The Five Healthcare Career Clusters

Diagnostic

Find out what is wrong. Create a picture of a patient's health at one point in time and determine a diagnosis.

Radiologic technologist, phlebotomist, pathologist

Therapeutic

Treat the patient. Maintain or restore health through direct patient care, changing health over time.

Nurse, physical therapist, pharmacist

Support Services

Keep the facility running. Non-clinical careers that let providers care for patients.

Food service, housekeeping, equipment maintenance

Health Informatics

Manage health information. Collect, protect and use health data to improve care.

Medical coder, health information manager, epidemiologist

Biotechnology R&D

Discover what is next. Research and develop new treatments, tests and products.

Biochemist, biomedical engineer, clinical research coordinator

ONE PATIENT VISIT, ALL FIVE CLUSTERS

1 · Check in
Registration staff check the patient in. **Support**

→

2 · Find the problem
A phlebotomist draws blood; a lab technician runs the test; an X-ray is taken.
Diagnostic

→

3 · Record it
Results go into the electronic health record; a medical coder codes the visit.
Informatics

→

4 · Treat it
A nurse gives medication; a physical therapist starts rehab. **Therapeutic**

→

5 · Behind it all
The medication and the X-ray machine came from research and development.
Biotech R&D

Diagnostic services

- **Role:** create a picture of a patient's health at a **single point in time**; determine a diagnosis for an illness or injury
- **Purpose:** use equipment, methods or systems to make an **accurate diagnosis**; work with other professionals to guide the plan of care; **empower patients** with information about their health

Therapeutic services

- **Role:** provide treatment to **maintain or restore** optimal health; help others through **direct patient care**
- **Purpose:** change a patient's health status **over time**; address what may affect treatment outcomes: **physical, mental and emotional** health

Examples to remember

Diagnostic tests

Blood tests · urinalysis · X-ray · CT (CAT) scan · MRI · ultrasound · EKG/ECG (heart rhythm) · biopsy

Therapeutic careers

Registered nurse · physical therapist · respiratory therapist · pharmacist · occupational therapist · athletic trainer

Support services (non-clinical)

Administration · housekeeping · security · switchboard · patient transport · front desk · equipment maintenance · waste management · mail · food and nutrition · IT · supply management

SKETCH NOTES: DRAW ONE THING THAT HELPS YOU REMEMBER EACH CLUSTER

Diagnostic

Therapeutic

Support

Informatics

Biotech R&D

Name _____

Diagnostic Technicians and Technologists

Career	What they do	Works with	Education
Phlebotomist	Draws blood for tests, transfusions and donations	Physicians, lab staff	Certificate: weeks to one semester
Clinical laboratory technician	Tests blood, urine and tissue samples in the lab	Pathologists, physicians	Associate's degree
Cardiovascular technologist	Tests the heart and blood vessels: EKGs, stress tests, heart ultrasound; assists with heart procedures	Cardiologists	Associate's degree + certification
Radiologic technologist	Takes X-rays and CT scans	Radiologists	Associate's degree
Diagnostic medical sonographer	Uses ultrasound (sound waves) to image organs, blood flow and babies during pregnancy	Radiologists, OB/GYNs, cardiologists	Associate's or bachelor's
MRI technologist	Uses magnets and radio waves (no X-ray radiation) to image soft tissue	Radiologists	Associate's; often a rad tech first
Nuclear medicine technologist	Gives small amounts of radioactive drugs, then images how organs work	Radiologists, nuclear medicine physicians	Associate's or bachelor's
EMT and paramedic	Assess and treat patients at the scene and on the way to the hospital	Emergency physicians	See the ladder →

Imaging ladder

Radiology technicians start at the basic level as **radiologic technologists**, then can move up to more advanced imaging.

