

Effective and Rational Use of Data and Information

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MHA621
Healthcare Informatics

Lecture 2



Intended Objectives

1. Distinguish between the meta-structures of data, information, knowledge, and wisdom.
2. Detail prerequisite conditions for effective and rational use of data and information.
3. Provide exemplars of effective and ethical use of data and information within healthcare.
4. Relate issues and concerns for effective and ethical use of healthcare data and information.
5. Discriminate between the terms big data, data science, data analytics, and data modeling.

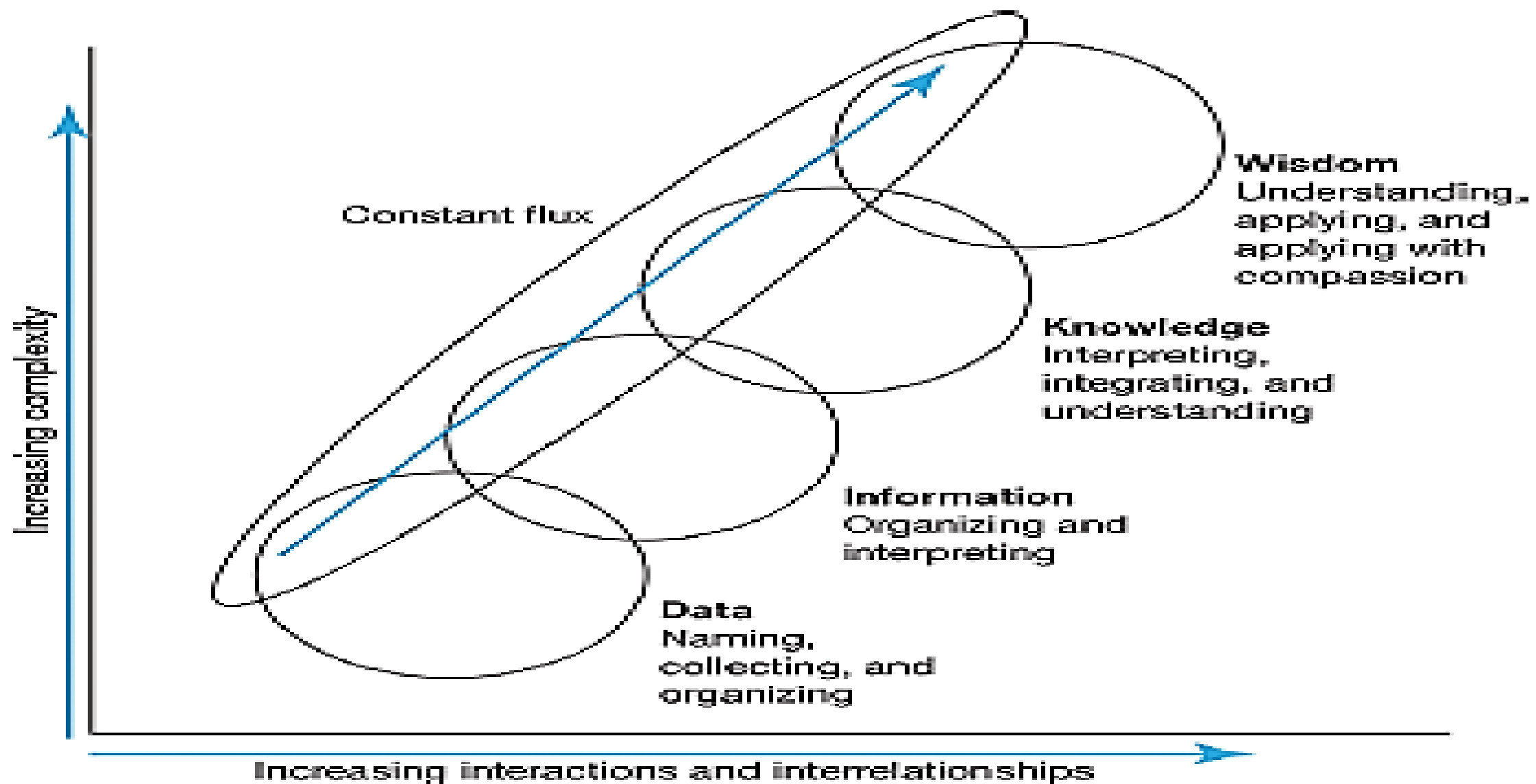
Overview of Data and Information

DIKW framework

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- **Data:** Discrete entities that are described objectively without interpretation.
- **Information:** Data that have been interpreted, organized, or structured.
- **Knowledge:** Synthesized information showing formally recognized relationships.
- **Wisdom:** The ability to appropriately use knowledge to solve complex problems.



Data Sharing vs. Data Silos

- **Data Silos:** Create incomplete and redundant data, leading to errors.
- **Health Information Exchange (HIE):** Facilitates sharing to improve care and reduce costs.
- **Challenges:** Interoperability, legal frameworks, and governance.
- **Ethical and Scientific Imperative:** Sharing data for public health gains.

Data Sharing vs. Data Silos

➤ Data Silos:

- **Example:** A hospital's radiology department maintains its own database, which is not integrated with the hospital's electronic health record (EHR) system. This makes it difficult for clinicians in other departments to access imaging results, delaying diagnoses and treatment planning.

Data Sharing vs. Data Silos

➤ Data Sharing:

- **Example:** A hospital shares patient data with primary care providers and pharmacies via a Health Information Exchange (HIE). This allows seamless coordination of care, avoiding duplicate tests and ensuring continuity of care during patient transitions.

Data Quality and Integrity

- **Data Integrity:** Ensures authenticity and wholeness in data handling.
- **Common Issues:** Input errors, incomplete documentation, and faulty data storage.
- **Solutions:** Education, system checks, and data cleansing processes.

