Chapter 12: Computers and Specimen Handling and Processing

Objectives

1. Define the key terms and abbreviations listed at the beginning of this chapter.
2. Describe components and elements of a computer, identify general computer skills, and define associated computer terminology.
3. Trace the flow of specimens through the laboratory with an information management system.
4. Define how bar codes are used in healthcare and list information found on a bar code computer label.

Objectives (cont’d)

5. Describe routine and special specimen handling procedures for laboratory specimens.
6. List time constraints and exceptions for delivery and processing of specimens.
7. Identify OSHA-required protective equipment worn when processing specimens.
8. Describe the steps involved in processing the different types of specimens and list the criteria for specimen rejection.

Computerization in Healthcare

• Computer Uses in Healthcare
  - Manage data (information collected for analysis or computation)
  - Monitor patient vital signs
  - Aid in diagnosis

• Computer Literacy
  - Know basic computer terminology
  - Understand computer & functions it performs
  - Perform basic operations using computers
  - Demonstrate willingness to adapt to changes computers bring to our lives
Computerization in Healthcare (cont’d)

- Computer Types
  - Supercomputers
  - Personal computers w. CPU tower
  - Hand-held PCs (ideal for patient ID using bar code systems)
  - Personal digital assistants (PDAs)

Common Computer Terminology

- **Accession number**: unique number generated when test request is entered into computer
- **CPU**: central processing unit
- **Cursor**: flashing indicator on monitor
- **Data**: information collected for analysis or computation
- **Hardware**: equipment used to process data
- **Icon**: image that signifies a computer application
- **ID code**: unique code used to identify a person for tracking
- **Input**: data entered into computer

- **LIS**: laboratory information system
- **Logging on**: entering as a user on system via password
- **Middleware**: third party vendor software
- **Mnemonic**: memory-aiding code or abbreviation
- **Online**: computer is connected to system & is operational
- **Output**: processed information generated by computer
- **Password**: secret word or phrase used to enter system
- **Peripherals**: all additional equipment attached to CPU
- **RAM**: random access memory; temporary storage of data in CPU

- **ROM**: read-only memory; contains instruction for operation of computer installed by manufacturer
- **Software**: coded instructions required to control hardware in processing of data
- **Storage**: a place for keeping data; outside computer, it is called secondary storage
- **Verify**: to confirm or check for correctness of input
Computerization in Healthcare (cont’d)

- Computer Networks
  - A group of computers linked for purpose of sharing resources
  - Offers advantage for:
    - Coordinating data
    - Communicating more efficiently
    - Sharing hardware & software
  - Individual computer stations are called nodes
  - Include simple interoffice connections & complex systems between several organizations in different cities (Internet)
  - Speed up processing, increase productivity, & reduce cost

Computerization in Healthcare (cont’d)

- Three Basic Components of Computer Systems
  1. Input
  2. Process
  3. Output

Computerization in Healthcare (cont’d)

- Computer Components
  - Input
    - Keyboard
    - Light pen
    - Touchscreen
    - Scanners
    - Mouse
    - Glidepad
    - CD/DVD or other external memory device

Computerization in Healthcare (cont’d)

- Computer Components
  - Process
    - CPU
      - “Brain” of computer
      - Compares, calculates, & makes decisions
  - Output
    - Printer
    - Computer screen
    - Smart phones
Computerization in Healthcare (cont’d)

- Three Elements that make up a computer system
  1. Hardware
  2. Software
  3. Storage

Computerization in Healthcare (cont’d)

- Elements of the Computer
  - Hardware
    - Defined: Equipment used to process data
      - CPU
      - Keyboards
      - Monitors
      - Bar code readers
      - Scanners
      - PDAs
    - Hand-helds
    - Fax machines
    - Printers
    - Modems
    - Routers

Computerization in Healthcare (cont’d)

- Elements of the Computer (cont’d)
  - Software
    - Programming designed to operate computer hardware in processing of data
    - Two types
      - Systems: built-in, pre-installed basics that operate computer (operating system)
      - Applications: programs designed to perform specific tasks required by users
      - Examples: spreadsheets, communication systems, database systems, word processing, & graphics
  - Storage
    - RAM: limited temporary storage in CPU
    - ROM: internal hard drive memory in CPU
    - Secondary storage: storage outside CPU
      - External hard drives
      - USB drives
      - CDs & DVDs
Computerization in Healthcare (cont’d)

- Laboratory Information System (LIS)
  - A customized software package designed to facilitate a variety of workflow models in the laboratory
  - **Objectives**
    - File results
    - Accumulate statistics to determine workload
    - Generate report forms
    - Monitor quality assurance & quality control in lab

- **Advantages**
  - Improved accuracy in testing
  - Reduced clerical & billing errors
  - Flexible delivery options for reports
  - Increased efficiency
  - **System manager** is responsible for:
    - Training personnel & updating them on software changes
    - Solving day-to-day problems that develop after system is installed

- **ID code**
  - Unique identifier, combination of letters and numbers
  - Allows access to certain system functions to each person
  - Logged w. every transaction, allowing system manager to identify users

- **Password**
  - Uniquely identifies the person allowing, him/her to become a system user
  - Must be kept strictly confidential

- **Icons & mnemonic codes**
  - Used to request appropriate program or function necessary to enter data

