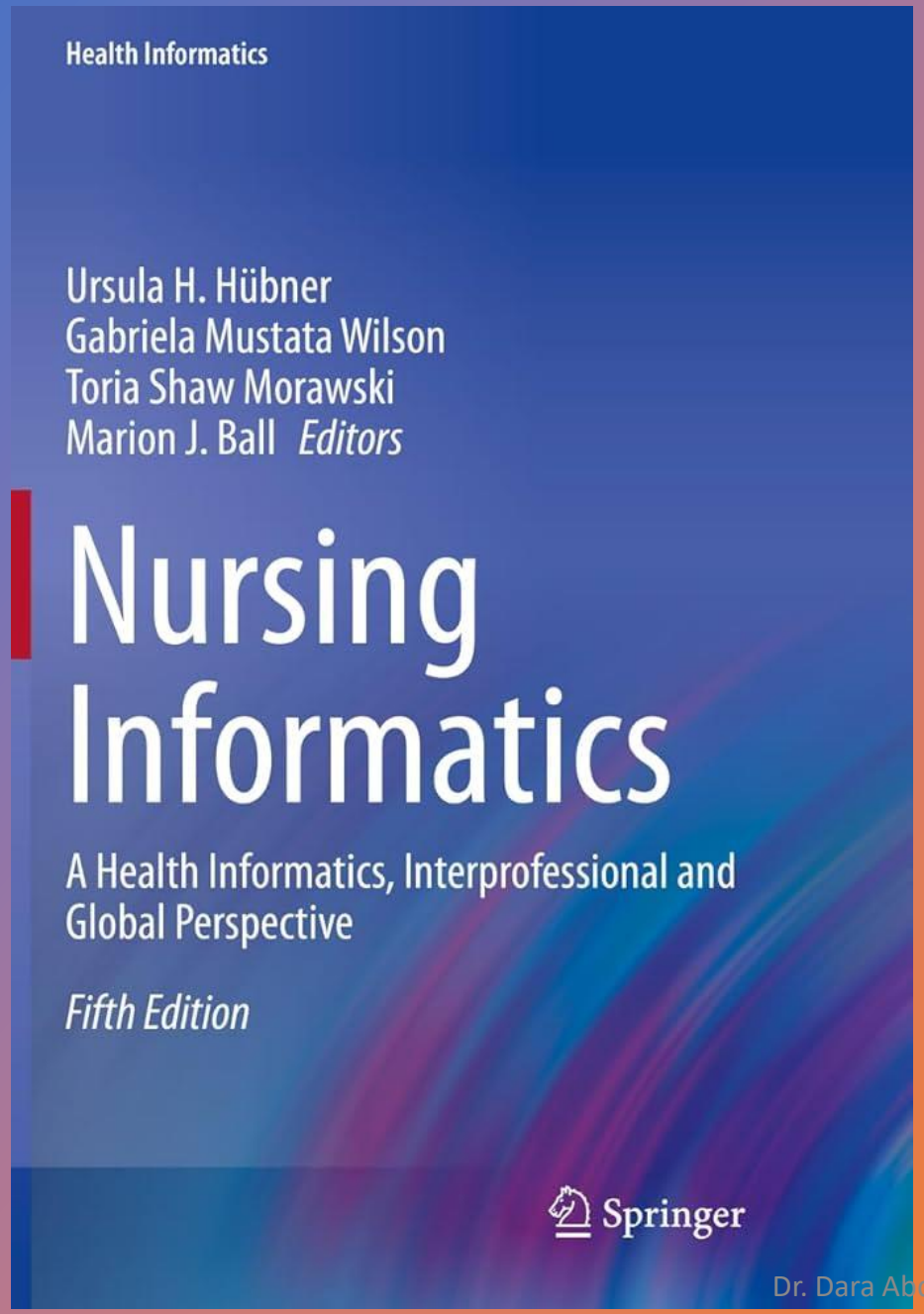

2 & 3. Nursing Informatics Course

Information, Information Science, Information Systems

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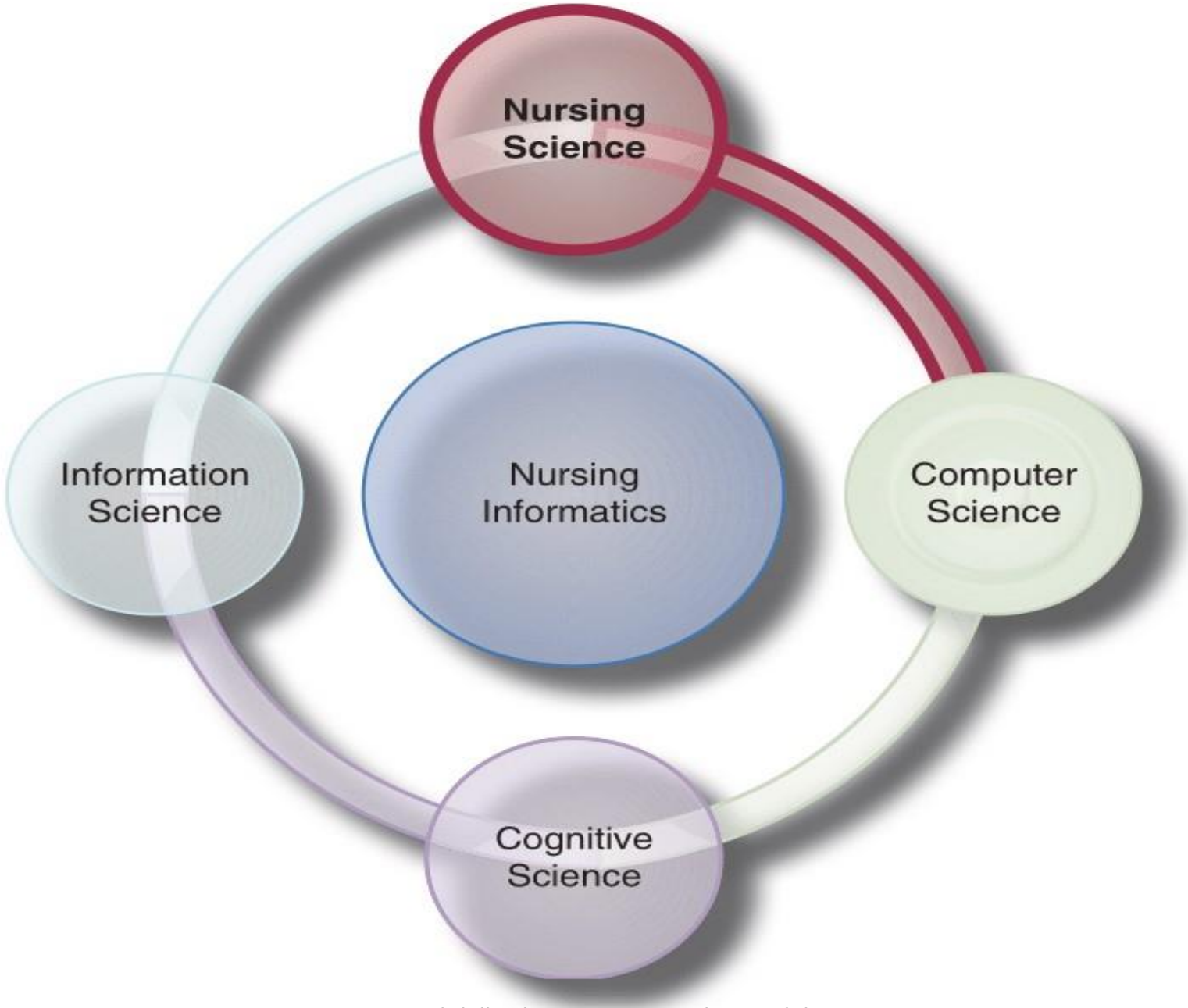


Figure 1-1 Building Blocks of Nursing Informatics

Information Systems in Healthcare

This presentation explores information, information systems (ISs), and information science as fundamental building blocks of informatics in healthcare. We'll examine how healthcare professionals, as knowledge workers, process complex healthcare information daily to inform their practice. We'll also look at key initiatives and challenges in managing healthcare information technology.

