patients

**Labs**

LAB Reports by DATE:

No Hgb A1C within XX days

No LDL within XX days

No Alb/Cre Ratio within XX days

LAB Reports by Result:

Last HGB A1C Result Over XX (n)

Last LDL Result Over XX (n)

Last Alb/Cre Ratio Result: Over XX (n)

Back to Main Menu

Record: 1 of 1

## Diabetes Registry All Clinics Report Selection Screen

Microsoft Access - [frmReport\_AllClinics : Form]

File Edit Insert Records Window Help

**All Clinics Report**

REPORT:

**Summary**

Demographics
Labs/BP
Preventive Care
Learning/Physical/Cognitive

**Labs**

Lab Reports by DATE:	Lab Reports by Result:
No Hgb A1C within XX days	Last HA1C Result Over XX (n)
No LDL within XX days	Last LDL Result Over XX (n)
No Alb/Cre Ratio within XX days	Last Alb/Cre Ratio Result Over XX (n)

Back to Main Menu

Record: 1 of 1

start | frmMain : Form | frmReport\_AllClinics : ... | 16:48

## Diabetes Registry Primary Care Provider Report Selection Screen

Microsoft Access - [frmReport\_PCP : Form]

File Edit Insert Records Window Help

**PCP Report**

Select Clinic: DAVIS

Select PCP: SURI, MALVIKA

Back to Main Menu

**Summary**

Demographics and Labs*
Preventive Care*
Learning/Physical/Cognitive*

**Comparison**

HGB A1C and LDL (Comparison between clinic)\*

\* Reports can take 5-25 minutes to produce

**Visit Information**

No LCR Encounter Visit in past XX days

**Registry Information**

List of Pts

**Labs**

By Date:	By Result:
HGB A1C:	HGB A1C:
No Hgb A1C within XX days	Last HGB A1C Result Over XX (n)
HGB A1C within XX days	Last HGB A1C Result Under XX (n)
Do not have 2 HGB A1C within 1 Year, 90 days apart*	LDL:
2 HGB A1C within 1 Year, 90 days apart	Last LDL Result Over XX (n)
LDL:	Last LDL Result Under XX (n)
No LDL within XX days	Albumin/Creatinine Ratio:
LDL within XX days	Last Alb/Cre Ratio Result Over XX (n)
Albumin/Creatinine Ratio:	Last Alb/Cre Ratio Result Under XX (n)
No Alb/Cre Ratio within XX days	
Alb/Cre Ratio within XX days	

**Preventive Care and Misc**

By Date:	By Result:
No Foot exam in past xx days**	No PHQ9 in past XX days
No Eye exam in past xx days**	Last PHQ9 score Over XX (n)
No Dental exam in past xx days**	
No Pap Smear in past xx days	
No Mammogram in past xx days	
No Occult Blood (3) in past xx days	
No Colonoscopy in past xx days	

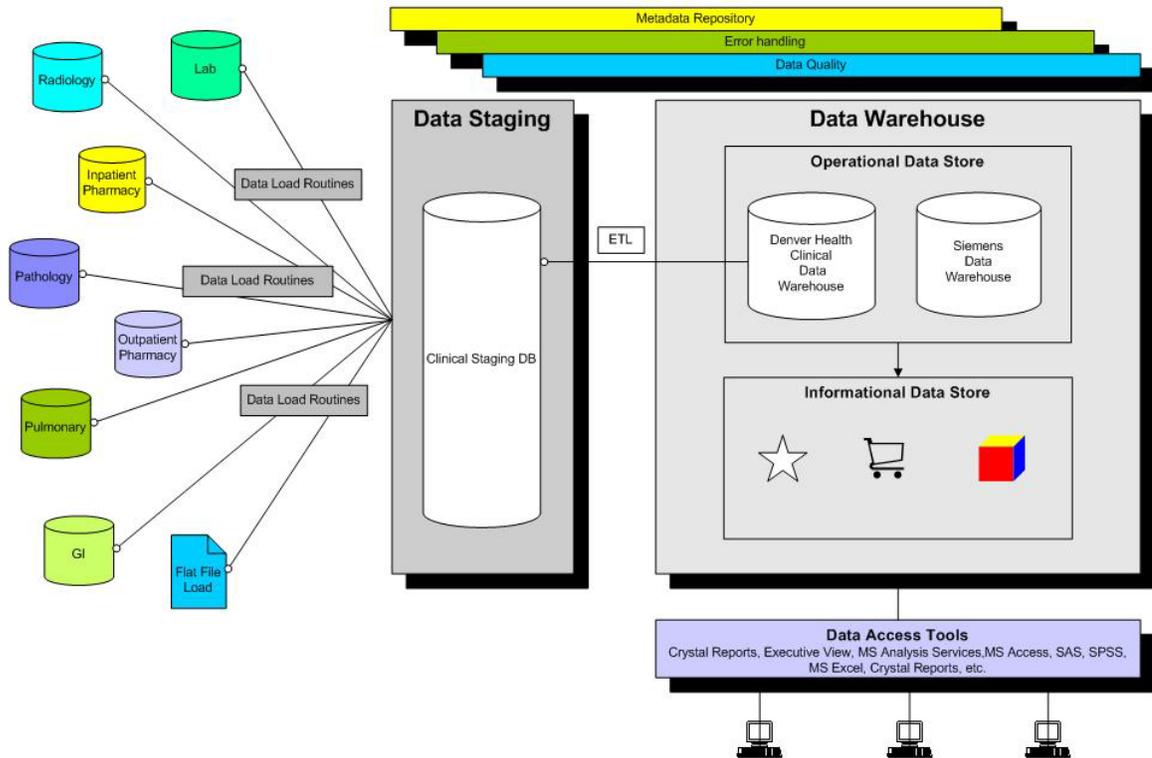
\*\*Only accurate for Pts with an LCR Encounter Visit (if a pt has not been through LCR encounter, they will show as not having an exam regardless of status)

