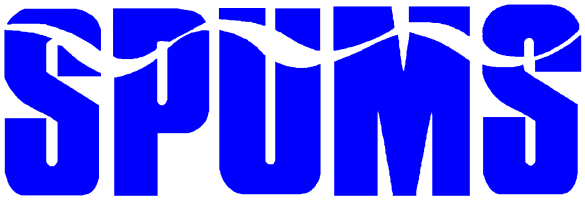
THE SOUTH PACIFIC UNDERWATER MEDICINE SOCIETY



GUIDELINES ON MEDICAL RISK ASSESSMENT FOR RECREATIONAL DIVING

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SPUMS suggests that members have pages 12 – 19 reproduced as the form which they use for their diving medical examinations.
The Statement of Health for Recreational Diving on page 19 should be used as a certificate of fitness to dive.
The pro-forma statement on page 33 should be added to the certificate in Section C, for use when counselling divers with diabetes about their diving.

Notice
Neither the South Pacific Underwater Medicine Society Incorporated nor its officers assume any liability for any injury and/or damage to persons or property arising from this publication.

www.spums.org.au

SECTION A

PRE-DIVING MEDICAL EXAMINATION FOR RECREATIONAL DIVING

A1 INTRODUCTION

The medical criteria discussed in this document are relevant to the examination of individuals undertaking or considering recreational compressed gas diving and are addressed to registered medical practitioners. This document does not apply to occupational divers.

The purpose of the diving medical assessment is to assess the medical risks of diving and communicate these to the candidate, diver or legal guardian. This includes the assessment of both general risks related to compression and breathing compressed gases, and specific risks relating to the health of each individual.

All candidates for diving should have a medical risk assessment before commencing diving and this assessment should be repeated after any significant illness or change in health status. Divers with chronic medical conditions may require assessment at regular intervals as appropriate. All diving candidates and established divers aged 45 years and over should undergo a medical assessment with a focus on cardiovascular evaluation, preferably by a doctor with training in diving medicine. This recommendation is based on commonly used age criteria cardiovascular risk calculators.[1, 2] Appendix A provides recommendations for the evaluation of the cardiovascular system in divers.
The South Pacific Underwater Medicine Society Incorporated (SPUMS) recommends that divers should be re-assessed at intervals of no more than five years after the age of 45, even in the absence of other health issues.

The medical practitioner should be satisfied the candidate understands the relevant medical risks when deciding whether or not to undertake dive training. Where the medical practitioner considers such risks are unacceptably high, he or she will decline to clear the candidate for diving, and this decision should be explained to the candidate in unambiguous risk-related terms.

Safe diving involves a degree of physical fitness and capability in the water (see A2 below). Unless the candidate is clearly unfit, these aspects should be assessed as functional capabilities during the practical phase of dive training.

The medical criteria discussed in this section are in no way exhaustive. The trained personnel doing the medical are expected to use their own discretion.

This document applies only for recreational diving. The criteria for medical examination of persons intending to train for occupational diving are given in AS/NZS 2299.1 (2015). Occupational diving operations - Standard operational practice. Standards Australia, http://www.standards.org.au.

This medical risk assessment should be conducted by a medical practitioner who has successfully completed an approved course of training for medically assessing recreational divers. SPUMS recommends that medical examiners undertake continuing education in the field of diving medicine. In the absence of a relevant regulatory authority, the Academic Board (chaired by the Education Officer) of SPUMS is the authority approving courses. Courses which have been approved are given in Paragraph A5.

NOTE

SPUMS publishes a list of members who have received appropriate qualifications and who do diving medicals. This list is posted on the SPUMS website at www.SPUMS.org.au.

In the event of any difficulty in interpreting this document, if a candidate's problems lie outside the expertise of the examining practitioner, or if the candidate disputes an adverse decision about diving, then he or she should be referred to a specialist diving physician, one who holds the SPUMS Diploma of Diving and Hyperbaric Medicine (DipDHM), the ANZCA Diploma of Advanced Diving and Hyperbaric Medicine (DipAdvDHM)or an acceptable overseas equivalent, who may also refer to a specialist in the medical area under question (e.g., otologist, cardiologist or respiratory physician) for a further opinion.

A formal medical risk assessment should be carried out before the candidate first uses compressed air underwater (including in a swimming pool).

The results of any chest X-ray and specialist tests or opinion should be known before a medical statement is issued.

The record of medical risk assessment should be retained by the medical practitioner. A medical statement outlining the relevant elements of the risk assessment and any advice should be given to the candidate. A suggested medical form for this purpose is given in Section B, page 14.

The training establishment shall hold a record of the date of this statement, and the name and address of the medical practitioner who performed that examination.

A2 NEED FOR FITNESS CRITERIA

Recreational diving may require physical exertion. The management of unexpected emergencies underwater or on the surface will depend upon training, mental stability and physical and medical fitness.

Physical fitness is not synonymous with fitness to dive. Any disorder which causes an increased risk of sudden death, impaired consciousness, impaired judgement, risk of disorientation, impaired mobility, risk of barotrauma or risk of decompression sickness may render a person at high risk whilst scuba diving.

Divers are exposed to pressures and physiological changes that do not apply to persons involved in other activities. As diving is carried out in a non-respirable environment, any loss of consciousness is likely to result in drowning. Some medical conditions are associated with such high risk during diving that they should be regarded as absolute contraindications. Some medical conditions are associated with only a modest (or an unquantified) increase in risk and are relative contraindications that may not preclude diving.

Diving in all forms places increased demands on the cardiovascular system. Immersion itself causes an increase in cardiac preload (increased venous return) and at the same time, peripheral vasoconstriction, causing an increase in blood pressure and afterload. These changes are typically accompanied by sustained mild to moderate exercise and occasional requirements for peak exercise in challenging circumstances. Given all this and the increasing age of the 'average' diver, it is not surprising about one third of recreational diving fatalities have a cardiac event as the disabling injury.[3] Specific guidance is provided in Appendix A for evaluation of the cardiovascular system for divers.

Any risk factors identified must be discussed with the prospective diver and an assessment of the hazards, as well as the effect of any restrictions advised.

A3 LIMITATIONS and ADVISORY NOTES

Some divers may require advice with regard to limitations on depth, decompression requirement, supervision, support, or other relevant parameters. **Any such advice on diving should be given to the candidate and written on the medical certificate.**

The physician should be aware when any proposed restrictions are likely to prevent the candidate from being certified according to the instructor organisation's requirements.

NOTE: As the greatest proportionate changes in the volume of a compressible air space occur in the water column close to the surface, certificates restricting candidates to shallow water only, or interim certificates for "training dives only" are not a valid means of reducing the risk of barotraumatic injury. Severe pulmonary overpressure incidents have occurred in a depth as little as 1 metre of water.

A4 FITNESS CRITERIA

A4.1 General
The systems outlined in Paragraph A4.2 to A4.16 should be evaluated by taking a medical history and performing a medical examination. The example medical form and medical certificate given in Section B may be copied for use by medical practitioners. The information and questions on the form shown in Section B shall form the minimum content of any alternative form used for recording the medical examination.

A4.2 Age
The SPUMS does not recommend diving for children under the age of 14 years. Any medical risk assessment of children under the age of 16 should include parents or guardians. This assessment should establish the child's physical and psychological maturity. Between the ages of 16 and 18 years it is preferable to consult the parents or guardians before conducting any risk assessment. There is no upper age limit provided appropriate medical fitness standards are met. The SPUMS recommends that from the age of 45 years, all candidates should have regular assessments at no longer than five yearly intervals, with emphasis on evaluation of cardiovascular fitness and pulmonary reserves. Emergency situations may demand a high degree of fitness.

A4.3 General fitness
Consideration must be given to the candidate having adequate reserves of physical fitness to cope with unexpected demands due to adverse weather or sea conditions, surfacing away from a boat, having to aid a distressed buddy or other emergencies. Whilst all candidates should undergo appropriate functional assessment during dive training, if the medical risk assessment reveals a probable lack of adequate physical fitness, this should be indicated in the advice given.

A4.4 Obesity
Obesity may imply a lack of physical fitness and also represents a possible hazard to divers by increasing the risk of decompression illness. Reduction in decompression stress by adopting conservative diving strategies is advised for the obese diver. The general medical risks of obesity should be discussed with the diver.

