APPLIED HEALTH INFORMATICS

Electronic Health Records (EHRs) & Health IT Systems

From Clinical Documentation to Health System Intelligence
EHR Implementation, Information Use & Digital Transformation

Presenter: Chamberlain Nwanne, PhD



Memorial Sloan Kettering Cancer Center



Copyright MSKCC. Confidential — do not distribute without permission.

Electronic Health Records (EHRs) & Health IT Systems

Week 3 & 4: From Clinical Documentation to Health System Intelligence

EHR Implementation, Information Use & Digital Transformation

Central Question: How does information captured during care influence future clinical, operational, and public health decisions?

Module Duration: 2 Hours

Format: Fully Asynchronous

OpenMRS Practice: OpenMRS Documentation Review & Information Audit

Office Hour: 1 hour

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Lesson Objectives

By the end of module, learners will be able to:

- ❑ Explain why EHR implementations succeed or fail.
- ❑ Analyze clinical workflows from an informatics perspective.
- ❑ Explain the role of governance and change management.
- ❑ Describe the secondary uses of EHR data.
- ❑ Evaluate how documentation quality influences organizational performance.
- ❑ Think like an informaticist when assessing the value of an EHR

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Looking back

Week 1: Healthcare creates information

↓

Week 2: Documentation creates reusable information.

↓

Week 3 & 4: High-quality information becomes organizational intelligence.

The value of an EHR is not the software itself.

It is the decisions the information enables.



Central Question:
How do healthcare organizations transform patient information into better decisions, improved care, and stronger health systems?

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain

Every Patient Encounter Creates an Opportunity for Better Decisions
Key Message: Each step depends on the quality of the previous one



Information Value Chain

Every interaction between a patient and the healthcare system generates information. However, information alone does not improve healthcare.

Value is created only when that information progresses through each stage of the information value chain and ultimately influences decisions and actions.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain

- **Patient Encounter:** The patient's interaction with the healthcare system is where information originates. Symptoms, examination findings, laboratory results, diagnoses, treatments, and follow-up plans are generated during this encounter.

- **Clinical Documentation:** Clinicians transform observations into documented information by recording what happened during the encounter. High-quality documentation preserves clinical knowledge and enables future providers to understand the patient's history.

- **Health Information:** Once documented and stored in the EHR, the information becomes a reusable organizational asset. It can now be retrieved, shared, analyzed, and used beyond the original clinical encounter.

- **Knowledge:** Information becomes knowledge when it is interpreted within context. For example, recognizing that a patient's blood pressure has remained uncontrolled over three consecutive visits provides insight that is not apparent from a single reading.

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain

- **Decision:** Knowledge supports informed decision-making. Clinicians determine treatment plans, managers allocate resources, quality teams identify care gaps, and public health officials monitor disease trends using the same underlying information.

- **Action:** Decisions lead to action. Actions may include prescribing medication, scheduling follow-up visits, modifying clinical workflows, initiating quality improvement projects, or implementing public health interventions.

- **Health Outcome:** The ultimate goal of the information value chain is improved patient and population health. Better information supports better decisions, which increase the likelihood of better clinical, operational, and public health outcomes.

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain – Applied Example

Mrs. Ade presents with a breast lump.

- ❑ **Patient Encounter:** She reports a breast lump that has been increasing in size.
- ❑ **Clinical Documentation:** The clinician documents the history, examination findings, and referral for biopsy.
- ❑ **Health Information:** The documented encounter is stored in the EHR and becomes available to other providers.
- ❑ **Knowledge:** The pathology result confirms invasive breast cancer and, when combined with the clinical findings, establishes the diagnosis.
- ❑ **Decision:** The multidisciplinary team recommends surgery followed by chemotherapy.
- ❑ **Action:** Treatment is initiated and follow-up appointments are scheduled.
- ❑ **Health Outcome**: Early treatment improves Mrs. Ade's prognosis and continuity of care.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain – Informaticist Perspective

An informaticist evaluates every stage of this value chain by asking:

- ❑ Was the right information captured during the encounter?
- ❑ Was it documented accurately and completely?
- ❑ Can it be easily retrieved when needed?
- ❑ Does it provide meaningful knowledge for decision-making?
- ❑ Will it support appropriate clinical, operational, or public health actions?
- ❑ How does it ultimately improve patient and population health?