- **Radiologic technologist** — X-ray, CT · first level
- **Sonographer** — Ultrasound
- **MRI technologist** — Magnetic imaging
- **Nuclear medicine technologist** — Most advanced

More training, more advanced imaging

Emergency: first responders

- **EMR** — Emergency medical responder · first aid, CPR
- **EMT** — Basic life support and transport · about one semester
- **AEMT** — Advanced EMT · adds IVs and some medications
- **Paramedic** — Advanced life support · 1–2 years · **most education**

More education, more skills

Common diagnostic tests

Test	What it shows
Blood test	Cell counts, blood sugar, infection, organ function
Urinalysis	Kidney problems, infection, diabetes
X-ray / CT	Bones and internal structures; CT gives cross-sections
MRI	Detailed soft tissue: brain, joints, organs
Ultrasound	Organs, blood flow, pregnancy
EKG / ECG	Electrical activity of the heart
Biopsy	A tissue sample checked for disease such as cancer

Invasive or not?

An **invasive procedure** enters the body (drawing blood, a biopsy). An X-ray or ultrasound is **non-invasive**.

Name _____

Medical Doctors and Specialists

All medical doctors have the letters **M.D.** or **D.O.**

The path to M.D. or D.O.

Bachelor's degree
4 years of college

→

Medical school
4 years → M.D. or D.O.

→

Residency
3 or more years of hospital training; longer for many specialties

At least **10–11 years after high school**. **M.D.** = Doctor of Medicine · **D.O.** = Doctor of Osteopathic Medicine (adds hands-on treatment of muscles and bones). Both can practice any specialty.

Doctor	Specializes in	Cluster
Family practitioner	Primary care for patients of all ages	●
Pediatrician	Infants, children and teens	●
Cardiologist	Heart and blood vessels	●
Dermatologist	Skin, hair and nails	●
Gastroenterologist	Digestive system: stomach, intestines, liver	●
Neurologist	Brain, spinal cord and nerves	●
Obstetrician/Gynecologist (OB/GYN)	Female reproductive system, pregnancy and childbirth	●
Oncologist	Cancer	●
Orthopedist	Bones, joints, ligaments and muscles	●
Pathologist	Diagnoses disease by studying tissue and body fluids in the lab	●
Geneticist	Genes and inherited conditions	●
Ophthalmologist	Eyes: disease and eye surgery	●
Anesthesiologist	Anesthesia and pain control during surgery	●
Psychiatrist	Mental illness; can prescribe medication	●

Which doctor would you see?

A rash that will not go away	**Dermatologist**	A broken wrist	**Orthopedist**
Chest pain and a racing heartbeat	**Cardiologist**	Headaches and numbness	**Neurologist**
Stomach pain after every meal	**Gastroenterologist**	A 5-year-old's checkup	**Pediatrician**

● Diagnostic specialist ● Therapeutic specialist

Physician Assistant (PA)

Has a **master's degree**. Works under the supervision of a doctor, but **can diagnose and prescribe medication**.

Veterinarian

Diagnoses and treats **animals**. **D.V.M.**: bachelor's degree + 4 years of veterinary school. Not a medical doctor.

Psychiatrist

- **M.D. or D.O.**: a medical doctor
- Diagnoses and treats mental illness
- **Can prescribe** medication

Psychologist

- **Ph.D. or Psy.D.**: a doctorate, not a medical doctor
- Talk therapy and psychological testing
- Usually **cannot prescribe**

Word parts that help

Part	Means	Example
cardi/o	heart	cardiologist
derm/a	skin	dermatologist
gastr/o	stomach	gastroenterologist
neur/o	nerve	neurologist
onc/o	tumor	oncologist
ped/i	child	pediatrician
path/o	disease	pathologist
ophthalm/o	eye	ophthalmologist
-ologist	specialist in	neurologist

Name _____

Therapeutic Services Careers

Career	What they do	Education
Athletic trainer (AT)	Prevents, evaluates and treats sports and activity injuries	Master's degree + certification
Massage therapist	Uses touch to relieve pain, reduce stress and help healing	Certificate (about 500+ hours) + license
Medical assistant (MCA)	Clinical and office tasks: vital signs, patient history, scheduling	Certificate (about 1 year) or associate's
Occupational therapist (OT)	Helps people do daily activities (dressing, cooking, working) after injury or illness	Master's or doctorate
Occupational therapy assistant (COTA)	Carries out the treatment plan an OT designs	Associate's degree
Pharmacy technician (CPhT)	Helps the pharmacist measure, package and label medications	Certificate + exam
Physical therapist (DPT)	Restores movement and strength; reduces pain	Doctorate (DPT)
Physical therapist assistant (PTA)	Leads exercises and treatments a PT plans	Associate's degree
Recreational therapist (CTRS)	Uses art, music, sports and games to improve health and well-being	Bachelor's + certification
Respiratory therapist (RT)	Treats breathing and lung problems; runs ventilators	Associate's degree (minimum)
Speech-language pathologist (SLP)	Treats speech, language and swallowing problems	Master's degree