Using Data for Quality Improvement

- Data is a **strategic resource** for regulatory compliance and value-based care.
- Attributes of **high-quality data**: Accuracy, completeness, and relevance.
- Supports better decision-making and outcomes.

Using Data for Quality Improvement

➤ Principles:

- Commitment to quality and collaboration.
- Measurable outcomes and continuous improvement.
- Systems thinking to focus on process improvements.

Using Data for Quality Improvement

➤ Examples of Tracked Data:

- **Patient satisfaction surveys:** Consumer Assessment of Healthcare Providers and Systems (**CAHPS**).
- **Patient fall rates:** National Database of Nursing Quality Indicators (**NDNQI**).
- **30-day readmission rates** for Medicare patients.

1. Data Management

- **Definition:** Controlling collection, storage, retrieval, and use of data to optimize accuracy and utility.
- **Key Elements:** Strategic planning, point of data entry, and database administration.
- **Strategies:** Use of data warehouses and employing data management experts.

Data Types and Formats

Raw vs. Processed

- **Raw data:** Data in its original, unrefined form as collected from a source, without any cleaning, transformation, or analysis.
- **Characteristics:** Unorganized, unstructured, and often includes errors, duplicates, or irrelevant information.
- **Examples:** (“temp”: 32.5, “humidity”: 60), survey responses as collected, including incomplete or contradictory answers.

Data Types and Formats

Raw vs. Processed

- **Processed data:** Data that has been cleaned, structured, or analyzed to make it usable and meaningful.
- **Characteristics:** Organized, often summarized or aggregated, and ready for analysis or decision-making.
- **Examples:** A report showing monthly average temperatures derived from raw sensor readings, survey results after removing duplicates, filling missing data, and visualizing insights in graphs.

Data Types and Formats

Structured vs. Unstructured

- **Unstructured data:** Data that lacks a predefined format or schema and is not organized in a traditional way.
- **Characteristics:** Often text-heavy, stored as files, and requires advanced tools for processing and analysis.
- **Examples:** Patient complaints recorded as audio files, social media posts about healthcare experiences, and doctor's handwritten notes.

