

## **Project Title: Cardiovascular Care Disparities: Safety-Net HIT Strategy**

<b>T. Bruce Ferguson, Jr., MD</b>	<b>LSU HSC, HCSD</b>	<b>Principal Investigator</b>
<b>Michael M . Butler, MD, MHA</b>	<b>LSU HSCD</b>	<b>Investigator</b>
<b>Claudia Campbell, PhD</b>	<b>Tulane SPHTM</b>	<b>Investigator</b>
<b>Tara A. Doskey, BS, MPH</b>	<b>LA DHH, OPH</b>	<b>Consultant</b>
<b>George J. Fandli, BS</b>	<b>ARMUS Corp</b>	<b>Consultant</b>
<b>Eric Ford, PhD</b>	<b>Tulane SPHTM</b>	<b>Investigator</b>
<b>Kathy A. Hebert, MD, MMM</b>	<b>LSU HSCD</b>	<b>Investigator</b>
<b>Ronald Horswell, PhD</b>	<b>LSU HSC, SPH</b>	<b>Investigator</b>
<b>Harlan Krumholz, MD</b>	<b>Yale University SOM</b>	<b>Consultant</b>
<b>Julie Morial, MD, MPH</b>	<b>Tulane SOM</b>	<b>Co-Project Director</b>
<b>Bettina Owens, BS</b>	<b>LSU HSC, HCSD</b>	<b>Investigator</b>
<b>Gyula Sziraczky, BS</b>	<b>ARMUS Corp</b>	<b>Consultant</b>
<b>Wayne Wilbright, MD</b>	<b>LSU HSC</b>	<b>Investigator</b>

**Organization: LSU Health Sciences Center, New Orleans**

**Dates: 9/30/2004 – 9/29/2005 (extended due to Hurricane Katrina)**

**Federal Project Officer: David Stevens, MD**

**This grant project was supported by the Agency for Healthcare Research and Quality as part of the Translating Healthcare Quality Through Information Technology (THQIT) Planning Grant Program.**

**Award #: P20 HS15305-01**

## I. Structured Abstract

**Purpose:** The purpose of this THQIT grant was to plan the design and implementation of a longitudinal CVD information system (LCIS) platform to address disparities in CVD in the unique safety-net Charity population in Louisiana.

**Scope:** Using the Congestive Heart Failure (CHF) Disease Management program within the eight-hospital Health Care Services Division (HCSD) of the LSU Health Sciences Center (HSC) as the template, the LCIS design process was undertaken by a unique Partnership between LSUHSC (Schools of Medicine and Public Health), Tulane University Schools of Medicine and Public Health and Tropical Medicine, ARMUS Corporation as technology provider, and the LA Department of Health and Hospitals Office of Public Health.

**Methods:** The design process evaluated the infrastructure, information technology, and care delivery processes within the HCSD. The focus was directed at augmenting existing resources and creating an LCIS for collecting, analyzing, and coupling clinical and financial data to assess the medical and financial care effectiveness in this CHF population. This LCIS would enable addressing the significant care delivery- and patient-related disparities within this population and setting.

**Results:** A model prototype of the LCIS was developed from this Partnership's consensus analysis and development process, including testing and evaluation components. This patient-provider, encounter-driven prototype enabled multiple, diverse providers to collect longitudinal CHF data from patient encounters within multiple care delivery settings. Prototype testing and refinement was being undertaken at the time hurricane Katrina devastated LSU and Tulane Schools of Medicine and disrupted forever the HCSD/Charity safety-net population and system.

**Keywords:** *cardiovascular; longitudinal; patient-provider encounter; safety-net*

## II. PURPOSE

The purpose of this THQIT Planning Grant was to plan the design and implementation of a longitudinal CVD information system (LCIS) platform to address disparities in CVD. Fundamental characteristics that distinguished this effort from many others were 1) viewing CVD in the context of a life-long disease process and recognizing the implication of this viewpoint on the design of the LCIS; 2) addressing the extreme limitations of resources available to LSUHSC and the HCSD in the design and implementation of this LCIS; 3) recognizing the need to create a multi-center platform for CVD management, given the structure of the HCSD Charity system and the socioeconomic and educational status of the patients; and 4) designing a HIT system that, though focused on this remarkably important and unique CHF patient population, was inherently generic and fluid in its structure and applicable to multiple other disease-based areas of medical care. Given the significant limitations inherent in this safety-net system, the THQIT Planning Grant group leveraged the partnership, technology, and leadership attributes of the institutions, technology partners, and resources to accomplish this purpose during the Planning Grant process.

The ***Specific Aims (Long-term Goals)*** of the Proposal were:

- 1) to use this partnership to design a (LCIS) for this safety-net system, built in collaboration with the considerable HIT infrastructure that already exists in the HCSD;
- 2) to build into the design the resources to enable the partnership to improve safety and quality of CVD care and to perform clinical and health services research to examine healthcare disparities in this CVD population;
- 3) to build into the design the resources to enable the partnership to evaluate the impact of implementation of this LCIS into cardiovascular care practice in this safety-net population;

- 4) to use the information from this system to transition CVD care to a longitudinal platform evaluated by appropriateness, efficiency, effectiveness, and clinical quality metrics; and
- 5) to package this combination (partnership, AHRQ-funded Planning Grant effort, testbed results and the plan itself) to leverage additional funding by year's end for the full implementation of this safety-net LCIS.

Therefore, the **overall objective** of this THQIT Planning Grant proposal was to address CVD in the HCSD, and the disparities that exist, with the design of a Longitudinal Cardiovascular Information System (LCIS) for this safety-net population. We have created a unique and comprehensive partnership to execute this Planning Grant activity.

### III. SCOPE

**Background:** The delivery of healthcare to the indigent, minority, and disadvantaged populations has represented at once Louisiana's greatest burden and its greatest opportunity. The 70-year-old Charity safety-net system, administratively run as the LSU Health Sciences Center (LSUHSC) Health Care Services Division (HCSD), encompassed a state-wide eight-hospital, 360-clinic network that cared for almost 850,000 patients. Despite delivering some of the highest-quality care in LA, the medical funding mechanism was antiquated, and the financial burden for the care of this HCSD population was overwhelming (Issue Brief, 2004).

In terms of clinical care, it was recognized by the LSUHSC/HCSD leadership that novel approaches to this problem were necessary for survival. Comprehensive Disease Management programs were established in 2000 within this HCSD context for HIV/AIDS, Diabetes, Asthma, and Congestive Heart Failure (CHF), with considerable success at local hospital levels; expansion of these programs was limited in part by the lack of comprehensive medical information across the HCSD facilities.