A4.5 Vision
Good vision is essential to safe diving both for reading gauges, timing devices or decompression tables (near vision), and for locating the dive boat, exit point or dive buddy (distant vision). Any marked loss of visual acuity will diminish an individual's ability to dive safely under normal conditions unless corrected appropriately. To achieve correction while diving, contact lenses may be used in a dive mask, or the mask itself may contain a prescription face plate. A risk of corneal ulceration exists if non-permeable contact lenses are used.

Visual acuity should be assessed for every candidate. Visual acuity is here defined as the best obtainable vision with or without glasses or contact lenses and should be tested using a standard visual acuity chart (Snellen chart or equivalent). Assessment should be made of both corrected and uncorrected acuity. Diving is not advised if the person's visual acuity in the better eye or with both eyes together is worse than 6/12 (corrected or uncorrected).* Near vision should be adequate to read gauges and dive tables. Very poor, unaided visual acuity may become important if the diver loses their face mask or contact lenses during diving and this risk should be discussed with the candidate. The assessment of other significant visual and ocular abnormalities may require referral to an optometrist or ophthalmologist.

**This statement is consistent with that required for the issue of a conditional driving license in Australia (Austroads. Assessing Fitness to Drive for Commercial and Private Vehicle Drivers. Medical Standards for licensing and clinical management guidelines. As amended up to August 2017. (5th edition), Sydney, 2016, reprinted 2017.; AP-G56/17. www.austroads.com.au).*

A4.6 Ear, nose and throat
The middle ears and sinuses will develop problems on descent unless the pressure in these spaces equals ambient pressure. There is no way of establishing the patency of sinus ostia by clinical examination. However, patency of the Eustachian tubes, and so the ability to equalise the middle ear pressures, can be established. Observation of the tympanic membranes while the patient holds their nose shut, shuts the mouth and blows gently (similar to a Valsalva manoeuvre) will show entry of air to the middle ear by movement of the drum. Eustachian tube patency can also be assessed with dynamic tympanometry if available. The Eustachian tube opening in the naso-pharynx is normally closed. Swallowing opens the ostium. Therefore, a combination of a modified Valsalva (with the vocal cords open) and swallowing during the manoeuvre will give the best chance for air to travel up the Eustachian tube. Another way of opening the Eustachian tube is to protrude and wriggle the jaw from side to side while performing a modified Valsalva manoeuvre. Failure to auto-inflate a middle ear will make diving impossible due to pain in the ear and will be associated with damage to the middle ear structures. These candidates should be strongly advised against attempting to dive. Referral to an ENT specialist for formal assessment and treatment may be appropriate.

Clinical assessment should be undertaken specifically to establish the following:

(a) Both tympanic membranes should be intact and mobile and both Eustachian tubes should be patent. If not, the candidate should be strongly advised against diving because of a high risk of middle ear barotrauma, and possibly inner ear barotrauma (see above).

(b) Any evidence of chronic outer or middle ear discharge; this may indicate increased risk of barotrauma.

(c) Any evidence of chronic or recurrent sinusitis, catarrh, cleft palate (repaired or otherwise) or severe allergic conditions of the respiratory tract may increase the risk of barotrauma; this may indicate increased risk of barotrauma.

(d) Any history of middle ear surgery (including tympanoplasty); these candidates should be referred for diving specialist opinion and possibly specialist ENT opinion in order to assess the risk associated with compression.

(e) *Audiometry*. Audiometric examinations should be considered when hearing loss is suspected, or as baseline for later comparison in the event of diving injury. The audiogram should be conducted at 500, 1,000, 1,500, 2,000, 3,000, 4,000, 6,000 and 8,000 Hz. If there are any significant abnormalities in either audiometry or labyrinthine function the patient should be referred to a diving specialist. Hearing loss is not necessarily a contraindication to diving.

A4.7 Dental
Dentition and jaw function should be assessed for ease of retention of a diving regulator or snorkel mouthpiece. Carious teeth or teeth with incompletely filled caries are at risk of dental barotrauma. Recent extractions can lead to air entering the tissues and causing subcutaneous emphysema.

A4.8 Central nervous system
(a) A full examination of the central nervous system should be undertaken when neurological abnormality is suspected. Any abnormalities should be accurately documented for future reference.

(b) A candidate with a history of fits (apart from childhood febrile convulsions), or unexplained blackouts should be strongly advised against diving. Any condition associated with fits or blackouts will be a grave risk to life during diving.

(c) Candidates with a history of migraine require further assessment. Particular attention should be paid to the pattern and timing of headaches. Both decompression illness and migraines with neurological 'aura' are associated with patent foramen ovale and consideration should be given to a bubble-contrast transthoracic or transoesophageal echocardiogram to exclude this condition, particularly if headaches have been associated with previous scuba diving or focal neurological signs.

(d) Candidates with a history of head injury involving significant unconsciousness or concussion associated with repeated headaches, or intra-cranial surgery should be individually assessed by a neurologist in order to determine any risk of seizures or impairment of neurological function.

(e) The Modified Sharpened Romberg test is useful in assessing vestibular and cerebellar function, and should be tested as a baseline. This test is performed by having the candidate stand on a hard floor, barefoot, with the feet touching heel to toe in a straight line and with arms crossed on the chest. When steady in this position the eyes are closed. From the time the eyes are closed the ability to maintain balance is timed and recorded in seconds. If the candidate fails to maintain the position for 60 seconds the test is repeated up to four times and the best performance recorded. This is necessary as there is a learning curve which is much assisted by the candidate relaxing. Balance maintained for less than 25–30 sec is considered abnormal.

A4.9 Mental health disorders
Medical conditions that may be associated with poor cognition or decision-making are a risk for diving and any medical assessment of the suitability of a candidate for diving should include an assessment of mental state. Unfortunately, there is little evidence on which to base decision-making in this area. Referral should be made to the regular medical team treating the condition if there is any doubt about the suitability for diving.

It seems reasonable to advise any candidate against diving who is:

- out of touch with reality
- severely depressed and suicidal
- paranoid with delusions and hallucinations
- suffering significant anxiety with panic attacks

There are many other conditions that will require careful assessment on an individual basis, including general anxieties, hyperactivity and attention deficit disorders, narcolepsy and neuroses. In particular, any anxiety states provoked by the underwater environment will need to be thoroughly discussed with the candidate and may involve assessment after an initial exposure to that environment. Panic is commonly associated with diving deaths.

Mood-altering drugs used to treat these conditions also require careful consideration and must be used with caution when diving. On the other hand, stopping these drugs in order to dive may be unwise.

A4.10 Cardiovascular system (CVS)
28% percent of recreational diving fatalities have a cardiac event as the disabling injury. It follows that the primary goals of evaluating the cardiovascular system in a diving candidate are to identify those at risk of myocardial ischemic events, myocardial insufficiency, or other cardiac events (such as arrhythmias) that might be disabling underwater.
All divers or diving candidates aged 45 and over are at higher risk of cardiac disease even when asymptomatic. Therefore, all should be assessed according to the guidelines documented in Appendix A.

Appendix A also provides guidance for assessment of younger candidates or other high-risk groups who have a history indicating increased cardiac risk or in whom physical examination reveals cardiovascular abnormalities.

A4.11 Respiratory system
(a) A comprehensive history and examination should be performed. Any abnormal findings should be fully investigated and specialist opinion sought where appropriate. Particular attention must be paid to any condition that might cause retention and trapping of expanding gas in any part of the lungs during decompression (e.g., asthma).

(b) The following conditions may be associated with excessive risk of pulmonary barotrauma or inability to cope with the physical demands of diving:

(i) Any chronic lung disease, past or present
(ii) Any history of spontaneous pneumothorax, penetrating chest injuries, or open chest surgery
(iii) Any fibrotic lesion of the lung that may cause generalised or localised lack of compliance in lung tissue
(iv) Any history of acute fulminating asthma or admission to ICU for the treatment of asthma
(vi) Any evidence of obstructive airways disease (e.g., current asthma or chronic bronchitis). In cases of doubt, specialist medical opinion should be sought. Such opinion should include provocation testing if the possibility of bronchial hyper-reactivity exists (see Appendix A for a suggested approach to assessment of an asthmatic diver).

(c) A full-plate postero-anterior chest X-ray should be considered for all candidates who have a significant past or present history of respiratory diseases; abnormalities in the respiratory system on clinical examination or an abnormal pulmonary function test (see Appendix B). If there is no history of cardio-respiratory disorders, a normal physical examination and normal lung function tests, then a chest X-ray may not be required.