Data Types and Formats

Structured vs. Unstructured

- **Structured data:** Data that is organized in a predefined format or schema, typically in rows and columns, making it easy to search and analyze.
- **Characteristics:** Follows specific format, stored in databases or spreadsheets, and easily accessible for processing.
- **Examples:** Patient records in a hospital database with defined fields like name, age, diagnosis, and treatment, and medication inventory database with fields like medication name, stock, and expiry date.

- **Raw vs. Processed:** focuses on the stage of data preparation (unprocessed vs. refined).
- **Structured vs. Unstructured:** focuses on the format and organization of the data.



Data Governance

- **Definition:** Policies, standards, and controls ensuring data availability, security, and proper access.
- **Challenges in Health Information Exchange (HIE):** Privacy, liability, and unfair market advantages.
- **Solutions:** Data-sharing agreements and robust governance structures.

Big Data in Healthcare

- **Definition:** Extremely large datasets analyzed for patterns and new learning.
- **Features:** Includes structured, semi-structured, and unstructured data.
- **Applications:** Identify outcomes, predict trends, and improve decision-making.

Big Data Analytics

- **Data Mining:** Uses AI and statistical techniques to uncover patterns in large datasets.
- **Forms of Analytics:**
 - **Real-Time Analytics:** Offers immediate, actionable insights at the point of care.
 - **Small Data:** Limited datasets, used for **case management** and **benchmarks**.
 - **Predictive Analytics:** Forecasts risks and outcomes using past and current data.

Challenges in Big Data Use

- **Limited Incentives:** To share data, reducing its value.
- **Proprietary Issues:** Hinder interoperability between systems.
- **Infrastructure and Expertise:** Often lacking in organizations.
- **Data Quality:** Incomplete metadata limits usability.

2. Information and Knowledge Management

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➤ Good Information Management:

- Ensures access to the right information at the right time for the right people.
- Involves vast volumes of information exceeding the processing capacity of individuals.
- IT tools like intranets ensure version control and eliminate uncertainties.

2. Information and Knowledge Management

➤ Benefits of Good Information Management:

- **Provides resources for safe, efficient, quality care, such as:**
 - Clinical guidelines, standards of practice, policy and procedure manuals, research findings, drug databases, and community resources.
- Eliminates redundant data collection, reducing wasted resources.
- Becomes crucial in the era of big data for improved decision-making.

2. Information and Knowledge Management

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➤ Knowledge Management (KM):

- Selectively applies knowledge from past experiences to improve current and future decisions.
- Employs structured systems to store, distribute, and apply both tacit knowledge (personal experience) and explicit knowledge (evidence).
- Provides organizations with a competitive edge by discovering hidden knowledge through data mining.

Information Management

Example

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- A hospital uses an electronic health record (EHR) system to store and share patient medical histories. The EHR contains clinical guidelines, diagnostic test results, medication records, and policy manuals.
- When a healthcare provider needs to reference the latest protocol for sepsis management, they access the system to retrieve the most recent evidence-based guidelines. The system ensures version control so that everyone in the organization accesses the same updated resources.

Information Management

Example

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➤ Outcome:

- Efficient retrieval of accurate and up-to-date information helps deliver consistent and safe patient care.
 - Reduces redundancy by preventing duplicate data entry or storage.
- This represents **Information Management** as it involves organizing, storing, and ensuring access to structured data and information at the right time.

Knowledge Management

Example

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- A hospital creates a "**lessons learned**" database for its ICU staff to improve sepsis outcomes. After treating sepsis cases, healthcare providers document what worked well and what didn't, including **decision-making patterns** and **innovative approaches**.

Knowledge Management

Example

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- **This knowledge repository** includes both **tacit knowledge** (personal experiences of clinicians) and **explicit knowledge** (research findings). **Data mining tools** are used to analyze **past cases**, revealing patterns like **early identification** of infection markers improving outcomes.
- The findings are applied to **train staff** and **refine future sepsis protocols**.