The Importance of Information in Healthcare

1 Knowledge Workers

Healthcare professionals are known as knowledge workers because they deal with and process information on a daily basis to make it meaningful and inform their practice.

2 Complex Information

Healthcare information is complex and abounds with concerns and issues, such as ownership, access, disclosure, exchange, security, privacy, disposal, and dissemination.

3 Electronic Health Records

The widespread implementation of electronic health records (EHRs) has promoted collaboration among public and private sector stakeholders on a wide-ranging variety of healthcare information solutions.

Key Healthcare Information Initiatives

1

Health Level Seven International (HL7)

An international standard for transfer of clinical and administrative data between software applications.

2

Consolidated Health Informatics (CHI)

An initiative to adopt federal government-wide health information interoperability standards.

3

National Health Information Infrastructure (NHII)

A network to improve health and healthcare by connecting health information across the country.

4

Nationwide Health Information Network (NHIN)

A set of standards, services, and policies for secure health information exchange over the Internet.

Health Information Exchange Systems

NHS Connecting for Health

A national program in the UK for improving IT infrastructure in healthcare.

eHealth Initiative

A non-profit organization focused on improving healthcare through information technology.

Federal Health Information Exchange (FHIE)

A system for exchanging health information between the Department of Defense and the Department of Veterans Affairs.

Indiana Health Information Exchange (IHIE)

A non-profit organization providing a secure, robust health information exchange.

Massachusetts Health Data Consortium (MHDC)

A non-profit organization promoting the use of health IT and exchange of health data in Massachusetts.

Health New England

A health plan serving members in Massachusetts and Connecticut, utilizing health information technology.

Legislative Impacts on Health Information Technology

1

HITECH Act of 2011

Set the 2014 deadline for implementing EHRs and provided the impetus for HIE initiatives.

2

21st Century Cures Act

Promotes interoperability and the access, exchange, and use of electronic health information (EHI).

3

Office of the National Coordinator for Health Information Technology (ONC)

Responsible for implementing key provisions of the 21st Century Cures Act and addressing information blocking.

Understanding Information: From Data to Knowledge

1

Data

Raw facts, such as the number 99.5, which could represent various things without context.

2

Information

Processed data with meaning, such as knowing that 99.5°F is Ms. Howsunny's temperature.

3

Knowledge

The awareness and understanding of information and how it can be used to support tasks or decisions.

Types of Data in Healthcare

Alphabetic Data

Letters used in patient names and other text-based information.

Numeric Data

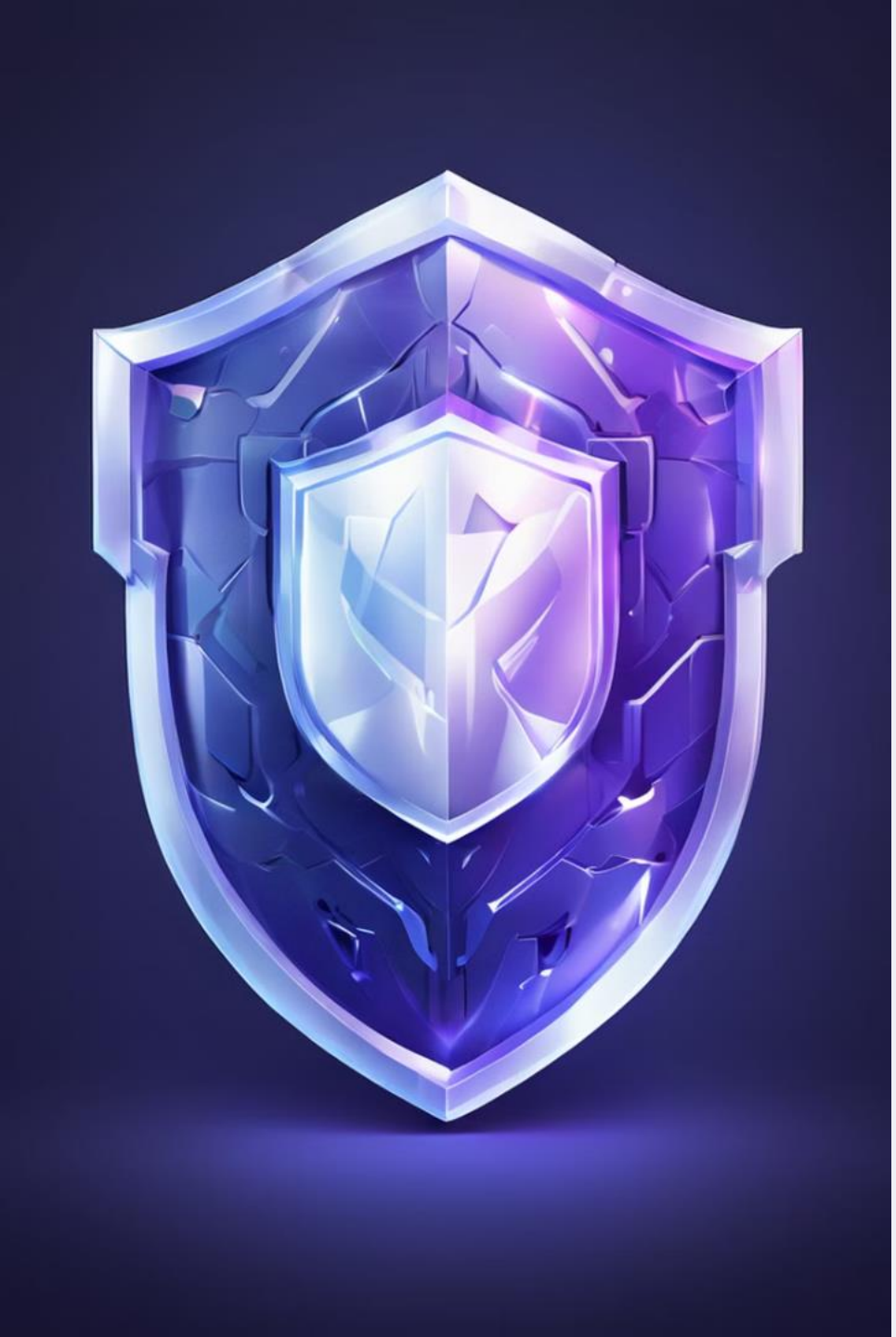
Numbers used in measurements, test results, and other quantitative information.

Audio Data

Sounds, noises, or tones, such as monitor alerts or recorded messages.

Image Data

Graphics and pictures, including radiographs, MRI outputs, and CT scans.



Data Integrity in Healthcare

Definition

Data integrity refers to whole, complete, correct, and consistent data.

Threats

Data integrity can be compromised through human error, viruses, hardware failures, transmission errors, or hackers.

Safeguards

IT helps decrease errors by implementing safeguards such as routine file backups, error detection for transmissions, and user-friendly interfaces.

Importance

High-quality data are essential for creating meaningful information to inform assessments and decision-making in healthcare.

Characteristics of Valuable Information in Healthcare

Accessibility	Security	Timeliness	Accuracy
Relevancy	Completeness	Flexibility	Reliability
Objectivity	Utility	Transparency	Verifiability
Reproducibility			

Accessibility and Security in Healthcare Information

Accessibility

The right users must be able to obtain the right information at the right time and in the right format to meet their needs. Getting meaningful information to the right users at the right time is as vital as generating the information in the first place.

Security

A major challenge in healthcare information systems is ensuring that unauthorized users are blocked while authorized users have open and easy access. This balance is crucial for maintaining the integrity and confidentiality of patient data.

Quality Aspects of Healthcare Information

1 Timeliness

Information must be available when needed for the right purpose and at the right time.

2 Accuracy

There should be no errors in the data and information.

3 Relevancy

Information must be applicable to the user's specific needs.

4 Completeness

All necessary essential data must be included in the information.

Flexibility and Reliability in Healthcare Information

Flexibility

Information should be usable for a variety of purposes. For example, inventory information on a nursing unit can be used by nurses to check item availability and by managers for ordering and economic assessments.

Reliability

Information must come from clean data gathered from authoritative and credible sources. This ensures that healthcare professionals can trust the information they're using to make critical decisions.