Teaching Point

The true value of an EHR is not that it stores patient records.
It is that it transforms clinical documentation into trusted information, actionable knowledge, informed decisions, and measurable improvements in health outcomes.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The Information Value Chain – Impact of documentation

Documentation Is the Foundation

Without documentation:

- ❑ Care cannot continue safely.
- ❑ Reports cannot be trusted.
- ❑ Research cannot be conducted.
- ❑ Dashboards become misleading.
- ❑ Policies may be based on incomplete evidence.

Everything begins with documentation.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

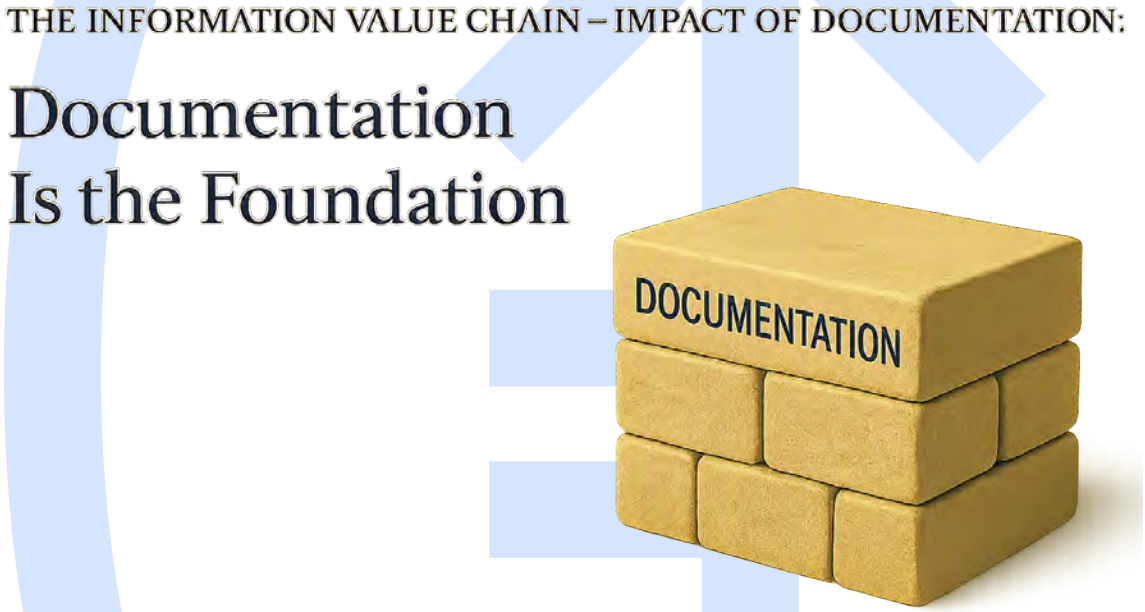
The Information Value Chain – Impact of documentation

Documentation Is the Foundation

Without documentation:

- ❑ Policies may be based on incomplete evidence
- ❑ Care cannot continue safely.
- ❑ Reports cannot be trusted.
- ❑ Research cannot be conducted.
- ❑ Dashboards become misleading.

Everything begins with documentation.



Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The EHR Value Pyramid

How Healthcare Organizations Create Value from Information



The pyramid illustrates that every level depends on the integrity of the level below it.

