MedLab: VITAL SIGNS

AT A GLANCE

Students will become familiar with the field of health science by participating in six hands-on vital sign activities and applying what they learn to complete a patient diagnosis.

OBJECTIVES

Students will:

- Use various medical science techniques to accurately measure vital signs
- Identify the different components of a medical patient chart
- Diagnose a patient by analyzing vital signs and other symptoms

KEY VOCABULARY

vital signs, baseline vitals, body temperature, homeostasis, hyperthermia, fever, hypothermia, pulse, heart rate, palpate, respiratory rate, breathing sounds, wheeze, stridor, stertor, crackle, stethoscope, systolic & diastolic blood pressure, hypertension, sphygmomanometer, patient chart, diagnosis, differential diagnosis

SUGGESTED GRADE LEVELS:

8—12

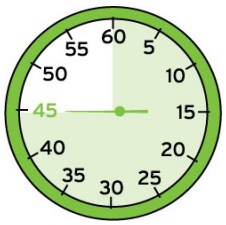
IL LEARNING GOALS

11.A; 12.A, B; 13.A, B; 22.A, B, C; 23.A, B; 24.B

NGSS MS-LS1, HS-LS1

PACE YOURSELF

TWO 45 MINUTE PERIODS



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ADVANCE PREPARATION

1. Determine how you want to divide your students: pairs for the Warm-Up and groups of 5 for the Activity.
2. Set up six Vital Sign stations: body temperature, heart rate, respiratory rate & breathings sounds, blood pressure, and eye function.
3. Make copies of the station instructions (one copy per station).
4. Make copies of the student worksheets (one copy of each per student).
5. Make copies of Patient Charts (two copies of each patient).

MATERIALS

Per Class:
Thermometers
Stethoscopes
Sphygmomanometers (blood pressure cuff)
Pen lights (or small flashlights/phone lights)
Alcohol wipes
Instructions

Per Student:
Patient Diagnosis Worksheet

Per Group:
Two Patient Charts

WHAT YOU NEED TO KNOW

A doctor's visit is a meeting between a patient and a physician designed to offer health advice or to assess and treat health condition. When you go to the doctor's office, your vital signs are among the first things your health professional will evaluate. **Vital signs** are clinical measurements that indicate the state of a patient's essential body functions. Vital signs are a quick and effective way to monitor a patient's health. **Baseline vital signs** represent a person's typical state of health. Baseline vitals are determined by using the patient's own well/healthy vital signs. It is important to use the patient's baseline vitals whenever possible since each vital sign has a range of acceptable values. Even the most well-known—a temperature of 98.6° Fahrenheit—is only a rule of thumb, calculated by averaging human temperatures. A deviation from the patient's baseline vitals generally suggests a change in physiological function and/or the

need for medical intervention. There are four main vital signs that are standard in medical settings from office visits to emergency departments: body temperature, heart rate (pulse), respiratory function (respiratory rate and breathing sounds), and blood pressure. In this lesson we will also outline one that is widely used during check-ups and hospital visits—eye function. (Another health indicator typically used in hospitals– oxygen saturation– is outlined in the "Alternate Instructional Strategies" section below.)

BODY TEMPERATURE

Body temperature is a measure of the internal heat produced by the chemical reactions of processes such as digestion, liver function, and muscle contraction. Chemical reactions such as these aid the body in maintaining an internal balance called **homeostasis**–a narrow range of conditions organisms must maintain in order to be healthy and function efficiently. Average body temperature is 98.6°F, or 37.0°C, although this may vary depending on age, weight, and activity level.

Distinguishable variations in body temperature can represent abnormal health conditions. **Hyperthermia** is an elevated body temperature related to the body's inability to effectively release or reduce heat. The most common form of hyperthermia is a fever. A **fever** is the temporary increase in the body's temperature in response to infection, disease, or illness. Generally, professional medical intervention is necessary only when temperature exceeds 101˚F, but even a "low grade" fever requires medical attention if it is persistent/chronic or if it is accompanied by other medical conditions. This figure varies with age, weight, and activity level. **Hypothermia** is low body temperature resulting from heat loss. This is typically due to prolonged exposure to cold temperatures, or blood loss. Both inhibit the body's ability to effectively retain or produce heat. Hypothermia is classified by a body temperature below 96˚F (as measured by an oral thermometer).

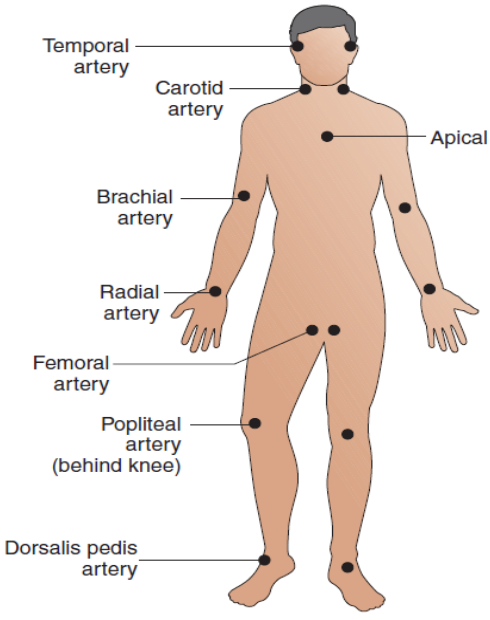
Body temperature is measured with a **thermometer**. Typically, body temperature is taken orally by placing a thermometer underneath the tongue; however rectal (in the rectum), aural (in the ear), and axillary (under the armpit) methods are used when obtaining temperatures for infants and young children or those who are unable to use a thermometer or are uncooperative with oral temperature measurements.