Therapist and assistant pairs

Physical therapist → PTA
DPT plans · PTA (associate's) carries it out

→

Occupational therapist → COTA
OT plans · COTA (associate's) carries it out

→

Pharmacist → pharmacy tech
PharmD checks and counsels · CPhT prepares

Therapeutic services

Role

- Provide treatment to **maintain or restore** optimal health
- Help others through **direct patient care**

Purpose

- Change a patient's health status **over time**
- Address what can affect treatment outcomes:

Physical health · **Mental health** · **Emotional health**

Doctorates that are not medical doctors

A bachelor's degree, then 3–4 years of specialized training.

Professional	Focus
Audiologist · Au.D.	Hearing and balance; fits hearing aids
Pharmacist · PharmD	Dispenses medications and teaches patients how to take them safely
Physical therapist · DPT	Movement, strength and recovery from injury
Psychologist · Ph.D./Psy.D.	Mental and emotional health through therapy and testing

Remember the letters

AT · **OT** · **COTA** · **PTA** · **DPT** · **CPhT** · **RT** · **SLP** · **CTRS**

Name _____

Nursing, Dental and Vision Careers

The nursing ladder: a nurse can have many different letters after their name

CNA
Certified nursing assistant
1 semester + CNA certification exam
Cannot give medications
Works under all nurses

LPN
Licensed practical nurse
About 1 year + NCLEX-PN exam
Gives many medications
Works under RNs and doctors

RN
Registered nurse
2-year associate's degree + NCLEX-RN exam
Can give medications

BSN
Bachelor of Science in Nursing
4-year bachelor's + NCLEX-RN exam
Can give medications

NP · CRNA · CNM
Advanced practice nurses
BSN + master's or doctorate (DNP)
Can prescribe medications
Work with a supervising physician

More education, more responsibility

NP nurse practitioner: general care · **CRNA** nurse anesthetist: works with an anesthesiologist · **CNM** nurse midwife: works with an OB/GYN

The dental field

Dental assistant
3–12 months · lowest level of education

Dental hygienist · RDH
Associate's degree · cleans teeth, teaches care

Dentist · DDS or DMD
Bachelor's + 4 years dental school

Orthodontist
Dentist + 2–3 year residency · braces and alignment

Oral and maxillofacial surgeon: bachelor's + 4 years dental school + 4 or more years of surgical residency. Operates on the mouth, jaw and face.

A routine dental visit

Dental assistant Seats you, prepares tools, helps take X-rays → **Dental hygienist** Cleans your teeth and teaches home care → **Dentist** Examines, diagnoses and fills cavities

Eye providers: the three O's

Provider	What they do	Education
Optician	Fits and adjusts glasses and contacts from a prescription	Certificate or associate's + license
Optometrist · O.D.	Eye exams, vision tests, prescribes glasses and contacts. Uses an **occluder** to cover one eye during the exam.	Bachelor's + 4 years optometry school
Ophthalmologist · M.D./D.O.	A medical doctor: treats eye disease and performs eye surgery	Medical school + residency

Memory trick: the **optician** makes the glasses, the **optometrist** measures the eyes, the **ophthalmologist** operates.

Tools in an eye exam

Occluder	Covers one eye so each eye is tested on its own
Snellen chart	The letter chart for checking how clearly you see at a distance
Phoropter	The lens machine used to find your prescription

Health Informatics

Key terms

Health information (HI): personal information about a person's health: medical records, test results, insurance and billing, genetic information, and personal and contact information.