The financial challenges were even more difficult:

- In 2001, 845,000 (19.3%) of LA's population lacked health insurance, consistently ranking among the highest rates of all states in the US.
- The rate of uninsurance remained almost constant (19 to 20% range) despite a significant expansion and contraction of economic cycles within the state. The four major metrics of 1) high levels of poverty and unemployment, 2) low educational levels, 3) low-wage jobs, and 4) prevalence of small employers, many of whom do not offer healthcare coverage, contributed to this high rate of uninsurance.
- The **total** population dependent upon the safety-net system for health coverage was nearly 39% of the LA population, or 1.7 million individuals; those who would be uninsured but for Medicaid coverage (N = 889,000) constitute a group as large as the remaining uninsured.
- Medicaid coverage was disparate across subsets of the population; the greatest segment of the LA without commercial insurance, Medicare, or Medicaid coverage was disproportionately adult and male (the subset at highest risk for heart disease). Recent significant budget cuts that targeted funding for the uninsured also targeted healthcare access for this subset, with obvious implications related to prevalence of cardiovascular disease.
- Socioeconomic status (SES) barriers existed, preventing a broad goal of access to care for all citizens. LA had the second-highest level in the nation of population living in families with incomes below the federal poverty level (22%). Moreover, 46% lived in families with incomes below 200% of poverty, which is the point at which incomes are considered to just be able to

cover such basic necessities as food, housing, and clothing. This percentage was the highest in the nation.

Additional political factors significantly worked against the HCSD at the State Department of Health and Hospitals and Louisiana Hospital Association levels. The disparity of care delivery between the private and public hospital sectors was dramatic:

- In contrast to national safety-net circumstances, the HCSD comprises an integrated, statewide system of care for the uninsured (IOM, 2003).
- Approximately 85% of total uncompensated inpatient hospital costs in Louisiana hospitals are incurred by the LSU facilities, although this varies between state hospital facilities.
- Many outpatient services for the HCSD patients that are provided by non-state facilities and reimbursed through Medicaid DSH are inefficiently delivered through ER visits and not through regularly scheduled outpatient management.
- Overall, non-state (e.g., private and for-profit) hospitals reported a total uncompensated care cost of \$93.2 M, less than 3% of total statewide healthcare costs in FY 2001. The percentage of total hospital costs represented by uncompensated care in the private and for-profit hospitals was only 3%, compared to 6% nationally.

Finally, there was a substantial disparity between the state support for this indigent, safety-net healthcare and the quality of care delivered in both public and private hospital sectors in LA:

- Perhaps because of the existence of this statewide HCSD system, LA ranked 48th out of the 50 states in the Index of Support for Public Health Care, calculated by the UnitedHealth Foundation. This Index is an imperfect but reasonable summary indicator, based on the total state and local expenditures for health and hospitals and public welfare as a percentage of the total general expenditures of all state and local government units, adjusted for the percentage of the state population with a national household income below \$15,000 (Hadley, 2003; Holohan, 2003).
- Using contemporary estimates of cost/person/year for the 845,000 uninsured in LA, costs for average private, average public, and average Medicaid managed-care coverage premiums range from \$2.26 B to \$1.58 B per year. By comparison, in estimates for FY 04, the expenditure by the state on care for Louisiana's 845,000 uninsured was approximately \$510 M, one-quarter to one-third of what it would cost to cover the health needs of this safety-net population if these needs were met by existing public or commercial coverage in US.
- In the private sector, the quality of delivered cardiovascular care in the state ranks 51st out of 50 states and Puerto Rico for certain cardiovascular disease conditions (Jencks, 1999; 2001).
- The **CHF Disease Management Program** documented a 39% increase in patients under management for CHF throughout the system:
  - All patients were enrolled on the basis of echocardiographic examination (EF <40% as evidence of systolic dysfunction).
  - Patients are followed in the specific CHF clinic and treated according to the guideline algorithms developed for CHF management. Different HCSD personnel (Cardiologist, Internist, or Nurse Practitioners) are in charge of the CHF programs at each of the facilities.
  - This program has resulted in a system-wide 68% reduction in hospital days, a 72% reduction in admissions, and a 61% reduction in ER visits for CHF (Hebert 2001; 2002).
  - Benchmarks for CHF pharmacologic intervention are within the top 10 state metrics in the country (compared to the Jencks data); together with BNP testing in each of the

eight acute-care facilities and an IV continuous Lasix infusion protocol, these have resulted in a cost avoidance of \$27 million for the HCSD.

- The CHF program at Chabert Medical Center was recognized as the 2003 NAPH Accountability and Quality Improvement Award recipient from the National Association of Public Hospitals and Health Systems.

To address these overwhelming financial issues, it was understood that marked improvements in medical and financial efficiencies were necessary. Key to this evaluation and improvement in efficiency was access to medical information. It was against this background that this THQIT Planning Grant was developed.

### **Context:**

The LSU Health Sciences Center (LSUHSC) Health Care Services Division (HCSD) overspent its limited resources (defined by state allocation) for cardiovascular technology on an annualized basis, yet by national benchmarks was underutilizing these technologies based on risk factor prevalence. With this huge safety-net population and the promise that additional, new, more expensive technologies will continue to be developed, the ability to provide even a marginally adequate level of cardiovascular care to these patients was recognized as increasingly in jeopardy.

This safety-net system was also recognized as caring for **priority populations** with a preponderance of **disparities** in CVD. This further emphasizes the need to re-engineer the system of care for CVD in the HCSD, because:

- there was not enough money available **now** to provide care;
- we didn't know if what we were doing was the right thing to do, and if what were doing was being done well;
- we didn't know if the money being spent was most appropriately for the benefit of patients in the system;
- the current system wasn't able to provide the information necessary to evaluate and improve clinical outcomes in patients, to measure effectiveness of care, or to determine how to decrease the financial burden of care in the future;
- a broad spectrum of providers was responsible for the delivery of CVD care in multiple and different healthcare settings;
- the SES and educational status (average grade achieved in CHF population in the DM program was sixth grade) of the population was low;
- the fact that this population relied almost exclusively on the HCSD for healthcare delivery for most of their adult life created an unprecedented opportunity to evaluate these CVD processes from this longitudinal perspective.

