

Vital Signs! Who Cares?

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Disclosure

- I have no actual or potential conflict of interest in relation to this presentation/program

Vital Signs!

- What are vital signs and why do we do them?
 - Is it just part of the job?
 - Are they just numbers that you record?
 - Do they have any meaning?
- Vital Signs:
 - A set of clinical measurements, specifically Pulse Rate, Body Temperature, Respiration Rate, and Blood Pressure, that indicate the state of a patient's essential body function.
 - (Merriam-Webster)

Temperature

- Benchmark for normal temperature is 37 C(98.6 F) – Dr. Carl Wunderlich (19th century German physician)
- Temperature varies throughout the day
- Normal body temperature in children?
 - 36.1 C(97.0 F) - 37.9 C(100.3 F)

Temperature

How to measure?

- Rectal
 - Oral
 - Axillary
 - Temporal/Forehead
 - Tympanic
 - Plastic Strip Thermometers
 - Grandma's forehead kiss
- Rectal temperature is 0.3 C (0.5 F) – 0.6 C (1 F) higher than oral temperature.
 - Axillary temperature is 0.3 C (0.5 F) – 0.6 C (1 F) lower than oral temperature.
 - Axillary temperature is 0.6 C (1 F) higher than rectal temperature.
 - Temporal temperature is 0.3 C (0.5 F)- 0.6 C (1 F) higher than oral temperature.
 - Tympanic temperature is 0.3 C (0.5 F) – 0.6 C (1 F) higher than oral temperature.

Temperature

Indications/Contra-indications to Method

Method	Indication	Contra-indication
Rectal temperature	Birth to 5 years (truly any age) Mandated under 3 months of age	Newborn Small child with rectal surgery Rectal disease/anomalies Infectious diarrhea Neurological (spinal cord injury) Neutropenia Cardiac anomaly
Axillary temperature	At any age as a temperature screen (always third choice)	
Oral temperature	Older than 5 years	Seizure disorder Confused/disoriented Less than 2 years of age Mouth surgery Unconscious

Temperature

What does it mean?

- Hyperthermia: (>100.4 F)
 - Sepsis in infants
 - Bacterial infections
 - Viral infections
 - Medications
 - Illicit drugs
 - Illnesses related to heat exposure
 - Allergies
 - Inflammatory diseases
 - Over bundling
- Hypothermia: (<95 F)
 - Sepsis in infants
 - Cold exposure
 - Radiant
 - Contact
 - submersion

Pulse Rate/Heart Rate

- The heart rate is the number of contractions the heart makes per minute.
- Varies mainly due to the need for oxygen absorption, and the need for carbon dioxide excretion.
- Measured apically in children along with radial or brachial check.
- Heart rate range at rest varies with age/position.

Heart Rate

Range of Norms based on Age

based on PALS Guidelines

Age	Awake Rate	Sleep Rate
Neonate(<28days)	100-205bpm	90-160bpm
Infant(1month-1yr)	100-190bpm	90-160bpm
Toddler(1-2yrs)	98-140bpm	80-120bpm
Preschool(3-5yrs)	80-120bpm	80-120bpm
School-Age(6-11yrs)	75-118bpm	58-90bpm
Adolescent(12-15yrs)	60-100bpm	50-90bpm

Heart rate

Tachycardia - Causes

- **Sinus Tachycardia**

- Infections/fever
- Hypovolemia/Dehydration
- Pain
- Anxiety/Fear/Crying
- Medications
- Illicit drugs
- Excitation/Activity
- Hypoxia
- Anemia
- Shock
- Hyperthyroidism
- Hypocalcaemia
- Myocardial Infarction
- Pulmonary Embolism

- **Arrhythmia**

- Supraventricular tachycardia(AV re-entry, junctional, or atrial ectopic)
- Ventricular Tachycardia
- Atrial Flutter
- Atrial Fibrillation

Heart Rate

Bradycardia - Causes

- Sinus Bradycardia
 - Hypothermia
 - Hypothyroidism
 - Malnutrition
 - Hypokalemia
 - Hypoxia
 - Athlete
- Sick Sinus Syndrome
 - Cardiomyopathies
 - Congenital heart defects
 - Ischemia
 - Kawasaki's Disease
- Medications
- Increased Vagal Tone
- AV Nodal Block
 - Ebstein's, ASD, AVSD,
 - Lupus

Heart Rate

- How does Temperature Affect the Heart Rate

Heart Rate

- There is a rise of the heart rate by 10 beats per minute for every degree rise in body temperature from normal.
- If a 2 year old with a resting heart rate of 125bpm and has a temperature measured at 103.5 F. What would his expected heart rate be only on the basis of the fever?

Respiratory Rate

- The Respiratory Rate is the number of times a person breathes in and out in a full minute.
- Respiratory rate should be measured for a duration of a full minute especially in infants below 6 months of age. Why?
- Respiratory Rate Varies with age.

Respiratory Rate

Periodic Breathing versus Apnea

- Periodic Breathing is a normal breathing pattern found in premature and full term infants
- Involves regular breathing with pauses in breathing for no more than 10 seconds at a time followed by a series of rapid, shallow breaths, than returns to normal.
- Common until 6 months of age.
- May be accompanied by in or oxygen desaturation, and bradycardia.