Health informatics: the science of how to use data, information and knowledge to improve human health and the delivery of health care services.

Health information management (HIM): HIM professionals organize, oversee and **protect** patient health information. They connect **clinical** and **administrative** functions and ensure **compliance** with federal regulations (such as HIPAA).

Biosurveillance: actively monitoring air, water, soil and wildlife for bacteria, viruses, fungi and other biological threats to human, animal or plant health.

Health information systems

Computer systems that store and share patient records. The **electronic health record (EHR)** holds a patient's whole history in one place.

Most common in our area: **Epic**, used by WakeMed, UNC Health and Duke Health. Patients see their records through the **MyChart** app.

What does health information exchange (HIE) improve?

Sharing records electronically between providers improves the **speed**, **quality**, **safety** and **cost** of patient care: fewer repeated tests, fewer errors, faster treatment.

Public health informatics

Uses widespread health data to guide disease intervention and prevention and improve the health of a **community**.

Applied health informatics

Uses the technology, data and outcomes in the health system to give the best possible care to **individual patients**.

	Public health informatics	Applied health informatics
Focus	Population health and disease prevention	Individual patient care and clinical data
Goal	Monitor and improve public health outcomes	Improve clinical processes and patient outcomes
Data	Surveillance systems, EHRs, public health reports	Patient records, EHRs, lab systems, clinical databases
Uses	Disease surveillance, outbreak management, health policy	EHR management, decision support, telehealth, data analytics
Users	Public health officials, epidemiologists, policymakers	Providers, clinicians, healthcare IT specialists
Example	A system that tracks an infectious disease outbreak	A decision support system that alerts doctors

What informatics professionals do

- Manage and protect electronic health records
- **Track disease patterns** and identify threats to humans, animals and plants
- Transfer medical information electronically and securely
- Turn health data into reports and statistics

Protecting information

PHI (protected health information) is any health information that can be tied to a person. **HIPAA** is the federal law that protects it.

Name _____

Informatics and Support Services Careers

Informatics career	What they do	Education
Epidemiologist	Studies patterns and causes of disease in populations	Master's (MPH)
Health educator	Teaches people and communities healthy habits	Bachelor's
Health information technician	Organizes and checks patient records for accuracy	Associate's
Healthcare administrator	Manages a hospital, clinic or department	Bachelor's; often master's
Medical coder	Turns diagnoses and procedures into codes for billing and records	Certificate
Medical illustrator	Draws medical images and animations for books, education and research	Master's
Medical transcriptionist	Types providers' recorded notes into written reports	Certificate

Support services

Non-clinical careers that allow healthcare providers to care for patients.

Administration	**Housekeeping**	**Security**
Switchboard	**Patient transport**	**Front desk**
Equipment repair	**Waste management**	**Mail**
Food and nutrition	**Informatics / IT**	**Supply management**

Purpose

- Better patients' overall health and well-being
- Support the work of other healthcare professionals
- Provide a safe and welcoming environment
- Meet the standards that keep daily clinical work running

Support career	What they do	Education
Dietitian (RDN)	Plans nutrition and medical nutrition therapy	Bachelor's (master's for new RDNs since 2024) + exam
Dietetic technician (DTR)	Carries out nutrition plans a dietitian designs	Associate's + exam
Environmental health specialist	Inspects restaurants, water and buildings for health hazards	Bachelor's
Genetic counselor	Explains genetic test results and inherited risks	Master's
Marriage and family therapist	Counsels couples and families	Master's + license
Medical equipment technician	Installs, tests and repairs medical equipment	Associate's
Mortician	Prepares the deceased and arranges funerals	Associate's + license
Social worker	Connects patients and families with resources and support	Bachelor's; master's for clinical

Dietitian

- Bachelor's or higher + RDN credential
- **Designs** personalized nutrition plans
- Can work independently
- Higher pay

Dietetic technician

- Associate's + DTR exam
- **Carries out** the dietitian's plans
- Works under a dietitian
- Lower pay

Daily duties in support services

Writing memos, emails and business letters · accessing, completing and filing medical records and forms · scheduling appointments · documenting electronic medical information · providing accurate health data and statistics

Name _____

Biotechnology Research and Development

Biotech research has led to

- Knowledge of **diseases** and medical conditions
- Advancement in **treatment**
- Advancement in disease **prevention**

NEW TREATMENT OPTIONS

Nanotechnology
Medicine at the nano scale. A **nanometer** is one-**billionth** of a meter.