HEART RATE

The **pulse**, or **heart rate**, is the number of times the heart beats per one minute. The heart acts as a pump, which distributes blood throughout the body by way of blood vessels. This pumping action consists of two phases: contraction and relaxation. The combination of one contraction phase and one relaxation phase is equal to one heartbeat. A healthy adult should have a pulse that ranges from 60-100 heartbeats per one minute; however this rate can vary during times of physical exercise, sleep, stress, or illness.

A pulse can be detected at areas of the body where a large artery is close to the surface of the skin. By **palpating** (pressing down on) these areas, one can feel the pulse and track the rate of the heart cycle. The most common pulse points are the wrist (radial) and neck (carotid). The inner elbow (brachial), where the thigh meets the

Figure 1: Various pulse sites on the body



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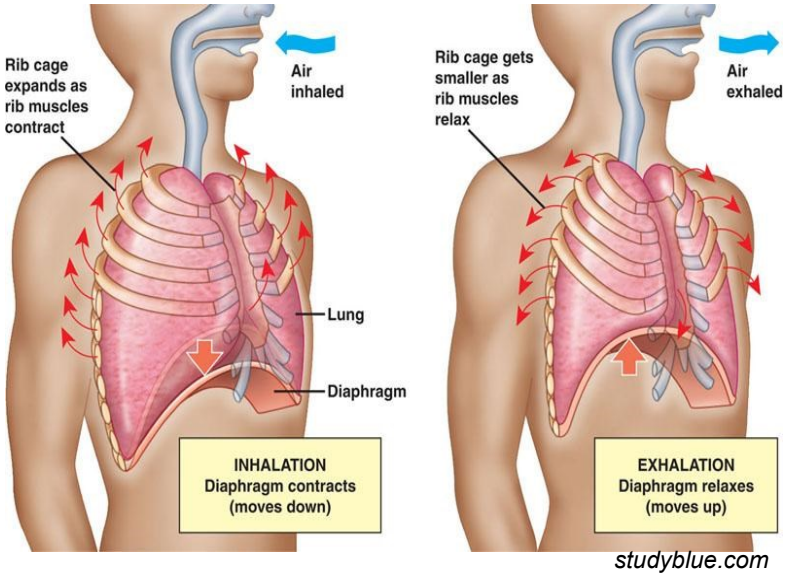
groin (femoral), the temples (temporal), tops of the feet (dorsalis pedis), behind the knees (popliteal), and the chest over the heart (apical) are pulse points as well. Besides heart rate, a healthcare provider checks pulse sites for pulse rhythm and strength to evaluate the health of the patient.

RESPIRATORY FUNCTION

Figure 2: Inhalation and exhalation



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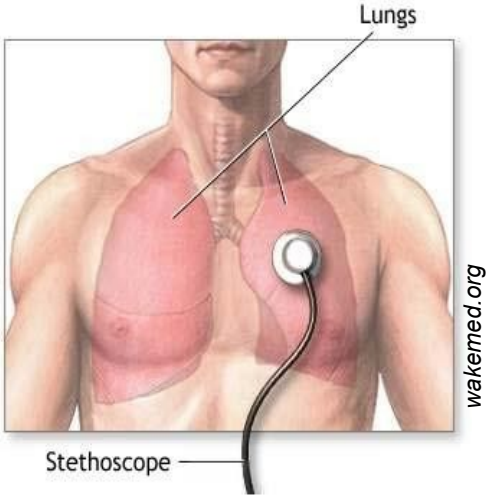
Respiratory function is quickly assessed in two ways—respiratory rate and breathing sounds. A health professional measures **respiratory rate** by counting the number of breaths taken per one minute. Respiration is the process of taking in oxygen and expelling carbon dioxide from the blood. This is done via the lungs as air is drawn in (inhaling) and expelled (exhaling) and oxygen and carbon dioxide molecules are exchanged with the blood in the alveoli. One complete breath consists of two phases: inhalation and exhalation. A respiratory rate is measured when the patient is at rest, by simply counting the number of breaths in one minute. A healthy, resting respiratory rate is 12-20 breaths per minute.