Objectivity and Utility in Healthcare Information

Objectivity

Information should be as close to the truth as possible, factual and impartial rather than subjective or biased.

Utility

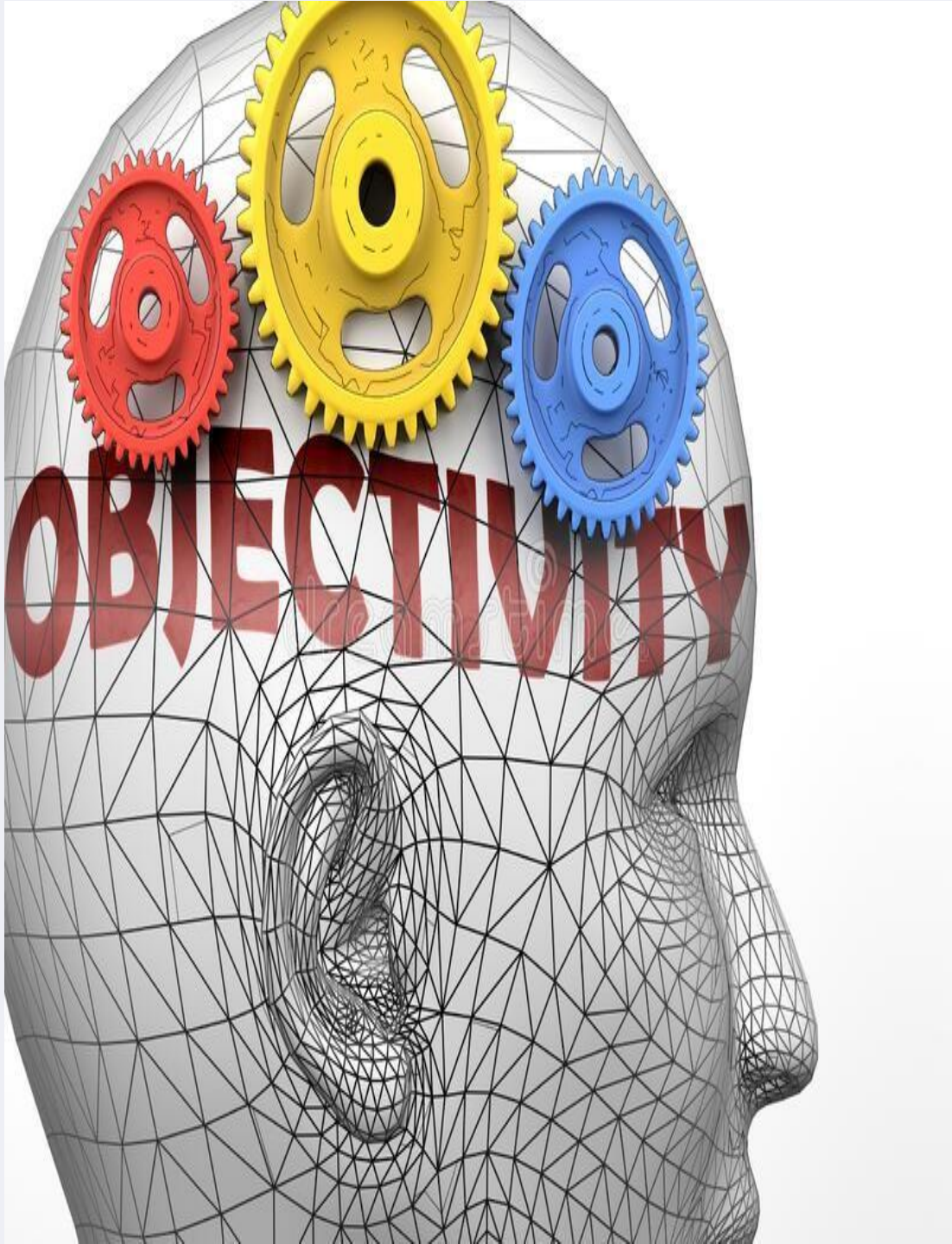
The ability to provide the right information at the right time to the right person for the right purpose is crucial in healthcare settings.

Transparency

Users should be able to apply their intellect to accomplish tasks while the tools housing the information disappear into the background.

Verifiability and Reproducibility

Information should be checkable to prove its correctness and reproducible to ensure consistency.



The Future of Healthcare Information Technology

1

Sensory Input

As technologies mature, more input will be obtained through all five senses, enhancing the way healthcare professionals interact with information.

2

Gesture Recognition

Increasing use of gesture recognition will change how people interface with healthcare technology and become informed.

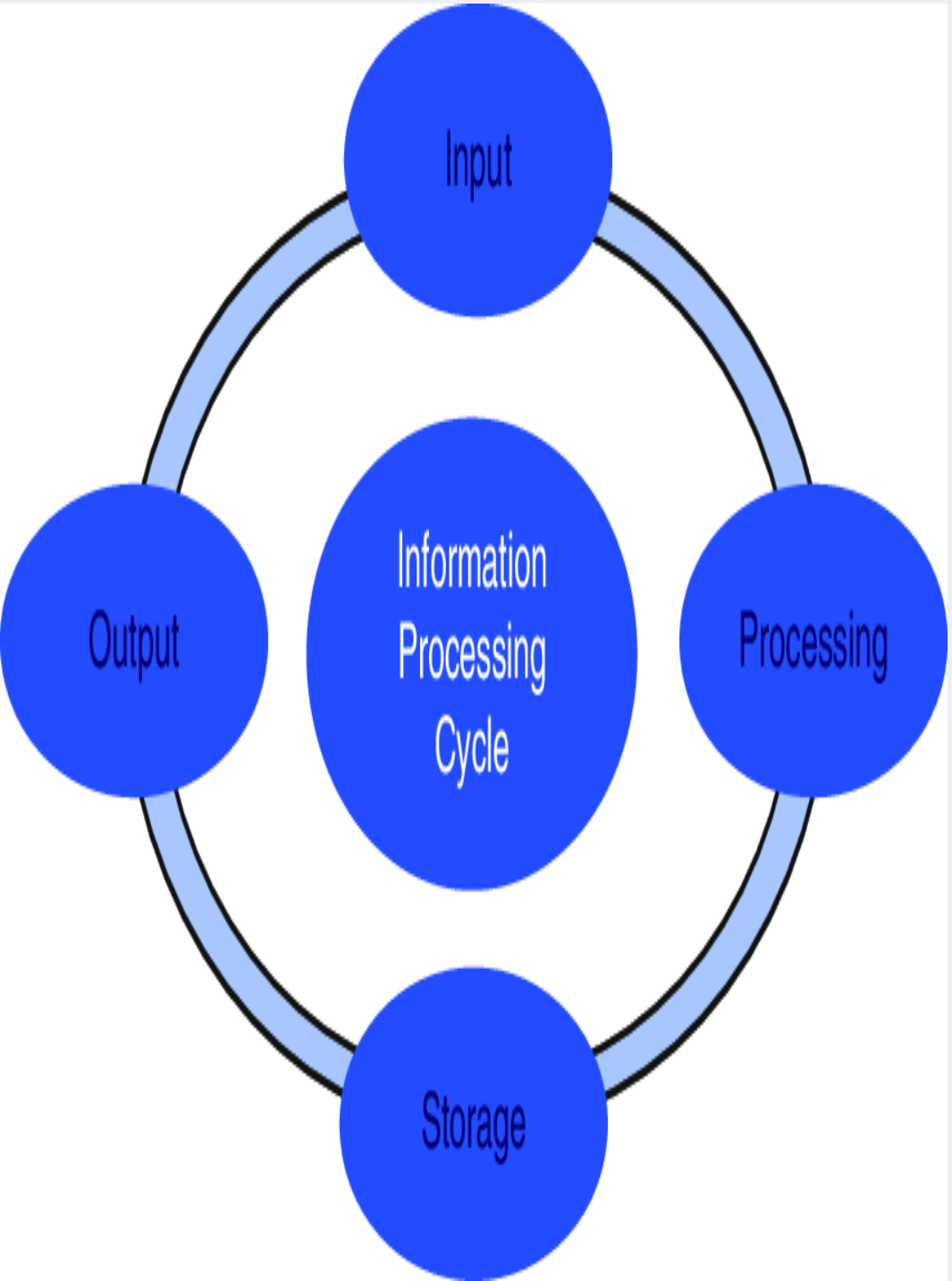
3

Continuous Learning

Healthcare professionals are constantly discovering, learning, and becoming informed, adding to their personal knowledge base to provide the best possible care.

