



DFA Pro

Neurological Assessment

Brain Injury

- Occurs when blood flow to the brain is interrupted
 - result of AGE in scuba diving
 - stroke
- Prompt intervention can prevent or reduce permanent disability

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Neurological Assessment

F-A-S-T examination is an easy way to determine if signs neurological injury are present

- Occurs on one side of the face; can involve left or right side
- Ask the injured person to raise both arms, wait 10 seconds for any lowering
- Inability to speak clearly or verbalize. Often associated with facial droop
- Call 9-1-1 (emergency services) if any of these symptoms are present

F

Facial droop

A

Arm weakness

S

**Speech difficulty, sudden
severe headache**

T

**Time (note the time, and
call EMS immediately)**

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Neurological Assessment

Remember F-A-S-T First

Regardless of cause, if a neurological injury is suspected

- Call local EMS immediately
- Be prepared to initiate CPR
- If injury is dive related, provide oxygen first aid
- Complete full neurological assessment

Note:

Performing a neurological assessment should never interfere with EMS activation, evacuation or essential first-aid measures such as CPR or stopping severe bleeding.

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Neurological Assessment

SKILL

F-A-S-T

F

Facial droop

A

Arm weakness

S

Speech difficulty, sudden
severe headache

T

Time (note the time, and
call EMS immediately)

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Conducting a Neurological Assessment

Use as a Follow-up to F-A-S-T

- May help to uncover subtle symptoms
- Once a problem is identified, call EMS
- Provide oxygen if injury is dive related
- Be prepared to initiate CPR

Neurological Assessment (Neuro)

History
Date _____ Time _____
Injured Person's Name _____
Conduct F-A-S-T (check areas of abnormal findings)
☐ Facial Symmetry ☐ Arms ☐ Speech/Sudden Headache ☐ Time
(activate EMS if any abnormal findings are present)

Complete S-A-M-P-L-E (note responses in spaces provided)
Signs and Symptoms _____
Allergies _____
Medications _____
Pre-existing conditions _____
Last oral intake (what and time) _____
Events leading up to incident _____

For Divers:
Dives during previous 24 hours:
Last dive: _____ Depth _____ Bottom Time _____
Surface interval: _____
Previous dive: _____ Depth _____ Bottom Time _____
Surface interval: _____
Previous dive: _____ Depth _____ Bottom Time _____
Surface interval: _____
Previous dive: _____ Depth _____ Bottom Time _____
Surface interval: _____
Unusual features of any dive _____
Diver used: ☐ Computer _____
Location of any pain _____
Does movement change _____
Locate dive buddy (p) _____

Notes: (attach)

Vital Signs Time _____ Pulse _____ Resp. _____ 2nd Time _____ Pulse _____ Resp. _____

Mental Function
Consciousness (check one):
☐ Alert
☐ Verbal
☐ Pain
☐ Unresponsive
Ability to follow commands: _____
"Stick out your tongue and close your eyes."
Ex: "no its, ands, or buts" ☐ Yes ☐ No
Name three objects (able to complete): _____
Ex: Father/Son Student/Teacher Pencil/Paper ☐ Yes ☐ No
Calculations: count backward from 100 by 7s (circle misses): _____
63 86 79 72 65 58 51 44 37 30 23 16 9 2 ☐ Yes ☐ No
Memory (able to recall the three items identified earlier): ☐ Yes ☐ No

Orientation (check erroneous answers):
☐ What is your name?
☐ Where are you?
☐ What is the day and time?
☐ Why are you here?

Cranial Nerves
Eyes (circle any direction unable to look): Left Right Up Down
Facial Symmetry "Close your eyes and smile": ☐ Yes ☐ No
Hearing Symmetrical from about 30 cm (1 foot): ☐ Yes ☐ No

Motor Function
Scale (note in blank next to area): Normal (N) Weak (W) Paralyzed (P)
Upper Body Shoulders L _____ R _____ Lower Body/Hip Flexors L _____ R _____
Biceps L _____ R _____ Quadriceps L _____ R _____
Triceps L _____ R _____ Hamstrings L _____ R _____
Finger spread L _____ R _____ Foot - up L _____ R _____
Grip Strength L _____ R _____ Foot - down L _____ R _____

Coordination and Balance
Able to complete:
Finger - Nose - Finger: Eyes open: ☐ Yes ☐ No Eyes closed: ☐ Yes ☐ No
Walk: ☐ Normal ☐ Wobbly ☐ Unable Romberg: ☐ Yes ☐ No

Exam Repeated
Time _____
Time _____

Comments _____
Comments _____

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Conducting a Neurological Assessment

Begin with Taking a History

- Identify what happened
- Uncover pre-existing conditions

- S** - Signs/Symptoms
A - Allergies
M - Medications
P - Pertinent medical history
L - Last oral intake
E - Events leading to the current situation

Neurological Assessment (Neuro)

History

Date _____ Time _____

Injured Person's Name _____

Conduct F-A-S-T (check areas of abnormal findings)

☐ Facial Symmetry ☐ Arms ☐ Speech/Sudden Headache ☐ Time

(activate EMS if any abnormal findings are present)

Complete S-A-M-P-L-E (note responses in spaces provided)

Signs and Symptoms

For Divers:

Dives during previous 24 hours:

Last dive: _____ Depth _____ Bottom Time _____

Surface interval: _____

Previous dive: _____ Depth _____ Bottom Time _____

Surface interval: _____

Previous dive: _____ Depth _____ Bottom Time _____

Surface interval: _____

Previous dive: _____ Depth _____ Bottom Time _____

Surface interval: _____

Previous dive: _____ Depth _____ Bottom Time _____

Unusual features of any dive _____

Diver used: ☐ Computer

Location of any pain _____

Does movement change _____

Locate dive buddy (p) _____

Notes: (attach)