(d) Pulmonary function testing is indicated on all divers who require medical consultation for respiratory reasons. The tests should include a single-breath flow-volume loop, if necessary by referral to a pulmonary laboratory. The equipment used should be subject to regular testing of function and calibration. An FVC or FEV_1 of more than 20% below predicted values and/or FEV_1/FVC ratio of less than 75% requires further assessment (see Appendix B).

A4.12 Gastro-intestinal tract
a) A history and examination should be performed. Any abnormal findings should be investigated.

(b) Any abdominal herniation may represent a risk of gastrointestinal barotrauma. Consideration should be given to the surgical repair of hernias if there may be a significant risk.

(c)Candidates should be free of significant acute or chronic gastro-intestinal problems that may cause an acute crisis or incapacity (e.g., peptic ulceration, severe reflux). Specialist opinion should be sought if required.

A4.13 Musculoskeletal
Any impairment of musculoskeletal function should be carefully assessed against the potential requirements of emergencies that might occur in the water. The weight of diving equipment out of the water can represent a significant hazard to those with pre-existing back or other joint injury or disease. This should become clear on functional assessment during diving training, but any suspicion concerning significant musculoskeletal capability should be communicated to the diver. It may be useful to require the candidate to lift and carry a typical set of diving gear in order to demonstrate sufficient musculoskeletal strength and function.

A4.14 Pregnancy
The safety of diving while pregnant has not been established. The level and nature of risks to the foetus remain uncertain, but divers who may be pregnant should be strongly advised not to dive.

A4.15 Diabetes mellitus

Diabetes mellitus is potentially associated with several problems for divers, including effects of this disease on end organs (e.g., heart, kidneys) that may limit the physical ability to dive and the potential for hypoglycaemia during immersion. Some individuals with either insulin-requiring or non-insulin requiring diabetes may be able to dive with an acceptable level of risk. People with diabetes who wish to dive should be well informed of the potential risks and those who require insulin should be referred to a programme specifically designed for divers with diabetes. Co-operation between the physician managing diabetes and the diving physician should be sought for best practice management (see Appendix C).

Divers with diabetes should be selected for suitability for these 'diabetic diving' programmes, arrangements made for annual surveillance of health and diabetic control, limits put on recommended diving following any change in medication or intercurrent illness and a procedure established for blood sugar management on diving days (see Appendix C). Non-insulin requiring candidates with diabetes may be at a lower risk of hypoglycaemia, but have significant risks of end-organ damage that may preclude diving. Heath surveillance plans for diving should address all relevant risks. The diving candidate should demonstrate a good understanding of diet, exercise, stress, temperature and blood glucose levels and the need for screening for silent myocardial ischaemia (see Appendix A).

A4.16 Other conditions

(a) Candidates taking medication of any type, including non-prescription drugs, require individual consideration. Many medications have altered effects or risks underwater, they may increase decompression illness risk or the effects of nitrogen narcosis. Drugs that affect the cardiovascular, respiratory or neurological systems may be associated with a significant increase in risk. In particular, cardiac, blood pressure-lowering medication and central nervous system drugs require careful assessment.

(b) Cigarette smoking has deleterious effects on cardiac, pulmonary and upper respiratory systems and should be strongly discouraged in divers.

(c) The effects of alcohol can be detrimental to divers, increasing the risks of inert gas narcosis, dehydration, decompression illness and vomiting. Dehydration following alcohol intake may be a risk factor for decompression illness.

(d) Use of illicit drugs. The impact of illicit drugs and their withdrawal syndromes should be assessed and discussed with the individual. Use of illicit drugs in any form should be strongly discouraged.

A5 QUALIFICATIONS REQUIRED FOR MEDICAL PRACTITIONERS PERFORMING PRE-DIVING MEDICALS ON ENTRY-LEVEL SCUBA DIVERS

NOTE: **Medical practitioners without training in diving medicine should not perform diving medicals. If for some reason the medical has to be done by someone untrained in this field, then any abnormalities detected, on either history or examination, should result in referral for specialist medical advice or examination by a medical practitioner with training in diving medicine.**

Registered medical practitioners shall undergo accredited formal training and have verified capability of performing diving medical examinations before carrying out pre-diving medicals. In Australia, these medicals are covered by an Australian Standard (AS 4005.1).
The Academic Board of SPUMS approves recognises specific courses in the teaching of this skill. The current list appears on the SPUMS web site at <www.spums.org.au>. At the last assessment in May 1999 the board had recognised the following courses:

ANZHMG Introductory Course in Diving and Hyperbaric Medicine*
Christchurch Hospital Basic Course
Diving Medical Centre Medical Examiner Course
Fremantle Hospital Medical Assessment of Divers Course
Institute of Naval Medicine (U.K.) Medical Examiner course
Royal Adelaide Hospital Basic Course
Royal Adelaide Hospital Advanced Course (preceded by the basic)*
Royal Australian Navy Diving Medical Course*
Royal New Zealand Navy Basic Course
School of Public Health and Tropical Medicine, James Cook University, Course in Diving Medicine
Townsville General Hospital Diving Medical Course
United States Navy Diving Medical Officer Course*

*denotes a course of at least 10 working days. It is a recommendation by SPUMS that only doctors who have satisfactorily completed one of the courses marked by an asterisk perform occupational diving medicals, AS/NZS 2299.

It is likely that other courses of equal standing will be approved in the future. As a general rule for approval, at least 12 hours of any diving medicine course should be spent specifically on the requirements of the diving medical examination. These 12 hours do not include a description of diving medicine, diving physics, etc. Any such course should also be under the control and instruction of specialist diving physicians. Courses in introductory diving medicine, such as the Resort Medical Diving Courses and many of the others throughout the world, would not be accepted, on the basis that these are not specifically designed to teach doctors the techniques and complexities of diving medical examinations. Many of these courses bear no relationship to the Australian Standards requirements.

Special application can be made to SPUMS for recognition of training in underwater medicine. The address for the Academic Board of SPUMS is:
The Education Officer
South Pacific Underwater Medical Society
C/o Australian and New Zealand College of Anaesthetists,
630 St Kilda Road,
Melbourne, Victoria 3004, Australia.

SECTION B

SUGGESTED SCOPE OF A MEDICAL QUESTIONNAIRE FOR SCREENING CANDIDATES FOR RECREATIONAL SCUBA DIVING

HEALTH STATEMENT FOR PERSONS WISHING TO UNDERTAKE SCUBA-DIVING TRAINING

The provision of inaccurate, incomplete or misleading information, or withholding any information is likely to place you at risk and renders any subsequent medical opinion unreliable.

Introduction

This is a medical questionnaire designed to identify any health issues that may increase the risk to you from undertaking SCUBA diving.

In order to undertake dive training you will be required to sign this form on the understanding that relevant medical details may be passed to your dive trainer.

You will also be informed of some potential risks involved in scuba diving and of the conduct required of you during the scuba training programme. Your signature on this statement is required for you to participate in the scuba training program offered.

If you are under 18 years of age, you must have this questionnaire signed by a parent or guardian.

Training to be offered by_____and

_____ (Instructors) located at (Facility)

_____

_____

Diving is an exciting and demanding activity. When performed correctly, applying correct techniques, it is relatively safe. To scuba dive safely, you should not be extremely overweight or out of condition. Diving can be strenuous under certain conditions. Your lungs, heart and circulation must be in good health. All body air spaces such as the sinuses and middle ears must be normal and healthy. A person with heart disease, a current head cold or lung congestion, epilepsy (fits), any severe medical problem or who is under the influence of alcohol or drugs should not dive. If you have asthma, heart disease, other chronic medical conditions or you are taking medications on a regular basis, you should inform the doctor and the instructor before participating in this programme.

You will also learn from the instructor the important safety rules regarding breathing and ear clearing while scuba diving. Improper use of scuba equipment can result in serious injury. You must be thoroughly instructed in its use under direct supervision of a qualified instructor to use it safely.

If you have any additional questions regarding this Medical Statement or the Medical Questionnaire section, review them with your instructor before signing.

Candidate initials_____

Please read carefully before signing.

1. Surname _____ Other Names _____

2. Date of Birth (dd/mm/yyyy) _____

3. Address _____

_____

State: Postcode _____

4. Sex Male / Female

5. Telephone (Home) _____

6. Principal Occupation _____

7. Telephone (Work) _____

8. Email (Optional) _____

9. How often do you exercise (minutes per week)? _

What is your estimated level of intensity of that exercise (High-Medium-Low)?