Information Science: The Science of Information

Information science has evolved over the past 50 years as a field of scientific inquiry and professional practice. It can be thought of as the science of information, studying the application and usage of information and knowledge in organizations and the interface between people, organizations, and information systems. This extensive, interdisciplinary science integrates features from cognitive science, communication science, computer science, library science, and social science.



Core Concepts of Information Science

1 Focus on Information Processing

Information science is primarily concerned with the input, processing, output, and feedback of data and information through technology integration. It aims to comprehend the perspective of stakeholders and apply IT as needed.

2 Systemic Approach

It deals with the big picture of technology rather than individual pieces, taking a holistic view of information systems and their impact.

3 Response to Technological Determinism

Information science can be seen as a response to technological determinism, which views technology as an autonomous system controlling other subsystems of society.

4 Interdisciplinary Nature

It explores interactions between people and technology, how technology shapes individual lives and social groups, and how people's use of technology influences new developments.

Information Processing in Human and Machine Systems

1

Data Acquisition

Humans and machines constantly acquire data from their environment and various sources.

2

Information Processing

Data is processed using knowledge to create meaningful information. For information to be valuable, it must be accessible, accurate, timely, complete, cost-effective, flexible, reliable, relevant, simple, verifiable, and secure.

3

Knowledge Generation

Information is transformed into knowledge through understanding and application to specific tasks or decisions.

4

Knowledge Dissemination

Generated knowledge is shared and disseminated to support decision-making and problem-solving.

The Importance of Knowledge in Information Science

Knowledge Definition

Knowledge is the awareness and understanding of an information set and ways that information can be made useful to support a specific task or arrive at a decision. It involves choosing or rejecting facts based on their significance or relevance to a particular task.

Knowledge Viability

Knowledge viability refers to applications that offer accessible, accurate, and timely information obtained from a variety of resources and methods, presented in a manner that provides the necessary elements to generate knowledge.

Knowledge and Wisdom

Wisdom uses knowledge and experience to heighten common sense and insight to exercise sound judgment in practical matters. It is developed through knowledge, experience, insight, and reflection. Wisdom is focused on one's own mind and the synthesis of one's own experience, understanding, and knowledge.

Information Science in Healthcare

Integration of Systems

Healthcare organizations have developed integrated information systems that can handle the needs of the entire organization, moving away from siloed systems for different departments.

Role of IT Leadership

Many healthcare facilities have hired Chief Information Officers (CIOs) or Chief Technical Officers (CTOs) to manage IT infrastructure and technological research and development.

Focus on Quality Care

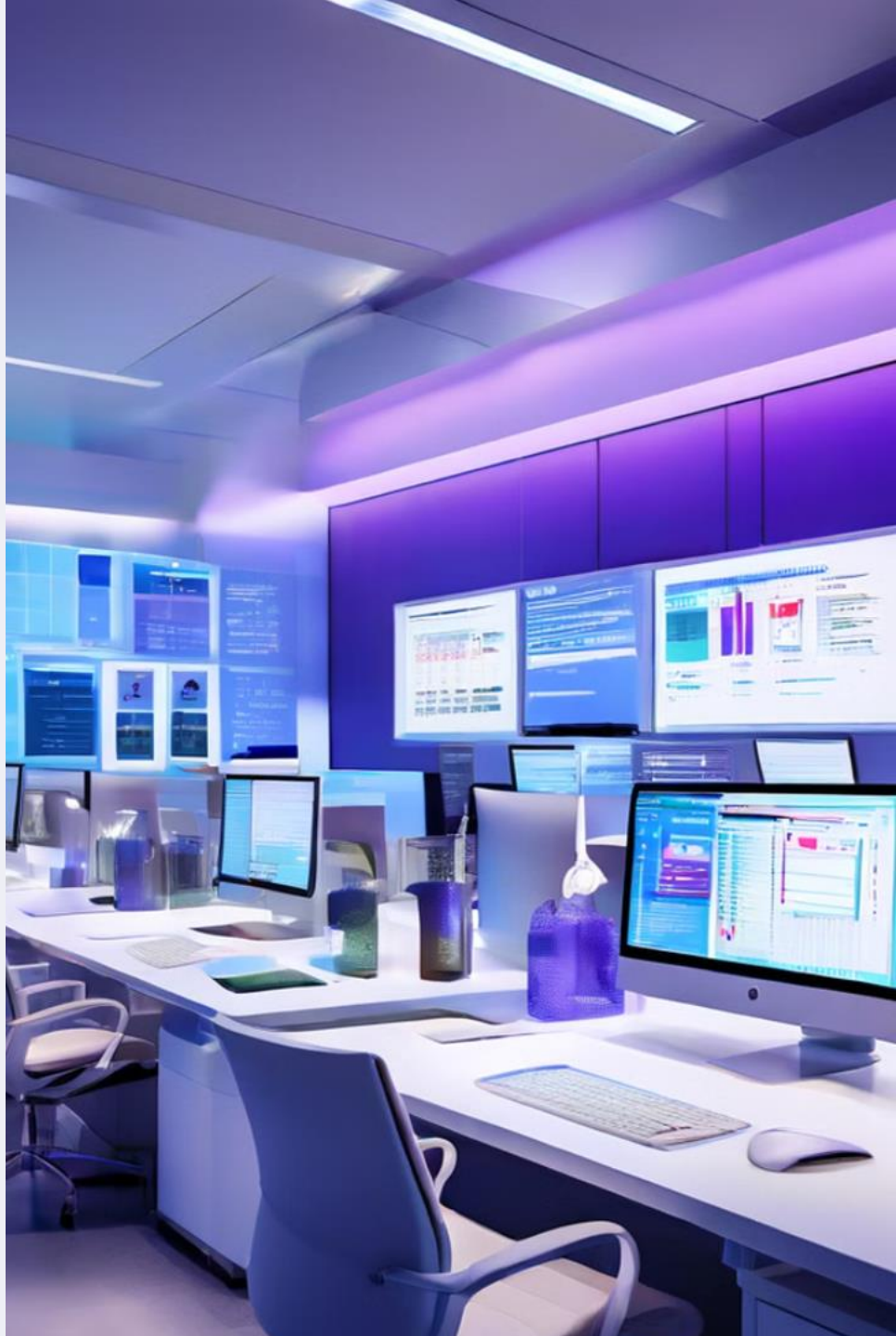
In healthcare, information systems must handle the volume of data and information necessary to generate needed information and knowledge for best practices, with the goal of providing the highest quality patient care.

Challenges and Risks

While information science technology has brought many benefits, it has also introduced new risks such as glitches, loss of information, and potential security breaches.

Types of Information Systems in Healthcare

System Type	Description
Clinical Information System (CIS)	Comprehensive system managing administrative, financial, and clinical aspects of a clinical facility
Decision Support System (DSS)	Organizes and analyzes information to help with decision-making under uncertainty
Executive Information System (EIS)	Supports executives with strategic decision-making by providing summarized vital information
Geographic Information System (GIS)	Handles information related to geographic locations or the Earth's surface
Management Information System (MIS)	Provides summaries of internal information sources for decision-making
Knowledge Work System (KWS)	Promotes knowledge creation through user-friendly interfaces and necessary tools



The Multidisciplinary Nature of Information Science

Computer Science

Deals with the theoretical and practical aspects of computation and information processing

Cognitive Science

Studies the mind and its processes, including how information is processed, stored, and retrieved

Social Science

Examines human behavior and interactions in relation to information and technology

Library Science

Focuses on the organization, management, and dissemination of information resources

Information science encompasses aspects of these disciplines to deal with obtaining, gathering, organizing, manipulating, managing, storing, retrieving, recapturing, disposing of, distributing, and broadcasting information. It has matured into a major field of management studies and is taught at major universities and business schools worldwide.

The Future of Information Science

1

Continued Evolution

Information science will continue to evolve and innovate, expanding its sphere of influence on human activities at all levels.