Vital Signs Time _____ Pulse _____ Resp. _____ 2nd Time _____ Pulse _____ Resp. _____

Mental Function

Consciousness (check one):

☐ Alert ☐ Verbal ☐ Pain ☐ Unresponsive

Ability to follow commands: _____

Ability to repeat a simple phrase: _____

Ex: "no ifs, ands, or buts" ☐ Yes ☐ No

Name three objects (able to complete): _____

Ex: Father/Son Student/Teacher Pencil/Paper ☐ Yes ☐ No

Calculations: count backward from 100 by 7s (circle misses): _____

Memory (able to recall the three items identified earlier): _____

Cranial Nerves

Eyes (circle any direction unable to look): Left Right Up Down

Facial Symmetry "Close your eyes and smile": ☐ Yes ☐ No

Hearing Symmetrical from about 30 cm (1 foot): ☐ Yes ☐ No

Motor Function

Scale (note in blank next to area): Normal (N) Weak (W) Paralyzed (P)

Upper Body Shoulders L _____ R _____ Lower Body/Hip Flexors L _____ R _____

Biceps L _____ R _____ Quadriceps L _____ R _____

Triceps L _____ R _____ Hamstrings L _____ R _____

Finger spread L _____ R _____ Foot - up L _____ R _____

Grip Strength L _____ R _____ Foot - down L _____ R _____

Coordination and Balance

Abilities to complete:

Finger - Nose - Finger: Eyes open: ☐ Yes ☐ No

Walk: ☐ Normal ☐ Wobbly ☐ Unable

Eyes closed: ☐ Yes ☐ No

Romberg: ☐ Yes ☐ No

Exam Repeated

Time _____

Comments _____

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Conducting a Neurological Assessment

SKILLS

Taking a History
Taking Vital Signs

Neurological Assessment (Neuro)

History
 Date _____ Time _____
 Injured Person's Name _____
Conduct F-A-S-T (check areas of abnormal findings)
☐ Facial Symmetry ☐ Arms ☐ Speech/Sudden Headache ☐ Time
 (activate EMS if any abnormal findings are present)
Complete S-A-M-P-L-E (note responses in spaces provided)
 Signs and Symptoms _____
 Allergies _____
 Medications _____
 Pre-existing conditions _____
 Last oral intake (what and time) _____
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 Diver used: ☐ Computer _____
 Location of any pain _____
 Does movement change _____
 Locate dive buddy (p) _____
Notes: (attach)

Vital Signs Time _____ Pulse _____ Resp. _____ 2nd Time _____ Pulse _____ Resp. _____

Mental Function
 Consciousness (check one):
☐ Alert ☐ Verbal ☐ Pain ☐ Unresponsive
 Ability to follow commands: "Stick out your tongue and close your eyes."
 Ability to repeat a simple phrase: Ex: "no ifs, ands, or buts" ☐ Yes ☐ No
 Name three objects (able to complete): Ex: Father/Son Student/Teacher Pencil/Paper ☐ Yes ☐ No
 Abstract reasoning (able to explain relationship): Ex: Father/Son Student/Teacher Pencil/Paper ☐ Yes ☐ No
 Calculations: count backward from 100 by 7s (circle misses): 100 93 86 79 72 65 58 51 44 37 30 23 16 9 2 ☐ Yes ☐ No
 Memory (able to recall the three items identified earlier): ☐ Yes ☐ No

Cranial Nerves
 Eyes (circle any direction unable to look): Left Right Up Down ☐ Yes ☐ No
 Facial Symmetry "Close your eyes and smile": ☐ Yes ☐ No
 Hearing Symmetrical from about 30 cm (1 foot): ☐ Yes ☐ No

Motor Function
 Scale (note in blank next to area): Normal (N) Weak (W) Paralyzed (P)
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Coordination and Balance
 Able to complete:
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The Four Functional Areas of a Neurological Assessment

- Mental function
- Cranial nerves
- Motor function
- Coordination and Balance

Note:

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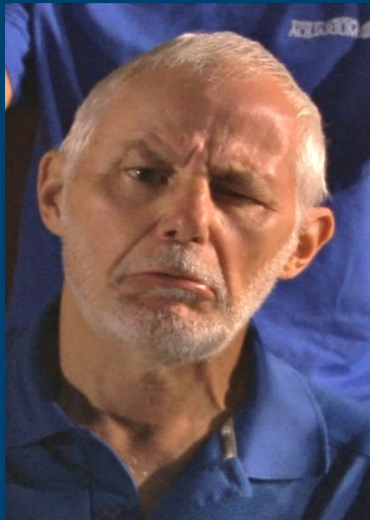


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The Four Functional Areas of a Neurological Assessment

Mental Function

- Assess Level of Consciousness (A V P U)
 - A**lert
 - V**erbal stimulus
 - P**ainful stimulus
 - U**nresponsive
- Orientation to person, place, time, reason for being there
 - Note whether answers were correct
- Language Comprehension - ability to follow commands
- Speech - slurring
- Arithmetic - simple calculations
- Memory - short term



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The Four Functional Areas of a Neurological Assessment

Cranial Nerves

Assess facial movement and hearing

- Eye Control
- Facial Symmetry and Control
- Hearing

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The Four Functional Areas of a Neurological Assessment

Motor Function

- Assess motor strength and function.
- Symptoms may range from weakness to paralysis.
- Proper examination entails comparison with the other side of the body.
- Subtle abnormalities are often detected or confirmed by this process.

