Information Quality Research from the Healthcare Perspective

ABSTRACT

IQ researchers have been engaged in investigating causes and solutions to IQ-Problems in a holistic way for the past two decades. This presentation provides a contemporary survey of IQ-research intended to give clinicians an overview of IQ methodologies and trends. IQ-assessment is discussed in some detail to account for types of IQ-problems, dimensions, and methods. IQ-management and impact on decision making are examined. Structured and unstructured information characteristics and methods are explored.

All statistics and examples used relate to healthcare while best- and existing-practices are compared and contrasted. The aim of this presentation is to stimulate inquiry among healthcare practitioners, and to incite adoption of IQ-initiatives to add value to their efforts.

BIOGRAPHY

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President
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Marilou Haines, president of Alamo Software Inc. and its new division AlamoIQ, received her M.B.A. and M.S. in Information Quality from the University of Arkansas at Little Rock. She is currently a PhD candidate of Applied Sciences with emphasis on Information Quality. Alamo Software, Inc. supplies business custom software to US franchises and AlamoIQ provides consultancy and software services related to Information Quality.
Information Quality Research

from the Healthcare point of view

by

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Agenda

1. Introduction
   - IQ Research
   - Healthcare Statistics
   - Challenges in the Healthcare Industry
2. Information Quality Objectives
   - Healthcare and Best Practices
3. IQ Research Methods
   - IQ Assessment
   - IQ Management
   - IQ Impact on the organization
   - IQ problems
     - Classification of IQ problems
   - Structured and Unstructured data
4. Data Governance
Introduction

Information Quality Research seeks to investigate causes of IQ problems and their solutions.

- In healthcare, patients risk being harmed beyond their existing problems. The number of errors attributed to Information Quality is well documented:
  - More people die yearly as a result of medical errors than from car accidents, breast cancer, or AIDS.
  - Medication related errors are frequent (one out of 100 admissions) resulting in an average increased cost of $4,700 per admission.
  - IOM reports that medical errors cost the nation $37.6 billion each year; $17 billion are associated with preventable errors.
  - Yearly lost productivity in the healthcare industry accounts for $9 billion and nearly $2 billion in hospital costs

Source: Institute of Medicine To Err is Human – Building a Safer Health System

Challenges in the Healthcare Industry

- In the US reimbursements are based upon costs and not upon efficiency or success in outcomes. Therefore, efficient services, generally yielding lower reimbursements, are practically discouraged.
- Healthcare is a highly complex labor- and skill-intensive service organization. Most physicians, however, rely primarily on paper tools, memory, and other traditional methods.
- Financial Short-term orientation presses management against higher quality initiatives which require long-term planning
- Failure to adequately invest in Information Technologies
  - Healthcare investment in technology is 3.5%-4.5% while most other industries invest close to 10% annually.
- Strong resistance to performance metrics due to non-conformity of processes, regional differences, and fear of litigation.
Information Quality Objectives

1. Maximize the **value** of an organization’s information assets.
   Value = degree to which goods, services, or other benefits exceed required investment
2. Assuring that the information products produced meet the needs and expectations of information consumers

Don’t Confuse Results with VALUE!

Example:
**Effort**: Standardization from twelve different prosthetic implants to two for any one clinical indication.
**Results**: No compromise in patient outcomes.
**Value**: Within two years, the net operating income went from negative to $8 million at the Rochester practice alone.

Source: Management Lessons from Mayo Clinic, Page 224
## Healthcare vs. Best Practices

<table>
<thead>
<tr>
<th>Healthcare</th>
<th>Manufacturing</th>
<th>Healthcare Best Practices</th>
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<tbody>
<tr>
<td>Survey of 3,000 hospitals reports that only 1.5% of nonfederal US hospitals use a comprehensive EHR system; only about 8% use a basic EHR in at least one unit. Source: New England Journal of Medicine, March 25 2009 online version.</td>
<td>GE invested $450 million to achieve $2 billion savings. Source: Arthur Jay (2004) Six Sigma Simplified</td>
<td>Mayo Clinic: In the 1990s the migration from paper to EMR began. Today, the EMR is instantly available throughout Mayo System once information is posted.</td>
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<tr>
<td>Healthcare error rate is approx. 6,210 errors per million or .62% (3.8 sigma). For some treatment activities as high as 1% Source: Trusko Brett (2007) Improving Healthcare Quality and Cost with Six Sigma</td>
<td>Manufacturing error rate is approx. 3.4 errors per million for all processes or 99.9997% ERROR FREE Source: Trusko Brett (2007) Improving Healthcare Quality and Cost with Six Sigma</td>
<td>Introduction of IQ initiatives to healthcare. Charleston Medical Center reduced infection rate of colon and vascular site infections by 91% (2.86 sigma). Annual savings in excess of $1 million. Source: Basics of Quality Improvement in Health Care. Mayo Clinic Proceedings. Page 737</td>
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## IQ-Research Method

Most of IQ-Research tries to answer the following three questions:

1. **How to assess** Information Quality including IQ- problems, dimensions, and methods.
2. **How to manage** Information Quality including quality-, information-, and knowledge-management.
3. **How IQ impacts** organizational contexts in Information Systems, Decision Making, and other contexts.
IQ Assessment

IQ Assessment is the process of assigning values to IQ characteristics (dimensions) in a given setting.

