Healthcare in the United States
The healthcare industry in the United States is going through an unprecedented transformation. The industry facts when compared to other advanced nations are somewhat astounding:

- The United States spend more for health care than the citizens of any other country.
- About 60% of Americans have health insurance through an employer.
- Cost is the primary reason for being uninsured.
- The United States have highest healthcare costs per capita in the world. Healthcare spending rises with age; < 25 yrs spend $704 out-of-pocket, > 75 yrs spend $4,210.
- Health share of GDP in the United States is around 16%; almost $2 trillion and rising.
- The United States of America is the only wealthy, industrialized nation that does not provide universal health care.
- Medical errors account for more deaths than breast cancer, AIDS and motorcycle accidents.
- By 2015, 15% of the population will be receiving Medicare benefits.
  - In 2020, one in five Americans will be on Medicare.
- 42.5 million Americans are enrolled in Medicare.
  - By 2016, 54.5 million Americans will be enrolled.
  - In 2025, 72.5 million Americans will be Medicare recipients
- Healthcare is 10-15 yrs behind business in adoption of IT.

Healthcare Information Predicament
In today’s world it is not uncommon to hear about the amazing progress made in clinical and surgical technologies. Laser eye surgeries, doctors performing surgeries using robotic arms, and highly sophisticated prosthetics for severe limb injuries are just a few remarkable developments we hear about and see on television.

However, we have also heard horror stories of surgeries performed on the wrong knee. The surgeon did not have the correct patient chart. Patients have died under medical supervision due to medical infection. Over 100,000 patients die every year due to completely avoidable medical errors.

Healthcare organizations across the value chain have been lagging in the adoption of information technology compared to other industries. The increased legal and regulatory requirements coupled with consumerism have contributed to the increased pressure on Healthcare Information Technology. There is an emphasis on electronic records to stay compliant and prevent costly medical errors. It is likely to lower healthcare costs for consumers as well.
**Electronic Records**
We will use the following definitions of electronic records as described by the Health and Human Services and the National Alliance for Health Information Technology.

**Electronic Medical Records (EMR).** An electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization.

**Electronic Health Records (EHR).** An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization.

**Patient Health Record (PHR).** An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards that can be drawn from multiple sources while being managed, shared, and controlled by the individual.

The holy grail in the healthcare industry is to have every patient in the United States have accurate electronic records quickly accessible to caregivers; it matters the most when time is of essence, particularly in Emergency Rooms -- that is creation of a paperless care facility. Electronic records will provide the higher quality care and patient safety.

There are several challenges surrounding adoption of electronic records – the deep-rooted culture of doctors who are resistant to change, the initial investments required for the electronic records infrastructure, and conversion of existing health and medical records.

**Standardization and Interoperability**
In the healthcare industry there is still some confusion amongst solution developers about what standards to adopt for electronic records. If there is no standard for data definition the industry will be in a state of chaos. We will have vendors building systems which will not talk to each other. For example, hospitals, doctors, and care centers will want to share data with each other and the pharmacies. Data exchange needs to be streamlined to cut through the bureaucracy of paper forms which exists today. Patient data privacy challenges must be addressed. Information security has been addressed in the financial services industry. When we have the infrastructure to support standardization and interoperability we will be on a good path to automating data flow processes.

Automation of electronic record creation and exchange is a good first step. However, unless data captured is analyzed for insights the value of an electronic healthcare environment will not be completely realized. Several questions must be answered, for example -- will better treatment and disease management decisions be made based on patient history which will become available over time? Will healthcare outcomes improve from better, more accessible information? Will we be able to predict conditions based on today’s health risk assessments?
Business Intelligence and Analytics in Healthcare

Answers to questions raised depend on turning data into insights. That is going to ultimately create a better healthcare experience. Healthcare is still playing catch up. Healthcare is data rich, but, information poor. Good, talented, and knowledgeable resources will be necessary to make sense of the massive amounts of healthcare data available. Additionally, data in healthcare comes from heterogeneous sources and varying formats. Data must be read, parsed, joined, and stored in a database for data analysis and interpretation which forms the foundation of business intelligence. In order to get started with BI a solid infrastructure foundation must exist as well.

Healthcare Business Intelligence Architecture

The illustration depicts a practical architecture deployed for healthcare business intelligence and analytics. The following sub-systems are necessary to complete a basic foundational architecture:

- Source Systems (structured, unstructured data)
- Data Quality and Integration
- Healthcare Data Warehouse
- Healthcare Business Intelligence & Analytics Engine
- Healthcare Portal

Data sources can be structured or unstructured. The data quality and integration process is responsible for converting data into a format readable by the database. The Healthcare Data Warehouse stores data in a database for access by the BI and Analytics Engine. Finally, the healthcare portal serves as the display device for healthcare consumers.

Iterative and Incremental Approach

The authors are proponents of an iterative and incremental approach to building healthcare business intelligence and analytics capability. The methodology brings quick wins with demonstrated results which in turn builds the confidence in the development team; it eases the business case for future funding. The multi-million dollar, multi-year, enterprise-based (i.e. “big bang”) approach to developing BI and analytics capabilities has proven to be too risky and too expensive. It is vitally important to study and understand the business, technology, and information architecture while following an iterative & incremental method. The primary objectives should be quality deliverables using existing or economical applications and focusing on long-term objectives and cumulative short term results.
Integrated Data Lifecycle Management™

The Data Quality and Integration technology platform is critical to healthcare BI & Analytics environment. A strong emphasis on this aspect is necessary during the BI & Analytics planning phase. Solutions are available to integrate a wide variety of data exchange standards and message formats, including EDI, XML, HL7 versions 2 and 3, custom message formats, as well as CDA attachments.