Knowledge Management

Example

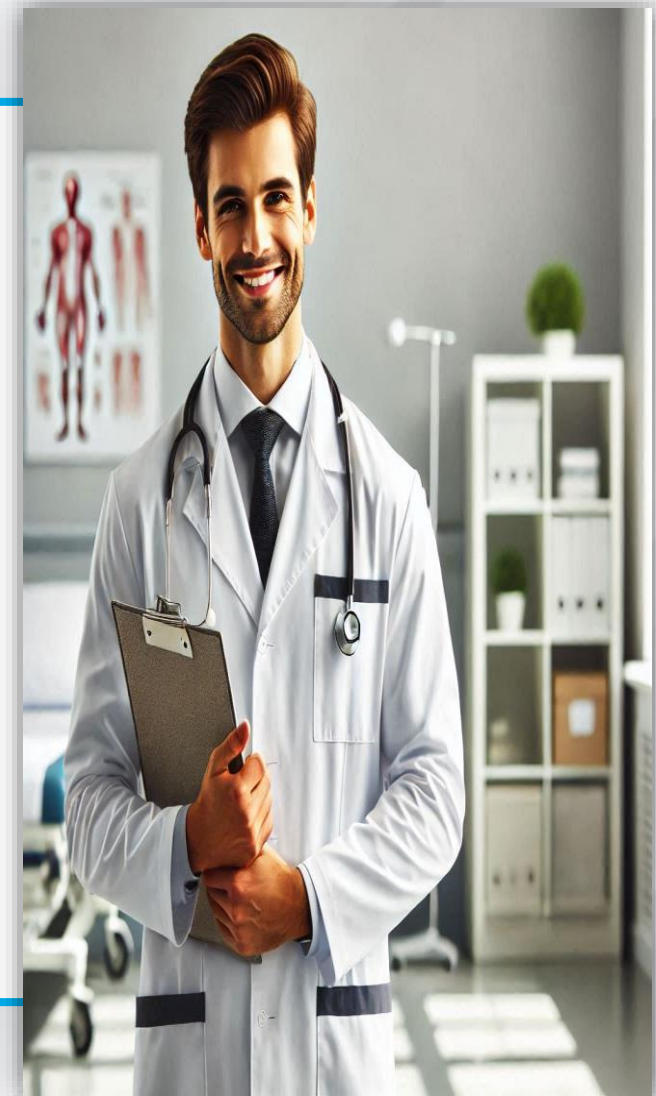
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➤ Outcome:

- The hospital leverages its staff's collective knowledge to improve sepsis treatment and patient survival rates.
- This fosters innovation and ensures the organization stays competitive in providing quality care.

Case Study



Case Study

- The Ministry of Health in Country X implemented a national electronic health records (**EHR**) system five years ago to improve patient care. The system collects vast amounts of structured and unstructured data from public and private healthcare providers. Recently, the government launched a “**Predictive Analytics for Public Health (PAPH)**” project to analyze this data and predict health trends, focusing on chronic diseases such as diabetes, hypertension, and cardiovascular conditions.

Case Study

- Dr. Amal, a public health informatician, is leading a team using big data analytics to predict diabetes trends in urban and rural populations. The project aims to improve resource allocation and preventive care programs. However, several challenges and ethical concerns have emerged:

Case Study

1. Data Integrity Issues:

- Some datasets have incomplete patient information, and others are riddled with errors due to inconsistent documentation practices across clinics.

Case Study

2. Privacy and Consent:

- Some patients are unaware their data is being used for analytics. Although de-identified, there's a risk of re-identification due to the combination of datasets.