_____

10. Are you taking any prescription tablets, medicines or drugs?

List: _____

_____

11. Have you had any reactions to drugs or medicines or foods?

Details: _____

12. Tobacco Smoking History.

Do you smoke tobacco now? Y/N

Have you ever smoked tobacco? Y/N

How many cigarettes per day do/did you smoke and for how many years?

_____

If other forms of tobacco, please detail_____

13. Do you drink alcohol?_____Y/N

Estimate how many standard drinks per night or week._____

_____

14. Do you currently consume illicit drugs? Y/N

Detail:_____

Please answer the following questions on your past or present medical history (from question 15 onwards) with a YES or NO.

- If you have never heard of the condition or had the diagnosis applied to you – then reply **NO**
- If you are not confident that you understand the question, then leave this blank and discuss with the doctor

Have you ever had or do you now have any of the following?	**YES**	**NO**	**Physician's comments**
15. Any continuing eye or visual problems (apart from needing glasses or contact lenses)?			
16. Sinusitis (e.g. hay fever, sinus infections)?			
17. Any other nose or throat problem (apart from previous coughs and colds)?			
18. Dentures or plates that are removable?			
19. Deafness or ringing noises in ear(s)?			
20. Discharging ears or other infections?			
21. Previous ear operation (including as a child)?			
22. Giddiness or loss of balance?			
23. Severe motion sickness?			
24. Any ear problems or severe headaches when flying in aircraft?			
25. Severe or frequent headaches, including migraine?			
26. Faints or blackouts?			
27. Convulsions, fits or epilepsy?			
28. Any episodes of unconsciousness?			
29. Depression requiring medical treatment?			
30. Claustrophobia?			
31. Mental illness or mental health issues requiring therapy of treatment?			
32. Bronchitis or pneumonia?			
33. Pleurisy or severe chest pain?			
34. Coughing up phlegm or blood?			

Have you ever had or do you now have any of the following?	YES	NO	Physician's comments
35. Chronic or persistent cough?			
36. Tuberculosis ("TB")?			
37. Pneumothorax ("collapsed lung")?			
38. Frequent chest colds?			
39. Asthma or wheezing?			
40. Use a puffer (medication inhaler for asthma)?			
41. Any other chest complaint?			
42. Operation on chest, lungs, or heart?			
43. Peptic ulcer or acid reflux requiring treatment?			
44. Vomiting blood or passing red or black motions?			
45. Jaundice, hepatitis or liver disease?			
46. Malaria?			
47. Severe loss of weight?			
48. Hernia or rupture?			
49. Major joint or back injury?			
50. Paralysis, muscle weakness or numbness?			
51. Kidney disease?			
52. Diabetes?			
53. Blood disease or bleeding problem?			
54. Could you be pregnant, or are you trying to become pregnant?			
CARDIOVASCULAR RISK QUESTIONS			
55. Do you have any known heart disease or have your ever consulted a cardiologist (specialist heart doctor)?			
56. Is there a family history of heart disease or diabetes?			
57. Is there a family history of sudden death at a young age?			
58. Are you ever aware of a racing or irregularly beating heart, or any other known problems with your heart beat?			
59. Have you ever had giddiness, light headedness of periods of unconsciousness whether or not associated with exercise?			
60. Do you ever get discomfort in your chest with exertion (angina)?			
61. Do you ever get very short of breath on exertion (out of proportion to the exercise, or before your legs get tired)?			
62. Have you ever been short of breath lying down or woken from sleep with breathlessness?			

CARDIOVASCULAR RISK QUESTIONS	YES	NO	Physician's comments
63. Do you have a pacemaker or implanted defibrillator?			
64. Have you ever had an operation on the heart including any placement of stents?			
65. Have you ever failed or had a significant medical issue with a diving medical in the past?			
66. Have you ever had a diagnosis of the following: • High blood pressure? • Rheumatic fever or problems with your heart valves? • High cholesterol? • Immersion pulmonary oedema? • Heart failure or a problem with heart muscle including cardiomyopathy or obstructive coronary heart disease? • A hole in the heart (PFO, ASD, VSD) or other congenital heart disease? • Blood clots on the lungs? • A stroke?	____ ____ ____ ____ ____ ____ ____ ____	____ ____ ____ ____ ____ ____ ____ ____	

Water skills and diving history

Previous Diving Experience? When, and how many dives?

Details: _____

_____

Previous qualifications (if any): _____

Can you swim? _____

Have you ever had any problem during or after swimming or diving?

Details: _____

Have you ever had decompression illness?

Details:_____

Do you snorkel dive regularly? _____

Candidate Statement

I certify that the above information is true and complete to the best of my knowledge. I hereby authorise (dive training organisation) _____ to pass this information to a diving doctor of my choosing. I also authorise that doctor to obtain or supply medical information regarding me to other doctors as may be necessary for medical purposes in my personal interest.

Signed: _____ **Date:** _____

Note
Any chronic disease, such as hepatitis A, B, C, AIDS or tuberculosis, may increase your risks from diving. If you have a chronic disease please discuss it with the doctor who will then be able to advise you whether you will be at increased risk.

SPUMS PRE-DIVE MEDICAL FORM FOR ENTRY-LEVEL SCUBA DIVERS

Append the diver medical statement above

Notes or additions to medical history: _____

_____

_____

MEDICAL EXAMINATION: To be completed by an Approved Medical Practitioner

1. Height cm	2. Weight kg	3.Visual acuity R 6/ Corrected 6/ L 6/ Corrected 6/	4. Blood Pressure mmHg	5. Pulse rate bpm
6. Urinalysis Albumin Glucose	7. Respiratory function tests including: (attach results) FVC FEV_1 Ratio (%)		8. CXR (if required) Date: Place: Result:	
9. Audiometry dB Right	(Hz) 500	1000 1500 2000 3000	4000 6000	8000
Left				
10. ECG (if indicated)				

Clinical Examination/Assessment	Normal	Abnormal	Notes on any abnormalities
11. Nose, septum, airway			
12. Mouth, throat, teeth, bite			
13. External auditory canal			
14. Tympanic membrane			
15. Middle ear autoinflation			
16. Neurological Eye movements Pupillary reflexes Limb reflexes Finger-nose Sharpened Romberg Test			
17. Abdomen			
18. Chest auscultation			
19. Cardiac auscultation			
20. Other abnormalities			

STATEMENT OF HEALTH FOR RECREATIONAL DIVING
This Section to be completed by a Medical Practitioner with appropriate training in diving medicine

This is to certify that I have today interviewed and examined:

Name.....

Address.....

.....

Date of birth...../...../.....

Initial the statements that apply:

	I have assessed the candidate in accordance with the SPUMS Recreational Dive Medical.
	I can find no conditions which are incompatible with compressed gas, scuba and surface supplied breathing apparatus (SSBA) and / or breath-hold diving.
	I have explained the health risks of diving disclosed by this examination to the candidate and we have discussed how these risks may be reduced. The candidate appears to have a good understanding of these risks.
	Based upon my assessment, the candidate should not dive with compressed gases (scuba and SSBA).
	Based upon my assessment, the candidate should not breath-hold dive.

Advice: (append further notes as required)

Condition 1: _____

Condition 2: _____

..../...../.....
(Signature of Medical Practitioner) (Date)
(Name, address and telephone number of the Medical Practitioner)

This Section to be completed by the Candidate
Initial the statements that apply:
..... I understand the health risks that I may encounter in diving and how these risks may be reduced.
..... I also understand that the medical practitioner's recommendation herewith is based, in part, upon the disclosure of my medical history.
..... I agree to accept any responsibility and liability for health risks associated with my participation in underwater diving, including those that are due to or are influenced by a change in my health and / or my failure to disclose any existing or past health condition to the medical practitioner.
..... I hereby authorise the medical practitioner to supply information with regard to my medical fitness to dive to the diving instructor.

..... ……..... ...../...../.....
Signature of candidate Name of Candidate Date

APPENDIX A

SUGGESTED EVALUATION OF THE CARDIOVASCULAR SYSTEM FOR DIVERS

The SPUMS cardiovascular risk advice committee: Nigel Jepson, Rienk Rienks, David Smart, Mike Bennett, Simon Mitchell, Mark Turner and Andrew Fock.