Neurological Assessment (Neuro)

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Date _____ Time _____
Injured Person's Name _____
Conduct F-A-S-T (check areas of abnormal findings)
☐ Facial Symmetry ☐ Arms ☐ Speech/Sudden Headache ☐ Time
(activate EMS if any abnormal findings are present)
Complete S-A-M-P-L-E (note responses in spaces provided)
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Calculations: count backward from 100 by 7s (circle misses): ☐ Yes ☐ No
63 86 79 72 65 58 51 44 37 30 23 16 9 2
Memory (able to recall the three items identified earlier): ☐ Yes ☐ No
Facial Symmetry: _____ your eyes and smile: ☐ Yes ☐ No
Head: symmetrical from about 30 cm (1 foot): ☐ Yes ☐ No

Motor Function
Scale (note in blank next to area): Normal (N) Weak (W) Paralyzed (P)
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Coordination and Balance
Able to complete:
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The Four Functional Areas of a Neurological Assessment

Coordination and Balance

- Assess coordination and balance if the injured person's responses are normal to this point
 - Finger-nose-finger
 - Walking
 - Romberg
- DCI or other injuries may cause nerve-cell injury or impairment affecting coordination and balance.



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Conducting a Neurological Assessment

SKILLS

Mental Function
Cranial Nerves
Motor Strength
Coordination and Balance

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Oxygen First Aid in Scuba Diving Injuries

Oxygen and Diving Injuries

Handling Oxygen Safely

Oxygen Delivery Systems
and Components





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Oxygen and Diving Injuries

Oxygen is the primary first aid for scuba diving and submersion injuries

Goal is to **deliver highest concentration of oxygen** possible

Benefits of oxygen administration

- Acceleration of inert gas elimination
- Reduces bubble size and improves circulation
- Enhances oxygen delivery to tissues
- Reduces swelling



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Oxygen and Diving Injuries

Nonfatal Drowning

- When someone nearly died because they were submerged and unable to breathe
- Oxygen first aid indicated as well

Symptoms:

- Difficulty breathing
- Bluish discoloration of lips
- Abdominal distention
- Chest pain
- Confusion
- Frothy sputum
- Irritability
- Unconsciousness

Rescuer Actions:

- Monitor vital signs
- Provide supplemental O₂
- Transport to nearest medical facility



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Oxygen and Diving Injuries

Variables impacting delivered oxygen concentrations:

- Mask fit and flow rate
- Enhanced flow rates are inefficient compensation for poor mask fit

Priority of oxygen delivery in remote areas:

- Deliver highest inspired fraction of oxygen



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Oxygen and Diving Injuries

Hazards of Breathing Oxygen

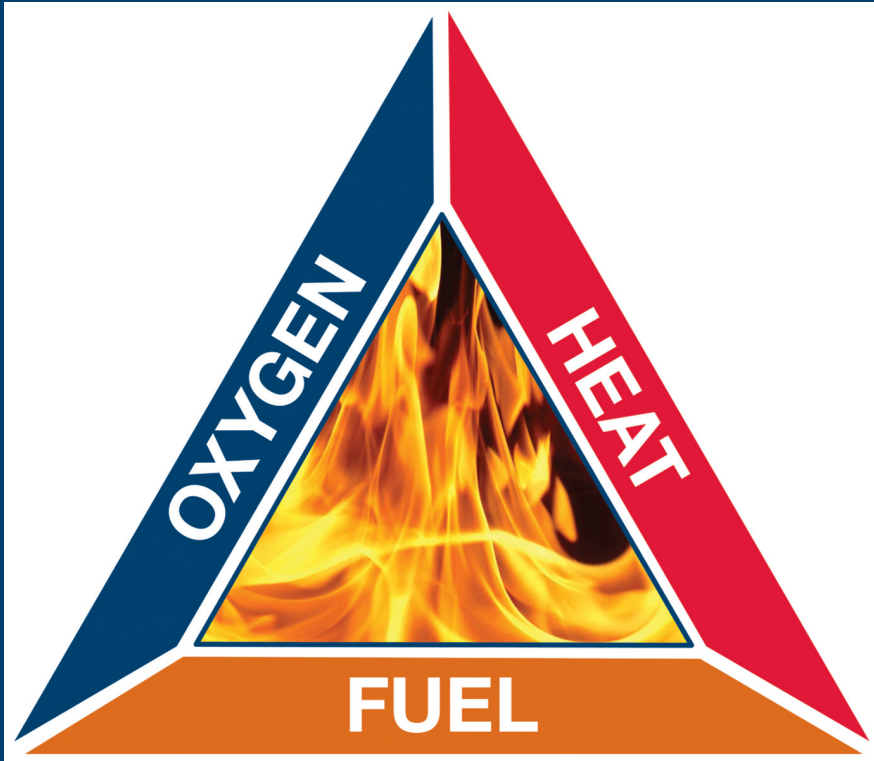
Oxygen toxicity is *not* a concern when rendering first aid

Two forms of oxygen toxicity:

Central Nervous System toxicity occurs when breathing oxygen at pressures usually greater than 1 ATM

- A concern for divers using diving gases with higher concentrations of oxygen (> 21%)

Pulmonary Oxygen Toxicity initial symptoms may occur after 12-16 hours of breathing high concentrations of oxygen for prolonged periods at the surface



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Handling Oxygen Safely

Oxygen is not flammable, but all substances need oxygen to burn and may burn violently in an environment of pure oxygen.

Fire Triangle is made up of three elements:

- Heat
- Fuel
- Oxygen

Reduce risks of handling oxygen by

Avoid fuel deposits

(oil, hydrocarbons, lubricants)

Avoid heat from direct sun and from rapidly opening cylinder valve



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Handling Oxygen Safely

Oxygen Grades

- Aviator-grade oxygen
- Medical-grade oxygen
- Industrial-grade oxygen

Each must be 99.5 % pure oxygen

NOTE: differences exist in how cylinders are filled which affects overall purity of the oxygen.

Industrial-grade oxygen is not recommended for use with dive injuries.