- **Bar codes**
  - Alternately spaced black bars and white spaces representing a code
  - Used for:
    - ID of patients
    - Supply inventory
    - Specimen identification
    - Pharmaceutical drug name, dose, & route
  - Require wireless hand-held scanner
Computerization in Healthcare (cont’d)

• A computerized label generated when the requisition order is entered

![Computerized Label Example]

Computerization in Healthcare (cont’d)

• Laboratory Information System (LIS)
  - Radio frequency ID
    • Composed of a reader & a tag or label
    • Tag is applied to product or person to identify & track using radio waves
    • Wireless scanner can track more than one tag at a time
    • Used to:
      - Monitor patients
      - Identify & track specimens, equipment, & records

Computerization in Healthcare (cont’d)

• General Laboratory Computer Skills
  - Logging on
  - Cursor movement
  - Using icons
  - Entering data
  - Correcting errors
  - Verifying data
  - Making order inquiries
  - Cancelling orders

Computerization in Healthcare (cont’d)

• Computerized Analyzers
  - Sophisticated computer systems designed to:
    • Manage patient data
    • Interface w. the LIS & main hospital intranet
      - Unidirectional (data goes from analyzer to LIS computer)
      - Bidirectional (data transfer is in both directions)
Computerization in Healthcare (cont’d)

• Connectivity Industry Consortium (CIC)
  - Established to ensure that any POC analyzer can talk to any LIS
  - Allows workers to transfer POC test results into patient’s chart
  - Guideline for standardization developed by manufacturers, LIS vendors, & healthcare providers

• Computerization Trends
  - Decentralization & increased POC testing
  - Increase in remote lab testing facilities networks
  - Further development of microchip technology in POC analyzers

Specimen Handling

• Preanalytical Phase
  - Defined: all the steps taken before the actual testing of the sample
  - Estimated that 46% to 68% of all laboratory errors occur prior to analysis
  - Specimen handling is a critical part of this phase

Specimen Handling (cont’d)

• Routine Handling
  - Mixing tubes by inversion
    • Additive tubes require 3-10 gentle inversions
  - Transporting specimens
    • Stopper should be up
    • Should be in plastic bags w. biohazard logo, liquid-tight closure, & a slip pocket for paperwork
  - Delivery time limits
    • Routine blood specimens should arrive at lab within 45 min.
    • Centrifugation, if required, should occur within 1 hr of arrival

Specimen Handling (cont’d)

• Special Handling
  - Body temperature specimens
    • Should be collected in a pre-warmed tube
    • Should be transported at or near normal body temp. of 37°C
    • Use portable heat blocks to maintain temp. during transport
  - Chilled specimens
    • Should be immersed in a slurry of crushed ice & water
    • Should be tested immediately or refrigerated
  - Light-sensitive specimens
    • Wrap in aluminum foil or use light-blocking amber-colored container
Specimen Handling (cont'd)

- Special Handling
  - Specimen processing
    - Central processing area in large labs
    - Here, specimens are:
      - Identified
      - Logged/accessioned
      - Sorted by department & type of processing required
      - Evaluated for suitability for testing

- Specimen Suitability
  - Specimens are rejected for:
    - Hemolysis
    - Insufficient amount of specimen
    - Clotting
    - Inadequate, inaccurate, or missing specimen ID
    - Wrong or outdated tube
    - Improper handling
    - Wrong collection time
    - Exposure to light
    - Delay in testing
    - Delay or error in processing

Specimen Handling (cont'd)

- Centrifugation
  - Centrifuge: a machine that spins blood tubes at high rpm
  - Centrifugal force separates cells & plasma or serum
  - Tubes awaiting centrifugation
    - Stoppers should remain on to prevent inaccurate results, evaporation, & contamination
  - Centrifuge operation
    - Tubes must be balanced (equal-size tubes w. equal volumes of specimen must be placed opposite one another)

Specimen Handling (cont'd)

- Centrifuging plasma specimens
  - Plasma specimens may be centrifuged without delay

- Centrifuging serum specimens
  - Serum specimens must be completely clotted before centrifugation
  - Complete clotting takes 30 to 60 min. at room temp.
Specimen Handling (cont’d)

- Centrifugation
  - Stopper removal
    - Some testing machines sample specimens directly through stopper
    - Most require stopper removal
    - Stopper may be removed by removal devices or robotics
    - If removed manually:
      - Face shield or splash shield should be used
      - Gauze or tissue should cover stopper
      - Stoppers should be pulled straight up & off

Aliquot preparation

- Aliquot: a portion of specimen used for testing
- Used when:
  - Multiple tests are ordered
  - Tests are performed on different instruments or in different areas
  - Prepared by transferring a portion of specimen into one or more tubes labeled w. same ID info. as specimen tube
  - Each aliquot tube should be covered or capped as soon as it is filled

Chapter 12 test: Matching

- LIS
- Menu
- Mnemonic
- Network
- Output
- Password
- POA
- Software
- Storage
- ROM
- Terminal
- USB drive
- RAM

- peripherals
- RFID
- verify
- accession number
- bar code
- central processing
- CPU
- cursor
- data
- DOT
- enter key
- hardware
- HPC
- icon
- ID code
- input
- interface
- LAN