2

Integration with Emerging Technologies

The field will likely incorporate advancements in artificial intelligence, machine learning, and big data analytics to enhance information processing and knowledge generation.

3

Addressing New Challenges

As technology advances, information science will need to address new challenges related to data privacy, security, and ethical use of information.

4

Shaping Society

The impact of information science on society will grow, influencing how people acquire, process, and use information in both personal and professional contexts.

Information science has already had a tremendous impact on society and will undoubtedly expand its sphere of influence further as it continues to evolve and innovate human activities at all levels. What visionaries only dreamed of is now possible

Information Systems:

The Backbone of Modern Computing

Information Systems (ISs) are the foundation of modern computing, combining hardware, software, telecommunications, networks, users, and procedures. This presentation will explore the key components and functions of computer-based information systems, their role in organizations, and how they process and disseminate data to meet specific objectives.

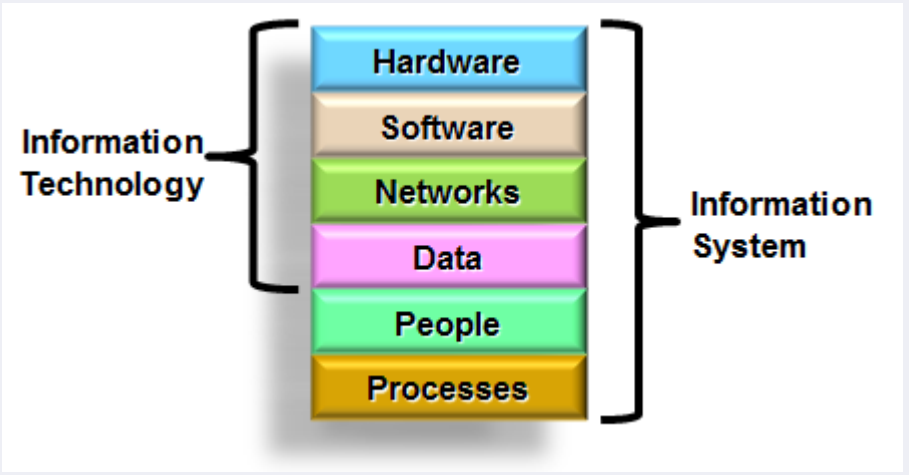
Components of Information Systems

Hardware

Computer equipment that performs input, processing, and output activities

Software

Programs that control the operation of the computer and organize data



Networks

Telecommunications infrastructure connecting computers globally

The Role of Users in Information Systems

1 **System Design and Development**

Users are responsible for designing, developing, and programming the system

2 **Operation and Management**

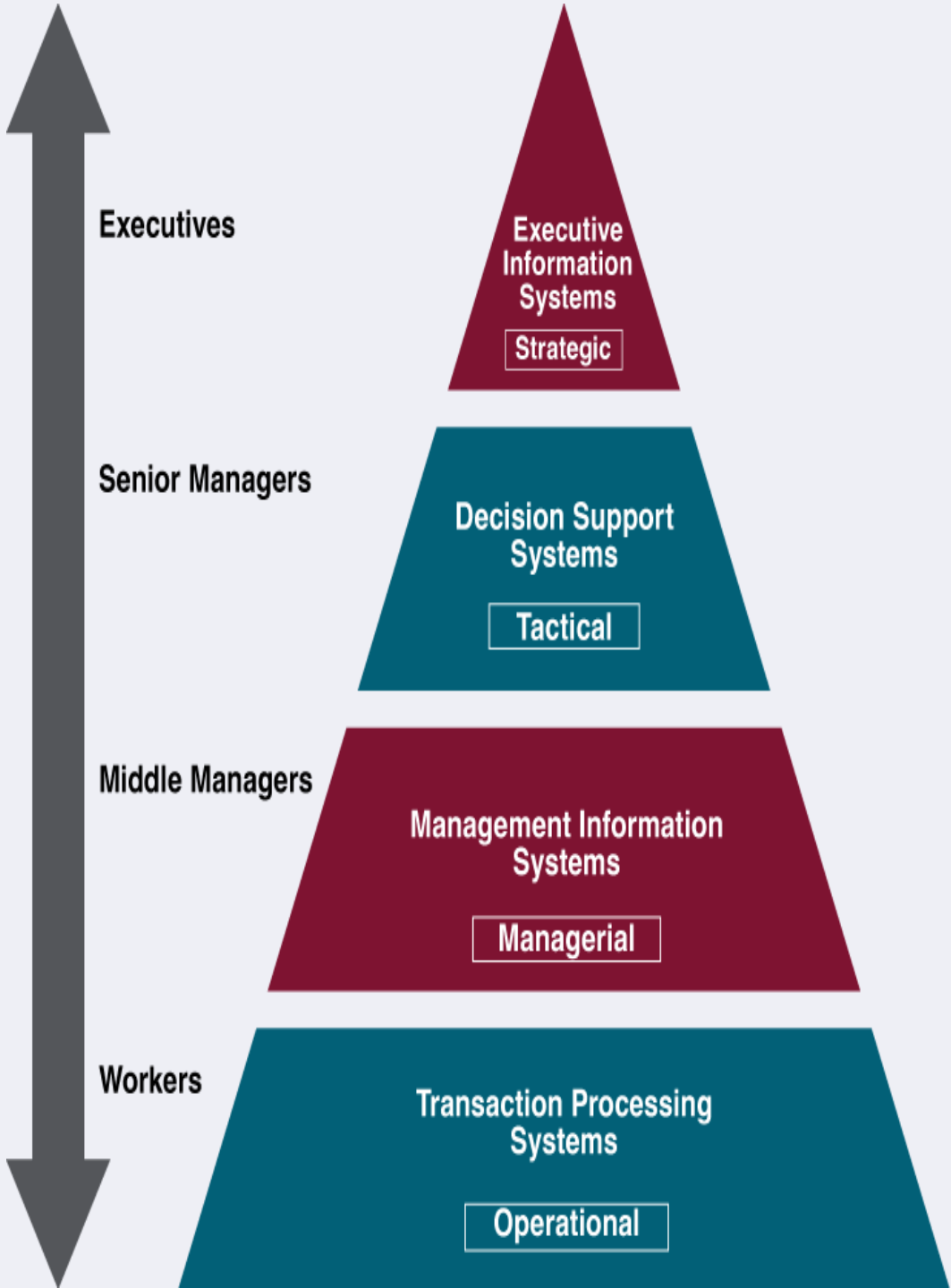
Users operate, manage, and maintain the information system

3 **Data Handling**

Users collect, create, input, analyze, and distribute meaningful data and information

4 **Procedure Creation**

Users devise procedures, strategies, policies, methods, and rules for using the system



Defining Information Systems

Interconnected Elements

ISs are collections of interconnected elements that work together

Data Processing

They gather, process, store, and distribute data and information

Feedback Structure

ISs provide a feedback structure to meet specific objectives

Organizational Purpose

They are designed for specific purposes within organizations

Functionality of Information Systems

1. **Decision-making Capabilities**

   ISs are only as functional as the decision-making capabilities built into them

2. **Problem-solving Skills**

   The problem-solving skills programmed into the system affect its functionality

3. **Programming Potency**

   The strength of the programming determines the system's capabilities

4. **Data Quality**

   The quality of data and information input into the system impacts its functionality