***These observations significantly shaped the design process for the developed LCIS system for the HCSD.*** The opportunity to transform and integrate cardiovascular care delivery into a single, longitudinal continuum of disease management (distinct from the fragmented, intervention-based approach utilized in nationwide cardiovascular care today) was recognized. That this could be done in a safety-net system in which all the stakeholders – providers, administrators, and patients – are not encumbered by moral hazard and adverse selection issues, nor by financial disincentives that influence “doing the right thing,” was also recognized.

### **Settings:**

CVD care overall was delivered within the HCSD in a typically fragmented fashion within the eight hospitals and clinics. Not all facilities had dedicated cardiology clinics or full-time cardiology coverage, and much of cardiovascular care was delivered by internists or primary care physicians, often with the support of allied healthcare personnel. This lack of uniformity in care providers created significant obstacles in the planning and design of the LCIS, because education, training, and motivating a PCP to use an information system for only two CHF patients among the 20 patients to be seen in the clinic that day was difficult, and the low frequency of utilization would make learning and adoption of the technology more difficult.

Tertiary-level care was primarily delivered at the Medical Center of Louisiana in New Orleans, which comprised the University Hospital campus (cath lab, EP lab, and CT Surgery operating rooms) and the Charity campus (outpatient cardiovascular clinics). In ischemic heart disease, the HCSD was challenged to deal with patients presenting for interventions in these chronic disease processes 15 years earlier than the rest of the national population with the same disease processes (Ferguson 2004).

Finally, the ability to re-allocate resources toward primary and secondary prevention of CVD in this population was limited at best.

### **Participants:**

The Partnership created for this THQIT Planning Grant was one of the most important accomplishments. This cross-institution collaboration was difficult to accomplish but was successful due to historical precedents, the collective recognition of the important, critical opportunity, and the leverage of this AHRQ Planning Grant opportunity.

The historical Charity partnership was embodied by the systematic linkage of Graduate Medical Education (GME) and care for the uninsured. In terms of GME, Tulane and LSU residency programs operated side by side at the Medical Center Louisiana in New Orleans (MCLNO), composed of the Charity Hospital and University Hospital campuses located approximately ½ mile apart. The Tulane School of Medicine was on one side of the Charity facility, and the original LSU Medical School building was on the other side; the newer LSU School of Medicine facilities were located between the Charity and University hospital campuses. At MCLNO, LSU supported 386, and Tulane supported 239, residency positions in 2002 (Issue Brief, 2004).

In cardiovascular disease, the partnership was also embodied in the MCLNO Cardiovascular Center, where tertiary-level inpatient cardiovascular care and outpatient services were provided by the combined Tulane and LSU cardiology services and the LSU cardiothoracic surgical service. In addition, both schools had faculty who actively participated in the CHF Disease Management Program.

To these **existing clinical partnerships** between LSUHSC, the HCSD, and the Tulane School of Medicine embodied in the Charity system, this Planning Grant brought the Tulane Department of Health Systems Management (**financial outcomes and effectiveness of care**), a leading CVD software company (**system architecture; clinical and financial data concatenation**; ARMUS Corp.), the LA Office of Public Health (**LA Healthy People 2010 initiative**), and outside expert CVD consultants (**longitudinal CVD database design**; Dr. Harlan Krumholz) for this THQIT Partnership.

Ultimately, this Partnership was maintained and augmented in the THQIT Implementation Grant proposal based on this Planning Grant effort.

### **Incidence and Prevalence:**

**The incidence and prevalence of CVD make Louisiana a critical locus for examining disparities in cardiovascular healthcare delivery and an ideal clinical setting in which to implement and test the impact of HIT.** Heart disease still remains the single most important disease process in Louisiana, accounting for 27% of all deaths in the state in 2001. The 2000 Age-Adjusted Death Rate of 375.7 for Total Cardiovascular Disease is considerably higher than the national average (345.3). Similarly, the AADR for stroke is higher than the national average. However, it is just below the national norm for coronary heart disease, which is of interest, given the marked difference in total cardiovascular disease (LaRosa, 2001; AHA 2004). In contrast to national trends over the past 5 years, the CVD-related cause of death rate has been stagnant in LA.

According to the LA Report Card from the DHH, Office of Public Health, age-adjusted mortality in 2001 from CVD was 283.0/100K in LA compared with 247.7 for the US. For cerebrovascular disease, the rate was 65.5 in LA vs. 57.9 in the US. Mortality from diabetes was at a rate of 42.2 vs. 25.2. American Heart Association data document significant increases in mortality rates from coronary heart disease or stroke in black vs. white females, and in males vs. females, within the state. CDC data from the 2003 Health Profile documented 1703.0/100K years of potential life lost before age 75 in LA vs. 1253.0 overall for the US.

Thus, there was no question that cardiovascular disease in LA was an enormous problem from a public health standpoint. A major and necessary component to addressing this problem, both from a care delivery perspective and from a race- and gender-based disease perspective, was the development of an information system for cardiovascular disease that could capture and analyze the necessary information to address these issues.

## **IV. METHODS**

### **Study Design:**

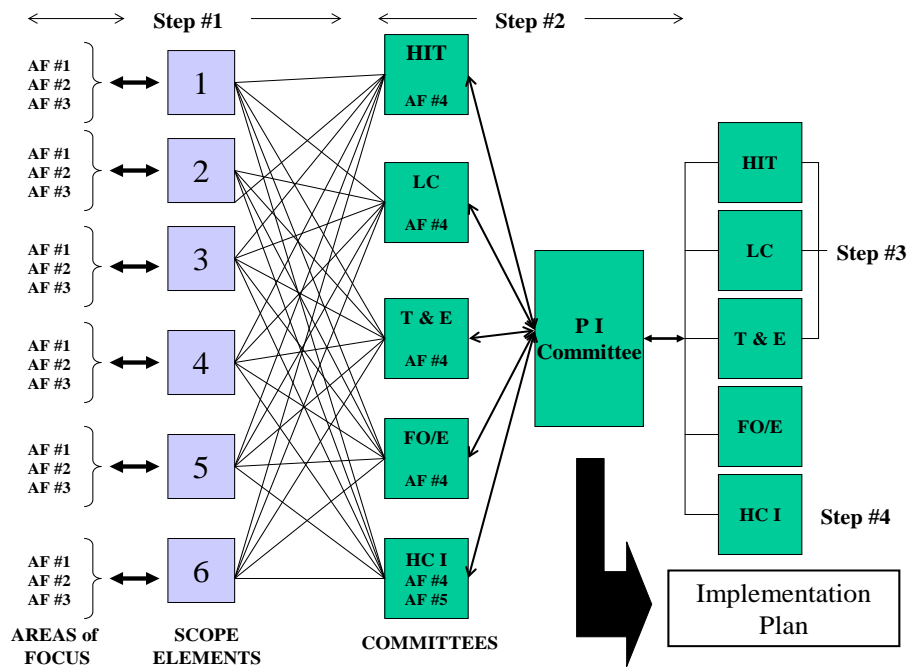
We used a multi-phase consensus development process for this Planning Grant effort. The partner members populated six key committees (Executive Steering Committee, HIT Implementation Committee, Longitudinal Cardiovascular Committee, Outcomes/Effectiveness Committee, Training and Education Committee, Project Implementation Committee, and HIT Impact Committee, which was responsible for the overall oversight of the Planning Grant Project and Process). During the course of the Planning Grant process, the evaluation component of the project was revised and augmented, and additional expertise in this area was brought to the project through the Tulane SPHTM Department of Health Management Systems.