Regenerative medicine
Seeks to **replace**, regrow or repair tissue or organs damaged by age, disease or injury.

Medications
New drugs, including **bio-pharma-ceuticals** made in living cells.

Medical devices and equipment
Prosthetics, implants, pacemakers, imaging machines.

Plant biotechnology
Plants with new or improved traits made through tissue culture and genetic engineering.

The scientific method in medical research

1. **Observation** — Identify a medical problem
2. **Question** — Ask a question about the problem
3. **Literature review** — Gather what is already known
4. **Hypothesis** — Predict the outcome
5. **Study design** — Choose a research design to test the hypothesis
6. **Collect data** — Run the study and record results
7. **Analyze data** — Interpret the data and look for patterns
8. **Conclusions** — Summarize the findings, which raise new questions

Technical skills needed

- Applying **medical terminology**
- Applying the **scientific method** in research studies
- **Technical writing**
- Following **standard operating procedures** (SOP)
- Properly using a **microscope**

Microscope basics

- Carry it with two hands: one on the **arm**, one under the **base**
- Start with the **lowest-power** objective lens
- Focus with the **coarse** knob first, then the **fine** knob

Technical writing

Takes complex **information** and writes it clearly and simply: user **manuals**, instructional guides, **research** reports and **technical** documentation.

Standard operating procedures

A set of written **instructions** that outline, step by step, how to perform routine tasks in healthcare.

Skills used in biomedical fields

- **DNA modification:** changing an organism's genetic makeup
- **Molecular (gene) cloning:** copying a gene in a host
- **Tissue culture analysis:** growing tissue outside the body
- **Genetic testing:** looking for changes in DNA
- **Biopharmaceutical R&D:** making medicines in living cells
- **Biomedical informatics:** data from equipment such as CT scanners

Name _____

Biotechnology, Research and Development Careers

Most research careers start with a science bachelor's degree

Career	What they do	Education
Clinical laboratory technician	Runs tests on blood, urine and tissue samples	Associate's
Clinical research associate	Monitors clinical trials to make sure they follow the rules and keep patients safe	Bachelor's
Clinical trials research coordinator	Runs a trial day to day: enrolls patients, schedules visits, keeps records	Bachelor's
Pharmacologist	Studies how drugs affect the body and develops new ones	Ph.D. (or PharmD/M.D.)
Biochemist	Studies chemical processes in living things	Bachelor's → Ph.D.
Cell biologist	Studies the structure and function of cells	Bachelor's → Ph.D.
Microbiologist	Studies bacteria, viruses, fungi and other microbes	Bachelor's → Ph.D.
Biomedical engineer	Designs medical devices: artificial organs, prosthetics, imaging machines	Bachelor's in engineering
Biological technician	Sets up and runs lab experiments for scientists	Bachelor's
Geneticist	Studies genes, heredity and genetic disorders	Ph.D. or M.D.
Forensic scientist	Analyzes crime scene evidence in a lab	Bachelor's in science
Toxicologist	Studies how poisons and chemicals harm living things	Bachelor's → Ph.D.
Crime scene investigator	Collects and documents evidence at the scene	Police or criminal justice training + certification

	Biochemist	Cell biologist	Microbiologist
Focus	Chemical processes in living organisms	Structure and function of cells	Microbes and their interactions
Tools	Spectrophotometers, chromatography	Microscopes, cell cultures	Petri dishes, incubators, microscopes
Used for	Drug development, genetics, metabolism	Cancer research, genetics, stem cells	Infection control, vaccines, ecology
Workplaces	Pharma, hospitals, research labs	Universities, biotech firms	Hospitals, environmental labs
Similar	Pharmacologist, toxicologist	Geneticist, biomedical scientist	Epidemiologist, immunologist

Forensic scientist

- Analyzes evidence **in the lab**
- DNA analysis, toxicology, reports
- Science degree: biology, chemistry, forensic science
- Regular lab hours
- Court: expert witness on lab results

Crime scene investigator

- Collects evidence **at the scene**
- Photographs, labels and preserves evidence
- Police or criminal justice training + CSI certification
- Nights, weekends, emergency calls
- Court: describes how evidence was collected

Lab or field?