Breathing sounds refer to the specific sounds identified in the lungs when a person takes a breath. These sounds should be assessed with a stethoscope. A **stethoscope** is a medical instrument used to transmit internal body sounds to the ear of the listener. The presence of abnormal breathing sounds may suggest some form of respiratory complication. The five most common breathing sounds are clear, wheeze, stridor, stertor and crackle. A **clear breath** is produced by the free-flow of air throughout an unobstructed respiratory tract (airway). A **wheeze** is a high-pitched sound produced by a narrowed or obstructed airway. They can be heard best during exhalation and are commonly associated with conditions such as asthma and emphysema. A **stridor** is a higher pitched "wheeze-like" sound heard when a person inhales; usually due to a blockage of air flow in the trachea or larynx. A stridor can be present as a result of laryngitis, tonsillitis or allergic reactions. A **stertor** is described as a snoring sound with heavy breathing heard during both inhalation and exhalation that usually arises from the vibration of fluid or blockage around the throat (pharynx). A stertor can be a result of conditions such as pneumonia or bronchitis. A **crackle** is a brief, discontinuous, rattling sound caused by the explosive opening of the small airways. Crackles are normally a result of inflammation or infection of the lung's airways and more common during the inhalation than exhalation. A crackle

Figure 3: Observation of breathing sounds



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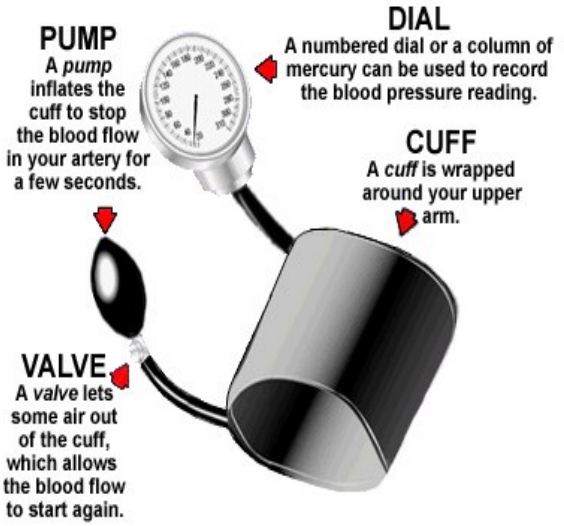
can also be a sign of pneumonia or chronic obstructive pulmonary disorder (COPD). Using a stethoscope to listen to a patient's breathing through her/his chest and back assists a medical professional in interpreting the differences between these somewhat similar sounds.

BLOOD PRESSURE

Figure 4: Parts of a manual sphygmomanometer



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When the heart beats, it pumps blood throughout the body to deliver the nutrients, oxygen, and other materials that it needs. As the blood moves, it pushes against the sides of the blood vessels and the force of this pushing is the **blood pressure**. Blood pressure is written as one number "over" another number and is often abbreviated to "BP". The top number is **systolic blood pressure**; the highest level the BP reaches when the heart pumps (contracts). The bottom number is **diastolic blood pressure**; the lowest level the BP reaches as the heart relaxes between the beats. The adult standard range for systolic BP is 90 to 120 mmHg (millimeters of mercury—a common measure of pressure) and 60 to 80 mmHg for diastolic BP. **Hypertension**, or high blood pressure, is indicated when systolic pressures are greater than 140 mmHg and diastolic pressures are greater than 90 mmHg. Common contributors to hypertension include: stress, anxiety, obesity, a high-sodium diet and certain genetic factors. **Hypotension**, or low blood pressure, is indicated when systolic pressure is lower than 90 mmHg and diastolic pressure is lower than 60 mmHg. Common contributors to hypotension include: blood loss, severe infection, allergic reaction, and hormonal imbalances. The medical device used to measure BP is a blood pressure cuff called a **sphygmomanometer** (pronounced sfig-mōh-ma-nom-ə-ter); it is composed of an inflatable cuff to restrict blood flow and a manometer to measure the pressure. The device is typically inflated around the upper arm (near the elbow) to restrict blood flow through the superficial (near the surface) arteries. Then, air is slowly let out of the cuff. When enough air has been let out of the cuff to allow blood to be pushed through the arteries when the heart pumps, the systolic BP is recorded. Air continues to be released until blood can be pushed through the arteries when the heart relaxes and the diastolic pressure is recorded. A sphygmomanometer can be manual or digital device, depending on the preference of the healthcare provider.

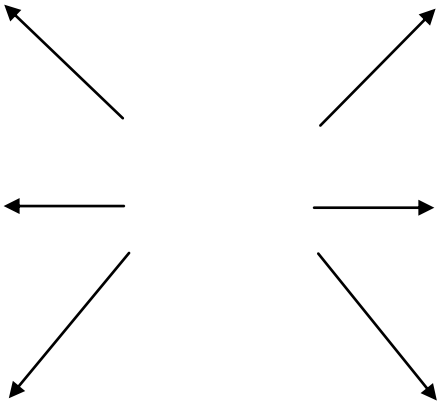
EYE FUNCTION EXAM (Neuro-optometric exam)

A medical professional may determine that a diagnostic eye function exam is in order. During this test, some of the patient's basic neurological health is assessed by determining how well the eye responds to different stimuli. (Not to be confused with a vision exam.) This test is not part of all basic vital signs testing, but it is a valuable assessment tool for head injuries or when specific ophthalmic (of the eye) or neurological syndromes are suspected. Many health professionals also include this examination in regular check-ups.