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Handling Oxygen Safely

Safety Precautions When Using Oxygen

Oxygen cylinders require the same care as scuba cylinders with a few additional precautions:

- Do not allow the use of any oil or grease on any cylinder or device that comes in contact with oxygen. The result may be a fire.
- Oxygen cylinders should not be exposed to temperatures higher than 125°F (52°C) in storage (for example, in a car trunk).
- Do not allow smoking or an open flame around oxygen and oxygen equipment.

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Handling Oxygen Safely



Standard SCUBA 'O' ring

Oxygen Washer

- Open valves slowly to pressurize system.
 - Only open one full turn once pressurized for quick shut off if necessary
- Remember to provide adequate ventilation when using oxygen.
 - Confined poorly ventilated spaces (the cabin of a boat, for example) may allow build up of oxygen concentration and create a fire hazard.
- Use only equipment (cylinders, regulators, valves and gauges) made to be used with oxygen.
 - Avoid adapting scuba equipment for use with oxygen.



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Handling Oxygen Safely

- Visually inspect the condition of valve seats and oxygen washers, and make sure the materials are compatible for oxygen use.
- Keep the valves closed with the system purged when the unit is not in use.
 - Close valves on empty cylinders.
 - Empty cylinders should be refilled immediately after use.
- An oxygen cylinder should always be secured so that it cannot fall.
 - When transporting an oxygen cylinder in a car, secure and block the cylinder so it cannot roll.
 - When carrying an oxygen cylinder by hand, carry it with both hands and avoid holding it by the valve or regulator.



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Handling Oxygen Safely

Obtaining Oxygen cylinder fills

- Prescription
 - Most common method
 - Prospective prescription allows for administration by trained provider
- Commercial Gas
 - Documentation of current training in use of emergency oxygen
 - DFA Pro provider
 - Retraining required every two years

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Handling Oxygen Safely

Storage and Maintenance

- Keep unit in storage case
- Fully assembled and off
- Protects from corrosive properties of sea water
- Check before every dive outing
 - Keep cylinder full and ready to use
- Clean thoroughly after each use



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Oxygen Delivery Systems & Components

Oxygen Delivery Systems

Include the following components

- Oxygen cylinder
- Pressure reducing regulator
- Hose
- Face mask





Cylinders showing green and white Shoulders.
The grey shoulder is an unpainted cylinder.

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Oxygen Delivery Systems & Components

Cylinder Maintenance

- Cylinders are subject to periodic testing
 - Visual inspection annually
 - Hydrostatic testing 2-5 years
 - U.S . is 5 years

Color coding of cylinders

- Green – United States, Caribbean
- White – Canada and Europe, parts of Asia Pacific.

**Check with your DFA Pro Instructor for
requirements in your region.**





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Oxygen Delivery Systems & Components

Oxygen Cylinders

- Should provide enough continuous delivery of oxygen from time of injury from farthest possible dive site to next level of emergency response
- Factors affecting delivery time
 - size of cylinder
 - oxygen flow rate
 - delivery device



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Oxygen Delivery Systems & Components

Oxygen Cylinders

- To determine oxygen delivery time
- *Capacity in liters / flow in liters per minute = approximate delivery time*
- Change cylinder when pressure drops to 200 psi (14 bar)
 - If another cylinder is not available, use until oxygen is depleted

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Oxygen Delivery Systems & Components

Oxygen Pressure Regulator

- Reduces cylinder pressure to intermediate pressure
- Three options
 - Constant Flow
 - Demand
 - Multi-function
 - Can provide oxygen to two injured divers





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Oxygen Delivery Systems & Components

Oxygen Regulator Attachment Options

- Pins engage some regulators
 - Pin alignment is specific for each gas
 - Prevents oxygen regulator from being placed on a cylinder containing a different gas
- Threaded gas-outlet valves specific for
 - oxygen also used in some areas
 - (Ex.: charter boats with larger cylinders)
- Adapters may be available for travel
 - to other areas
 - Must be oxygen clean

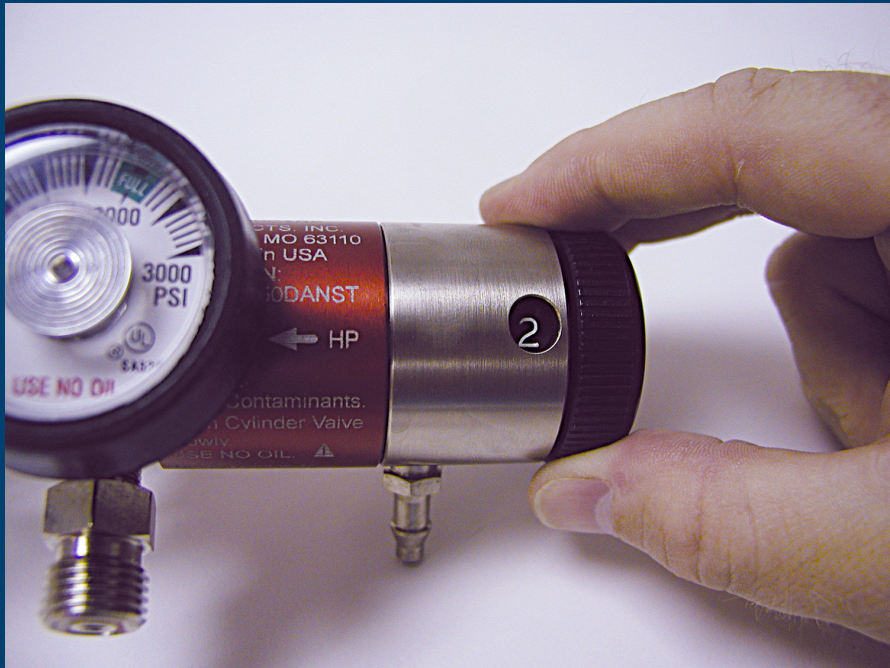


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Oxygen Delivery Systems & Components