These committees addressed the Areas of Focus (Needs Assessment, Barrier Identification, and Project Parameters) for each of the Six Scope Elements:

1. **DESIGN** a comprehensive longitudinal cardiovascular information system for the HCSD by augmenting existing in IT infrastructure
2. **DEFINE** clinical data requirements for this longitudinal cardiovascular information the system (parameters, processes, and outcomes necessary to monitor longitudinal cardiovascular care)

3. **UTILIZE** point-of-care provider interaction and feedback to reduce medical errors and improve quality by coupling clinical practice with guideline information and best practice benchmarks
4. **USE** the link between clinical and hospital/HCS D system financial data to improve efficiencies and value for the HCS D in cardiovascular care
5. **IMPLEMENT** metrics to determine how this cardiovascular information system impacts provider performance, efficiency, and effectiveness of care and the improvement in the quality of cardiovascular disease care and outcomes in the safety net population of the HCS D
6. **TEST** a scale version of the LCIS by incorporating an HCS D Disease Management Database and clinical infrastructure

The overall Planning Process Diagram used was as follows:



## V. RESULTS

### Prinicipal Findings:

The results of this process can be summarized as follows:

Through this process, we identified and addressed the major potential barriers to HIT implementation in this HCS D setting:

- **Administrative barriers:** diverse political and IT agendas of partners: align partner incentives through identification of member needs; identify and define benefits of this THQIT program for all members; carefully evaluate and commit to maintenance of existing legacy IT systems in the HCS D, and design solution to accommodate this and existing HIT agendas
- **Knowledge-based barriers,** both clinical---develop component for Quality Improvement and Disparities Education for Providers and Patients---and technical---provider misconceptions about HIT addressed through collaborative meetings with clinical and IT members to clarify these issues



- **Functional/System barriers:** determination that a thorough inventory of all aspects of HIT implementation (including IT technical, provider, patient, clinical, administrative, financial, resource, and the ability to conduct Education and Evaluation components) would be a critical early step
- **Structural barriers:** HCSD implementation would logistically strain resources (IT personnel, clinical CHF, and overall Project Administrative and Evaluation); led to partnership with STC
- **Financial barriers:** after years of vendor evaluation, it was realized that “integrated CVD solutions” were too expensive to purchase and support for the HCSD; proposed solutions must be evaluated from the long-term sustainability perspective

Major design parameters were identified:

- **Integration:** must integrate with multiple HSC/HCSD legacy information systems without disruption or obsolescence; maintain the integrity of the LSU HSC “legacy systems” in the data interfaces
- **Technologic:** leverage developing IT technologies and directions to maximize cost efficiencies; as the HSC moves forward with the overall enterprise-wide IT agenda (including possibly VisTA as an integrating backbone), full compatibility of this LCIS solution is required; the system would have to comply with the CHI-adopted Federal Health Information interoperability standards and HIPAA standards for protected health information;
- **Clinical data agenda:** move beyond documents containing clinical information (reports, operative notes) that cannot be used to clinical outcomes and effectiveness analyses; re-engineer data collection process

Clinical information collection and analysis parameters included:

- **Multi-site healthcare setting:** standardize data collection processes and information across all sites
- **Lack of provider adoption:** education of providers AND patients in the need for IT solution, in CVD health information, and in CVD disparities
- **Solution Complexity:** a system design that is too complicated for providers to use will eventually be abandoned
- **Support Complexity:** a system design that is too complicated for IT personnel to provide adequate programming and technical support will eventually be abandoned
- **Patient population characteristics :** significant education, cultural, socioeconomic (SES) issues addressed in IT solution and patient feedback information (Berkman, 2004; IOM, 2004)

Resources were identified as important in the design to:

- **Acquire data:** collect point-of-care clinical data directly at the time of the patient-physician interaction encounter; collect these clinical data from a variety of healthcare providers within the HCSD; if a longitudinal data construct is contemplated, “what we want to know and analyze” 3-5 years hence cannot be determined with any degree of reliability
- **Define data use parameters:** collect, analyze clinical data; link clinical and financial data for quality measurement, feedback, continuous improvement, and healthcare effectiveness analyses; feedback processes, outcomes to both providers and patients; have point-of-care data collection process and data be tightly integrated with powerful analysis capability that is simple for providers to learn and use
- **Synchronize with long-term goals:** longitudinal patient-centered data collection in which directed focus in primary prevention is possible; perform Health Services research to address CVD and care disparities and quality; create the HIT platform for ongoing evaluation and study of this unique population

**Thus, patient-level clinical data, collected longitudinally from multiple sites, in which the collection process is supported by education efforts directed at both providers and patients, is the fundamental requirement for data collection approved by the Planning Grant process.**

Because the existing “cardiovascular systems” supplied by major IT vendors and based on a relational database model had not been tested or validated in a multi-center system like the HCSD, and because the resources for such a system purchase and support maintenance did not exist, and because the established investments in the legacy information systems within the HCSD needed to be preserved and built upon with this LCIS, this “mainstream, off-the-shelf” approach was not an option for the HCSD/Charity system. This Planning Grant process determined that this “mainstream” approach was not an option; in addition, it would have been a huge informatic and financial mistake if the Specific Aims of the project were to be successfully addressed:

- **Lack of provider adoption risk:** Rigidly structured data entry is not intuitively part of patient/physician encounter workflow and is almost impossible to prospectively define and implement in a longitudinal construct; thus, a long learning curve for the many CHF providers in the HCSD could result.
- **Financial risk:** Retrospective data entry, as is commonly used with structured databases, is very expensive and usually requires additional data entry personnel; it also creates data quality and validation issues and additional resource needs, particularly in a multi-site setting such as the HCSD.
- **Support complexity risk:** Inefficient handling of repeated data makes analysis difficult; data integrity issues require validation, which requires constant support; manipulation or merging of datasets with different constructs is difficult; a complex user-level discrimination scheme is necessary for security but requires ongoing resources; analysis requirements are too complex for a majority of providers.
- **Acquire data, define data use parameter risk:** For longitudinal data collection, data elements will change over time, requiring that the data model that determines the underlying table-index relationship to be changed; managing multiple specification sets within a database is complex and sometimes impossible for providers and IT personnel, particularly with large populations.
- **Synchronize with long-term goals risk:** The system must be flexible enough to become clinical trials/translational research/effectiveness platforms.

