## COVID-19 Guidance for Referees – Revision 1

This revision takes into account the growing, but still limited, evidence base currently available, the introduction of a COVID-19 vaccination programme in the United Kingdom and the reported outcomes from the Health and Safety Executive's guidance on return to diving after COVID-19 for working divers. It is designed to minimise risk while avoiding restrictions and medical investigations that would deter divers from declaring issues that require assessment.

In order to minimise any confusion or apparent inconsistency, the guidance for recreational divers is now more closely aligned to HSE's guidance for working divers with adjustments to account for the minimum exercise capacity required of working divers which is more likely to identify a deficit in gas exchange.

Table 1 is an adaptation of the HSE guidance on return to diving. [1] Divers who were asymptomatic throughout their illness or had mild symptoms can use the total score from Table 2 to decide whether they need to contact a medical referee.

**Table 1**

| COVID-19 status | Minimum recovery time (with no symptoms) before diving can resume | Table 2 total score | Assessment by a UKDMC Medical Referee required | Notes |
|---|---|---|---|---|
| Previously asymptomatic and tested positive for coronavirus | 1 month | 4 to 5 | No | |
| | | 0 to 3 | Yes | |
| Previously had mild symptoms that recovered completely within a week. Back to your usual levels of fitness | 1 month | 4 to 5 | No | Symptoms are mild if they are relatively minor (no shortness of breath), self-limiting and resolve within 7 days. |
| | | 0 to 3 | Yes | |
| Previously had moderate symptoms. Back to your usual levels of fitness | 2 months | Any | Yes | Symptoms are moderate if they are more than mild but not severe enough to require hospitalisation. |
| Previously had severe symptoms requiring hospitalisation. Back to your usual levels of fitness | 3 months | Any | Yes | Symptoms are severe where an individual requires hospitalisation, for example, because of serious respiratory problems resulting from COVID-19. |

**Table 2**

| Factor | Score |
|---|---|
| Can answer "No" to all questions on the current Recreational Diving Medical Declaration. **ADD 2 POINTS** | |
| Age less than 45 [2]<br>OR<br>Received a full primary course (eg 2 doses of Pfizer, 2 doses of Astra Zeneca, 1 dose of Janssen) of any COVID-19 vaccine approved by UK Government [3] at least 2 weeks before first symptoms or diagnosis of COVID-19. [4] **ADD 1 POINT** | |
| Physical fitness (see standards below *)<br>for 'GOOD' **ADD 2 POINTS**<br>for 'SATISFACTORY' **ADD 1 POINT** | |
| **TOTAL** | |

*A recreational diver with a satisfactory standard of physical fitness can run 1.5 miles / 2.4 km in 20 minutes 30 seconds, or complete other exercise equivalent to a $VO_2$ Max of 7 METS (24.5 ml / kg /min) [5] [6]

*A recreational diver with a good standard of physical fitness can run 1.5 miles / 2.4 km in 12 minutes 30 seconds, or complete other exercise equivalent to a VO2 Max of 11.4 METS (40 ml / kg /min) [7]

## Guidance notes

1. Divers who have no known exposure to SARS-CoV2 and had no symptoms of COVID-19 may still have suffered asymptomatic disease which can be associated with damage to the lungs[8], heart and other organs which could lead to injury or death whilst diving. Contacts of known COVID-19 cases should follow the current guidance on testing and self-isolation. Undertaking medicals and / or invasive testing on all divers would be impractical and, since the risk is deemed to be low, there is no restriction on diving for individuals with no symptoms who do not have a positive diagnosis of COVID-19.

2. In one study clinical symptoms and signs did not predict lung involvement visible on Low Dose CT, but age greater than 54 years and diabetes were risk factors for more extensive lung involvement, and rhinitis and anosmia appeared to protect against lung involvement.[9] Several studies have reported that lung lesions are visible on CT imaging in similar proportions of patients whether they have asymptomatic, paucisymptomatic or mild to moderate disease. Case series have shown abnormalities persisting for at least 14 days after onset of symptoms in patients who did not have severe respiratory distress or require oxygen at any time.[10] While these lesions can last for many months and some are expected to fibrose and to become permanent, lesions visible in a significant proportion of asymptomatic to moderate cases have resolved completely within 2 to 3 weeks.[11] As a result, divers with asymptomatic disease or mild short-lived symptoms are advised to wait at least one month from when they have recovered before they return to diving. Neurological deficit and cognitive impairment have been associated with COVID-19, more usually in illness severe enough to require hospitalisation, and must also be considered.[12, 13,

[14] The diver can then be assessed as indicated below provided they are back to their previous level of aerobic fitness and have recovered neurologically and cognitively.