Respiratory Rate

Range of Norms Based on Age

Age Category	Age Range	Normal Respiratory Rate
Infant	0-12 Months	30-60 per min
Toddler	1-2 years	24-40 per min
Preschooler	3-5 years	22-34 per min
School age	6-12 years	18-30 per min
Adolescent	13-18 years	12-16 per min

Respiratory Rate

Tachypnea - Causes

- Pneumonia/ Atelectasis
- Fever/Sepsis
- Dehydration
- Anxiety
- Hypoxia
- Upper airway obstruction
 - nasal congestion
 - choanal atresia
 - Macroglossia
 - Laryngomalacia/Laryngospasm
 - Croup/ Subglottic Web
 - Epiglottitis
- Respiratory Failure
- Acidosis
- Hypercapnea
- High Altitude
- Poisoning
- Envenomation
- Pneumothorax
- Cardiac Causes
- Pulmonary Edema
- Pulmonary Embolism
- Foreign Body in lower airway
- Pulmonary Hypertension

Respiratory Rate

Bradypnea - Causes

- Pneumonia
- Asthma
- Carbon Monoxide
- Obstructive Sleep Apnea
- Head Injury
- Electrolyte Abnormalities
- Respiratory failure
- Drugs
- Hypothyroidism
- Guillian-Barre Syndrome
- Amyotropic Lateral Sclerosis
- Pulmonary Edema
- Illicit drugs

Respiratory Rate

- How does Temperature Affect the Respiratory Rate?

Respiratory Rate

- There is a rise of the respiratory rate by 5-7 breaths per minute for every degree rise in body temperature from normal in children under 2 years of age and 7-11 breaths per minute for every degree rise in infants (<12 months).
- If a 2 year old with a breathing rate of 30 breaths per minute and has a temperature measured at 103.5 F. What would his expected respiratory rate be only on the basis of the fever.

Respiratory Rate

- Final Message:

Please count respiratory rate for 1 full minute!

Blood Pressure

- Blood pressure is the measurement of the amount of pressure exerted by the blood on the wall of the arteries. Presented as Systolic/Diastolic.
- Systolic Blood Pressure: Is the pressure exerted when the heart muscle is contracting.
- Diastolic Blood Pressure: Is the pressure exerted when the heart muscle is relaxing.

Blood Pressure

How is it measured?

- Can be measured manually, or by machine.
- Patient must be seated or lying.
- Patient must be calm and rested.
- In seated position arm must be flexed, and at level of the heart.
- Wrap the cuff around bare upper arm (not over clothing).
- The length of the bladder of the cuff must at least be equal to 80% of the circumference of the arm.
- The blood pressure cuff should cover approximately 2/3 of upper arm length.

Blood Pressure

Range of Norms Based on Age (mm Hg)

Age	Systolic BP	Diastolic BP	Systolic Hypotension
Birth(12hr,<1000g)	39-59	16-36	<40-50
Birth(12hr, 3Kg)	60-76	31-45	<50
Neonate (96hr)	67-84	35-53	<60
Infant (1-12mo)	72-104	37-56	<70
Toddler (1-2 yr)	86-106	42-63	<70 + (age in years X 2)
Preschooler (3-5yr)	89-112	46-72	<70 + (age in years X 2)
School age (6-9 yr)	97-115	57-76	<70 + (age in years X 2)
Preadolescent (10-11yr)	102-120	61-80	<90
Adolescent (12-15yr)	110-131	64-83	<90

Blood Pressure

“70” BP Rule for Ages 1-10 yr

- This calculates the minimum Systolic blood pressure in children.
- Rule of 70:
 - Systolic BP = $70\text{mmHg} + (2 \times \text{age in years})$
- Therefore if a child who is 4 years old. The child's Lower limit of systolic blood pressure will be?

Blood Pressure

“90” BP Rule for Ages 1-10 yr

- This calculates the normal Systolic blood pressure in children.
- Rule of 90:
 - Systolic BP = $90\text{mmHg} + (2 \times \text{age in years})$
- Therefore if a child who is 4 years old. The child's normal systolic blood pressure will be?

Blood Pressure Hypertension (HTN)

- Hypertension can be Primary (essential) or Secondary.
- The younger the child and the higher the BP, greater the chance that it represents secondary HTN.
- Secondary hypertension is most likely found before puberty
- Primary hypertension is most likely found after puberty.