Introduction

All diving candidates and established divers aged 45 years and over should undergo a medical assessment and examination with a focus on cardiovascular evaluation, preferably by a doctor with training in diving medicine. This recommendation is based on commonly used age criteria cardiovascular risk calculators. [1,2]

Background

Diving in all forms places increased demands on the cardiovascular system. Immersion itself causes an increase in cardiac preload (increased venous return) and at the same time, peripheral vasoconstriction, causing an increase in blood pressure and afterload. These changes are typically accompanied by sustained mild to moderate exercise and occasional requirements for peak exercise in challenging circumstances. Given all this and the increasing age of the 'average' diver, it is not surprising about one third of recreational diving fatalities have a cardiac event as the disabling injury. [3]

The primary goals of evaluating the cardiovascular system in a diving candidate are to:

- Identify those who appear to be at increased risk of myocardial ischemic events, heart failure, dysrhythmias and other cardiac pathology that might disable a diver underwater and
- Establish the candidate has an adequate exercise capacity for diving.

Which divers with cardiovascular problems should not dive?

Diagnoses usually considered to make an individual unsuitable for diving include:

1. Untreated and/or symptomatic coronary artery disease

2. Left ventricular dysfunction of any cause. Divers with well treated or recovered left ventricular dysfunction with good ejection fraction (especially with EF > 50%) would usually be acceptable if there was good exercise capacity and the underlying causes treated. All such divers require cardiology review.

3. Hypertrophic cardiomyopathy would usually preclude diving. Cardiology review is required in all cases.

4. Congestive heart failure

5. Pulmonary hypertension

6. Long QT syndrome or other arrhythmia-inducing ion channelopathies

7. Paroxysmal arrhythmias causing unconsciousness or impairment of exercise capacity

8. Poor exercise capacity of apparent cardiac origin

9. Moderate to severe valvular lesions

10. Complex congenital cardiac disease. (Note that an ASD is not included here – ASD patients are at increased risk of neurological DCI and should be assessed by a diving doctor and a cardiologist before being cleared for diving).

11. The presence of an implanted cardiac defibrillator

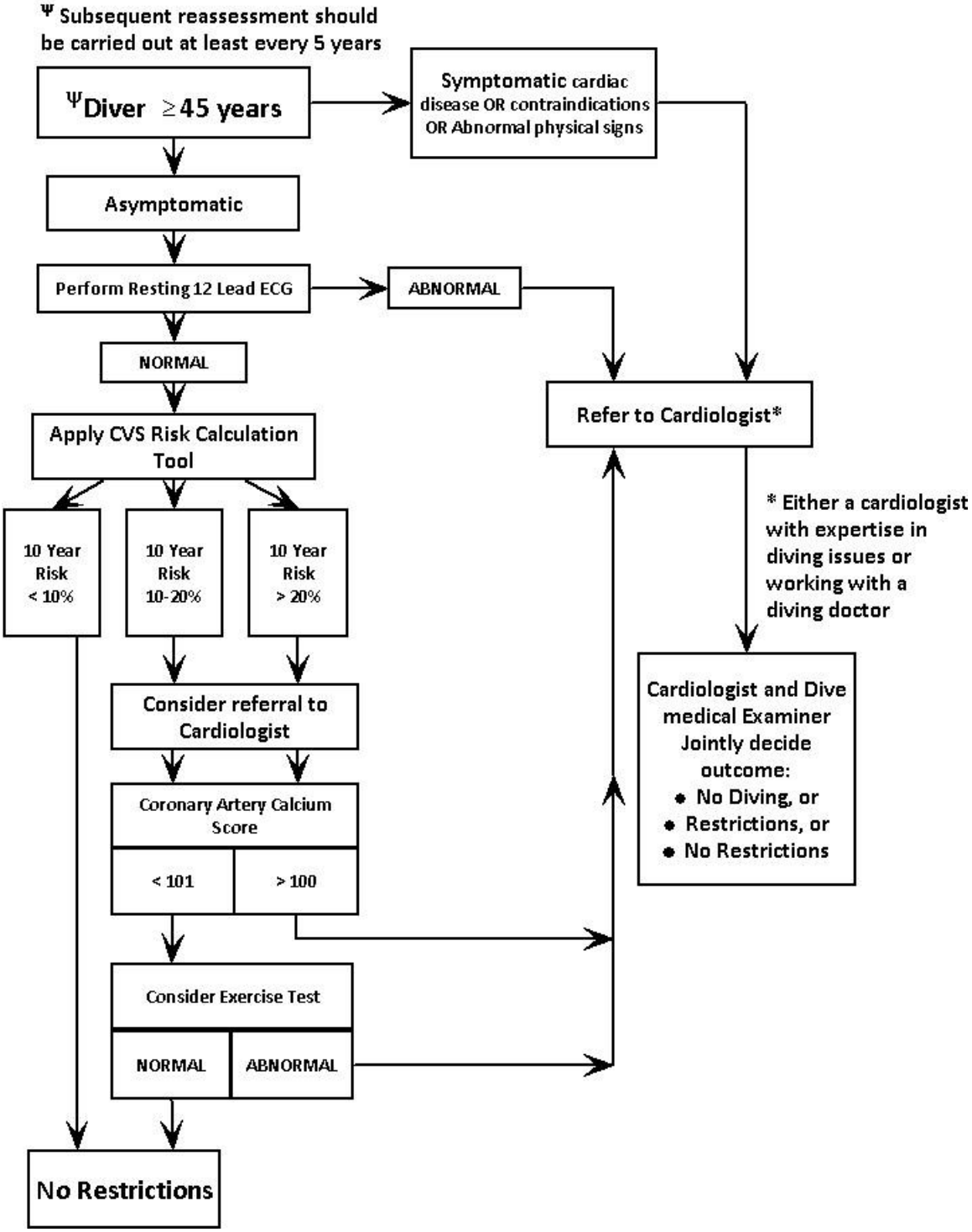
12. Recurrent syncope

13. Anticoagulation – including warfarin, direct thrombin inhibitors (e.g. dabigatran), and factor Xa inhibitors (e.g. rivaroxaban, apixaban) or similar – for whatever reason).* [This does not include single antiplatelet therapy (e.g. aspirin).]

**Some experts allow single anticoagulant therapy under selected circumstances. This remains a controversial area and the committee acknowledges the lack of reliable evidence to support either position.*

The successful treatment of some of these disorders may result in a candidate becoming suitable for diving. In particular, a candidate with coronary artery disease who has been successfully revascularised may be suitable for diving if inducible ischemia can be excluded and adequate exercise capacity demonstrated (see below). Another example is a candidate with a history of paroxysmal arrhythmia who has undergone successful pathway ablation. Following successful cardiac intervention, candidates may require some recovery time before commencing/resuming diving. Many cardiologists and diving physicians would not allow diving while on dual antiplatelet therapy. The precise period of diving abstinence should be determined by the cardiologist and diving physician.
Candidates with any of the above diagnoses who wish to consider diving after appropriate treatment should be referred to a physician with training in diving medicine for evaluation.

Figure 1. Flow diagram for the recommended screening of divers aged ≥45 years



Notes to accompany Figure 1:

1. All symptomatic candidates should be referred to a cardiologist for investigation.

2. Candidates with a positive cardiovascular history (including younger diving candidates or established divers < 45 yrs) should undergo a focused medical assessment; initially by a doctor with training in diving medicine. Cardiology referral should be considered.

3. All asymptomatic divers or candidates ≥ 45 yrs should have a resting ECG performed and any significant abnormalities should prompt referral to a cardiologist.

4. Asymptomatic candidates or divers ≥ 45 years should be assessed with a standard, validated, cardiovascular risk assessment tool (e.g the National Vascular Disease Prevention Alliance in Australia). [2] The specific tool used may vary.

5. Candidates with an estimated 10-year risk < 10% may proceed to diving with no further assessment. Some diving doctors would also perform a standard exercise test (with ECG monitoring). The diving medical may also prompt a discussion of life-style modification.

6. Candidates with a higher risk should have a coronary calcium score and those at > 20% 10-year risk should have a CT angiogram and/or functional stress test. Such testing may be best organised by a cardiologist.

7. A normal CT angiogram or a functional stress test negative for ischaemia suggests that the candidate should be able to dive without important excess risk.

8. A plan (including review frequency) for follow-up cardiac health surveillance tailored to the diver's risk profile should be established at the time of the initial evaluation.

Assessment of divers with known or symptomatic cardiovascular disease

All candidates for diving, or seeking ongoing monitoring for the suitability to continue diving should complete the full questionnaire that forms part of the *SPUMS Guidelines on Medical Risk Assessment*.