## Outcomes:

### Patient-Centered Healthcare Information Collection

These conclusions directed our attention to the collection of medical information at the point of care and to make the collection process “patient centered.” The collection of healthcare information in this patient-centered context requires that this patient-physician encounter be defined in terms of **process** and the collected medical information be defined in terms of **data dictionaries**. This data dictionary provides context for the health information, but, unlike a database specification set, it is a **language-based context**. If medical information covers the spectrum from free text written in paper medical record charts (and from which little if any information can be obtained after the fact without enormous expense) to a full relational database structure (in which parameters must be pre-defined, the ability to analyze one-to-many relationships is extremely difficult, and the database structure and content drives the data collection process at the time of the patient-physician encounter), this approach is a lot closer, and therefore much more natural and patient centered, to written or spoken free text.

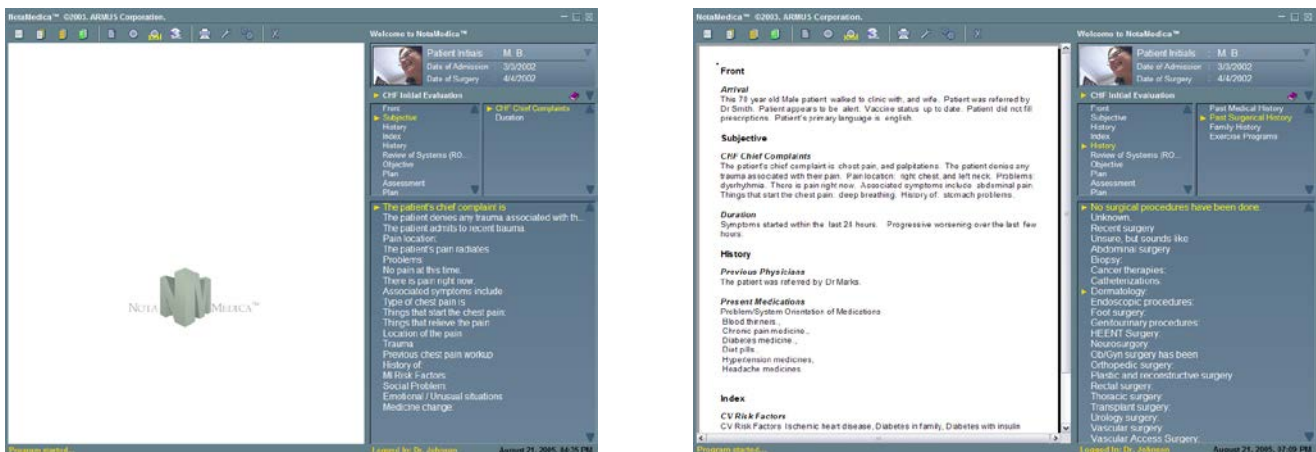
Three other critical components are necessary in order for information to be collected in this manner to be usable as healthcare information:

- It must focus on the patient-physician encounter as the seminal event for clinical data collection and provider and patient feedback.
- The collected information must be searchable.
- An analytical component must be available and interfaced, including populating relational datasets for analyses of outcomes, financial effectiveness, and quality of care.

The approach chosen in this Planning Grant program was to incorporate Application Service technology in an Internet Portal Design to facilitate the patient-centered nature of the process. This approach incorporated the ARMUS Outcomes<sup>3</sup> (ARMUS Corp.). Clinical and financial analysis interface as the system behind the point-of-care data collection process. This interface functioned to provide group discussion, communication tools, and a help desk, with a repository for all documents, applications, and dictionaries that are part of the LCIS system:

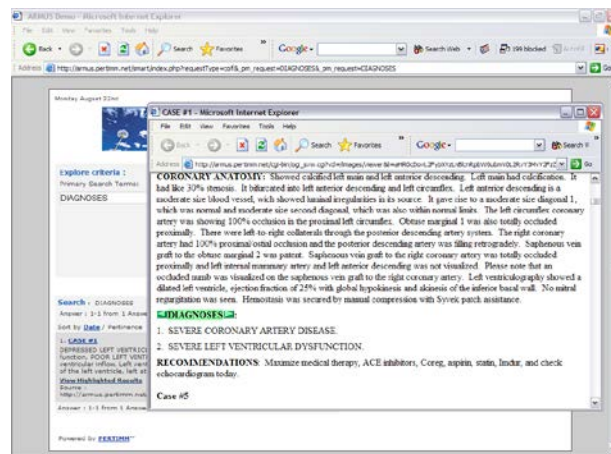
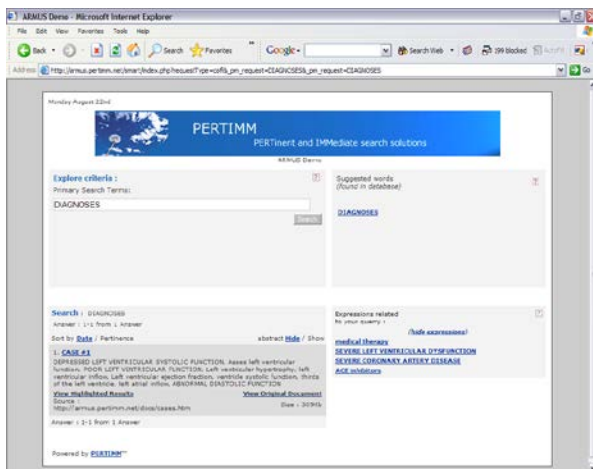


Through this web portal, clinical data can be collected as part of the patient-physician encounter prospectively in real time, using the tool *Nota Medica*. The LCIS design thus has a linguistic-based, patient-centered tool to organize the health information that is collected at the point of care. This technology generates medical notes that are captured in highly efficient and simplified formats that define the sequences of information and process interactions. By eliminating relational database structures from the documentation process, *Nota Medica* supports rapid intake of information while the background engine records *sequential* representations of the *process* that support intelligent assessment and review. Essentially every component of information relative to the encounter is recorded and *indexed* in a way that allows future analyses to evaluate the context of medical decision making. This solution is differentiated from electronic medical records primarily by its ability to mirror and enhance physician processes in providing clinical care:



This process creates medical documents by the assembly of clinical data, parameters, and linguistic phrases that are assembled into a Data Dictionary generally associated with the disease condition of the patient. The breadth and specificity of the dictionary is determined by the patients' clinical conditions, procedures, and interventions.

