

The Public Safety Diver Medical Evaluation Suggested Guidelines

Purpose and Intent

The Public Safety Diver Medical Guidelines are intended as a tool to assist in the evaluation of the medical competency of currently certified Public Safety Divers and candidates enrolled in Public Safety Diver certification courses in the United States. Though specifically targeted at the professional dive team, it is strongly urged that volunteer or part time teams consider the use of these guidelines. This document is intended to provide guidance to medical professionals who are tasked with conducting diving medical examinations on Public Safety Divers in their jurisdiction. It is hoped that these guidelines will assist those who are responsible for assessing entry level, periodic, and post incident fitness to dive issues. The primary goal of the guidelines is the health and well being of the public safety divers and those whose lives are placed in their trust and confidence.

All Public Safety Divers must pass a diving physical examination and be declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report. The medical evaluations recommended by this document should optimally be performed by a physician who has attended an approved course for “Medical Examiners of Divers”. When such an examiner is not available, the examination should be performed by, or under the direction of, a licensed physician of the diver’s or employing agency’s choice. This physician should have an adequate understanding of diving medicine.

Frequency of Medical Evaluations

Medical evaluations must be completed:

- Prior to the first in water session of the diver’s initial Public Safety Diver certification course;
- Upon application as a new member of a professional Public Safety Dive Team;
- Thereafter at 2-year intervals until age 55;
- After age 55 exams will be required yearly;
- After age 60, a cardiac stress test or equivalent supervised provocative test should be administered yearly, with the intent of uncovering potential arrhythmias or silent ischemia;
- After any major injury or illness, or any condition requiring hospitalization for more than 24 hours, clearance to return to diving from the diver’s primary care physician will be required. If the injury is dive-related, the medical evaluation should, ideally, be performed by a diving medicine physician. If such a physician is not available consultation by the primary care physician should be considered with a physician who has attended an approved course for Medical Examiner of Divers. “Dive-related” implies signs and symptoms related to barotrauma and/or decompression.

Content of Medical Examinations

Medical examinations conducted initially and at the intervals specified above should consist of the following:

- Diver's completion of the release of medical information (including copies of all previous passed or failed certifications).
- Medical history.
- Diving physical examination.
- Physician's written report: after medical examination the diver should obtain a written report prepared by the examining physician, which contains the examining physician's opinion of the individual's fitness to dive, including specific recommendations or limitations.

Initial certifying physical examination contents should emphasize the otorhinologic, respiratory, cardio-vascular, and neurologic systems and should consist of:

- Medical History
- Physical examination
- Audiogram (pure-tone air and bone)
- 12 Lead ECG
- Pulmonary function with flow loop
- Complete blood count (CBC)
- Urinalysis
- Additional testing including heavy metals, drug screen and other testing as indicated.
- A treadmill stress test should be performed for any candidate or diver found to be at intermediate risk (10-20% 10 year cardiovascular event rate) or high risk (above 20% 10 year event rate) according to the Framingham Risk Score.
- Further tests such as an echocardiogram as deemed necessary based on preliminary examination findings.

Re-examinations should consist of:

- Medical History
- Physical examination
- Pulmonary function with flow loop as deemed necessary
- Complete blood count (CBC)
- Urinalysis
- For examinees 40 years or over, assessment of coronary artery disease risk factors including lipid profile and diabetic screening.
- Further tests such as treadmill stress test (as above) or echocardiogram as deemed necessary based on preliminary examination findings.
- Additional heavy metals testing on an as-needed basis as a result of a suspected exposure.

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Physical fitness and stamina should be evaluated in the field yearly, by the sponsoring agency, utilizing one of the available systems such as the Watermanship Test developed by the International Association of Dive Rescue Specialists (IADRS) or an equivalent test that approaches a 12 METs threshold. This recognizes that typical diving scenarios require continuous activity at 4 – 6 METS and that capacity for continuous activity is typically 50% of the peak capacity.

Caution: In the case of a candidate diver who is unable to complete any portion of the “Watermanship Test” due to exercise intolerance, that diver should NOT re-test until evaluated and cleared by a physician. (see “inadequate exercise tolerance” under contraindications below).