Oxygen Regulator Features

- Pressure gauge
 - Provides ability to monitor oxygen consumption
- Flow meter for constant flow feature
 - Provides adjustable flow rate (0.5 – 25 lpm)



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Oxygen Delivery Systems & Components

Hoses and Tubing

- Intermediate pressure hose (for demand valve or MTV)
- Clear plastic tubing (constant flow)





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Oxygen Delivery Systems & Components

Demand Inhalator Valve with Oronasal Mask

- With demand valve provides up to 95% Oxygen concentration
- Similar to scuba second stage
- Delivers oxygen upon inhaling
- Best option for breathing, responsive diver
- Oxygen delivery can reach 95% with good mask seal
- Clean after each use



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Oxygen Delivery Systems & Components

Nonrebreather Mask

- Nonrebreather masks (uses constant flow function on regulator)
 - Variable oxygen delivery (up to 80% if mask seal is good)
 - Initial flow rate is 10-15 lpm
 - Contains 3 non-return valves and reservoir bag
- Use for unresponsive, breathing diver or when treating more than one injured diver
- Requires large supply of oxygen
- Second choice of delivery as concentration of oxygen delivered is lower
- Single use/disposable

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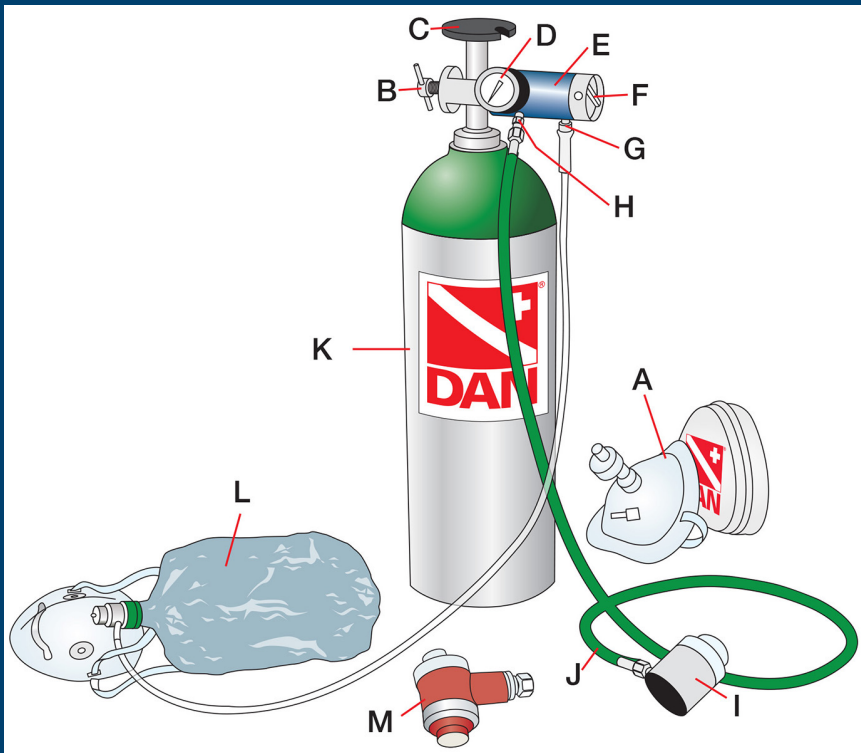
Oxygen Skills

SKILLS

Disassembly and Assembly of Oxygen Equipment

Demand Inhalator Valve

Nonrebreather Mask





DFA Pro

Cardiopulmonary Resuscitation (CPR)

Cardiopulmonary Resuscitation (CPR)

Starting CPR: Supporting Circulation

Continuing CPR: Supporting Respiration

Use of AEDs During CPR

Foreign Body Airway Obstruction



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Cardiopulmonary Resuscitation (CPR)

CPR Goal – provide & maintain critical blood flow to vital organs

- also ensure EMS has been activated

4-6 minutes without oxygen, organs (especially the brain) may start dying

Chest compressions take over heart function

Rescue breaths take over lung function

C

Circulation

A

Airway

B

Breathing

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Cardiopulmonary Resuscitation (CPR)

Key Steps in

Cardio-Pulmonary Resuscitation

Check for responsiveness

- activate EMS

Quickly check for pulse and normal breathing

Provide chest compressions if not breathing normally

Provide rescue breaths



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Cardiopulmonary Resuscitation (CPR)

Precipitating Conditions and Special Circumstances

- Heart Attack
- Pregnancy
- Opioid Overdose
- Drowning
- Children



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Cardiopulmonary Resuscitation (CPR)

Heart Attack

Term used to describe symptoms associated with blockage of arteries supplying the heart

Rescuer's role with unresponsive individuals is to initiate CPR (use AED if available) and activate EMS

Rescuer's role with a responsive individual is supportive

- Assist to position of comfort
- Activate EMS
- Aid with medications if prescribed
 - nitroglycerine: every five minutes up to 3 doses

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Cardiopulmonary Resuscitation (CPR)

Heart Attack Signs and Symptoms

- Heavy pressure or squeezing pain center of chest
- Shoulder, arm, neck or jaw pain
- Shortness of breath
- Sweating
- Nausea and vomiting
- Indigestion, heartburn
- Sense of impending doom



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Cardiopulmonary Resuscitation (CPR)