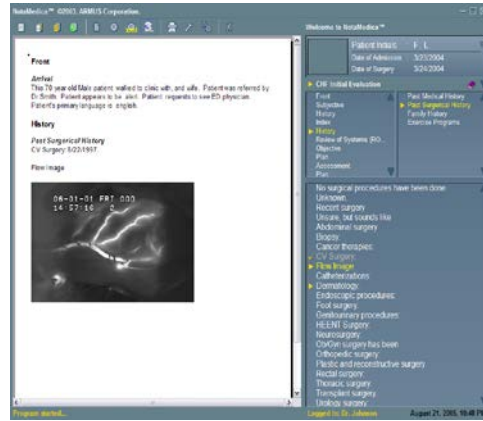
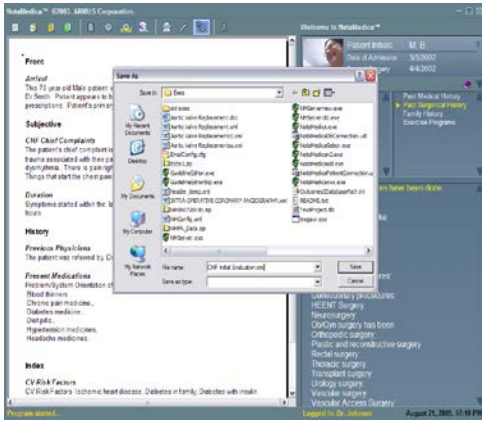
For the Planning Grant, a simplistic Data Dictionary for CHF was developed initially, with the intention to test this prototype and refine the dictionary based upon feedback acquired from providers and patients during this testing phase (Specific Aim #4). Due to hurricane Katrina's effect on the HCSD, this testing could not be performed; during the last month of the project, this CHF dictionary underwent further development based upon expert medical input, validation, and testing. To further this CHF dictionary development, a web-based search engine for extracting information from de-identified CHF patient data was developed:



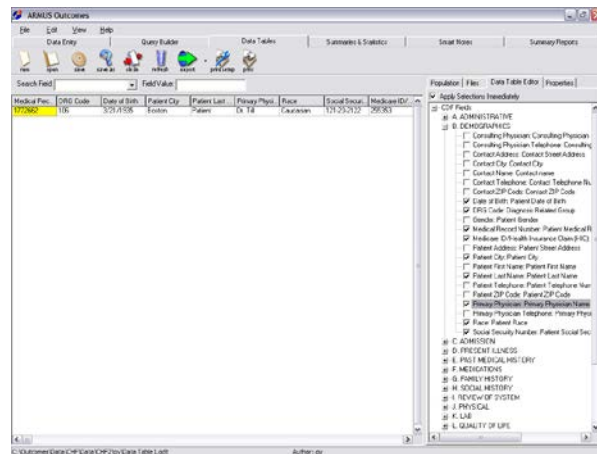
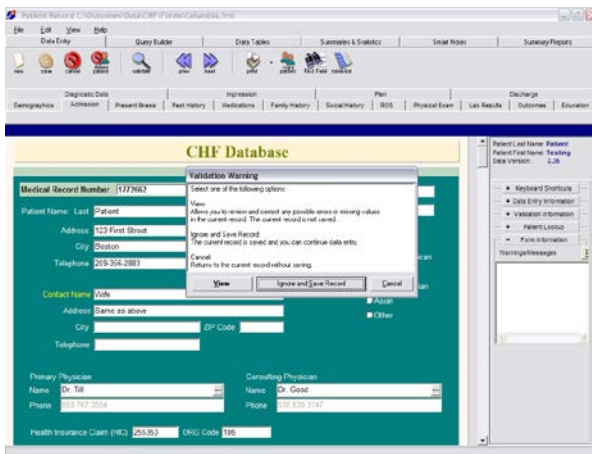
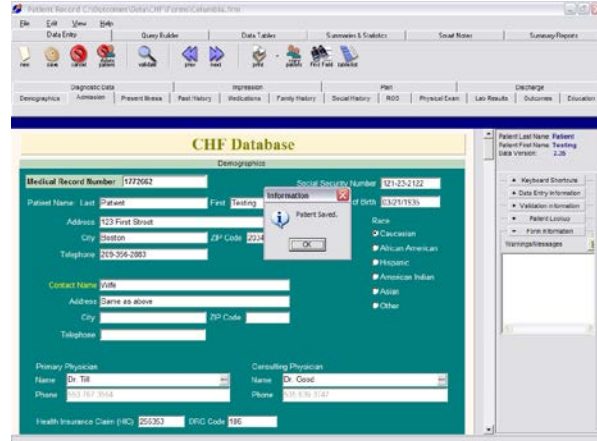
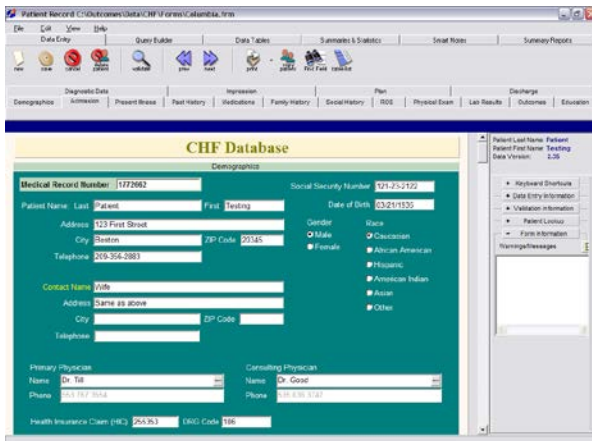
This dictionary development included a Microsoft SQL design and implementation, followed by the creation of the logic structure (within *Nota Medica*) for key medical terms used in the care, both short term and long term, of patients with a variety of clinical conditions that fall under the umbrella of Congestive Heart Failure. The additional development work performed after Katrina was to create a significantly greater number of different dictionary segments; the relationships between these additional terms were documented and then validated by expert medical opinion. Development, testing, and validation of search parameters to group key terms accurately was part of the CHF Data Dictionary creation process as well.