• The Wang-Strong Framework has 15 dimensions some of which are: accuracy, completeness, timeliness, and accessibility.
• Dimensions are linked to data by metrics
• IQ metrics can be linked to multiple dimensions causing dependencies with positive or negative correlations.
• Trade-offs can occur such as timeliness leading to inaccurate and incomplete data.

IQ Assessment (2)

• Objective view
  o Conducted by systems technicians engaged in tasks such as:
    ▪ Measuring data integrity and finding conflicting values
    ▪ Data profiling
• Subjective view
  o Focused on measuring “fitness for use” from the perspective of the information consumer
  o Handling information as a product and not as a by-product
IQ Problems

Garvin suggests three types of IQ problems:
1. Biased information
   - where the content is inaccurate or distorted due to the transformation process.
2. Outdated information
   - Data that is not updated to be fit for use
3. Massaged information
   - Referring to information with different representations

Classification of IQ problems

<table>
<thead>
<tr>
<th>Context - independent</th>
<th>Data Perspective (objective)</th>
<th>User Perspective (subjective)</th>
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<tbody>
<tr>
<td></td>
<td>• Spelling errors</td>
<td>• Inaccessible information</td>
</tr>
<tr>
<td></td>
<td>• Missing data</td>
<td>• Information is insecure</td>
</tr>
<tr>
<td></td>
<td>• Duplicate data</td>
<td>• Information is difficult to aggregate</td>
</tr>
<tr>
<td></td>
<td>• Incorrect values</td>
<td>• Errors created during</td>
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| Context – dependent   | Violation of domain constraints  | Information is not factual                           |
|                       | Violation of business rules      | Information is not credible                          |
|                       | Violation of company or government regulations | Information is irrelevant                           |
|                       | Violations of constraints of database administrator | Information is incomplete                           |
|                       |                                  | Information cannot be understood                     |
|                       |                                  | Information cannot be manipulated                    |
IQ Management

- The objective of IQ management is to improve the usefulness and validity of information.
- IQ management has merged three domains of management:
  - Information management
    - Following the principle “integration, validation, contextualization, activation” to structure the IQ handling and value adding activities. Eppler connects IQ management and information management with the information cycle.
  - Quality management
    - Wang proposes to “manage information as a product” for Total Quality Management to deliver high quality information products to information consumers.
  - Knowledge management
    - With the principle “Know-what, know-how, know-why” Huang et al. propose to improve the quality of information and to transform it into organizational knowledge.

IQ and Decision Making

- Regarding information overload, Keller and Staelin propose a model on how decision effectiveness is affected by IQ and information quantity.
- Based on crisis decision, Belardo and Parzer present the relationship between IQ and decision quality.
- Ballou and Parzer analyze tradeoffs between accuracy and timeliness in decision making.
- Chengalur-Smith et al. consider task complexity and decision strategy.
Structured Information

**Formatted for computer use**
- Data is presented in a uniform, repeating format ready for computer processing.
  - Relational databases, flat files, XML
  - Information can always be found in the same format and place
- Information has been formatted for use in automated processes
  - Electronic medical records, insurance billing systems, sales transactions

Unstructured Textual Information

**Formatted for humans to use**
- Although images and sound are increasingly used by enterprises, the vast majority of untapped unstructured information is textual
  - Medical records, notes, annual reports, letters, documents, e-mails, spreadsheets, etc.
- On unstructured information, entities and attributes must be located, identified, and translated into a standard format to be ready for computer processing.
  - Printed or hand-written documents, reports, magazine articles, photos, recordings
- Information is not mapped into a Database Management System schema
### Structured vs. Unstructured Systems

<table>
<thead>
<tr>
<th>Structured Systems</th>
<th>Unstructured Systems</th>
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<tr>
<td>Designed, built, and operated by IT Department</td>
<td>No predetermined rules or structure</td>
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<tr>
<td>Closely tied to day-to-day operations</td>
<td>Full of textual data</td>
</tr>
<tr>
<td>Make cost justification, ROI easier</td>
<td>Fueled by the need for communications, informal analysis, personal analysis</td>
</tr>
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<td>Growth fueled by competitiveness</td>
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### Textual Analytics Evolution

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<th>First Generation</th>
<th>Second Generation</th>
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<tr>
<td>Keyword search engines</td>
<td>Integrating (pre-conditioning) of unstructured data before it is searched</td>
</tr>
<tr>
<td>Tagging</td>
<td>Ability to integrate unstructured data at the point of analysis</td>
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<tr>
<td>Indexing</td>
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Data Governance Definition

“Data Governance can be defined as a system of decision rights and accountabilities for developing, organizing, and implementing policies, procedures, and standards for the effective use of an organization’s data assets”


- Data governance initiatives are sometimes driven by the desire of improving data quality. However, more often than not, they are driven by external regulations such as HIPAA in the healthcare industry.


Data Governance

Data Governance is the process of managing data in a comprehensive manner including data collection, creation, processing, manipulation, storage, protection, and its archival. Data governance clearly defines who manages the data and who has authority to make changes and other types of decisions.