The following table indicates the likelihood that the conditions listed would constitute a contraindication to diving. Several contextualizing comments are necessary. First, it is emphasized that this table refers to selection of Public Safety Divers who will dive in a fully or semi-professional capacity. The determinations are therefore relatively conservative. Second, it is recognized that many of these diagnoses are subject to interpretation and significant variations in severity. It follows that the respective determinations should not be interpreted as immutable in all situations. There is scope for consultant-level diving physicians to depart from the generic recommendations prescribed here in cases where this can be appropriately justified.

CONTRAINDICATION	TYPE	COMMENT
CARDIOVASCULAR		
Untreated coronary artery disease	Definite	Unresolved acute coronary ischemia
Inadequate exercise tolerance	Definite	
Implanted pacemakers & defibrillators	Definite	
Aortic stenosis	Definite	Exercise syncope, sudden death.
Mitral stenosis	Definite	Exercise induced pulmonary edema
Atrial septal defect	Definite	Paradoxical arterial gas embolism
Idiopathic hypertrophic subaortic stenosis	Definite	Exercise syncope, sudden death
Multifocal PVCs	Definite	
Long QT syndrome	Definite	
Profound diving bradycardia	Definite	(see Bove 4 th ed, pp. 499)
Arrhythmias causing incapacitation, significant impairment of functional capacity, or loss of consciousness	Definite	
Valvular surgery	Possible	Increased bleeding risks if anticoagulated. Requires review by cardiologist with diving knowledge.
Patent foramen ovale	Possible	
Cardiovascular drugs	Possible	See list of medications
Hypertension	Possible	Resting BP should not be above 140/90 on initial exam (see Bove 4 th ed, pp. 538); daily BP checks should be recorded until actual resting BP established. Controlled hypertension is not necessarily a contraindication.
Coronary bypass surgery & angioplasty	Temporary	Requires normal stress EKG to 12 METs

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ENDOCRINE/METABOLIC		
Diabetes mellitus	Definite	There are numerous physiological and psychological stresses associated with PSD activities. The divers are required to rapidly respond, can be subject to fatigue from extended deployments and can be exposed to both hyper- and hypo- thermic stresses. The diver's safety, team safety, and mission could be compromised.
Endocrine disorders	Possible	Should be assessed by Endocrinologist and Diving Medicine Specialist
Obesity (BMI > 30)	Possible	Viewed as a risk factor for hypertension, heart disease, reduced physical performance in the water, and decompression sickness (see Neuman & Thom, pp. 88).
ENT		
Middle ear surgery	Definite	Stapedectomy, placement of middle ear prosthesis
Incomplete root canal	Definite	
Meniere's Disease	Definite	Symptoms mimic inner ear decompression sickness; if medically uncontrolled, diving contraindicated.
Laryngcocele	Definite	
Tracheostomy	Definite	
Round window rupture	Definite	
Monomeric tympanic membrane	Possible	
Hx of middle ear surgery	Possible	
Hx of vertigo	Possible	
Unilateral deafness	Possible	
Bifid uvula with palatal submucosal cleft	Possible	
Recurrent sinusitis	Possible	Disqualifying until resolved.
Past hx of barotraumatic or "idiopathic" facial nerve paralysis	Possible	
URI, sinusitis	Temporary	
Allergic rhinitis	Temporary	
Exostoses	Temporary	Diving approved if they don't cause otitis externa; may need surgery if they do.
Eczema, especially of ears	Temporary	
Otitis Externa, recurrent	Temporary	
Vestibular DCI	Temporary	Complete recovery must be documented.
GASTROINTESTINAL		
Chronic inflammatory intestinal disease	Definite	
GERD	Possible	Risk of in-water bronchospasm.