Professionals look for several things during a this type of exam—strabismus/convergence, pupillary response (light response), cardinal fields of gaze, and visual acuity (eye chart). These measures, when compared to the patient's baseline, can reveal a lot about the neurological health of the patient. Most

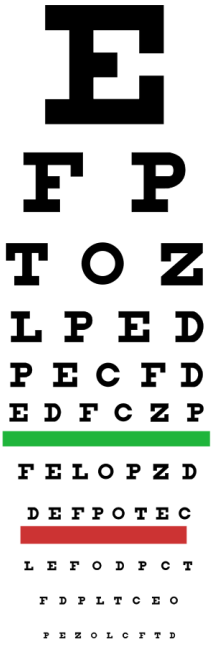
commonly, the exam is used to determine if a person has suffered **concussion**—a brain injury due to head trauma.

Figure 5: Cardinal fields of gaze



The **cardinal fields of gaze** are the 6 directions of eye movement that are linked to 3 major cranial nerves associated with the eyes. The directions are - upper-right, upper-left, directly right, directly left, lower-right, and lower-left. In this test, the examiner is looking for smooth motion of the eyes. **Nystagmus**, or shaky eye movement, can indicate nerve trauma such as may be found in concussions. In this exam, the medical professional will hold a finger (or other small object) directly in front of the patient at approximately 14 inches. The patient will then be asked to track the object with her/his eyes as it is moved to each cardinal field of gaze. For example, the object will be moved from directly in front of the patient to the examiner's upper-right at the extent of the examiner's reach and then back to directly in front of the patient before moving the object to the next cardinal field of gaze. The patient's head should remain motionless throughout the test. Only the eyes should move.

Figure 6: Snellen chart



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Finally, a **visual acuity** test may be performed in which the patient's vision is tested using an eye chart (Snellen chart) and compared to his/her baseline vision. This is different from a vision test done by an eye doctor in that it is not seeking to diagnose vision deficits/prescribe corrective lenses. Rather, in this test, patients with corrective lenses should wear them during the test. The examiner is looking for sudden changes is visual acuity brought on by head trauma/concussion.

Strabismus—pupils that do not line up properly—and **convergence**—a type of strabismus where both pupils point toward the nose/midline of the face—can indicate concussion, but they are not the only diagnostic test for the affliction. Patient history is especially important for determining the validity of this test. If the patient has a history of having a "lazy eye" at times, strabismus can be due to stress, fatigue or illness. During this exam, the medical professional will look carefully at the patient's eyes and look for the "sparkle" of the overhead lights or a separate light source shined from slightly above and in front of the patient. The reflection of the lights should sparkle with a bright dot in the same position on each eye.

A **pupillary response test** assesses the automatic responses of the patient's pupils (hence, "pupillary") in focusing and with light exposure. There are **four** major components of this test. **1.** The medical professional simply looks at the pupils. The pupils should be of equal size. **2.** A small light is shined at a slight angle (not directly) into each pupil for a very brief moment. The pupils of both eyes should constrict (get smaller). The medical professional looks for "direct response" in the eye that he/she is shining the light on, and a "consensual response" in the other eye; therefore, the light should be shined on the eye twice—one to observe direct response and one to observe consensual response. Both eyes should be tested in this way. **3.** Pupillary constriction is observed after dilation (getting bigger) due to restriction of light. In this test, each eye is covered in turn for several seconds and the cover is then removed. The pupil should constrict with the return of the light to that eye. Consensual response is observed as well but may be more subtle in this test. **4.** Pupillary accommodation is tested. In this test, the patient is asked to focus on

an object at a distance (the far wall, for example) and then asked to shift focus to something at approximately 3-4 inches from the patient's nose (the examiner's pen or finger, for example). When the focus is shifted from far to near, the pupil should constrict.

PATIENT RECORDS

A single vital sign measurement cannot definitively diagnose a medical condition; but, taken together, these measurements can help a doctor to determine if further examination and/or testing is needed to properly treat a patient. A patient's vital signs are recorded in a patient chart. A **patient chart** is a confidential document that contains detailed and comprehensive information. This serves as both a medical and legal record of an individual's clinical status, care, history, and treatment. Think of a patient chart as a patient health database—the main source of information the healthcare team needs to treat the patient.

While patient charts will vary depending on the type of medical facility and department (e.g., hospital vs. clinic, cardiology vs. pediatrics), each charting system contains a common set of components. These components are:

- **Patient information** consists of the patient's name, date of visit, and, when possible, contact info, occupation, employer, and insurance carrier.
- **Episodic information** includes the reason for the patient's visit; including specific symptoms and concerns.
- The **triage tag** is a result of the process of sorting patients into groups based on their need for, or likely benefit from, immediate medical treatment. Most patients are separated into one of four categories: minor, delayed, immediate, morgue.
- **Patient history** provides a description of the patient's health and social history. It also contains information about the medical history of the patient's family.
- The **medical orders** component contains orders written by healthcare providers. These can be orders for tests, orders for medication, or recommendations for procedures.
- The **lab/test results** section identifies the laboratory tests that were performed and the results of those tests. The test results usually contain the numeric or graphical results and a narrative that describes the examiner's findings.
- The **notes** section includes additional observations made by a healthcare provider, such as a physician, physician's assistant (PA), or nurse, relating to the patient's care.
- The **care plans and discharge** component documents the treatment goals and plans for future care. It also contains final instructions for the patient before the chart is closed.