Candidates who have responded indicating they may have known or symptomatic cardiovascular disease need further specialist investigation by an appropriate physician. This may include myocardial perfusion scan, stress echocardiography or stress exercise ECG ("stress test"). Although an exercise ECG is relatively insensitive to early coronary disease, it has the advantage of demonstrating exercise capacity and can be modified to test sustained exercise at 6 MET. *Sustained exercise at a minimum of six METs is a pragmatic expectation for a recreational diver but there may be an occasional need to exercise transiently at higher levels during diving.*

Notes on specific diagnoses

1. *Treated hypertension* with adequate control and in the absence of other risk factors that would indicate screening for coronary artery disease is acceptable for diving. Although local practices may vary in some details, hypertension should always be investigated and treated according to contemporary evidence-based guidelines.[4] *Hypertension* above 160/100 mmHg is a contraindication until investigated and treated.

   For divers taking antihypertensive drugs, certain antihypertensive drugs may be preferred to others in the context of scuba diving, and participation in scuba diving may be of consequence for antihypertensive treatment choices. Expert opinion should be sought. It is recommended that subjects with hypertension be assessed for signs of cardiac ischemia and/or dysfunction and be referred to a vascular specialist or cardiologist for cardiovascular screening when deemed appropriate. Divers with hypertension be informed about the symptoms of immersion pulmonary oedema and receive specific instructions to immediately abort a dive in case of these symptoms.

2. *Atrial fibrillation* where the rate is adequately controlled in a candidate without inducible myocardial ischemia and who exhibits adequate exercise capacity is acceptable in diving. However, many such patients are anticoagulated and anticoagulation is itself a contraindication for diving (see above). All patients with atrial fibrillation should have a cardiac echocardiogram to exclude structural heart disease and assess for diastolic dysfunction. Successful aberrant pathway ablation in case of Wolff Parkinson White (WPW) syndrome and atrio-ventricular nodal re-entry tachycardia (AVNRT), or pulmonary vein isolation in case of atrial fibrillation may also render the candidate acceptable for diving, however these individuals should have a bubble-contrast echo to ensure no persistent hole remains through the inter-atrial septum.

3. *A cardiac pacemaker* is not an absolute contraindication to continued diving, but the underlying pathology is important to consider, as is the proven ability of the device to function at depth. Pressure capability of a device can usually be obtained from the manufacturer.

4. A previous episode of *immersion pulmonary oedema, Takotsubo cardiomyopathy* or a diagnosis of *obstructive cardiomyopathy* should contra-indicate further diving until appropriately assessed.
A diver or new diving candidate with such a history should be referred to a physician with training in diving medicine for discussion of the relevant issues.

5. Patent Foramen Ovale

SPUMS does not advise routine testing for the presence of a Patent Foramen Ovale (PFO).[5]

A PFO that exhibits right to left shunting with no or minimal provocation is a risk factor for serious neurological decompression sickness (DCS). In established divers, such lesions are usually discovered by bubble contrast echocardiography conducted after a relevant episode of DCS or the development of a suspicious rash following shortly after diving.
These divers are usually advised to cease diving, modify their diving to reduce venous bubble formation or to have the PFO repaired. There are some data to suggest the incidence of DCS remains high in those who elect to modify their diving, and this option is less often recommended than previously.[6] When this option is taken for whatever reason, it would be reasonable to advise diving more conservatively in order to minimise venous bubbles. There are various strategies that might be employed to reduce the risk of significant venous bubble formation after diving, or the subsequent right-to-left shunting of such bubbles across a PFO.

The appropriateness of this approach, and the strategies chosen, need to be considered on an individual basis, and in discussion with a diving medicine expert. Examples include reducing dive times to well inside accepted no-decompression limits; restricting dive depths to less than 15 metres; performing only one dive per day; use of nitrox with air dive planning tools; intentional lengthening of a safety stop or decompression time at shallow stops and avoidance of heavy exercise and unnecessary lifting or straining for at least three hours after diving. [5 – 7]

Occasional new diver candidates have a previously discovered PFO and in such cases an objective assessment of the shunting behaviour of the lesion is required in order to adequately counsel the candidate about the implied risks in diving. If not already done, this is best achieved using a bubble contrast echocardiogram and provocative manoeuvres.
It is strongly recommended the results of such tests are discussed with a physician who has training in diving medicine.

References for Appendix A

1. New Zealand Ministry of Health Guidelines Group. New Zealand Cardiovascular Risk Charts 2009. [Online]. http://www.moh.govt.nz/NoteBook/nbbooks.nsf/0/9874D7743DE4CCA9CC2579E2007E4FA2/$file/090311_cvd_poster_final.pdf. [Accessed 28 August 2019].
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APPENDIX B

SUGGESTED ASSESSMENT FOR THE DIVER WITH ASTHMA

Introduction

Asthma is a chronic inflammatory lung disorder characterised by wheezing, cough, shortness of breath and chest tightness. Inflammatory changes cause the bronchial smooth muscle to be hyper-responsive to a variety of stimuli including exercise and dry air. The narrowed airways, combined with the production of thick dry mucus, mean airflow may be severely limited and threaten life if not promptly treated. Prevalence depends greatly on how asthma is defined and may be as much as 30% in Australia and even higher in New Zealand.[1,2]

Importantly for diving physicians, a resolution of asthma during adolescence may be more apparent than real, suggesting it may be unwise to assume that once clinically resolved, asthma will not pose a future threat to health in a young diving candidate.[3]

Asthma and diving

There are several reasons why divers with asthma may be at greater risk of misadventure than those without asthma:

1. Bronchial hyper-responsiveness may lead to air trapping during ascent, overpressure within the lung units involved, and therefore increase the risk of pulmonary barotrauma (PBT) and cerebral arterial gas embolism.
2. Even in the person with well-controlled asthma, an exacerbation may be provoked in response to exercise (submerged or on the surface), salt water aspiration or breathing dry, cold air. Such an exacerbation is difficult to treat while submerged and may restrict the ability of a diver to safely complete or abort the dive.
3. A diving regulator may produce a fine mist of seawater (hypertonic saline with added biological material) which may provoke bronchoconstriction.
4. Bronchial constriction, added resistance in the regulator and increased gas density at depth will increase the work of breathing, further exhausting an individual with acute bronchospasm.
5. There is a possibility that bronchodilators may provoke the passage of bubbles across the pulmonary filter and therefore predispose an asthmatic to DCI.
6. There is some evidence that breathing through a diving regulator increases airway resistance in people with asthma compared with those who do not have asthma.[4]

Prospective divers with asthma may be so well controlled by the current generation of inhaled corticosteroids (ICS) and long-acting bronchodilators that their lungs are no longer reactive to stimuli such as exercise and salt water. Such ‘well-controlled’ individuals may have risks from diving that are close to those without asthma. If this is so, then the implication is that people with asthma who are asymptomatic and show normal lung function on testing with spirometry and bronchial provocation may be able to dive with an acceptable level of risk.

Asthma therapy

The emphasis is on the administration of long-term modulation of airway inflammation with inhaled corticosteroids (ICS), combined with long-acting beta-2 agonists (LABA). These two classes of agents complement each other by acting on the two major components of asthma – inflammation and bronchoconstriction. The general approach to pharmacological therapy is to step up medication until control of symptoms is achieved. Current guidelines for treatment are published by the National Asthma Council Australia and can be found online through their website at < www.nationalasthma.org.au>. This organisation publishes an evidence-based guide to managing asthma that is available without cost in hard copy or electronic format (*The Asthma Management Handbook*).[2] These comprehensive guidelines emphasise the importance of an established doctor-patient relationship within which adequate attention can be paid to education,

joint goal-setting, monitoring, review and the identification of risk factors. Any consideration of the suitability for a candidate to undertake diving should start with the assurance that such an arrangement is in place.

Assessing a candidate with asthma for diving

These candidates should have simple spirometry including measurements of forced vital capacity (FVC), forced expiratory volume in the first second (FEV_1), the ratio of FEV_1/FVC and peak expiratory flow (PEF). A single-breath flow-volume loop is recommended (by referral to a pulmonary laboratory, if necessary) as the information obtained (particularly changes in mid-expiratory flow rates and in the response to bronchodilators or to exercise), provides better evidence of small airways disease than an FEV_1/FVC ratio alone. The best of three attempts should be accepted.