Healthcare organizations realize value only when information progresses upward through the pyramid, from documentation to decisions and ultimately to improved patient outcomes.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The EHR Value Pyramid – Understanding each level

Patient Encounter & Care
Healthcare begins with interactions between patients and providers.
Every consultation, procedure, laboratory test, medication administration, or follow-up visit generates information.
Without patient care, there is no information to manage.

High-Quality Clinical Documentation
Documentation transforms observations into permanent records.
This stage determines whether information is:
- ❑ Accurate
- ❑ Complete
- ❑ Timely
- ❑ Standardized
- ❑ Reusable

Poor documentation weakens every layer above it

High-Quality Information
Once documented in the EHR, clinical data becomes organizational information. It can be
- ❑ Retrieved
- ❑ Shared
- ❑ Aggregated
- ❑ Reported
- ❑ Analyzed

This is where the EHR begins creating organizational value.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The EHR Value Pyramid – Understanding each level

Actionable Knowledge
Information becomes knowledge when analyzed in context.
Examples include:
- ❑ Increasing diabetes admissions
- ❑ Rising maternal mortality
- ❑ Delayed pathology turnaround
- ❑ High readmission rates

Knowledge answers the question: What does the information mean?

Better Decisions
Healthcare leaders use knowledge to make decisions such as:
- ❑ Hiring additional staff
- ❑ Purchasing equipment
- ❑ Revising clinical workflows
- ❑ Expanding cancer screening
- ❑ Improving medication safety

Better Health Outcomes
The ultimate objective is never documentation.
The goal is:
- ❑ Safer care
- ❑ Earlier diagnosis
- ❑ Better coordination
- ❑ Higher qualityl
- ❑ mproved patient experience
- ❑ Better population health

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

The EHR Value Pyramid – Informaticist Perspective

An informaticist continuously asks:

- ❑ Where is value being lost?
- ❑ Which layer is weakest?
- ❑ Is documentation producing reliable information?
- ❑ Can information become trustworthy knowledge?
- ❑ Are decisions evidence-based?
- ❑ Are patients benefiting?

Teaching Point

The true value of an EHR is not that it stores patient records.
It is that it transforms clinical documentation into trusted information, actionable knowledge, informed decisions, and measurable improvements in health outcomes.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

SECTION II
EHR Implementation

EHR Implementation – Why Do Organizations Implement EHRs?

Beyond digitizing paper records, EHRs aim to:

- ❑ Improve continuity of care
- ❑ Enhance communication
- ❑ Reduce duplication
- ❑ Improve information quality
- ❑ Support quality improvement
- ❑ Enable reporting and research
- ❑ Strengthen health system performance

Organizations implement Electronic Health Records (EHRs) **to transform clinical quality**, **optimize operational workflows, and unlock advanced medical data analytics**.

While removing paper saves physical space, the ultimate objective of an EHR is to **establish a connected, intelligent health ecosystem**

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

EHR Implementation – Why Do Organizations Implement EHRs?

Enhancing Patient Safety and Care Quality & Reducing Medical Errors

- **Clinical Decision Support:** Systems analyze live patient data to provide real-time alerts for drug allergies, harmful drug interactions, and critical lab values. Built-in validation eliminates misinterpretations caused by illegible handwriting, missing pages, or unstandardized abbreviations.

- **Evidence-Based Medicine:** Care providers utilize integrated clinical guidelines and standardized care pathways directly within the patient chart to optimize treatment choices.

Interoperability and Coordination of Care

- **Unified Patient Histories:** EHRs break down data silos, allowing hospitals, pharmacies, specialists, and laboratories to securely exchange a single longitudinal medical record.

- **Reduced Care Duplication:** Instant access to previous diagnostic results prevents organizations from ordering costly and unnecessary repeat lab tests or imaging.

- **Seamless Transitions:** Care teams coordinate patient transfers between facilities smoothly because complete clinical summaries travel with the patient instantly.

Copyright MSKCC. Confidential — do not distribute without permission.

EHR Implementation – Why Do Organizations Implement EHRs?