After obtaining a patient's vitals and completing components of the patient's chart, the medical staff will make a diagnosis to determine a patient's current state of health. A **diagnosis** is the medical decision determined after the healthcare team examines all the possible causes for a set of symptoms. A **differential diagnosis** consists of listing as many diseases or conditions that can possibly cause the presented symptoms, followed by a process of elimination, aiming to reach the point where only one disease or condition remains likely. The final result may also remain as a list of possible conditions, ranked in order of probability or severity. This diagnosis will determine if a patient must be admitted into the hospital for continuous care or if she/he is stable enough to administer treatment from their own homes.

During this lesson your students will be able identify six common vital signs, list the medical instruments

used to obtain vital sign measurements, demonstrate the procedure for taking vital signs, and review and interpret a medical patient chart. They will also have the opportunity to apply this content knowledge by acting as medical professionals to make differential diagnoses of their own.

WARM UP

1. Use the Vital Signs PowerPoint to review the concept of vital signs; highlight the vitals included in this lesson and explain why they are monitored in medical settings.
2. After reviewing the PowerPoint, inform students that they will work in partners to measure vital signs: temperature, heart rate, respiratory rate, breathing sounds, blood pressure, and eye function.

ACTIVITY 1

1. Break students into pairs and divide those pairs equally amongst six vital signs stations.
2. Have students record their vitals on paper (as long as they are comfortable doing so).
3. Each pair will have five minutes at each station to collect and record their data. Every five minutes, your students will rotate to the next station until all their vital signs have been recorded.
4. Print and, if possible, laminate the directions for each activity below to place at each station.

Temperature:

1. Follow directions on your thermometer. (Use new thermometers or covers for each user.)
2. Record the temperature.
3. Do 10 jumping jacks and immediately take your temperature again.
4. Record your temperature.
5. Fan yourself gently until you feel cooled off.
6. Take your temperature again.
7. Record your temperature.

Heart Rate/Pulse:

1. Have your partner place their arms to the side and bend their elbow. The palm of the hand should face upward.
2. Using your middle (long) and index (pointer) fingers, gently feel for the radial artery inside your partner's wrist. The radial artery is located on the inside of the wrist near the side of your thumb. *Note: If you have difficulty locating the radial pulse on your partner you can try to use the carotid (neck) pulse for a better reading. Place your index and middle finger on their neck– just under the jawbone and in a direct line below their temple.*
3. Count the number of beats for 30 seconds.
4. Multiply that number by 2 to calculate the number of beats per minute.
5. Record the pulse rate in BPM (beats per minute).

6. Now, switch roles with your partner.

Respiratory Rate:

1. Before you take your partner's respiratory rate, ask him/her to sit up straight with neck and spine in alignment. Your partner should clear his/her mind, relax and breathe normally.
2. Count the number of breaths your partner takes in 30 seconds. Remember, one complete breath consists of two phases: inhalation (chest cavity expands) and exhalation (chest cavity contracts). *Note: Placing a hand on your partner's back (with permission) may help you count breaths better.*
3. Multiply that number by 2.
4. Record your partner's respiratory rate.
5. Now, switch roles with your partner.

Breathing Sounds:

1. Before you observe your partner's breathing sounds, ask them to sit up straight with their neck and spine in alignment. Encourage them to relax and breathe normally.
2. Take the stethoscope and insert the tips of the device in your ears.
3. Place the stethoscope on your partner's back- between the spine and shoulder blades.
4. Listen to your partner's breathing sounds for 30 seconds.
5. Record the type of breathing sounds you observed (clear/obstructed). *Note: If you are able to distinguish the difference between obstructed airway sounds (i.e., wheeze, stritor, stertor, and crackle) specify that sound on your paper.*
6. Clean the earpieces of the stethoscope with an alcohol wipe.
7. Now, switch roles with your partner.

Blood pressure:

1. Have your partner roll up their sleeve, approximately five inches above their elbow.
2. Follow the directions of your sphygmomanometer.
3. Record your blood pressure results.
4. Now, switch roles with your partner.

Eye function:

Pupil alignment—check for strabismus (misalignment of pupils):

1. Sit directly in front of your partner facing each other.
2. Ask your partner to focus straight ahead.
3. Note the position of your partner's pupils (small black circles in the center of the eyes). They should be centered at the fronts of the eyeball.

4. Note the shine of the overhead lights (or of a pen light or phone light held above and slightly in front of your partner). The "sparkle" from the lights should be in the same position on each eye.
5. Record the results using the patient's left or right sides to describe any deviation from center.
6. Now, switch roles with your partner.

Cardinal fields of gaze—check for smooth eye motion/note nystagmus ("jerky" eye motion).

1. Sit directly in front of your partner facing each other.
2. Hold your index fingertip approximately 14 inches in front of your partner's nose (center).
3. Tell your partner to follow the movement of your fingertip with his/her eyes only (no head movement).
4. Move your finger on a diagonal up and to your right and note the movement of your partner's eyes.
5. Return your finger to center and then move it up and to your left, noting eye movement.
6. Return your finger to center and then move it down and to your right, noting eye movement.
7. Return your finger to center and then move it down and to your left, noting eye movement.
8. Return your finger to center.
9. Note any nystagmus, giving the specific direction(s) on which it occurred. (ie: up and to partner's left)
10. Now, switch roles with your partner.