Lab: biochemist, cell biologist, microbiologist, forensic scientist, toxicologist, biological technician. **Field:** crime scene investigator. **With patients:** clinical research associate and trials coordinator.

Name _____

Unit 3 Vocabulary

DIAGNOSTIC AND THERAPEUTIC

Diagnosis: identifying a disease from its signs and symptoms.

Invasive procedure: a medical procedure that invades (enters) the body.

Vital signs: clinical measurements, specifically temperature, pulse, respiration and blood pressure.

Telehealth: providing healthcare remotely by means of telecommunications technology.

HEALTH INFORMATICS

Health informatics (HI): the integration of healthcare sciences, computer science, information science and cognitive science.

Health information management (HIM): the collection, analysis, storage and protection of the quality of patient health information.

Health information technology (HIT): the processing, storage and exchange of health information.

Medical coding: the transfer of healthcare information into alphanumeric codes.

Personal identifying information: the information that distinguishes an individual's identity.

Protected health information (PHI): any health information that can be tied to an individual and is protected under HIPAA.

BIOTECHNOLOGY RESEARCH AND DEVELOPMENT

Biotechnology: the use of living systems and organisms to develop or make products.

Bioengineering: uses a combination of cells and engineering to restore, maintain, improve or replace different types of biological tissues.

Biomedical informatics: focuses on tissues and organs by advancing applications through data analysis using equipment such as the computerized tomography scanner (CAT scan).

Biopharmaceutical products: medicines manufactured in living organisms, including white blood cells or bacteria.

DNA modification: the alteration of the genetic makeup or original genome of organisms that would not occur by natural means.

Genetic testing: a medical test that analyzes your cells or tissue to look for changes in your DNA.

Molecular (gene) cloning: isolating a DNA sequence (often a gene) from any species and inserting it into a vector (host) for propagation, without altering the original DNA sequence.

Nanomedicine: the use of nanotechnology to achieve innovation in healthcare; medicine performed at an extremely small, nano-level scale.

Plant biotechnology: the use of tissue culture and genetic engineering techniques to produce genetically modified plants that have new or improved characteristics.

Regenerative medicine: develops methods to regrow, repair or replace cells, organs or tissues damaged by disease, trauma or congenital issues.

Scientific method: principles and procedures for the systematic pursuit of knowledge: recognizing a problem, collecting data, experimenting and testing hypotheses.

Standard operating procedure (SOP): step-by-step instructions used to carry out routine operations.

Tissue culture: fragments of tissue from an animal or plant transferred to an artificial environment where they can continue to survive and function.

Letters after the name

M.D. Doctor of Medicine **D.O.** Doctor of Osteopathic Medicine **PA** Physician assistant **D.V.M.** Veterinarian **DDS / DMD** Dentist **RDH** Registered dental hygienist	**O.D.** Optometrist **Au.D.** Audiologist **PharmD** Pharmacist **DPT** Physical therapist **Ph.D. / Psy.D.** Psychologist **SLP** Speech-language pathologist	**CNA** Certified nursing assistant **LPN** Licensed practical nurse **RN** Registered nurse **BSN** Bachelor of Science in Nursing **NP** Nurse practitioner **CRNA / CNM** Nurse anesthetist / midwife	**EMR · EMT · AEMT** Emergency responders **OT / COTA** Occupational therapist / assistant **PTA** Physical therapist assistant **CPhT** Pharmacy technician **RT** Respiratory therapist **AT** Athletic trainer	**RDN / DTR** Dietitian / dietetic tech **EHR** Electronic health record **HIE** Health information exchange **PHI** Protected health information **HIPAA** Federal health privacy law **SOP** Standard operating procedure

Name _____