The concept behind this dictionary is that different providers developed habits and use terminology that is specific for the patient's disease condition but also specific for the way they collect and assemble information in the provider-patient encounter. This approach allows for three different providers to use "CHF," "congestive heart failure," and "NYHA Class III failure" to define a patient's condition, under circumstances in which, for analysis purposes, all three linguistic terms can be defined to mean the same thing and then searched accordingly. To facilitate this search capability, *Nota Medica* saves the information in the screen-displayed medical notes in multiple formats, including XML; sample reports can automatically be produced, and medical images can readily be imported into the system:

Principal Investigator/Program Director (Last, First, Middle): Ferguson, T. Bruce Jr.

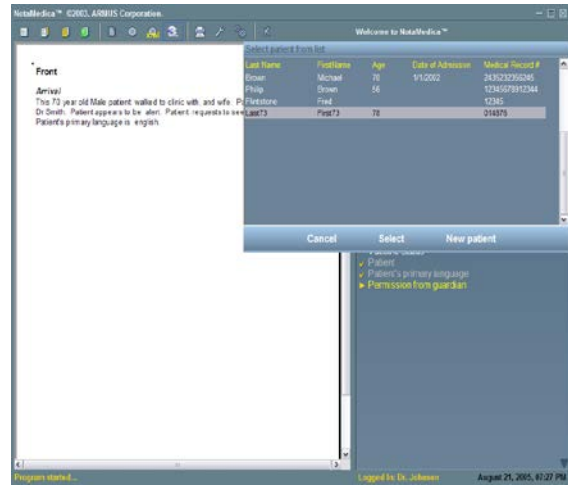
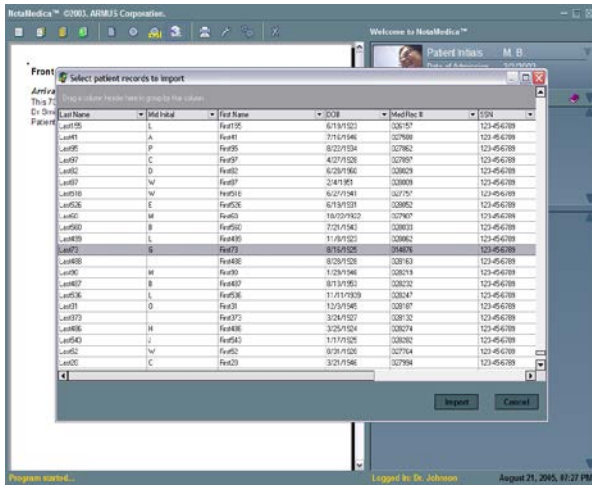


The dictionary thus functions behind the *Nota Medica* interface, and behind this combination is the analysis and interface component of Outcomes<sup>3</sup>. Thus, data and parameters from the *Nota Medica* patient-physician encounter process can populate database structures in Outcomes<sup>3</sup> for analysis, shown as a prototype CHF Patient Registry:

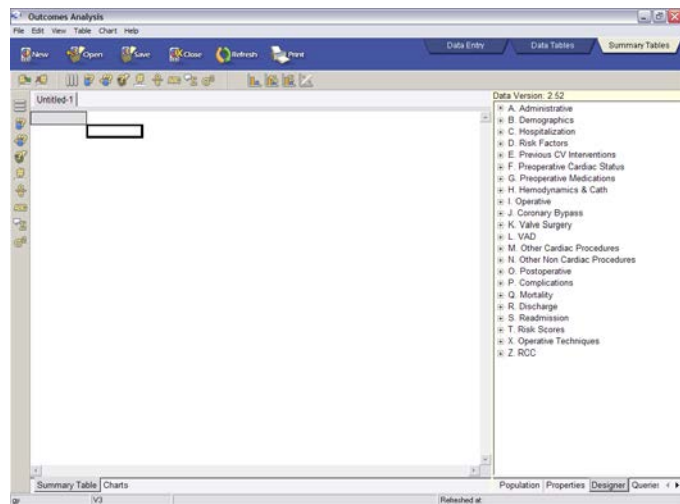
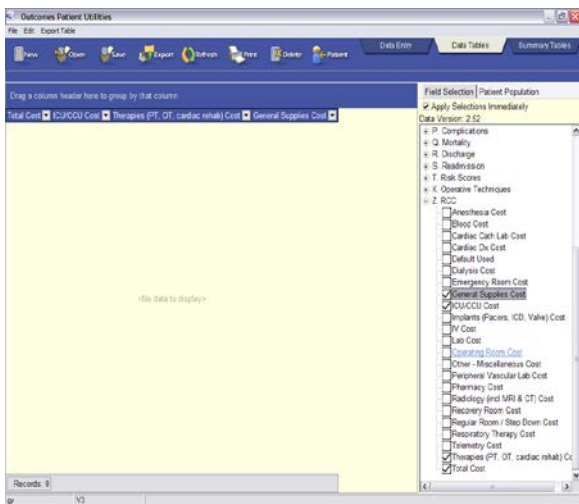


This includes importing patients from Outcomes into *Nota Medica* and dictionaries:

Principal Investigator/Program Director (Last, First, Middle): Ferguson, T. Bruce Jr.



Finally, ARMUS has succeeded in linking robust clinical data sets with financial data within the context of Outcomes<sup>3</sup>. This concatenating of clinical data with independently derived financial data creates the opportunity to link the CHF clinical data from the LCIS to the HCSD financial and decision support software already in place:



In addition, the architecture allows for the interfacing with essentially all major formats of IT systems, including financial and clinical decision support systems (CDSS), via standard HL-7 and LOINC interfaces that follow HIPAA guidelines. *Nota Medica* is already integrated with the ARMUS Outcomes<sup>3</sup> analysis software component (already in use in the HCSD).

The platform was initially demonstrated at the AHRQ THQIT IT Conference in June 2005 in Washington, DC, during the "Innovation Café" segment of the meeting. Because of issues related to the Microsoft 2003 Server environment, this prototype and those used for testing as part of this Planning Grant were established on tablet PCs.

## Conclusions:

With the exception of the pilot testing, all aspects of the Specific Aims of this Planning Grant were accomplished. A validated approach to collection of clinical information for CHF patients as part of the development of a Longitudinal Cardiovascular Information System was developed to the

prototype stage. This prototype was deliberately specified to fit into the context of the larger, multi-site LCIS.