Visual acuity—check for normal (baseline) vision.

1. Have your partner stand at the line several feet from the eye chart. You stand near the eye chart to check answers.
2. Your partner should read the lines from top to bottom until he/she can no longer read the letters. *Note: if he or she wears glasses, they should be worn during this test as well.*
3. Note any significant loss of visual acuity (quality of vision).
4. Now, switch roles with your partner.

(OPTIONAL) Oxygen Saturation (SpO_2):

1. Open the pulse oximeter clamp and insert your index finger with the fingernail facing upward (nail polish should be removed for an accurate reading).
2. Release the clamp and be sure to keep your hand stationary.
3. Turn on the pulse oximeter and wait 10 seconds for your reading.
4. Record your SpO_2 results.
5. Now, switch roles with your partner.

ACTIVITY 2

During this activity, your students will explore common health conditions that medical staff may treat in the Emergency Room. They will assume the roles of medical professionals by evaluating patient charts, assessing changes in standard vital sign measurements, and completing a differential diagnosis for their patient.

Some of the most common reasons people go to the Emergency Room are (in no particular order):

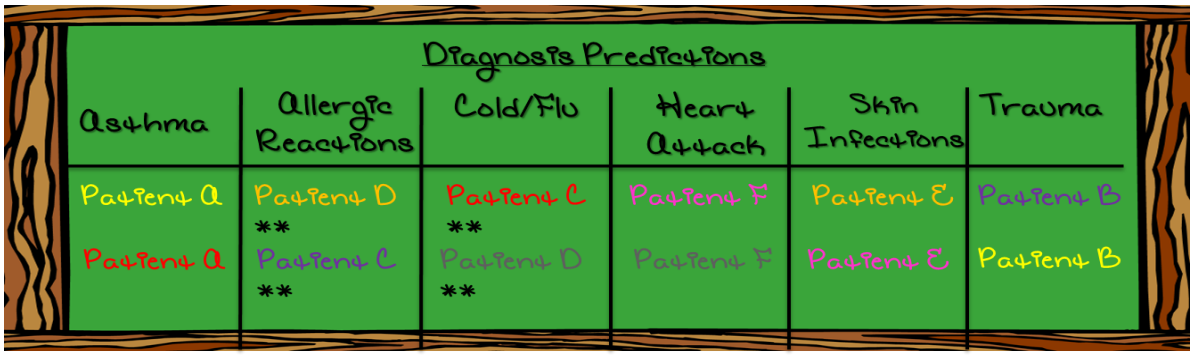
- Headaches
- Severe allergic reactions
- Abdominal pain
- Trauma/Broken bones/Sprains
- Chest pain/Heart attack
- Difficulty breathing/Asthma attack
- Cuts and Contusions
- Upper respiratory infections/Cold/Flu
- Skin infections
- Unconsciousness

The following chart highlights the changes in vital signs for six of the previously mentioned health conditions:

	Conditions					
	Asthma	**Anaphylaxis (Allergic Reaction)**	**Cold/ Flu**	**Heart Attack**	**Wound Infections**	**Trauma/ Broken Bones**
Symptoms						
Temperature	Baseline	Baseline	Elevated	Baseline	Baseline-Elevated	Baseline-Elevated
Heart Rate/ Pulse	Elevated	Elevated	Baseline-Elevated	Low or Elevated	Baseline-Elevated	Elevated
Respiratory Rate	Elevated	Elevated	Baseline-Elevated	Baseline-Elevated	Baseline-Elevated	Elevated
Breathing Sounds	Obstructed	Obstructed	Obstructed	Clear	Clear	Clear
Blood Pressure	Baseline-Elevated	Low	Baseline	Low	Baseline	Low-Baseline
Oxygen Saturation	Low	Low	Low-Standard	Low	Low-Baseline	Low-Baseline
Other symptoms include	Tightness/ pain in the chest, coughing, wheezing, gasping	Chest pain, narrowed airway, nausea, vomiting, diarrhea, swelling, itching, abdominal pain/cramps, unconsciousness, sudden weakness	Nausea with or without vomiting, runny nose, congestion, cough, chills, fatigue, aching muscles	Chest pain or pressure, sweating, nausea, lightheaded	Increased pain, swelling, redness or warmth around affected area. Drainage from affected area. Nausea, lightheaded, chills, etc.	Out-of-place or misshapen limb or joint, swelling, bruising, bleeding, pain, numbness or tingling, inability to move limb
Onset of symptoms	Commonly, after physical activity, inhalation of irritants, or exposure to allergens	May occur after being outside or eating certain foods (peanuts, shellfish, etc.)	Occurs when exposed to bacteria and viruses	Often, but not always, occurs in later adulthood	Occurs when open wound is exposed to bacteria	Fall, motor vehicle accidents, direct blow, repetitive forces, etc.