Financial and Operational Efficiency

- **Practice Management Automation:** EHRs tie clinical documentation directly into integrated scheduling, medical coding, and billing systems, accelerating the insurance reimbursement cycle.
- **Regulatory Compliance:** Systems automatically track and log quality metrics required to satisfy federal regulations and qualify for value-based reimbursement programs.
- **Detailed Audit Trails:** Digital tracking records exactly who accessed a chart and when, which streamlines compliance audits and dramatically simplifies legal reporting.

Data Analytics and Population Health

- **Research and Data Science**: De-identified aggregations of health records serve as massive foundational datasets for medical research, clinical trials, and epidemiological studies.
- **Predictive Risk Modeling**: Advanced analytics tools scour structured health data to identify at-risk patient populations, allowing proactive intervention for chronic diseases.
- **Public Health Monitoring**: EHR infrastructure enables automated reporting of infectious diseases and public health trends directly to government health agencies.

Patient Empowerment

- **Patient Portal Integration**: Connected patient portals give individuals immediate access to their lab results, medication lists, and care plans, which vastly increases treatment adherence.

Memorial Sloan Kettering Cancer Center | ARGO

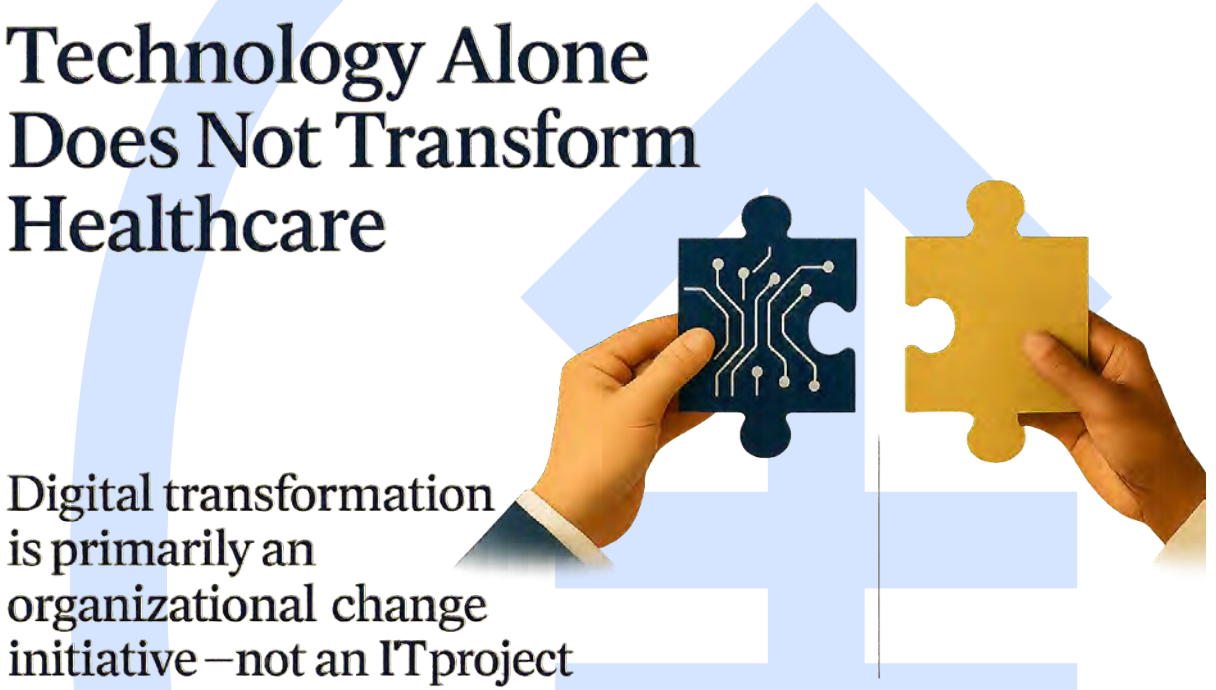
Copyright MSKCC. Confidential — do not distribute without permission.