Key Characteristics of Effective Information Systems

Timeliness

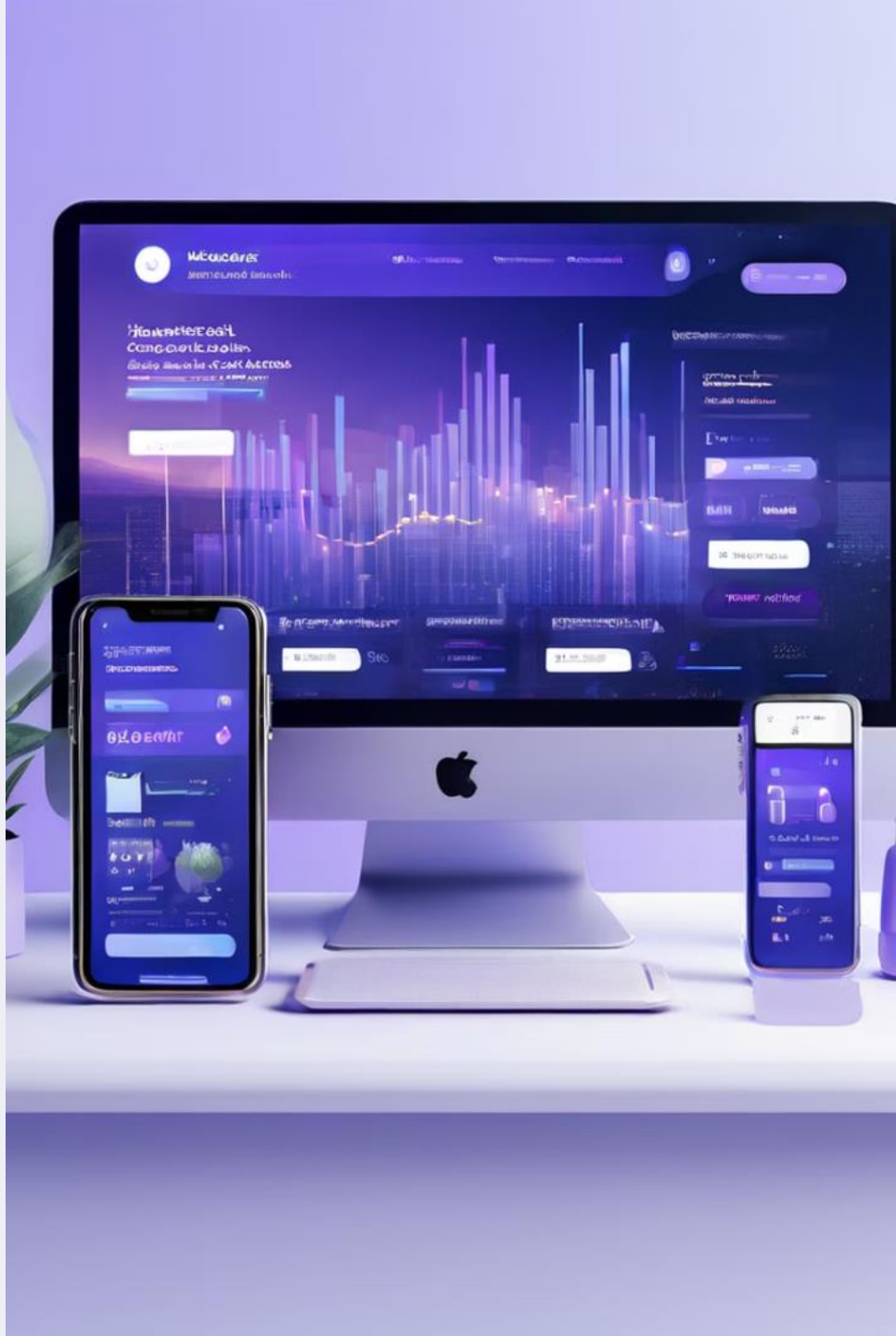
Provide the right information at the right time

Accessibility

Deliver information in the right place

User-Friendly

Easy to use and understand for all users



The Information System Process

1

Input (Data Acquisition)

Collecting and acquiring raw data through various input devices

2

Processing

Retrieving, analyzing, or synthesizing data into useful information

3

Output (Dissemination)

Producing helpful information in various forms such as reports or alerts

4

Feedback

Using system information to make modifications in input, processing, or outputs

Input Devices in Information Systems

1 Physical Input Devices

Keyboards, light pens, touch screens, mice, and other pointing devices

2 Automated Input Devices

Automatic scanners and machines that can read magnetic ink characters or lettering

3 Software Input Methods

Various software tools for data entry and acquisition

4 Telecommunications Input

Data input through network connections and communication channels

Processing in Information Systems

Data Storage

Storing data for future use

Data Comparison

Comparing different sets of data

Calculations

Performing mathematical operations on data

Formula Application

Applying formulas to transform data

Processing Devices in Information Systems

1

Processing Chips

Central Processing Unit (CPU) and main memory housed in chips

2

Specialized Chips

Innovative chips like the "bunny chip" for pharmaceutical testing

3

Biological Information Systems

HμREL Corporation's environments mimicking human body functions on chips

HμREL Microfluidic Biochip

Structure

Arrangement of separate but fluidically interconnected "organ" or "tissue" compartments