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GASTROINTESTINAL (cont.)		
Symptomatic hiatal hernia	Temporary	Symptom-free and without need for treatment during the past year (Bove 4 th ed, pp. 540).
Active peptic ulcer	Temporary	Symptom-free and without need for treatment during the past year (Bove 4 th ed, pp. 540).
Abdominal wall herniation	Temporary	Until repaired, risk of incarceration.
Acute or chronic hepatic disease	Temporary	Viral hepatitis: when active phase resolved and no longer antigen-positive, return to diving permissible.
GENITOURINARY		
Active GU Infections	Temporary	Until resolved.
GYNECOLOGIC		
Pregnancy	Definite	
Endometriosis with intractable pain	Definite	
MUSCULOSKELETAL		
Osteonecrosis	Definite	Juxta-articular dysbaric osteonecrosis.
Amputation	Possible	Functional assessment targeted at the likely functional requirements of public safety diving is recommended.
Scoliosis	Possible	Disqualifying if respiratory function significantly compromised.
Back pain	Possible	May need to do heavy lifting during rescue or recovery.
Cervical rib	Possible	If symptomatic
NEUROLOGIC		
Episodic loss of consciousness, presyncopal disorder	Definite	
Hx seizure	Definite	Other than febrile seizures occurring up to age 5
Hx intracranial aneurysm, AVM	Definite	
Hx neuro DCI with residual deficit	Definite	
Neurodegenerative disease	Definite	
Migraine	Definite	Migraine with transient neurologic dysfunction. If transient neurologic dysfunction present, a confounder in DCS symptom evaluation.

NEUROLOGIC (cont.)		
Hx of CVA, TIA	Possible	Consider the underlying risk factors for the event and the functional impact of any residual symptoms. Diving can be permitted if fundamental underlying pathology has been definitively addressed and off relevant medications (e.g. Plavix).
Hx of intracranial hemorrhage	Possible	Consider the underlying risk factors for the event, the functional impact of any residual symptoms, and the risk of post-event epilepsy.
Fixed neuro deficit	Possible	
Head injury with sequelae	Possible	Risk of post-traumatic epilepsy should be considered, based on severity of head injury. Sequelae other than seizure; require full neurologic and psychometric assessment.
CNS infection or neoplasm	Possible	Consider the risk of post-treatment epilepsy.
HNP (disc herniation)	Possible	
Peripheral neuropathy	Possible	
Hx spinal cord injury	Possible	
OPHTHALMOLOGIC		
Recent ocular surgery	Definite	Ocular surgery within 6 months
PSYCHIATRIC /BEHAVIORAL		
Agoraphobia	Definite	
Claustrophobia	Definite	
Suicidal ideation	Definite	
Psychosis	Definite	
Panic disorder	Definite	
Substance abuse	Definite	Alcohol and/or drugs irresolvable
Anxiety states	Possible	
Depression	Possible	
Psychiatric medications	Possible	Depends on medication type
PULMONARY		
Active asthma	Definite	Active or easily reactivated asthma; Some controversy exists (see Bove 4 th ed, pp. 537; and Neuman & Thom pp. 79).

PULMONARY (cont.)		
Chronic bronchitis, emphysema, bronchiectasis, lung fistula, blebs, bullae, cysts, neoplasms	Definite	
Hx of spontaneous pneumothorax	Definite	
Active TB	Definite	
Non-spontaneous pneumothorax provoked by trauma or surgery	Possible	Must rule out evidence of residual risk for pulmonary barotrauma such as lung scarring. Consider high resolution CT scan.
Any acute respiratory infection	Temporary	Return to diving after complete recovery with no sequelae.
SKIN/INTEGUMENT		
Acute or chronic skin conditions that are activity limiting or known to significantly worsen by exposure to diving environments (eczema, psoriasis, pityriasis rosea, lichen planus, urticarial, mastocytosis, scleroderma, and ichthyosis.	Possible	
Acute or chronic skin infections (fungal, bacterial, parasitic, viral)	Temporary	Must be cleared prior to diving allowed

Commonly Used Medications and Interactions with Diving (Bove, 2003: 713)

The physician should note that whilst these interactions are potentially important, it is frequently the condition that the medication is used to treat that is of most significance in diving.