Those who indicate a history of asthma in the last ten years, exhibit signs of wheezing or an unexplained cough, but have normal spirometry, should have bronchial provocation testing. The SPUMS recommended definitions of abnormal spirometry are one or more of: FVC < 80% of predicted, FEV_1 < 80% of predicted, FEV_1/FVC ratio < 75% predicted or PEF < 80% of predicted. For a more thorough discussion of lung function testing, please refer to the joint American Thoracic Society and European Respiratory Society document.[5]

Bronchial provocation testing

These tests should be performed in an appropriate laboratory in order that both challenge and response are measured in a standardised way. The role of testing was reviewed in 2004 by the Thoracic Society of Australia and New Zealand (TSANZ).[6]

Indirect methods including dry-air hyperpnoea, exercise and hypertonic challenges (saline or mannitol) are more specific for identifying individuals with current airways inflammation because they cause release of mediators from inflammatory cells in the airways, probably via an osmotic effect. The choice of which test to use will depend partly on local resources, but both exercise and 4.5% saline have the benefit of exposing the diver to stimuli that may actually be encountered during scuba diving. Another advantage is that treatment with ICS will reduce bronchial hyper-responsiveness over several weeks, making these tests useful indicators of the response to therapy.[7]

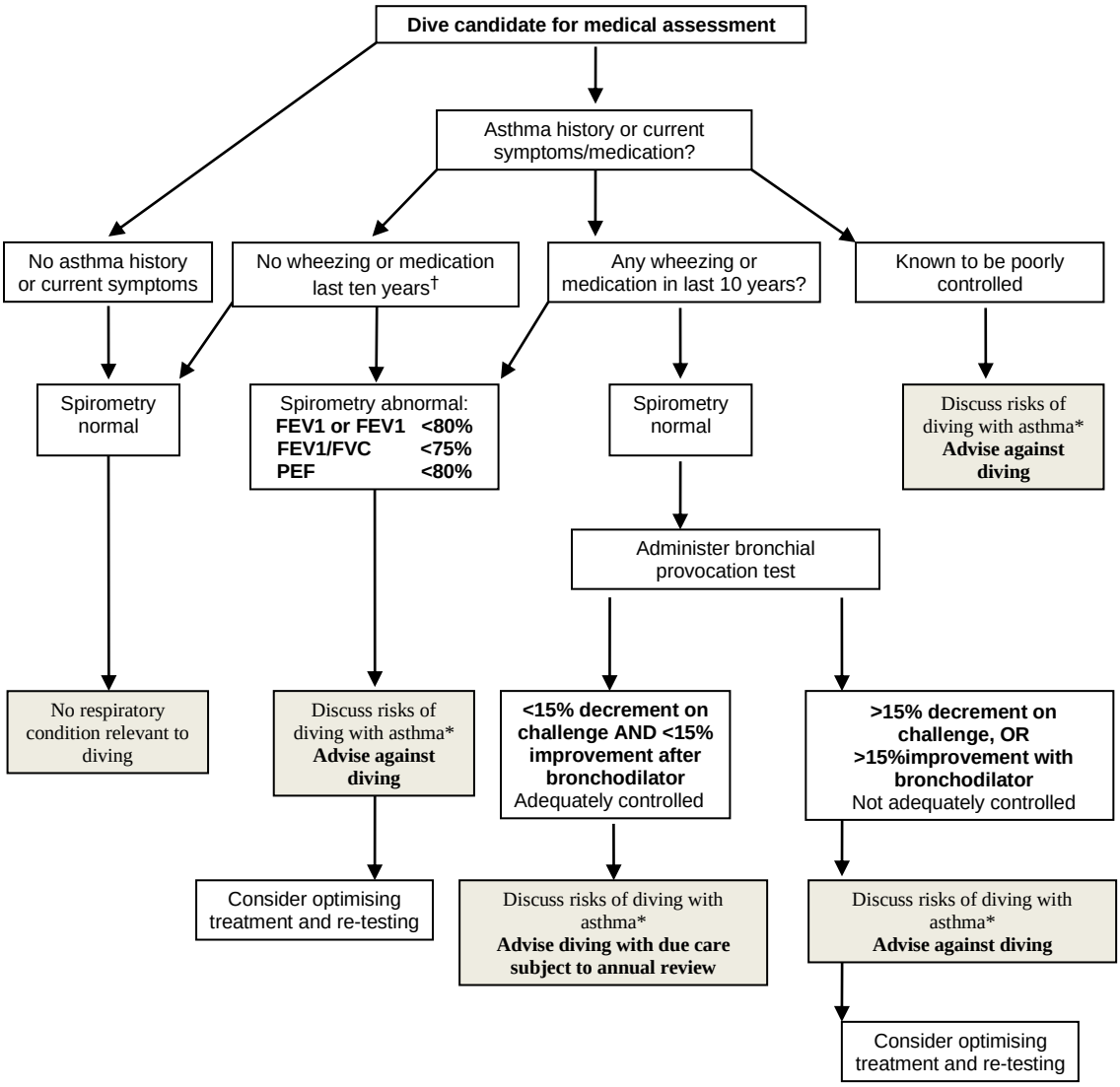
In general, most authorities accept a reduction in FEV_1 of greater than 15% as a ‘positive response’ to indirect challenges. The same implication is derived from demonstrating more than a 15% improvement with the administration of a bronchodilator. A positive response should lead to a recommendation against undertaking diving, but does not preclude re-testing and re-assessment after asthma control has been established. A proposed schema for dealing with an asthmatic patient is contained in Figure 2.

Advice to those who ‘fail’ bronchial provocation

Diving is inadvisable for any person with asthma who fails bronchial provocation testing by an indirect method. These candidates should be counselled with regard to the theoretical dangers discussed above and the implications of their response clearly pointed out.

Candidates may be re-tested when control has been established by stepwise escalation of therapy. Current data suggest that normalisation of response with treatment is possible, and these candidates may be able to dive at some future time provided asthma control is maintained. These individuals should be re-assessed annually.

Figure 2. A suggested schema for dealing with asthmatics who present for an assessment for fitness to dive



See text for a discussion of appropriate advice

† Assess these candidates with a low threshold for provocation testing if there is any doubt about possible symptoms of exercise-induced bronchospasm

Advice to candidates who 'pass' bronchial provocation testing

There are two groups of candidates who do not demonstrate bronchial hyper-responsiveness: those not taking medication do not require follow-up unless they develop symptoms; those taking anti-asthma medication should be re-assessed annually or sooner if they develop any symptoms.

All current divers with controlled asthma are strongly encouraged to monitor their peak flow twice daily during diving periods, with the recommendation to refrain from diving if PEF is more than 10% below their best value.[8] SPUMS strongly advises divers against diving when symptomatic. Medical review is required after the development of any symptoms related to asthma.

Conclusions and recommendations

- Asthma may place an intending diver at increased risk of drowning, pulmonary barotrauma, and/or arterial gas embolism.
- Those with asthma who are symptomatic or display hyper-reactivity of airways to indirect stimuli should be advised against diving due to the potential risk from pulmonary barotrauma and an exacerbation of their disease either underwater or on the surface.
- Spirometry should be performed in all intending divers with any respiratory symptoms or a history of significant respiratory disease. Peak flow meters are of limited use in assessing respiratory function for diving fitness, but may be useful for day to day monitoring of status. Spirometry should be a single-breath flow-volume curve, if possible.
- Divers with controlled asthma who are cleared for diving are advised to have annual review of their diving fitness.
- All risks should be explored fully in discussion with the candidate, and the diving physician should satisfy themselves that the candidate appreciates these risks. Written guidelines should be provided and the individual should accept responsibility for following these guidelines. The consultation should be carefully documented.

References for Appendix B

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APPENDIX C

SUGGESTED ASSESSMENT FOR THE DIVER WITH DIABETES

Introduction

Diving by individuals with diabetes has been one of the most controversial issues in 'fitness to dive' for several decades. A report from a joint UHMS/DAN workshop in 2005 has summarised the position.[1]

Diabetes and diving

Selection of appropriate individuals with diabetes (whether insulin-requiring or not) who could be recommended for diving is important because many of the acute and chronic complications of diabetes are potentially profound risks during and after diving. A brief summary of the major concerns is given in Table 1.