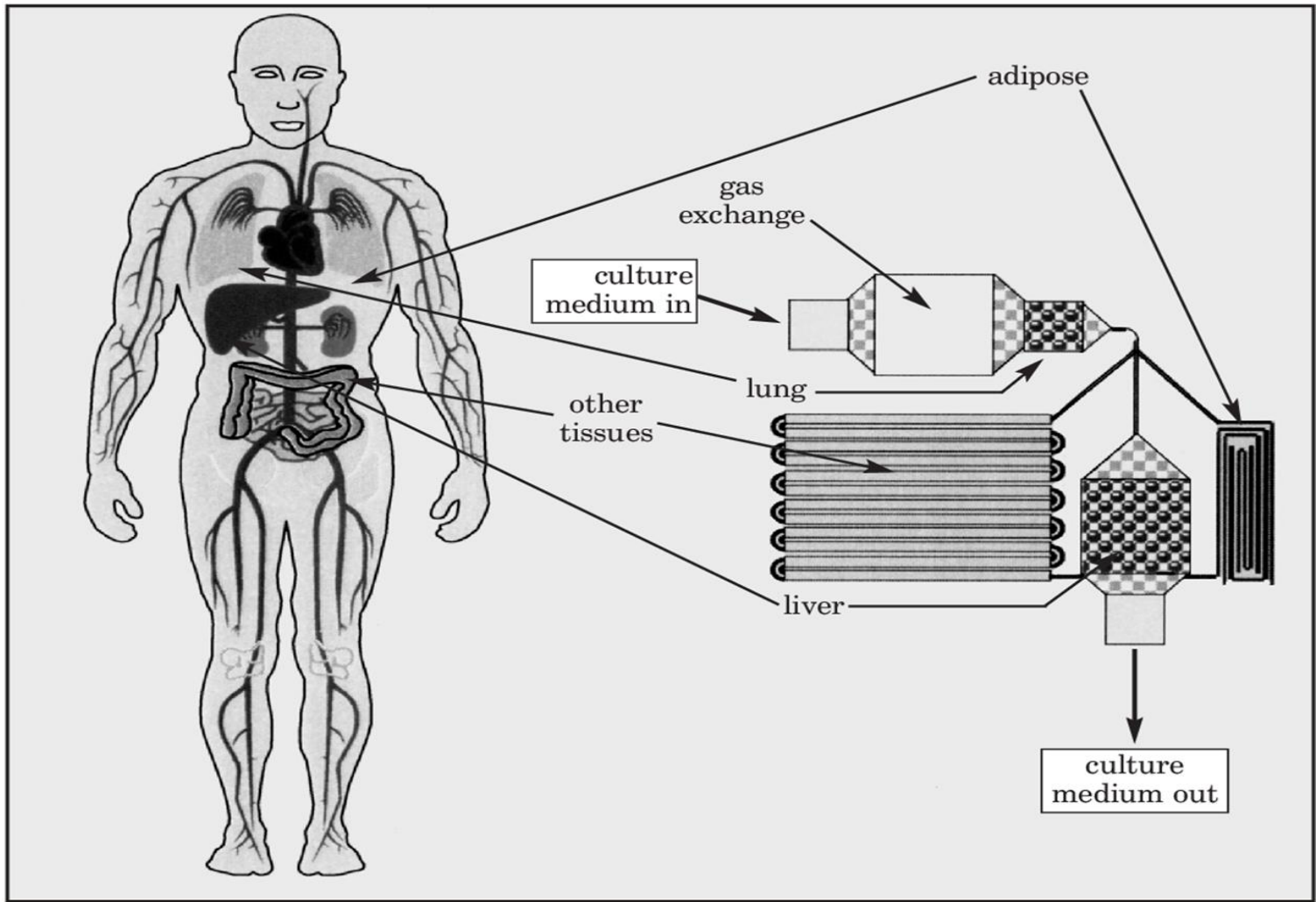
Function

Contains living cell cultures mimicking primary functions of organs or tissues

Application

Used for testing drug effects and toxicity without animal testing

e 1: A schematic representation of the Hurel™ microfluidic biochip



Output in Information Systems

Reports

Designed to inform, tailored to specific situations or user groups

Documents

Information that can be printed, saved, or shared

Summaries

Condensed versions highlighting major points

Alerts

Warnings, feedback, or additional information to assist users

Output Devices in Information Systems

Sound Output

Audio and speech synthesis outputs

Printers

Devices for producing physical copies of information

Monitors

Visual displays for presenting information

Feedback in Information Systems

1

Error Detection

Identifying issues in input, processing, or output

2

Correction Suggestions

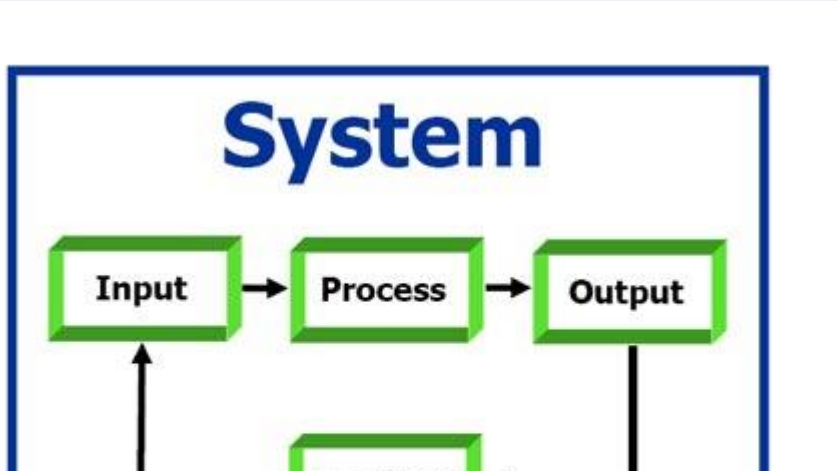
Providing information to correct detected errors

3

System Modification

Using feedback to improve system performance and accuracy

User Interaction



Acquiring Information in Daily Life

In our information-rich world, we constantly receive and process data from our environment. By observing our information intake over a two-hour period, we can gain valuable insights into how we distinguish between raw data and meaningful information. This exercise helps us understand the various sources of information we encounter and the cognitive processes involved in interpreting that data.

1

Identify Sources

Note down all sources of information you encounter, such as smartphones, computers, conversations, signs, and media.

2

Record Details

For each piece of information, document how you received it and why you consider it information rather than raw data.

3

Analyze Patterns

Look for patterns in the types of information you consume and how you process it throughout the two-hour period.

4

Reflect

Consider how this awareness of your information intake might influence your future interactions with various information sources.

Automatic Banking Machine as an Information System

Automatic Banking Machines (ABMs) are quintessential examples of Information Systems that have revolutionized personal banking. These systems function by interfacing with bank databases to provide real-time account information and facilitate transactions. ABMs offer convenience, 24/7 accessibility, and reduced wait times compared to traditional teller services. However, they also have limitations, such as cash withdrawal limits and potential technical issues.

Advantages

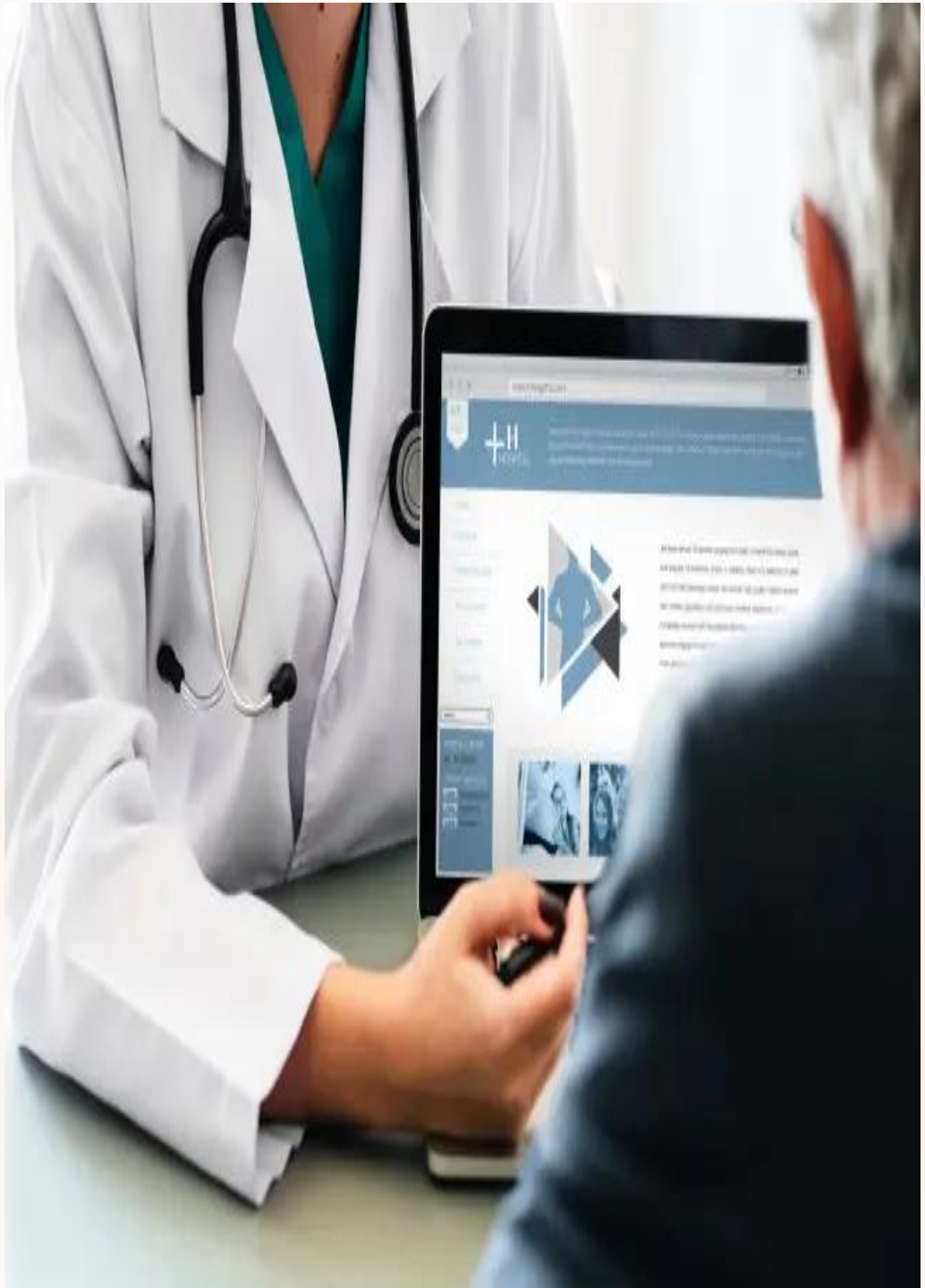
- 24/7 availability
- Reduced wait times
- Consistent service
- Multiple transaction types

Disadvantages

- Limited transaction amounts
- Potential technical issues
- Lack of personal assistance
- Security concerns

Potential Enhancements

- Biometric authentication
- Cardless transactions
- AI-powered assistance
- Integration with mobile apps



Nurse Interactions with Information Systems

In a typical healthcare setting, nurses interact with various Information Systems throughout their shifts. These systems range from Electronic Health Records (EHRs) to medication administration systems and patient monitoring devices. The frequency and nature of these interactions depend on the specific healthcare environment and the nurse's role.

1

Electronic Health Records (EHRs)

Nurses access and update patient information, including vital signs, medications, and care plans, multiple times per shift.

2

Medication Administration Systems

These systems are used to verify and document medication administration, often requiring interaction before each medication dose.

3

Patient Monitoring Devices

Nurses regularly check and respond to data from various monitoring devices, such as cardiac monitors and pulse oximeters.