3. Divers with severe symptoms are likely to undergo a structured programme of follow up [15] and, if there is objective evidence that lung lesions have resolved, then a return to diving can also be considered for this group provided the candidates are back to their previous level of aerobic fitness and have recovered neurologically and cognitively.

**Referee Consultation Guidance**

Assessment of divers who are asymptomatic throughout their infection or had mild symptoms: This will depend on the reason why the diver requires assessment. If the candidate has answered yes to a question in the Recreational Diving Medical Declaration which is unrelated to risks arising from COVID-19, then the medical referee will decide whether physical examination and / or investigation are required before the Recreational Medical Certificate can be signed. If they have an underlying medical condition which increases their risk of lung lesions, such as diabetes, then they are likely to require a more detailed assessment similar to that for divers with moderate or severe symptoms, depending on the Medical Referee' s clinical judgement.

Assessment of divers who have had moderate or severe symptoms of COVID-19: A careful history should be taken. Where the history is consistent with ongoing respiratory, cardiac or cognitive symptoms or other unresolved issues that impact adversely on diving safety, the diver is unfit to dive. If the diver has returned to their previous level of physical fitness and cognitive function, a medical examination should be carried out per existing guidelines with the following additional tests recommended:

a) Pulse assessment for 15 to 60 seconds [16] and at least long enough to determine if there are frequent ectopic beats. If frequent ectopic beats are detected or if the history indicates concerns such as palpitations, an ECG should be performed. If the ECG shows frequent ventricular ectopic beats or evidence of repolarisation changes (ST segment or T wave changes) or LBBB, the diver should be referred to a cardiologist for further investigation which should include an echocardiogram.

b) An exercise test (such as the Chester step test) with oxygen saturation monitoring. Do not proceed if the resting saturation is lower than 96%.[17] Comparison with previous exercise test results is useful (if available). A drop in $O_2$ saturation of more than 3% on exercise or an unexpected deterioration in exercise capacity (estimated $VO_2$ max) compared to previous values would preclude certification of fitness to dive. The test should be conducted and terminated as normal, but the result can only be accepted if the diver reaches and can maintain at least 7 METS ($VO_2$ 24.5 ml/kg/min) for 2 minutes before reaching any criteria for termination. Using the Chester Step Test this would require completion of Stage V with a 15 cm step or Stage III with a 30 cm step.[18]

c) Exclude any significant neurological or cognitive impairment

Those who required admission to hospital with COVID-19 are at very high risk of lung changes which can persist. Wu et al (2021) followed up a population of non-smokers with no

history of hypertension, diabetes, cardiovascular diseases, cancer, asthma or COPD with median age 60 years and median body-mass index 25·1 kg/m² who had severe COVID-19 but did not require invasive mechanical ventilation. Residual lung changes on CT were seen in 78% at 3 months after discharge and in 24% at 12 months. Length of hospital stay, peak HRCT pneumonia scores during hospitalisation, and requirement for High Flow Nasal Cannulae or Non Invasive Ventilation were associated with abnormal HRCT at 12 months after discharge. [19]

Huang et al (2021) followed up a population of hospitalised COVID-19 survivors with pre-existing co-morbidities at 6 and 12 months after discharge. The CT results are summarised below. [20]

| | Proportion of patients with at least one abnormal CT pattern | |
|---|---|---|
| | 6 months | 12 months |
| Scale 3: not requiring supplemental oxygen | 33/33 (100%) | 11/28 (39%) |
| Scale 4: requiring supplemental oxygen | 56/56 (100%) | 21/52 (40%) |
| Scale 5–6: requiring HFNC, NIV, or IMV | 39/39 (100%) | 33/38 (87%) |

Han et al found that approximately one-third of participants who had recovered from severe COVID-19 developed fibrotic-like changes in the lung within 6 months of disease onset. Older age (over 50 years), acute respiratory distress syndrome, and higher baseline CT lung involvement score (18 or more out of a possible score of 25) were associated with fibrotic-like changes in the lung.[21]

The diver will need to have returned to their previous level of fitness. In addition to the testing mentioned above, they will require more comprehensive chest imaging and possibly laboratory-based lung function testing, including assessment of residual volume. This is expensive and currently not available due to capacity issues within the NHS. It is however possible that these patients will have such tests undertaken as part of their post COVID-19 follow up from their hospital team.

**Referee Notes**

It is anticipated that a Referee's clinical judgement and shared decision making with the diver will form a large part of the fitness to dive assessment, especially with regard to the known and unknown potential risks of diving post COVID-19. In particular, the relationship of the lung changes to pulmonary barotrauma and consequent decompression illness is not known.

Where a diver has been found unfit to dive, it is expected that appropriate explanation is given and follow up advised through the diver's primary or secondary care teams as appropriate. It is unlikely that a Referee would be best placed to arrange further investigations themselves as interpretation and follow up of results along with the current logistical issues of arranging such tests is complex.