Importantly, this system was deliberately designed from the perspective of point-of-care, patient-centric data collection, with minimal derangement of the provider work flow and patterns of care delivery. The system was robust enough to interface with existing HIT systems within a multi-center delivery system that was patchworked together. Analytical tools and analysis capabilities were incorporated as extremely important components in the system to facilitate provider and patient-level feedback for use at the time of the patient-physician encounter.

This patient-centric approach to the design of the system facilitated the longitudinal collection over time of data on the same condition from the same patients, without the complications and limitations of multi-relational database systems. Changes to clinical care practices and the incorporation of new technology for CHF care can easily be incorporated by changing the parameters in *Nota Medica*, without having to re-structure a relational database or being forced to create multiple versions of the same database.

Finally, based upon prior experience with Outcomes<sup>3</sup>, the ability to address the clinical and financial effectiveness metrics and disparities in patient care delivery and conditions that are so critical to the long-term sustainability of this HIT system could readily be accomplished with this LCIS structure, in collaboration with the remarkable resources that this THQIT Partnership brought to the table.

### **Significance and Epilogue:**

It is a tragedy of enormous magnitude that this healthcare system was all but destroyed by hurricane Katrina. As a result, this LCIS CHF prototype will not be able to undergo pilot testing within the HCSD and LSUSHC, and the true significance of this approach to healthcare information will have to be tested in another healthcare delivery system under different circumstances.

Even now, almost 5 months after the storm, it is unclear what the future of healthcare delivery in Louisiana and in New Orleans will be. Both LSUHSC and Tulane Schools of Medicine have been forced to lay off > 25% of their full-time faculty; the HCSD has reduced its workforce statewide from > 4200 to about 350. The financial resources to provide for ongoing operations of both schools are very much in question at this time. For LSUHSC, the three main sources of income (state funding for resident education, private practice income, and government DSH funding) have all been drastically reduced because of the storm and subsequent lack of clinical patients and clinical practice facilities. Even today, neither LSU or Tulane has been able to re-establish a major hospital teaching facility in New Orleans.

The amount of destruction that occurred is beyond comprehension, unless perhaps you have seen it in person. All six LSUHSC teaching hospitals remain closed, as does Tulane University Hospital and the New Orleans Veterans Administration Hospital. The LSU HSC Cardiovascular Outcomes Research Group offices, from which this THQIT Planning Grant was administered, was not completely destroyed but is located in a building facility that for 4 months was considered condemned and still is uninhabitable, with no electricity or running water; the entire first floor of the three-story office building had been completely gutted. The complexity of the leadership decisions about the next steps in the restoration of healthcare in New Orleans and around the state is overwhelming.

Moreover, it is feared that a significant decline in house staff, residents, and fellows applying to training programs starting this summer will occur; this will make the justification for re-establishment of these training programs by renovating damaged hospital facilities or building new facilities a moot point, because there will be no educational opportunities even if the patients eventually return to the New Orleans area.

With respect to the HCSD patient population, things are equally bleak. Thus far, all attempts to re-establish cardiothoracic surgery for the HCSD population have been unsuccessful, and a significant number of these patients are simply not receiving care; this is true across the board for essentially all other medical conditions as well. Some indigent/safety-net care is being provided in the private hospitals, but the extraordinary separation of reimbursed vs. indigent care in LA that was facilitated by and a direct result of the presence of the HCSD/Charity system means that these private facilities can get little if any reimbursement for this care, because the mechanism for shifting these healthcare reimbursements does not exist. This in turn, coupled with the significant decline in the overall population of the greater New Orleans area, is putting a number of private non-profit and for-profit hospitals in serious financial risk. It is anticipated that as many as 50% of pre-Katrina hospitals in New Orleans will never reopen.

In all likelihood, the Charity safety-net system as it was pre-Katrina is gone for good for a variety of financial, political, infrastructure and socioeconomic reasons. Whether the healthcare system that is re-created in New Orleans can deliver the same quality of care with the same zeal, passion, and dedication that so magnificently characterized the Charity system remains to be determined.

The Investigators on this Grant effort cannot express the gratitude we have for the understanding and support that the leadership of AHRQ, in particular the Grant Personnel, have provided to the THQIT Planning Grant effort at LSUSHC before, during, and after the storm. It certainly has made the weathering of the consequences of this tragedy a bit easier.

#### Literature Cited:

Chappell V, Harrison LH, Heck HA, Rubenstein FS, Barbier G, Guccione L, Ferguson TB Jr. 2005. The impact of female gender on Safety-Net CABG patient outcomes. *Circulation Online*; presented at the AHA Quality Meeting, Washington DC, May 14-16, 2005.

Hadley J, Holahan J. 2003. Covering the uninsured: How much would it cost? *Health Affairs Web Exclusive*, June, 2003. Available at <http://www.healthaffairs.org> (limited access site).

Hebert K, Arcement L, Fleming M, Glanders P, Arabie C, Hebert C, Bergeron G, Scott E, Ventura H. 2002. What is the prevalence of the metabolic syndrome in ambulatory systolic heart failure patients? *J Cardiac Failure* 8:suppl 1:S65.

Hebert K, Arcement L, Liz D, Ferguson T, Ventura H. 2001. The experience of a cost-effective congestive heart failure disease management model applied to an indigent population. *J Am Coll Cardiol* 37:supplA: 492A.

Holihan J. 2004. Health Insurance Coverage of the Near Elderly. Kaiser Commission on Medicaid and the Uninsured. July, 2004. Accessed at <http://www.kkr.org>, 4/1/2005.

IOM, 2003. Institute of Medicine, Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington DC: National Academies Press, 2003.



Principal Investigator/Program Director (Last, First, Middle): Ferguson, T. Bruce Jr.

IOM, 2004. Committee on Health Literacy, Institute of Medicine. Health Literacy: A Prescription to End Confusion. Washington DC. National Academies Press; 2004.

Issue Brief, 2004. Available at <http://www.lsuhs.edu/hcsd/cmo/hcet/issuebrief.htm>. Accessed 4/20/04.

Jencks SF, Cuerdon T, Burwen D. 2000. quality of medical care delivered to Medicare beneficiaries. JAMA 284:1670-76.

Jencks SF, Huff ED, Cuerdon T. (2003). Change in the quality of care delivered to Medicare beneficiaries, 1998-1999 to 2000-2001. JAMA 289:305-312.

## **VII. Publications/Products**

None