4

Communication Systems

Nurses use pagers, smartphones, or other devices to communicate with team members and receive alerts throughout their shift.

Location and Accessibility of Healthcare Information Systems

The location and accessibility of Information Systems in healthcare settings significantly impact nursing care. Systems may be bedside-mounted, handheld, or station-based, each with its own advantages and challenges. The placement of these systems can affect workflow efficiency, patient interaction, and the timeliness of information updates.

Location	Advantages	Challenges
Bedside	Immediate access, patient involvement	Space constraints, privacy concerns
Handheld	Mobility, flexibility	Battery life, potential for loss
Station-based	Larger screens, ergonomic setup	Distance from patient, potential queues

Organization and Information Needs

Let's consider a large multinational corporation as our example organization. In this context, the need for information and knowledge significantly impacts both internal configurations and external interactions. The organization must establish robust information systems to manage vast amounts of data, facilitate decision-making, and ensure effective communication across diverse geographical locations and departments.

1

Data Collection

Gathering information from various sources, including market research, customer feedback, and internal operations.

2

Data Processing

Analyzing and organizing collected data into meaningful insights using advanced analytics tools.

3

Knowledge Distribution

Sharing processed information across the organization through intranets, databases, and collaboration platforms.

4

Decision Making

Utilizing distributed knowledge to inform strategic decisions and drive organizational growth.

Impact on Knowledge Workers

The need for information and knowledge in our example organization profoundly influences the nature of work and how knowledge workers interact. Employees are expected to be proficient in using various information systems and tools to access, analyze, and produce knowledge. This shift has led to more collaborative work environments, increased remote work capabilities, and a greater emphasis on continuous learning and adaptation.

Collaborative Work

Knowledge workers increasingly engage in team-based projects, leveraging digital collaboration tools to share ideas and information across departments and locations.

Remote Work

Advanced information systems enable employees to work from anywhere, accessing necessary data and tools securely through cloud-based platforms.

Continuous Learning

The rapidly evolving information landscape requires workers to constantly update their skills and knowledge through online training and educational resources.

The Five Rights of Clinical Information Systems

The Five Rights of Clinical Information Systems are crucial guidelines ensuring that healthcare professionals have access to the right information at the right time. These rights include: right information, right person, right time, right format, and right channel. Each of these rights plays a vital role in improving patient care, enhancing decision-making, and increasing overall efficiency in healthcare settings.

Right Information

Ensuring that the information provided is accurate, complete, and relevant to the specific patient and situation.

Right Person

Delivering information to the appropriate healthcare professional who needs it for patient care or decision-making.

Right Time

Providing information when it is needed, neither too early nor too late in the care process.

Right Format

Presenting information in a clear, easily understandable format that facilitates quick comprehension and action.

Right Channel

Using the most appropriate method or technology to deliver the information effectively and securely.

Prioritizing the Five Rights

If forced to choose only four of the Five Rights, the decision would depend on the specific context and priorities of the healthcare setting. However, for this exercise, let's consider omitting the "Right Channel" and explore the rationale for keeping the other four rights.

Retained Rights

- Right Information
- Right Person
- Right Time
- Right Format

Omitted Right

- Right Channel

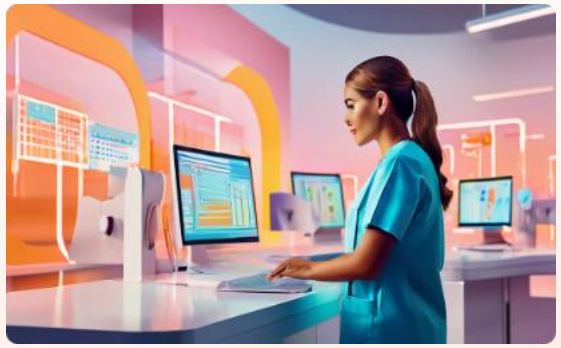
While important, the right channel could potentially be compensated for by ensuring the other rights are met effectively.

Rationale

The retained rights are fundamental to ensuring accurate, timely, and actionable information reaches the appropriate healthcare professional. The right channel, while valuable, could be considered less critical if the information is correct, reaches the right person at the right time, and is presented in an easily understandable format.

Information Science and Nursing Science

Information science and nursing science are closely intertwined disciplines that complement and enhance each other. Information science provides the theoretical and practical framework for managing, analyzing, and utilizing data in healthcare settings. Nursing science, on the other hand, focuses on the clinical knowledge and practices essential for patient care. The intersection of these fields has given rise to nursing informatics, a specialized area that bridges the gap between technology and healthcare delivery.



Data Management in Healthcare

Information science techniques enable efficient storage, retrieval, and analysis of vast amounts of patient data, supporting evidence-based nursing practice.

Enhanced Patient Care

The integration of information science tools in nursing allows for more personalized and effective patient care, improving outcomes and patient satisfaction.

Collaborative Practice

Information systems facilitate better communication and collaboration among healthcare professionals, leading to improved teamwork and coordination in patient care.

Artificial Intelligence in Healthcare

Artificial Intelligence (AI) is revolutionizing healthcare by enhancing diagnostic accuracy, treatment planning, and patient care. In your environment, you may encounter AI in various forms, from chatbots for initial patient screening to advanced imaging analysis tools. These AI systems can process vast amounts of data quickly, identify patterns, and provide insights that aid healthcare professionals in decision-making.

1

Diagnostic Support

AI algorithms can analyze medical images and patient data to assist in early detection of diseases and suggest potential diagnoses.

2

Treatment Planning

AI systems can help create personalized treatment plans by analyzing patient data and comparing it with vast databases of medical knowledge.

3

Administrative Tasks

AI-powered tools can streamline administrative processes, such as scheduling appointments and managing electronic health records.

4

Virtual Nursing Assistants

AI chatbots and virtual assistants can provide basic patient support, answer questions, and triage cases before human intervention.

Internet of Things in Healthcare

The Internet of Things (IoT) has found numerous applications in healthcare, creating a network of connected devices that collect and share data to improve patient care and operational efficiency. In your environment, you may encounter various IoT devices, from wearable health monitors to smart hospital beds and medication dispensers. These devices provide real-time data and insights, enabling more proactive and personalized healthcare.

Wearable Health Monitors

Devices that track vital signs, activity levels, and other health metrics, providing continuous data to healthcare providers.

Smart Hospital Equipment

Connected hospital beds, infusion pumps, and other medical devices that can be monitored and controlled remotely.

Medication Management

Smart pill bottles and dispensers that track medication adherence and send reminders to patients.

Artificial Intelligence of Things (AIoT) in Healthcare

The Artificial Intelligence of Things (AIoT) represents the convergence of AI and IoT technologies, creating intelligent, connected systems that can learn, adapt, and make decisions. In healthcare, AIoT devices combine the data collection capabilities of IoT with the analytical power of AI to provide more advanced and proactive healthcare solutions. These systems can predict health issues, automate care processes, and provide personalized health recommendations.

1

Data Collection

IoT devices continuously gather health and environmental data from patients and healthcare settings.

2

Data Analysis

AI algorithms process and analyze the collected data, identifying patterns and potential issues.

3

Predictive Insights

The system generates predictions and recommendations based on the analyzed data.

4

Automated Actions

AIoT devices can automatically adjust settings or alert healthcare providers based on the insights generated.

The Future of Information Systems in Healthcare

As we look to the future, the integration of advanced information systems in healthcare promises to revolutionize patient care, research, and healthcare management. Emerging technologies like quantum computing, advanced AI, and augmented reality are set to further enhance the capabilities of healthcare information systems. These advancements will likely lead to more personalized medicine, improved predictive analytics, and seamless integration of health data across various platforms and devices.

Personalized Medicine

Advanced AI and genomic analysis will enable highly tailored treatment plans based on individual patient characteristics and predicted outcomes.

Predictive Healthcare

Improved data analytics and AI will allow for better prediction of health trends and potential outbreaks, enabling more proactive healthcare interventions.

Seamless Data Integration

Future systems will likely offer smoother integration of health data from various sources, including wearables, home devices, and clinical systems, providing a more comprehensive view of patient health.

Enhanced Virtual Care

- **Thank you for Listening**

- Any Questions???
- Any Comments!!!