Special Circumstances with Resuscitation

Pregnancy

Effective compressions may require manual displacement of the uterus to her left

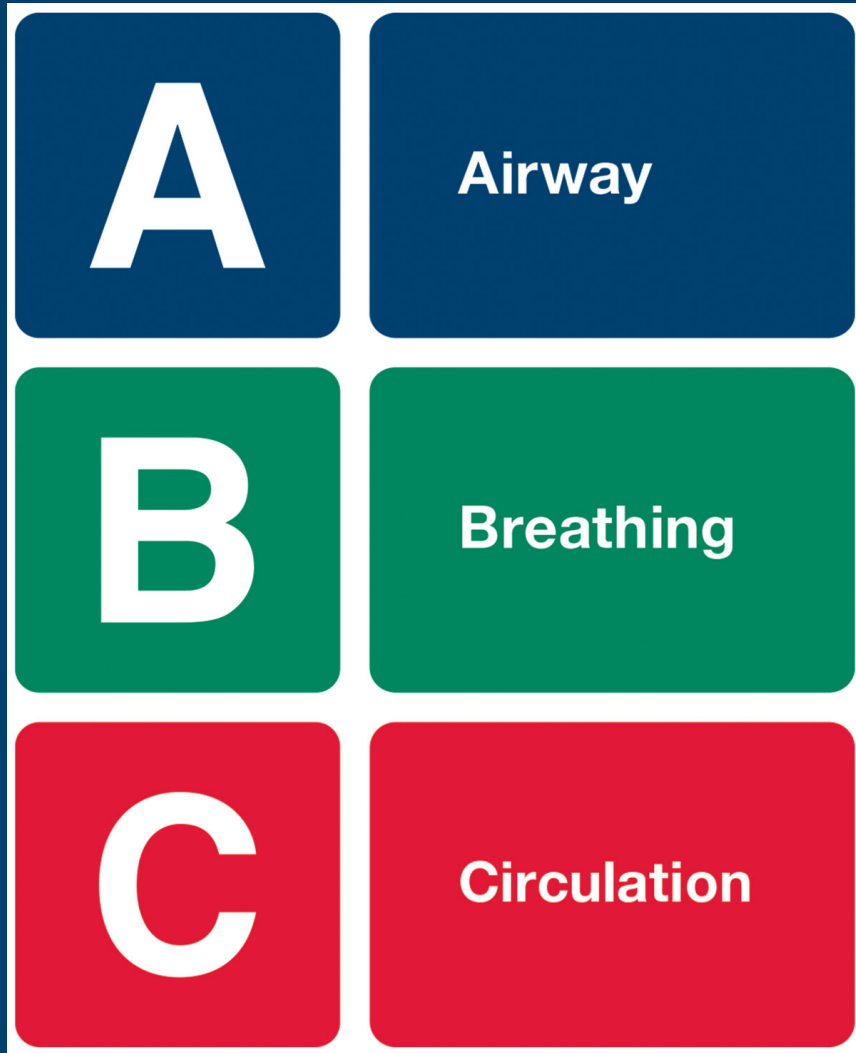
Reduces pressure on returning blood flow

Opioid Overdose

Became the leading cause of death between 25-60 year-olds in 2012

Can lead to respiratory arrest and cardiac arrest

Treat with Naloxone – interferes with action of opioids



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Cardiopulmonary Resuscitation (CPR)

Drowning

Conduct CPR **beginning with rescue breaths** for 2 minutes before activating EMS

Use the **A-B-C protocol** acronym to guide CPR efforts when responding to a drowning or immersion incident

- Requires multifaceted medical interventions
- Transport to nearest medical facility

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Cardiopulmonary Resuscitation (CPR)

Children

Conduct CPR **beginning with compressions** for 2 minutes before activating EMS – if alone and unable to call EMS on a cellphone using your speaker

- Cardiac arrest usually due to respiratory arrest
- Prompt intervention may prevent cardiac arrest



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Cardiopulmonary Resuscitation (CPR)

Chain of Survival

Six Links

1. Activation of EMS
2. High-Quality CPR
3. Defibrillation
4. Advanced Resuscitation
5. Post-Cardiac Care
6. Recover

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Cardiopulmonary Resuscitation (CPR)

Early Access

Recognition of a problem should be followed by rapid action

Call for help *immediately* after determining an adult is unresponsive

- For children, infants and drowning victims provide two minutes of CPR first - if alone