EHR Implementation - Alignment

Technology Alone Does Not Transform Healthcare

Successful implementation requires alignment between:

- ❑ People
- ❑ Processes
- ❑ Technology
- ❑ Governance
- ❑ Leadership



Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

EHR Implementation - Challenges

Common Causes of EHR Implementation Failure

- ❑ Poor workflow analysis
- ❑ Limited user engagement & Resistance to change
- ❑ Insufficient training
- ❑ Weak leadership support & Inadequate governance
- ❑ Poor data quality
- ❑ Fragile technical infrastructure

The most relevant cause of EHR implementation failure in Low- and Middle-Income Countries (LMICs) is infrastructure and resource scarcity combined with sustainability failures.

While high-income countries primarily struggle with clinician resistance or software workflows, LMICs face systemic barriers where the underlying physical, financial, and human foundations are missing or temporarily funded without a long-term plan

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

EHR Implementation – Informaticist Perspective

Workflow Before Technology

An informaticist asks:

- ❑ What is the current workflow?
- ❑ What problem are we solving?
- ❑ Will technology simplify or complicate care?
- ❑ How will information flow change?

Principle: Never automate a poorly designed workflow.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

SECTION III
People, Change & Governance

Change Management in Digital Health

Successful adoption should emphasize human-centered digital transformation and depend on:

- ❑ Shared vision
- ❑ Stakeholder engagement
- ❑ Training
- ❑ Continuous support
- ❑ Feedback
- ❑ Iterative improvement

Technology adoption is a journey, not an event.



Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance

Governance: Who Owns the Information?

Governance establishes:

- ❑ Documentation standards
- ❑ Data quality expectations
- ❑ Access permissions
- ❑ Privacy and confidentiality
- ❑ Accountability
- ❑ Stewardship

Key Question: Who is responsible for ensuring information can be trusted?

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Human Factors in EHR Success – Designing Systems That Work for People

EHR implementation is fundamentally about people adapting to new ways of working.

Key Concept

An Electronic Health Record is only successful when the people who use it can integrate it naturally into their daily work.

Many EHR implementations fail not because the technology is inadequate, but because the system was designed without sufficient consideration of how clinicians think, communicate, make decisions, and deliver patient care.

Human factors is the study of how people interact with technology, their environment, and each other to improve safety, efficiency, usability, and user satisfaction.

Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance (Human Factors Principles)

1. Technology Should Support Clinical Work – not Interrupt It

A well-designed EHR fits naturally into the clinical workflow.

For example:

- ❑ Registration staff should not have to enter the same demographic information multiple times.
- ❑ Nurses should be able to document vital signs quickly during routine patient assessments.
- ❑ Physicians should be able to review previous notes, laboratory results, and medications without navigating multiple screens.

Poor design increases cognitive burden and reduces efficiency.

2. Simplicity Improves Adoption

Systems that are intuitive require less training and encourage consistent use.

Characteristics of user-friendly systems include:

- ❑ Clear navigation
- ❑ Logical organization of information
- ❑ Minimal unnecessary clicks
- ❑ Consistent terminology

Complex systems increase frustration and decrease adoption.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance (Human Factors Principles)

3. Reduce Cognitive Load

Healthcare professionals make hundreds of decisions every day. An effective EHR reduces the mental effort required to locate, interpret, and document information. Examples include:

- ❑ Displaying recent laboratory results alongside medication lists.
- ❑ Highlighting abnormal values.
- ❑ Using templates for common clinical encounters.
- ❑ Providing clear summaries of previous visits.

The goal is to allow clinicians to focus on patient care rather than searching for information.

4. Support Team-Based Care

Healthcare is collaborative. An EHR should facilitate communication among:

- ❑ Physicians
- ❑ Nurses
- ❑ Pharmacists
- ❑ Laboratory staff
- ❑ Case managers
- ❑ Public health professionals

When information is accessible to all authorized users, care becomes safer and more coordinated.

Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance (Human Factors Principles)

5. Build Trust in the System

Users are more likely to adopt an EHR when they believe:

- ❑ Information is accurate.
- ❑ Data are available when needed.
- ❑ The system is reliable.
- ❑ Documentation improves patient care.

Incomplete records, duplicate patients, or system downtime, decrease confidence and workarounds emerge

LMIC Example

A district hospital introduces an EHR requiring clinicians to complete 25 mandatory fields before a patient can be seen. During busy clinic hours:

- ❑ Long queues develop.
- ❑ Documentation takes longer than patient consultations.
- ❑ Staff begin writing notes on paper and entering them later.
- ❑ Some encounters are never entered into the EHR.

The problem is not the software itself. It is that the documentation process does not align with the realities of clinical practice.

An informaticist would evaluate the workflow, identify unnecessary documentation requirements, and redesign the process to balance data quality with clinical efficiency.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance (Human Factors Principles)

5. Build Trust in the System

Users are more likely to adopt an EHR when they believe:

- ❑ Information is accurate.
- ❑ Data are available when needed.
- ❑ The system is reliable.
- ❑ Documentation improves patient care.

Incomplete records, duplicate patients, or system downtime, decrease confidence and workarounds emerge

LMIC Example

A district hospital introduces an EHR requiring clinicians to complete 25 mandatory fields before a patient can be seen. During busy clinic hours:

- ❑ Long queues develop.
- ❑ Documentation takes longer than patient consultations.
- ❑ Staff begin writing notes on paper and entering them later.
- ❑ Some encounters are never entered into the EHR.

The problem is not the software itself. It is that the documentation process does not align with the realities of clinical practice.

An informaticist would evaluate the workflow, identify unnecessary documentation requirements, and redesign the process to balance data quality with clinical efficiency.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

People, Change & Governance – Informaticist Perspective

Technology should adapt to healthcare workflows, not force healthcare workers to adapt to poorly designed technology.

When evaluating an EHR, an informaticist asks:

- ❑ Does this system make clinicians' work easier or more difficult?
- ❑ Does the workflow reflect how care is actually delivered?
- ❑ Are users spending more time caring for patients or navigating the software?
- ❑ Does the system improve communication across the care team?
- ❑ How might changes to the interface or workflow improve usability and adoption?

The objective is not simply to implement technology, but to create a digital environment that supports safe, efficient, and patient-centered care.

Teaching Pearl

Successful EHR implementation is not achieved when the software is installed.
It is achieved when healthcare professionals can use the system confidently, efficiently, and consistently to deliver better patient care.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

SECTION IV
Secondary Use of Health Data

Secondary Use of Health Data

Beyond **Patient Care,** Clinical documentation supports:

- ❑ Quality improvement
- ❑ Hospital management
- ❑ Research
- ❑ Disease surveillance
- ❑ Public health
- ❑ Health policy
- ❑ Resource allocation

This is known as the **secondary use of health data**.

The concept of **Information Entered Once, Used Many Times** illustrates reuse of data.
Example of reuse of a blood pressure reading:

- ❑ Clinical management
- ❑ Hypertension registry
- ❑ Quality dashboard
- ❑ Research dataset
- ❑ Ministry reporting

Reuse creates value.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Secondary Use of Health Data

Another secondary use of data is **Clinical Decision Support**
Examples:

- ❑ Drug allergy alerts
- ❑ Duplicate medication warnings
- ❑ Preventive care reminders
- ❑ Clinical guidelines

Decision support enhances – not replaces – clinical judgment.

Dashboards and Performance Monitoring
EHR data can answer:

- ❑ How many diabetic patients were seen?
- ❑ What is the average clinic wait time?
- ❑ Which services are most utilized?
- ❑ Where are care gaps occurring?