Case Study

3. Overcoming Data Silos:

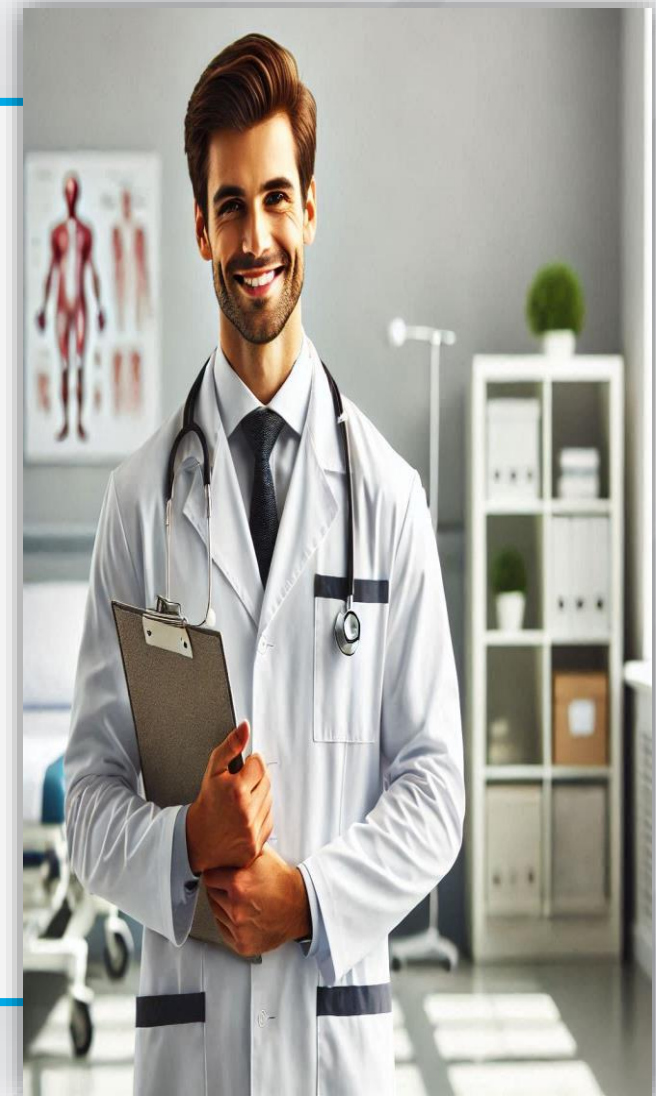
- What strategies can the government use to encourage private providers to share data?
- How can data governance frameworks be strengthened to build trust among stakeholders?

Case Study

4. Actionable Analytics:

- How can the analytics team make their models more transparent and acceptable to policymakers?
- What additional data or evidence might strengthen their case for preventive action?

Suggested Solutions



Solutions for Data Integrity and Privacy

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- **Improving Data Quality:** Standardize data entry protocols and use automated tools to detect and correct errors.
- **Enhancing Privacy and Consent:** Strengthen patient consent processes, use clear communication, and implement robust anonymization and encryption measures.

Solutions for Data Sharing

- **Facilitating Data Sharing:** Provide incentives for private clinics, establish clear governance policies, and improve system interoperability.
- **Making Analytics Actionable:** Promote model transparency with user-friendly visualizations and pilot programs to validate predictions and drive evidence-based policymaking.

Wrap Up

1. **Data, Information, Knowledge, and Wisdom (DIKW) Framework:**

Transform data into actionable wisdom for better healthcare decisions.

2. **Data Sharing:** Use HIEs to eliminate silos and improve care coordination.

3. **Data Quality:** Standardize and automate processes to ensure reliable data.

4. **Ethical Use:** Protect privacy with consent, de-identification, and encryption.

Wrap Up

5. **Big Data:** Leverage analytics to predict trends and enhance resource allocation.
6. **Governance:** Implement clear policies to manage and secure healthcare data.
7. **Actionable Insights:** Validate and communicate analytics for policymaking.
8. **Knowledge Management:** Use past experiences to refine protocols and improve care.



Thank You