The sooner EMS is called, the sooner advanced medical care is available

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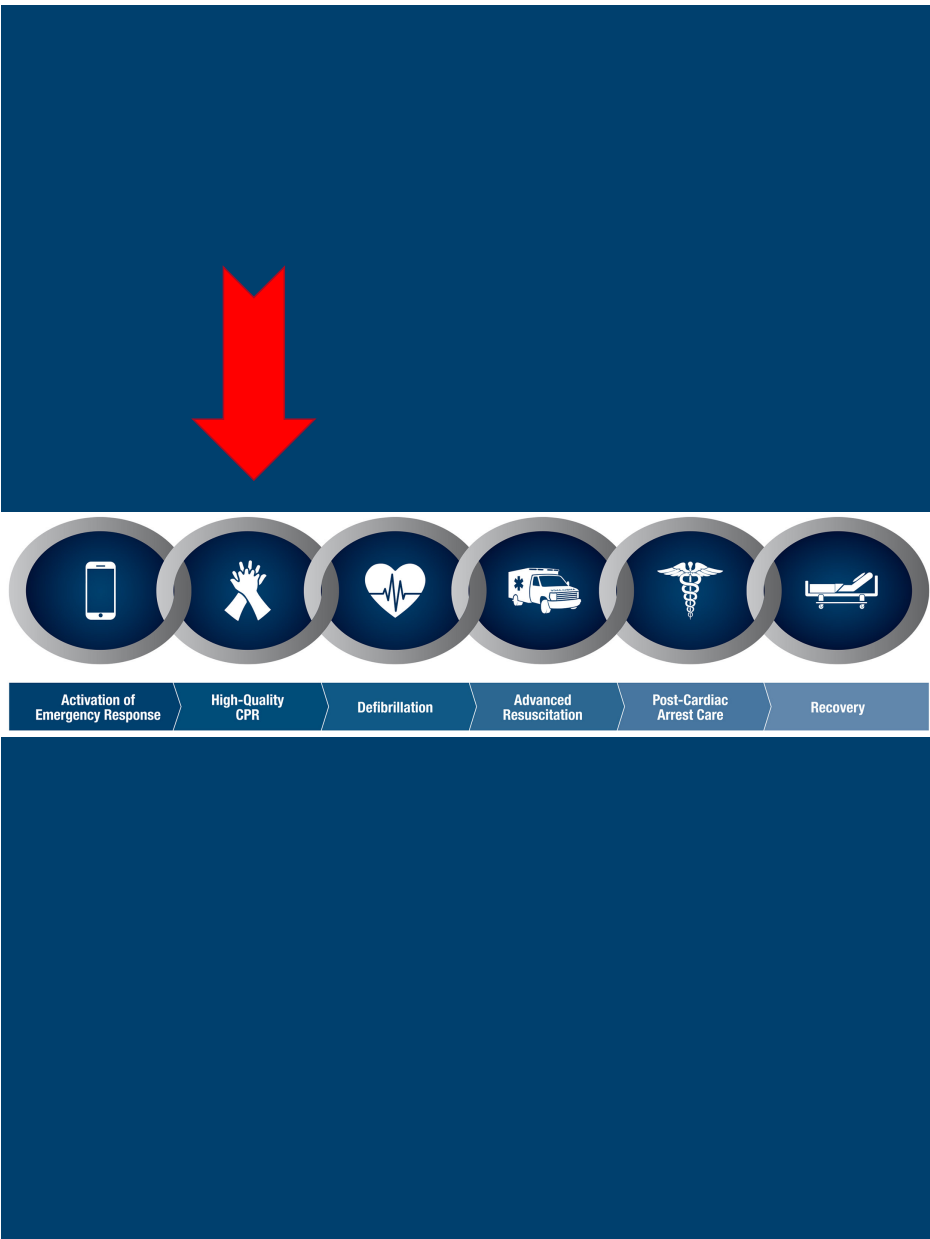
Cardiopulmonary Resuscitation (CPR)

Early CPR

Early and aggressive CPR

supports life until advanced care is available

CPR keeps oxygenated blood circulating to the brain and heart



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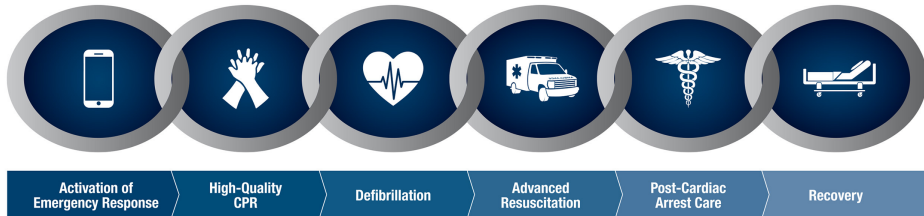
Cardiopulmonary Resuscitation (CPR)

Rapid Defibrillation

Sudden Cardiac Arrest (SCA) is a leading killer of adults

SCA often results from abnormal heart rhythm called **Ventricular Fibrillation**, where the heart muscle quivers ineffectively

Defibrillation is the *single* most important intervention in cardiac arrest



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Cardiopulmonary Resuscitation (CPR)

Advanced Life Support

Includes:

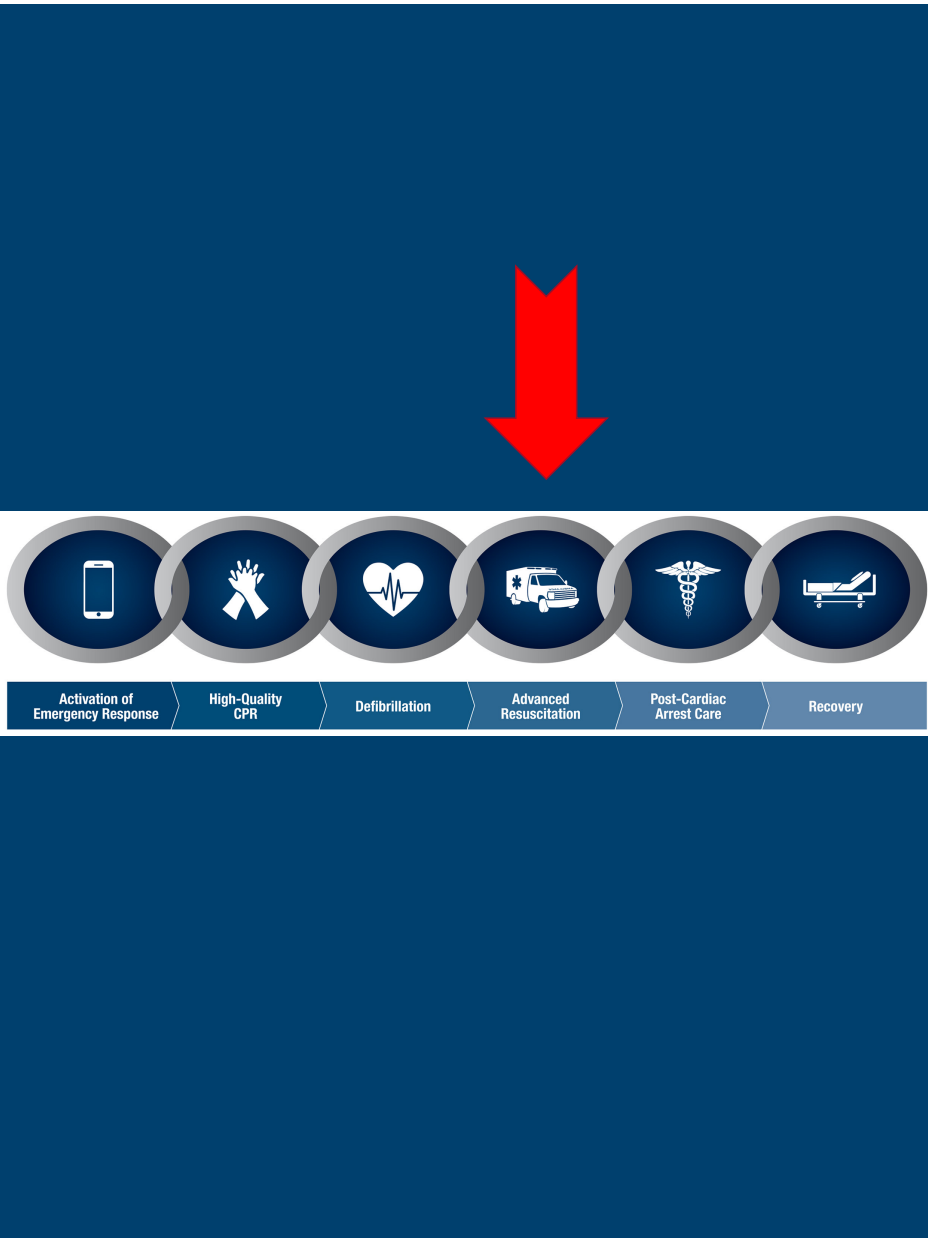
Advanced Airways

IV Medications

Advanced Heart Monitoring

Stabilizes patient for transport to hospital

Good ALS care revolves around good BLS care!



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Cardiopulmonary Resuscitation (CPR)

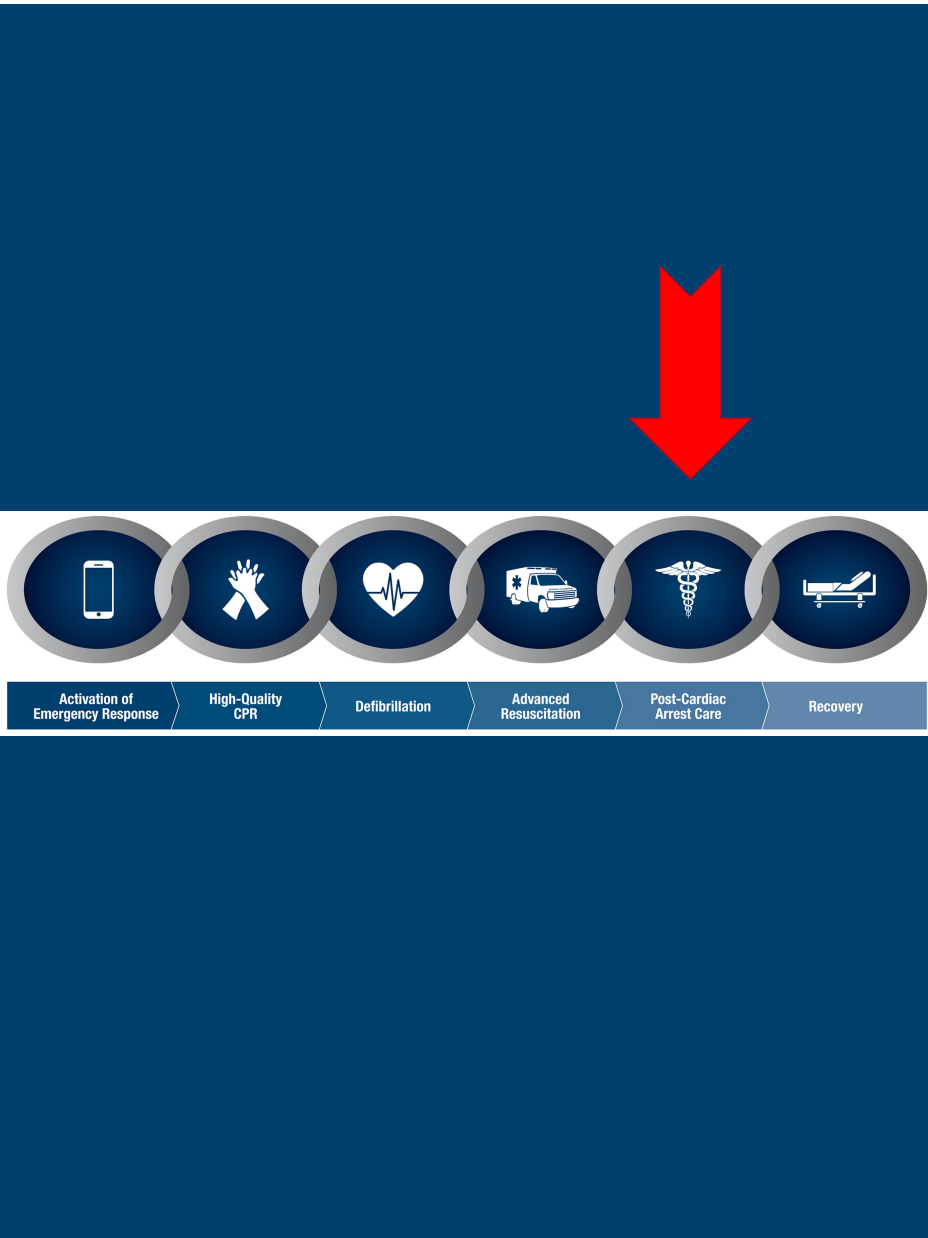
Post Cardiac-Arrest Care

Involves:

Maintaining airway

Heart Monitoring

Hospital interventions to treat the underlying cause of the cardiac arrest



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Cardiopulmonary Resuscitation (CPR)

Recovery

- Recovering from a cardiac arrest is a long-term process.
- Includes mental and emotional well-being as well as support for the physical healing processes.
- This support begins while the survivor is still hospitalized but needs to continue after discharge to assure a return to normal social functioning.