Blood Pressure Hypertension - Causes

Age Group	Causes
Newborn	Renal: Thrombosis, Stenosis, Anomalies Heart: Coarctation of Aorta Endocrine: Pheochromocytoma, Cushing's Disease
Preschooler/ Kindergartener (<6yr)	Renal: Parenchymal Disease, Vascular Disease, Wilm's, Heart: Coarctation of Aorta Endocrine: Pheochromocytoma, Cushing's Disease
School Age (6-10yr)	Renal: Parenchymal Disease, Vascular Disease, Neuroblastoma Endocrine: Pheochromocytoma, Cushing's Disease
Adolescence	Essential Hypertension Renal: Parenchymal Disease, Vascular Disease Endocrine: Pheochromocytoma, Cushing's Disease Drugs of Abuse

Blood Pressure Classification in Children

- **Pre-hypertension:**
 - Child with BP $>90^{\text{th}}$ percentile but $< 95^{\text{th}}$, or any adolescent with BP $>120/80\text{mmHg}$ even if BP $<90^{\text{th}}$ percentile.
- **Stage I Hypertension:**
 - Child with BP $>95^{\text{th}}$ percentile but $<99^{\text{th}}$ percentile plus 5 mmHg.
- **Stage II Hypertension:**
 - Child with BP $>99^{\text{th}}$ percentile plus 5mmHg.

Blood Pressure

Hypotension - Causes

- Postprandial Hypotension
- Orthostatic Hypotension/Hypovolemia/Neurocardiogenic Syncope
- Sudden Loss of Blood/Shock
- Severe Infection/Sepsis
- Severe Allergic Reaction/Anaphylaxis
- Myocardial Infarction
- Drugs
- Cardiac Arrhythmias/Heart Failure
- Diabetic Neuropathy

Orthostatic Blood Pressure and Heart Rate

- Orthostatic vital signs (OVS) measure heart rate and blood pressure in 3 minute intervals while,
 - Lying – Sitting – Standing
- This provides measure of Fluid Volume Deficit or level of Dehydration.
- Mild OVS – Heart Rate increases by 20 bpm, but no change in Blood Pressure, plus physical signs.
- Moderate OVS – Heart Rate increases by 20 bpm or more and the Blood Pressure drops, plus physical signs.

Pulse Oxymetry

- This is to measure the oxygen saturation.
- The amount of arterial oxygen attached to hemoglobin.
- Normal range: 95-100%, <92% cause for Respiratory Disease or Cyanotic heart Disease
- In infants may place on hand.
- In children may place on fingers or toes.
- Prerequisites:
 - Fingers or toes must be warm.
 - There should not be any nail polish present.

Pulse Oxymetry

Caveats

- Pulse Ox. is used to evaluate for respiratory illness.
- Pulse Ox. is used to evaluate for cyanotic heart diseases.
Used as a tool in nurseries.
- Continuous Pulse Ox. is not recommended unless patient is on oxygen supplementation.
- Clinical benefit of pulse oxymetry is not validated or well documented.
- Caution regarding Pulse Ox. reading post administration of bronchodilators in asthmatics.

Cushing's Triad

- Hypertension + Bradycardia + Irregular Respirations.
- Indicates signs of increased intracranial pressure.

Other Vital Signs

- Pain Scale
 - Faces Pain Scale
- Weight:
 - Weight check should be done on all pediatric patients
 - Can be estimated for children 1-10 years of age
 - 0-1 years (Age in months/2) + 4
 - 1-5 years (Age in years X 2) + 8
 - 6-12 years (Age in years X 3) + 7

Case 1

- Hx: A 3 year old comes in with complaints of vomiting and diarrhea for past 3 days. Will not keep anything down.
- PE: T:- 102.3F, P:- 170
RR:-54, BP:- 98/50,
Ox:- 98%
Laying in moms arms,
dry mucus membranes
- Can you guess the weight?
- Anything wrong with his vitals?
- Can they be explained?
- What is probable diagnosis?

Case 2

- Hx: A 2 year old was involved in a MVC, unrestrained passenger, thrown from vehicle. At scene, he was crying, has dirt all over.
- PE: T:- 98.8F, P:- 63, RR:- 18 with periods of short shallow breaths, Bp:-112/80, O₂:- 92%
- Alternating irritability with somnolence, Pupils sluggish, with Papilledema.
- Can you guess the weight?
- Anything wrong with his vitals?
- Can they be explained?
- Do vitals help along to corroborate your suspicions based on other findings?
- What is probable diagnosis?

Case 3

- Hx: A 4 month old is admitted to the hospital for presumed bronchiolitis versus asthma, he is just starting albuterol treatments. He is connected to monitors, IV established, He is having trouble breathing, but improving with treatment. You walk in to reassess.
- PE: T:- (103F)102.6F, P:- (180)200, RR:- (86)68, BP:-(94/49) 90/46, O₂:- (94%)90% Subcostal, intercostal retractions
- Can you guess the weight?
- Anything wrong with his vitals?
- Can they be explained?
- What is probable diagnosis?

Case 4

- Hx: A 9 month old comes to your office with irritability, not sleeping, nasal congestion, cough, some post coughing vomiting, and greenish diarrhea.
- PE: T:- 98.7, P:- 186
R:- 56, BP:- 90/44,
Ox:- 98%
Nasal drainage, right TM dull, with fluid behind TM, loss of landmarks.
- Can you guess the weight?
- Anything wrong with his vitals?
- Can they be explained?
- What is probable diagnosis?

Any Questions?

Thank you for this opportunity to
present today!

I Thank You Very Much!

References

- Will be Provided!