Indication	Category	Example	Diving Relation
Allergy	Antihistamine	Diphenhydramine	May cause sedation
		Loratadine	None
Anticoagulation	Anticoagulation	Warfarin	Contraindicated
Anxiety	Tranquilizer	Alprazolam	May aggravate narcosis
		Diazepam	“
		Fluoxetine	“
Congestion	Decongestant	Pseudoephedrine	None
Fluid retention	Diuretics	HCTZ	Aggravates dehydration
		Furosemide	“
		Triamterene	“
Gastric upset	Antacid	Magnesium/aluminum Hydroxide	None
	H2 blocker	Cimetidine	None
Heart problems	Antiarrhythmics	Procainamide	None
		Mexiletine	None
		Amiodarone	Skin sensitivity-UV
		Digoxin	None
		Verapamil	Gastric reflux
Hyperlipidemia	Statins	Atorvastatin	Muscle pain may be mistaken for DCS
		Simvastatin	“
Hypertension	Calcium blocker	Diltiazem	Gastric reflux
	Beta blocker	Atenolol	Cold intolerance. Possible association with immersion pulmonary edema.
	ACE inhibitor	Enalapril	None
	Angiotensin receptor blocker	Losartan	None
Infection	Antibiotics	Tetracycline	Skin sensitization-UV
		Ciprofloxacin	“
Motion sickness	Antimotion sickness	Scopolamine patch	Blurred vision
		Dimenhydrinate	Drowsiness
Skin rashes	Steroids	Hydrocortisone	May aggravate oxygen toxicity

PUBLIC SAFETY DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

Name: _____ Date: ____/____/____
 Sex: ____ Age: ____ Weight: ____ Height: ____

Sponsoring Agency: _____
 Agency Address: _____

TO THE APPLICANT:

Public Safety Diving can make considerable demands on you, both physically and mentally. Therefore, it is important to assess certain medical and physical requirements before beginning a diving or training program. Accurate answers to the questions are as important in determining your fitness as your physical examination. This form will be kept confidential.

Have you <u>ever had or presently have</u> any of the following	YES	NO	COMMENTS
Trouble with your ears, including eardrum rupture, difficulty clearing your ears, or ear surgery.			
Dizziness or vertigo.			
Syncope (loss of consciousness).			
Eye surgery.			
Depression, anxiety, panic attacks, fear of enclosed spaces.			
Substance abuse, including alcohol. Driving under influence.			
Head injury.			
Epilepsy or other seizures, convulsions, or fits.			
Stroke or a permanent neurological deficit.			
Recurring neurological disorders, including transient ischemic attacks.			
Abnormality in sensation, strength or movement.			
Aneurysms or bleeding in the brain.			
Decompression sickness or embolism.			
Disorders of the blood, or easy bleeding.			
Diabetes mellitus (abnormal blood sugar levels / control).			
Elevated cholesterol.			
Heart disease such as chest pain (angina).			
Heart rhythm problems.			
Disorders of heart valves, walls (e.g. patent foramen ovale) or other structures.			
Cardiac pacemaker or defibrillator.			

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Elevated blood pressure			
Collapsed lung			
Asthma			
Other lung disease			
Pregnancy			
Abnormalities of bone (e.g. osteonecrosis)			
Herniated disc			
Attention span deficit			

Please explain any "yes" answers to the above questions.

Previous hospitalizations? If yes explain below:

Previous surgery? If yes explain below:

Do you take any medications? If yes list below:

Do you have any allergies to medications, foods, or environmental agents? If yes explain below.

Do you have difficulty exercising or performing physical tasks?

I certify that the above answers and information represent an accurate and complete description of my medical history.

Signature: _____ Date: _____

PHYSICAL EXAMINATION FOR PUBLIC SAFETY DIVING

PATIENT NAME: _____ ID: _____

VITAL SIGNS

Height _____ Weight _____ B/P (seated) _____ / _____
Pulse _____ BMI _____

Vision: Without lenses R 20/ _____ L 20/ _____ Corrected R20/ _____ L 20 / _____;

Contact Lenses: Yes No

EXAMINATION

Check each item, giving details for abnormal findings

	<i>Normal</i>	<i>Abnormal</i>	<i>Details</i>
1. General Appearance			
2. Skin			
3. Eyes			
4. Ears			
5. Nose, nasal septum			
6. Mouth teeth gingivae, pharynx			
7. Neck			
8. Chest and lungs			
9. Heart			
10. Abdomen			
11. Hernia (unrepaired)			
12. Back and Spine			
13. Joints and extremities			
14. Operative scars deformities			
15. Mental status			
16. Neurologic			
<i>Cranial nerves</i>			
(I) Olfactory			
(II) Optic			
(III) Oculomotor			
(IV) Trochlear			
(V) Trigeminal			
(VI) Abducens			