Table 1. Acute and chronic complications or associations recognized in diabetes, and potential interactions with diving

Complication	Potential interaction with diving
Hypoglycaemia	- May be precipitated by stress, cold and exercise during diving - Potentially catastrophic consequences due to impaired mentation and consciousness underwater - Impending symptoms may be less likely to be noticed during diving - Potential for confusion with symptoms of DCI or other possible problems such as hypothermia or sea sickness
Hyperglycaemia	- May augment dehydration stress; a possible risk factor for DCI - May worsen outcome in neurological DCI
Coronary artery disease	- Impairment of exercise tolerance - Possibility of myocardial ischaemic event
Resetting of hypothalamic glucose control	- Release of adrenaline during hypoglycaemia occurs after neuro-glycopenia and patient may become incapacitated before noticing hypoglycaemic symptoms: a phenomenon known as "*hypoglycaemia unawareness*"
Autonomic neuropathy	- Blunting of adrenaline release expected when blood glucose falls thereby worsening potential for hypoglycaemia
Peripheral neuropathy	- Possible confusion with signs of DCI
Peripheral vascular disease	- Impairment of exercise tolerance
Renal impairment	- Multiple possibilities depending on severity

People with diabetes who are prone to acute complications (such as hypoglycaemia) or suffering chronic complications that might impact significantly on diving safety should be advised against diving. Similarly, the progressive nature of many complications of diabetes suggests there should be longitudinal health surveillance and periodic reassessment of suitability over the period of the individual's participation in diving.

Divers with diabetes should always have immediate access to the surface and adopt a strategic approach to management of blood glucose during a diving day.

Which people with diabetes may be able to dive?

The following criteria are appropriate for recreational dive training for a candidate with diabetes:

1. Aged 18 years and over;
2. At least six (6) months have passed since the initiation of treatment with oral hypoglycaemic agents (OHAs) or one (1) year since the initiation of treatment with insulin; an appropriate 'observation period' has been imposed after introduction or major change of medication;

3. No hypoglycaemic episodes requiring intervention from a third party for at least one (1) year, and no history of "*hypoglycaemia unawareness*".
4. HbA1c ≤ 9% when measured no more than one (1) month prior to initial assessment and at each annual review;
5. No admissions or emergency visits to hospital for any complications of diabetes for at least one (1) year;
6. No known retinopathy (worse than "background" level), significant nephropathy, neuropathy (autonomic or peripheral), coronary artery disease or peripheral vascular disease. This requires clinical judgement by both the physician managing the diabetes and the diving physician on a case-by-case basis;
7. Prior to the first diving medical assessment (see 8) and each annual evaluation, a review must be conducted by the candidate's physician managing their diabetes who must confirm that:
   - criteria 3 – 6 are being fulfilled;
   - the candidate demonstrates accurate use of a personal blood glucose monitoring device and
   - the candidate has a good understanding of the relationship between diet, exercise, stress, temperature and blood glucose levels.
8. Prior to commencing diving for the first time and at each annual review, a diving medical examination must be performed by a doctor who has completed a post-graduate diving medical examiners course. This examination will include appropriate assessment of exercise tolerance, and for candidates over 40 years old should include an exercise ECG. The focussed report from the physician managing the diver's diabetes must be available.
9. As part of the assessment by the diving medical examiner, the candidate must acknowledge (in writing):
   - receipt of and intention to use the recommended diabetic diving protocol (see below);
   - the need to seek further guidance if there is any material that is incompletely understood;
   - the need to cease diving and seek review if there are any adverse events in relation to diving suspected of being related to diabetes.
10. Steps 2 – 9 of this protocol must be fulfilled on an annual basis. Where possible the same diabetic physician and diving medical officer are used for these annual reviews.

Scope of diving

The following restrictions are appropriate for recreational divers with diabetes.

1. Divers with diabetes should undergo training within a programme designed specifically for that purpose.
2. Divers with diabetes are unsuitable for occupational diving, which involves focus on a task or purpose that demands attention and concentration. This will inevitably detract from self-monitoring and is not recommended.
3. Divers with diabetes should not undertake dives deeper than thirty (30) metres of seawater, dives longer than one (1) hour, dives that mandate compulsory decompression stops, or dives in overhead environments. These practices all hamper rapid access to surface support.
4. Divers with diabetes do not undertake more than two (2) dives per day and use a minimum surface interval of two (2) hours.
5. Divers with diabetes must dive with a buddy who is informed of their condition and aware of the appropriate response in the event of a hypoglycaemic episode.
6. Divers with diabetes should avoid combinations of circumstances that might be provocative for hypoglycaemic episodes such as prolonged, cold dives involving hard work.

Blood glucose management on the day of diving
The following protocol is taken from the Divers Alert Network guidelines for divers with diabetes and is reproduced with permission.[1]

Divers with diabetes (whether insulin-dependent or otherwise) should use this protocol to manage their health on the day of diving:

1. On every day on which diving is contemplated, the diver must assess him or herself in a general sense. If he or she is uncomfortable, unduly anxious, unwell in any way (including sea sickness), or blood glucose control is not in its normal stable pattern – DIVING MUST NOT BE UNDERTAKEN.
2. The diver should establish a blood glucose level (BSL) of at least 9 mmol L^{-1}, and to ensure that this level is either stable or rising before entering the water. Measurements should be taken 3 times before diving: at 60 minutes, 30 minutes and immediately prior to gearing up. Diving should be postponed if blood glucose is < 9mmol L^{-1}, or there is a fall between any two measurements.
3. Attempts to comply with the requirements at 2 (above) should not result in a blood glucose level greater than 14 mmol L^{-1}, and diving should be cancelled for the day if levels are higher than 16 mmol L^{-1} at any stage.
4. Divers must carry oral glucose in a readily accessible and ingestible form at the surface and during all dives. We strongly recommend that these divers also have parenteral glucagon available at the surface. If premonitory symptoms of hypoglycaemia are noticed underwater, the diver must surface, establish positive buoyancy, ingest glucose and leave the water. An informed buddy should be in a position to assist with or initiate this process.
5. Blood glucose levels must be checked at the end of every dive. The requirements for blood glucose status outlined at point 2 remain the same for any subsequent dive. In view of the recognized potential for late decrements in blood glucose levels following diving, BSL should be checked 12–15 hours after diving.
6. Divers are strongly recommended to drink between 1000 and 1500 ml of extra water over a period of several hours prior to their first dive of the day.
7. Divers must log all dives, associated diabetic interventions, and results of all blood glucose level tests conducted in association with diving.

This protocol should be combined into an information package to be given to the diver with diabetes by the examining doctor on completion of their diving medical examination.

Reference for Appendix C

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Pro-forma statement to be added to the certificate in Section B, for use when counselling divers with diabetes about their diving

STATEMENT REGARDING DIABETES AND DIVING

I, …… hereby acknowledge my understanding and acceptance of the following issues:

1. Altered consciousness, heart attack, or exhaustion during diving may lead to drowning and other life-threatening complications.
2. A history of diabetes implies a greater risk of these events.

Moreover,

3. Diving itself may make these events more likely in a diabetic diver by precipitating hypoglycaemia, or imposing high physical demands in certain situations.

And

4. That because of the issues described at 1 – 3, people with diabetes are frequently considered unfit to dive.

However, I also understand

5. That the extra risk in diving for a diabetic diver who meets certain criteria for selection as a diver and who practices appropriate diabetic diving technique is likely to be relatively small. Unfortunately, this risk has not been quantified.
6. That any decision for a person with diabetes to dive must be based on the perceived benefit weighed against the potential risk.

Having decided to proceed with diver training, I acknowledge

7. That Dr ……'s assessment of my risk in diving has been based in part on my own reports of blood glucose control, and my general state of health. I acknowledge my responsibility for the accuracy of those reports.
8. That if the pattern of my diabetes changes significantly, or if I suffer any adverse diabetes-related event in which I require assistance or medical consultation at any time, then the risk of diving may be increased and I should cease diving and discuss the issue with Dr…… again.
9. That I should not dive during any period likely to be associated with worsening of my glycaemic control, such as during a cold or other illness.
10. That if I find diving precipitates any problems in relation to my diabetes, I should cease diving forthwith and seek review with Dr …….
11. That I understand the necessity to more closely monitor and adjust my glucose levels on diving days, in accordance with the diabetic diving guidelines.
12. That I have read, understood, and had an opportunity to ask questions about the diabetic diving guidelines.
13. That I understand the necessity to inform my dive buddy and dive group about my diabetes.
14. That I must undergo annual review with Dr…….. or another diving doctor as long as I continue to dive.

Finally, I understand that

15. being informed of the above issues, having had my questions answered, and having been counselled about my risk in diving, I accept that I am responsible for my decision to dive. I hold no one else responsible for any adverse consequences of this decision.

Signed:…….....……Date:……

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