Each condition will not present itself the same way in every individual. Refer to the Teacher Guide for an explanation of why the vital signs were altered in the presence of these conditions. Please do not use this chart to self-diagnose. If you or your students are experiencing any symptoms, please see a doctor for an accurate diagnosis.

1. Use the attached PowerPoint to inform your students about a hospital Emergency Room Department, common health conditions presented in an ER and ways to assess a patient chart.
2. Write down the ten health conditions highlighted in the PowerPoint presentation on the classroom board. As a class, have your students brainstorm some of the symptoms that can be associated with each condition. As your students share their ideas make sure to write the symptoms on the board next to the corresponding condition. You do not need to write all of the symptoms down, just the ones that will assist students in making an accurate diagnosis. *Note: if you are limited on time, focus on the six health conditions presented in the chart rather than all ten.*
3. Divide your students into small groups and present two patient charts to each group. Give a *Patient Diagnosis Worksheet* to each student. Inform your students that each patient will have one of the following conditions: asthma, allergic reaction, cold/flu, heart attack, skin infection, or trauma/broken bone. *For example: Group 1– Patient A and B Group 2– Patient A and C Group 3– Patient B and C Group 4– Patient D and E Group 5– Patient D and F Group 6– Patient E and F.*
4. Make sure each group fills in today's date and the patient's age on their two charts.
5. Allow students to review the patient charts for 10 minutes. Explain that they will analyze the components of the patient chart, particularly vital signs, symptoms and history to diagnose their patients.
6. While students are evaluating the patient charts, make six columns on the classroom board: asthma, allergic reaction, cold/flu, heart attack, skin infection, and trauma/broken bone.
7. Also, make sure to walk around the classroom to clear up possible health misconceptions you overhear your students discuss.
8. Have students record their findings on the *Patient Diagnosis Worksheet*.
9. At the end of the 10 minutes, have a representative(s) from each group write the patient name in the column matching the predicted diagnosis. (see table below)
10. After each group has written their selections on the board, discuss each condition by having the students explain the process they took to reach their final assessments. If two groups have different answers, encourage the entire class to share ideas and suggestions to make a final diagnosis. Remember to design questions from the information in the Teacher Guide as scaffolds to help students make conclusions.



CHECK FOR UNDERSTANDING

1. Why are vital signs important to monitor? *Vital signs are clinical measurements that indicate the state of a patient's essential body functions. A variation in baseline vitals may suggest a change in physiological functioning or alert the need for medical intervention.*
2. What are the six vitals signs highlighted in this lesson?
    - *Temperature: a measure of the balance between heat lost and heat produced by the body*
    - *Heart Rate/Pulse: the number of times the heart beats per one minute*
    - *Respiratory Rate: the number of breaths taken per one minute*
    - *Breathing Sounds: the specific sounds identified in the lungs when a person takes a breath*
    - *Blood Pressure: a measure of the force of circulating blood pushing against the walls of the blood vessels*
    - *Eye function: a quick, informal assessment of neurological health*
3. What are the medical instruments used to measure each vital sign?
    - *Body temperature is measured with a thermometer.*
    - *To hear the heart, a stethoscope can be placed on the chest over the heart. To feel the pulse, fingers are placed over areas of the body where an artery is closest to the surface of the skin.*
    - *Respiratory rate is measured by observing the number of times a person takes a breath.*
    - *Blood pressure is measured with a sphygmomanometer.*
    - *Breathing sounds are assess via a stethoscope placed on the chest and/or back.*
    - *A Snellen chart (eye chart) is used to assess visual acuity.*
4. What is a patient chart? *A confidential document that contains detailed and comprehensive information to serve as both a medical and legal record of an individual's clinical status, care, history, and treatment.*
5. What section of the patient chart should be reviewed to determine a patient's reason for visit? *Episodic information*
6. What section of the patient chart should be reviewed to determine a patient's previous health conditions? *Patient history*
7. What section of the patient chart should be reviewed to determine a patient's treatment and future health regimen? *Care plans and discharge section*
8. What is a diagnosis? A diagnosis is the medical decision determined after the healthcare team examines all the possible causes for a set of symptoms.

Alternate Instructional Strategies

- If you are unable to purchase the necessary medical equipment for the Warm Up, continue the lesson with one of the following options.
    - Option 1: Have your students take some of their vitals outside of the classroom.
        - Temperature: use thermometer a from home
        - Blood Pressure: assign students to visit local pharmacies with free, public blood pressure monitors
            - ⇒ Here is a website to locate these pharmacies: http://www.lifeclinic.com/locator.aspx
        - Breathing sounds: listen to the various breathing sounds on-line
            - ⇒ Here are a few websites that provide sounds clips

- http://www.wilkes.med.ucla.edu/lungintro.htm
- http://www.practicalclinicalskills.com/heart-lung-sounds-reference-guide.aspx
- http://www.cvmbs.colostate.edu/clinsci/callan/breath_sounds.htm

* Option 2: Select six student volunteers, one from each group, to get their vital sign measurements recorded by the school nurse. The nurse will take the vital signs and can provide you with an anonymous report (avoiding a HIPAA violation). Alternately, the nurse may provide each student with their results and they may share with the class if they are comfortable doing so (you may need parental permission for this). Allow the class to review and discuss the measurements. Also, allow the student volunteers to discuss their experience (i.e., conversations with school nurse, description of equipment used, etc.).
* Option 3: After reviewing the Day 1 PowerPoint, skip the Warm-Up and proceed to the main activity.