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(VII) Facial			
(VIII) Acoustic			
(IX) Glossopharyngeal			
(X) Vagus			
(XI) Spinal Accessory			
(XII) Hypoglossal			
<i>Deep Tendon Reflexes (2+=N)</i>			
Biceps R/L			
Triceps R/L			
Patella R/L			
Achilles R/L			
<i>Cerebellar Function</i>			
Rhomberg Test			
Finger to Nose			
Heel to Shin Slide			
Rapid Alternating Mov't			
<i>Pathological Test</i>	Right	Left	Comments
Babinski			
Hoffman's sign			
Ankle clonus			
<i>Strength & Muscle Tone</i>	Strength	Tone	Comments
Deltoid			
Latissimus			
Biceps			
Triceps			
Forearm			
Hand muscles			
Hip flexion			
Hip extension			
Hip abduction			
Hip adduction			
Knee extension			
Knee flexion			
Ankle dorsiflexion			
Ankle plantar flexion			
Toes			

<i>Sensory Testing</i>	<i>Right</i>	<i>Left</i>	<i>Comments</i>
Pain and light touch			
posterior aspect of the shoulders (C4)			
lateral aspect of the upper arms (C5)			
medial aspect of the lower arms (T1)			
tip of the thumb (C6)			
tip of the middle finger (C7)			
tip of the little finger (C8)			
thorax, nipple level (T5)			
thorax, umbilical level (T10)			
upper part of the upper leg (L2)			
lower-medial part of the upper leg (L3)			
medial lower leg (L4)			
lateral lower leg (L5)			
sole of foot (S1)			
Vibration			
Temperature			
Position Sense			
Stereognosia			
Graphesthesia			
Two-Point Discrimination			

TESTS

	<i>Date Performed</i>	<i>Normal</i>	<i>Abnormal</i>	<i>Details</i>
Vision/Color				
Chest X-ray				
Audiometry				
CBC				
Urinalysis				
Chemprofile				
EKG				
Pulmonary function				
Heavy metal*				
Echocardiogram*				
Treadmill stress*				

*If deemed necessary

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DIVER'S NAME: _____

DATE OF EXAM: _____

PHYSICIAN RECOMMENDATION: (please check one)

- APPROVAL I find no medical condition(s) which I consider incompatible with diving.
- RESTRICTED See the REMARKS section.
- FURTHER TESTING I have encountered a potential contraindication to diving. Further tests will be performed before a final recommendation can be made. See the REMARKS section.
- REJECTED The diver / applicant has medical condition(s) which are not compatible with public service diving activities.

REMARKS:

CLINICIAN:

Name (Print): _____ Signature: _____

Affiliation: _____

Address: _____

Phone: _____ Fax: _____

After completion of examination, please send a copy of this page to the supporting agency

Selected References

- Bove AA. (2003). Fitness to Dive. In AO Brubakk & TS Neuman (Eds) Bennett and Elliott's Physiology and Medicine of Diving. 5th ed. (pp. 700-717). Cornwall: Saunders.
- Edmonds C, Lowry C, Pennefather J & Walker R. (2002). Diving and Subaquatic Medicine. 4th ed. London: Arnold.
- Mitchell SJ & Bennett MH. (2008). Clearance to Dive and Fitness for Work. In TS Neuman & SR Thom (Eds) Physiology and Medicine of Hyperbaric Oxygen Therapy. (pp. 65-94). Philadelphia: Saunders.
- Mitchell SJ & Bove AA. (2011). Medical screening of recreational divers for cardiovascular disease: Consensus discussion at the Divers Alert Network Fatality Workshop. Undersea Hyper Med 38(4):287-294.
- Pollock NW, Ugucioni DM, Dear G deL, eds. (2005) Diabetes and Recreational Diving: Guidelines for the Future. Proceedings of the Undersea and Hyperbaric Medical Society / Divers Alert Network 2005 Workshop, Las Vegas, NV, USA. Durham NC, Divers Alert Network.
- Wilson PW, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. (1998). Prediction of coronary heart disease using risk factor categories. Circulation 97:1837-1847.

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Disclaimer

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