Dashboards convert information into actionable insight.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

SECTION V
Information Quality & Organizational Performance

EHR Implementation Case Study: Lagos General Hospital Scenario

Lagos General Hospital is a 250-bed public hospital transitioning from paper records to an EHR in its Medical Outpatient Department. After six months, the hospital has successfully registered over **12,000 patients**, and clinicians are documenting encounters electronically. Hospital leadership is excited about using an EHR to improve patient care and generate reports for quality improvement.

However, the first performance review reveals that the reports do not reflect what clinicians are seeing in practice.

What the Hospital Expected

The leadership expected the EHR to provide reliable information to answer questions such as:

- ❑ How many hypertension patients were seen this month?
- ❑ How many diabetic patients missed follow-up appointments?
- ❑ How many breast cancer patients were referred for surgery?
- ❑ What was the average clinic waiting time?
- ❑ Which medications were prescribed most frequently?

Instead, many reports contained incomplete or inconsistent information.

Copyright MSKCC. Confidential — do not distribute without permission.

Information Quality & Organizational Performance

EHR Implementation Case Study: Lagos General Hospital Scenario

Lagos General Hospital is a 250-bed public hospital transitioning from paper records to an EHR in its Medical Outpatient Department. After six months, the hospital has successfully registered over **12,000 patients**, and clinicians are documenting encounters electronically. Hospital leadership is excited about using an EHR to improve patient care and generate reports for quality improvement.

However, the first performance review reveals that the reports do not reflect what clinicians are seeing in practice.

What the Implementation Team Discovered

During a review of clinical documentation, the implementation team identified several common problems**:**

- ❑ Clinicians entered diagnoses as free text instead of selecting standardized diagnoses.
- ❑ Blood pressure and weight were occasionally documented in progress notes rather than structured fields.
- ❑ Follow-up appointments were inconsistently recorded.
- ❑ Some encounters were saved without completing required clinical sections.
- ❑ Different clinicians used different abbreviations for the same condition (e.g., "HTN," "Hypertension," and "High BP").

Informaticist Reflection

The EHR software was functioning correctly. **The challenge was not the technology – it was the quality and consistency of the information entered into the system.**

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Information Quality & Organizational Performance

From Documentation to Better Decisions: Lessons from Lagos

Impact of Poor Information Quality

Because documentation was inconsistent, the hospital experienced several downstream challenges:

Documentation Issue	Organizational Impact
Free-text diagnoses	Inaccurate disease reports and dashboards
Missing follow-up information	Difficulty identifying patients lost to follow-up
Inconsistent terminology	Poor data aggregation and unreliable trend analysis
Incomplete encounters	Reduced confidence in quality improvement reports
Missing structured data	Limited ability to support research and Ministry reporting

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.

Information Quality & Organizational Performance

How the Hospital Responded

Rather than replacing the system, the implementation team focused on improving documentation practices:

- ❑ Standardized clinical documentation templates within the EHR.
- ❑ Refreshed clinician and nurse training on structured data entry.
- ❑ Introduced mandatory fields for key clinical information.
- ❑ Developed simple documentation standards and job aids.
- ❑ Performed monthly documentation quality audits with feedback to departments.
- ❑ Established a multidisciplinary governance committee to oversee data quality and user adoption.

Within three months, documentation completeness improved, reports became more reliable, and clinical teams reported greater confidence in using the EHR data for patient care and quality improvement.

Informaticist Perspective

An informaticist would conclude that:

- ❑ Successful EHR implementation is measured by the quality of information it produces—not simply by the number of computers installed or patient records digitized.

- ❑ Technology creates the opportunity for improvement, but people, processes, governance, and high-quality documentation determine whether that opportunity becomes organizational value.

Memorial Sloan Kettering Cancer Center | ARGO

Copyright MSKCC. Confidential — do not distribute without permission.



Memorial Sloan Kettering
Cancer Center

END