- Before you begin the main activity, assign each group one of the six featured health conditions: asthma, allergic reaction, cold/flu, heart attack, skin infection, and trauma/broken bone. Allow your students to investigate how vitals are altered in the presence of these conditions. Have each group present their findings to the class.

- If your school has the resources to purchase more materials, blood oxygen saturation is another indicator of health used during hospitalizations (ie, not a general vital sign taken during an office visit) and can be measured with a pulse oximeter. This measure can replace the eye exam activity (also not a typical vital sign) or it may be used as an additional activity. See below:

OXYGEN SATURATION

Oxygen saturation (SpO_2—saturation of peripheral capillary oxygen) is a measurement of oxygen carried by the red blood cells throughout the body. As blood is pumped from the heart into the body, it passes through the lungs where oxygen molecules bind to red blood cells. The percentage of red blood cells that are fully saturated with oxygen is called blood oxygen saturation. A healthy blood oxygen saturation reading is between 97-100%.

A SpO_2 reading is obtained through the use of a **pulse oximeter**. This is a small device that clips onto the patient's fingertip or ear lobe and shines two beams of light through the skin of the patient. Typically, one light is red and one is infrared,. Oxygenated blood absorbs light at 660nm (red light), where deoxygenated blood absorbs light at 940nm (infra-red). The light beam enables the device to read small changes in the color of the patient's blood, which in turn provides an immediate estimate of blood oxygen saturation. The amount of light transmitted through the tissue is converted to a value representing the percentage of blood saturated with oxygen.

Figure 6: Pulse Oximeter w/ monitor

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DIFFERENTIATED INSTRUCTION

* Follow the recommendations of any Individualized Education Programs (IEPs) that you may have for students in your classes.
* Simplify vocabulary for any students who may need it. Use “healthy” or “unhealthy” to relate what vital signs can tell us. (ie: a high temperature is unhealthy.) Use ‘breathing rate” for respiratory rate. Etc.

* Use recorded heartbeat sounds for students with touch sensitivities instead of asking them to use the stethoscope. These students may also take their own vitals instead of working with a partner.

EXTENSIONS

SCIENCE

There are many health science careers that your students can pursue with varying amounts of schooling and training. Have your students choose a career in which they are interested from the chart below and prepare a poster about what steps they would need to take to get there (college, vocational training, volunteer experience, etc.).

GED/HS Diploma with or w/o Certification	Associate Degree with or w/o Certification	Bachelor Degree	Graduate Degree (add'l 1-2 yrs)	Graduate Degree (add'l 3 or more yrs)
Emergency Medical Technician	Anesthesia technician	Cytotechnologist	Epidemiologist	Audiologist
Healthcare Interpreter	Clinical Laboratory Technician	Dietician	Medical Dosimetrist	Chiropractor
Medical Coder	Dental Hygienist	Health Administrator	Medical Illustrator	Dentist
Medical/Dental Assistant	Dietetic Technician	Kinesiotherapist	Nurse Practitioner	Forensic Pathologist
Nurse's Aide	Licensed Practical Nurse	Medical Technologist	Occupational Therapist	Pharmacist
Pharmacy Technician	Paramedic	Perfusionist	Physician Assistant	Physical Therapist
Phlebotomist	Respiratory Therapist	Registered Nurse	Speech Language Pathologist	Physician

LANGUAGE ARTS

Throughout the lesson, the importance of the entire medical staff has been stressed. Each part of the team contributes in some way to a patient's experience, diagnosis, treatment and recovery. Have your students research the differences between the following professions: Physician, Medical Resident, Physician Assistant, Registered Nurse, Licensed Practical Nurse and Medical Assistant. Have students compare and contrast each type of schooling, as well as roles and responsibilities on the job.

MATH

Break students into five groups, each group representing one of the five vital signs (breathing sounds excluded). Provide each of those groups with the Class Vital Signs Worksheet. Remember, that all measurements are anonymous. Give students butcher or graph paper so they are able to create a visual of results to share with the class. Each group is only responsible for graphing the data of the vital sign they were assigned. This vital sign data is best displayed in the form of a bar or pie graph. Bar and pie graphs compare different groups or parts of a whole, where a line graph highlights numerical changes over a period of time. Other values to have students calculate include: mean, median, mode, range and percentage of students above or below standard measurements.

DIGITAL RESOURCES

- Explore Health Careers:
  http://explorehealthcareers.org/en/home
- Listen to breathing sounds:
  http://www.wilkes.med.ucla.edu/lungintro.htm
  http://www.practicalclinicalskills.com/heart-lung-sounds-reference-guide.aspx
  http://www.cvmbs.colostate.edu/clinsci/callan/breath_sounds.htm
- Student-friendly information on anatomy and health:
  http://www.kidshealth.org
- Test your own vitals at these locations:
  http://www.lifeclinic.com/locator.aspx

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