Divers in very low and high risk groups may seek additional reassurance of dive fitness through chest imaging or pulmonary function testing. It is important to note that while this may be feasible and a normal result reassuring, there are likely to be a proportion where

abnormalities are found. Translating such abnormalities into barotrauma risk or knowing if further investigation is then appropriate (especially if large radiation doses or significant cost is involved) is very complex and this should be discussed with the diver in advance. The sensitivity and specificity of identifying those at risk of pulmonary barotrauma or other complications such as immersion pulmonary oedema using investigations such as desktop spirometry, peak flow measurements, chest plain films or CT imaging is currently unknown but these tests may be considered based on clinical judgement.

The Association for Respiratory Technology and Physiology (ARTP) suggests a range of tests including spirometry for clinical follow up after COVID-19.[22] Simple desktop spirometry will, however, be difficult to interpret in the absence of results prior to exposure to, or infection with, SARS-CoV2. In one series FVC, FEV1, FEV1/FVC and mid-expiratory flows were in the expected range in the large majority of 110 patients at discharge. The only spirometry measurement that reached statistical significance in this series was $FEF_{75\%}$ in the 19 patients who had severe pneumonia, of whom 5 had values lower than 65% of predicted.[23] A more recent review by Thomas et al (2021) concludes that spirometric indices appear to be generally well preserved, but that reductions in total lung capacity are commonly reported and a defect in diffusing capacity (DLco) is present in 20–30% of those with mild to moderate disease and 60% in those with severe disease and improves in most cases during a 3–6-month convalescent period.[24] Spirometry is, however, simple, widely available and non-invasive so, although the information above suggests that an abnormal result is unlikely to be due to COVID-19, it would be a trigger for further assessment in any diver regardless of the underlying abnormality. It might also be useful as a baseline for follow-up of a candidate who has not yet fully recovered since objective evidence of further deterioration, instead of an improvement, would be a valuable prompt for the diver to seek advice from their general practitioner. When considering spirometry, ARTP guidance or other appropriate procedures for infection control should be taken into account.

According to the British Thoracic Society Guidance, follow-up chest x-rays are likely to be offered routinely to all patients who had abnormalities on imaging whether they were admitted to hospital or were assessed in hospital but then cared for in the community. Some of these patients will be discharged with a normal chest x-ray and others will proceed to more detailed investigation which will be useful when eventually reviewing fitness to dive. There will be some divers who lack objective evidence of resolution, such as those who are discharged from secondary care with “minor insignificant changes”, others who had symptoms but no imaging and asymptomatic divers with evidence of past infection. Although the radiation risk associated with a chest x-ray is low, there is currently no evidence regarding the significance of some of the lung abnormalities seen in COVID-19 on which to base clear advice for or against further imaging and its optimal timing, especially if abnormalities persist and repeat imaging needs to be considered. It is also worth bearing in mind that a chest x-ray might miss lesions related to COVID-19 that would have been identified by a CT scan.[25] Where guidance already exists for an abnormality, such as pneumothorax, this should be followed. In other circumstances, the medical referee will either need to seek specialist advice or to make a decision on the requirement for further imaging based on an overall assessment of risk, taking into account factors such as the likelihood of infection with SARS-CoV2, the nature and severity of symptoms and the type, distribution and number of lesions last shown on imaging.

**Background**

To date, UKDMC has adopted a conservative approach in order to accommodate the gaps in the evidence base relevant to diving after COVID-19.

At the UKDMC conference on 4 November 2021, a presentation by DDRC Healthcare, and subsequent discussion including Dr Steve Forman representing the UK Health and Safety Executive, concluded that:

- lung lesions occur in a significant proportion of cases of symptomatic and asymptomatic COVID-19
- many other viral infections of the lung cause similar lesions but infections other than COVID-19 do not require additional investigations or precautions beyond those justified on clinical grounds.
- the risk of pulmonary barotrauma arising from these lung lesions has not been quantified
- there have been no cases of pulmonary barotrauma reported in individuals who have returned to diving after COVID-19 in accordance with the UK Health and Safety Executive's guidance for working divers

In view of these observations, the UKDMC guidelines have been relaxed by aligning them more closely with the HSE guidance on return to diving after COVID-19.

**Review of Guidelines**

This guidance is based on current understanding at the time of writing, but all Medical Referees should continue to remain up to date with latest data on COVID-19.

The references below have been used in the development of these guidelines and may form a useful adjunct for clinical decision making and discussions with divers.

The committee will review this document at least every 3 months or earlier if important new evidence becomes available. If you find any new information that you think is relevant, please let the committee know via http://www.ukdmc.org/contact-us/.

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