All healthcare players must ensure data quality and integration solution is not only meeting current business needs but will also build a solid foundation to accommodate future growth in data and user base. The long term view enables them make strategic decisions surrounding information delivery within their organization. Over time, there will be an explosive growth in the number and types of data sources and targets.

The Integrated Data Lifecycle Management™ approach provides a flexible framework to ensure we take advantage of architectural advances and build in “flex” points to avoid the “lock-in effect” of existing practices that eventually become obsolete, forcing organizations to “rip and replace” technology. This helps protect investments by leveraging ongoing evolution and establishing processes that sustain healthcare data integration efforts over the long term.

Overlaid transparent rectangles in the illustration show SAS® products used in the physical implementation of the architecture.
Outer Circle
The outer circle stresses on getting data integration right. There should be a logical progression to activities. Understanding business requirements and identifying data, quality, and security needs set the stage for building a robust data integration solution. Finally, a mechanism to measure and manage efficiencies closes the data integration cycle.

Inner Circle
The inner circle forms the quality cycle. Activities are performed in conjunction with data integration. Data is profiled and assessed to incorporate appropriate validation and improvement measures. As data flows through the corporate plumbing, it needs to be monitored constantly for quality. A consolidated dashboard of data quality and integration helps organizations stay proactive and make decisions with confidence.

Core
At the core of the lifecycle is your organization's data engine. Clearly understanding data and its appropriate use puts organizations in a position where they are not reacting to situations as they encounter them. Addressing current and future needs at the building block (“data”) level allows organizations to cope with changing economic conditions, demographic shifts, regulatory mandates, and changes in the service-level expectations of their customers.
Resourcing Strategy

Healthcare organizations must resist the temptation of leveraging existing resources involved with the reporting or analytical functions to build the entire system. Instead, an approach based on partnership will yield better results. Tenured professionals can make great subject matter experts. Inspire them to make the time contribution to create a better world. Get them to work with expert professionals from the field of business intelligence and analytics.

“First, get the right people on the bus.” There is strong evidence that healthcare business intelligence and analytics projects can be run successfully when you have the right person for the right job at the right time. Rigorous selection and recruitment processes are mandatory to ensure success.

Relevant SAS® Products

**SAS® Enterprise Data Integration Server.** SAS Enterprise Data Integration Server is a powerful, configurable and comprehensive solution that can access virtually all data sources; extract, cleanse, transform, conform, aggregate, load and manage data; support data warehousing, migration, synchronization and federation initiatives; support both batch-oriented and real-time Master Data Management solutions; and create real-time data integration services in support of service-oriented architectures. Visit: [http://www.sas.com/technologies/dw/entdiserver/index.html](http://www.sas.com/technologies/dw/entdiserver/index.html)

**SAS® Enterprise BI Server.** SAS® Enterprise BI Server is a comprehensive, easy-to-use business intelligence software solution that integrates the power of SAS analytics and data integration to share insights that power better business decisions. It includes role-based, self-service interfaces for all types of users within a well-defined IT governance framework and a centralized point of administration. This helps organizations simplify and speed business intelligence deployment. Visit: [http://www.sas.com/technologies/bi/entbiserver/index.html](http://www.sas.com/technologies/bi/entbiserver/index.html)

**SAS® Analytics.** SAS Analytics provides an integrated environment for predictive and descriptive modeling, data mining, text analytics, forecasting, optimization, simulation, experimental design and more. From predictive analytics to model deployment and process optimization, SAS provides a range of techniques and processes for the collection, classification, analysis and interpretation of data to reveal patterns, anomalies, key variables and relationships, leading ultimately to new insights and better answers faster. Visit: [http://www.sas.com/technologies/analytics/index.html](http://www.sas.com/technologies/analytics/index.html)


**SAS® Enterprise Guide.** SAS Enterprise Guide provides a SAS graphical interface that helps you exploit the power of SAS and publish dynamic results in a Microsoft Windows client...
application. The solution is the preferred SAS interface for business analysts, programmers and statisticians and a key application in SAS Business Intelligence offerings. Visit: http://www.sas.com/technologies/bi/query_reporting/guide/index.html

**SAS® Scalable Performance Data Server.** SAS® Scalable Performance Data Server® delivers subsets of information harvested from large stores of enterprise data, quickly and on demand. The solution ensures that business intelligence and analytic applications maintain consistent performance and that extraction, transformation and loading (ETL) processes do not exceed the time windows that are available. Visit: http://www.sas.com/technologies/dw/storage/spds/index.html

**SAS® Metadata Server.** SAS Metadata Server provides an open, centralized repository for storing and managing enterprise metadata that is created and required by an organization to support its business analytics strategy. Unless organizations operate with a single source of integrated metadata (information about data sources, content, business rules and access authorizations), it is a struggle to deliver consistent information. Visit: http://www.sas.com/technologies/bi/appdev/base/metadatasrv.html

**CONTACT INFORMATION**
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