Record: 1 of 1

start | frmMain : Form | Microsoft Access - [fr... | 16:51

# Appendix C: Data Warehouse

## Denver Health and Hospital Authority Data Warehouse Overview May 16, 2007



# Appendix D: Patient Report Card Surveys

Dear Participant:

Please do not send any personal information (name, address, report card, etc) along with this filled out survey.

Recently, Denver Health began sending “ABC Report Cards” to help patients manage their diabetes. By now, you should have received at least one report card in the mail.

You have been randomly selected from a group of Denver Health diabetes patients to give your opinion about the ABC Report Card. The information you provide will help us to make the report card better and more useful for you. There are no right or wrong answers, so please let us know what you think. Your opinion is very important to us.

Please take the time to complete the following survey. All responses will be treated confidentially. You can return the survey to us in the enclosed postage-paid, preaddressed envelope.

Thank you for your help.



## ABC REPORT CARD PATIENT SATISFACTION SURVEY

1. How many report cards have you received (including this one)?.....\_\_\_\_\_

Please circle your answer to each of the following questions.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2a. The report card was clear and easy to understand.	1	2	3	4	5
2b. The information on the report card was correct.	1	2	3	4	5
2c. The information on the report card was helpful.	1	2	3	4	5
2d. I would like to keep receiving report cards.	1	2	3	4	5

*Please continue on other side*

3a. Did you take the report card to your health care provider?.....YES NO

Please circle your answer to each of the following questions.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3b. My health care provider helped me understand the report card.	1	2	3	4	5
3c. My health care provider helped me use the report card.	1	2	3	4	5
3d. My health care provider should take more time to review my report card with me.	1	2	3	4	5

3e. If you did not take the report card to your health care provider, why not?

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Please circle your answer to each of the following questions.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4a. The report card helped me set goals to improve my diabetes.	1	2	3	4	5
4b. My diabetes has gotten better since receiving report cards.	1	2	3	4	5
4c. I can control my diabetes.	1	2	3	4	5

5. Do you have any other comments or suggestions about how we could make the report card better?

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Thank you for your participation!

Please put the survey in the postage-paid, preaddressed envelope and drop it in the mail.

# Appendix E: Interview Guide

## Methodology

The interview guide format seeks to both ensure that specific items of interest are covered in the interview while also allowing the opportunity to obtain rich data through open-ended exploration of developed topics.

*Question:* How long have you been treating diabetes patients?

*Intent:* Addresses history/background/qualifications of provider.

*Question:* What are some of the ways in which you go about helping patients to manage their diabetes?

*Intent:* Examines treatment methodology and provider involvement.

*Question:* What are some methods your clinic used in 2008 to try to improve diabetes care?

*Intent:* Examines concomitant diabetes QI efforts around Denver Health during the AHRQ study

*Question:* How can providers and Denver Health help diabetic patients improve intermediate outcomes (A1c, lipids, BP)? Or, what kind of chronic disease management programs will have the most impact for diabetics at Denver Health?

*Intent:* Explores provider attitude toward disease management strategies (e.g., is there buy-in to the efficacy of provider and patient feedback).

**Provider Report Cards**

*Question:* How would you describe the “provider report card” program? (Probe: ask about card content, format, and delivery method.)

*Intent:* Examines provider perception of cards; also identifies standard (control) v. enhanced (intervention) group.

*Question:* Do you use the provider report cards in any particular way? Also, for enhanced report cards, does patient specific feedback (e.g. lists of patients not at goal) help you manage your panel?

*Intent:* Nonconfrontational assessment of provider perception of card utility.

*Question:* How effective do you think the provider report cards are?

*Intent:* Seeks to elicit judgment of card program and/or insight into problems.

*Question:* Is there anything that you think would make the cards better?

*Intent:* Seeks to develop recommendations for card program improvement.

Interview Guide Continued

**Patient ABC Report Cards** (all providers may have come across these through the mailings; providers where the cards were printed on-site at registration will be very familiar with them—Eastside, La Casa, Montbello, Park Hill)

*Question:* How would you describe the patient ABC report card?

*Intent:* Examines provider perception of cards

*Question:* Do you use the patient report cards in any particular way?

*Intent:* Nonconfrontational assessment of provider perception of card utility.

*Question:* How effective do you think the patient report cards are?

*Intent:* Seeks to elicit judgment of card program and/or insight into problems.

*Question:* Is there anything that you think would make the cards better?

*Intent:* Seeks to develop recommendations for card program improvement.