

# Vaccines and variants: an update on cardiopulmonary assessment prior to return to high-hazard occupations following COVID-19

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## Background

The Aviation and Occupational Cardiology Task Force of the European Association of Preventative Cardiology produced a position statement providing the recommendations for the return of individuals to high-hazard occupations (including flying, diving, and remote workplaces) following symptomatic coronavirus disease 2019 (COVID-19) in early 2022.<sup>1</sup> This position statement was based on the initial variants of COVID-19, in a predominantly unvaccinated population, and recommended the use of a systematic combined clinical and occupational assessment, for those deemed at high risk following clinical risk triage, using specialist cardiopulmonary evaluation (including peak exercise capacity and imaging, where appropriate). Cardiopulmonary exercise testing was central to this assessment, as the gold-standard exercise test modality, and has now been shown to have utility in identification of exercise limitation, ventilatory inefficiency, and other abnormal physiology in hospitalized and non-hospitalized individuals who have been infected with COVID-19.<sup>2,3</sup>

Since the release of the original position statement, COVID-19 has evolved, through the Delta and Omicron variant waves, with large-scale vaccination programmes introduced to mitigate the worse impact of the disease. This update of the initial position statement aims to update the recommendations for the safe return of

individuals to high-hazard activities following COVID-19, considering these changes.

## Omicron variant

New variants of SARS-CoV-2 (especially Delta and Omicron) has contributed to the rise in case numbers, with new variants typically less severe and easier to transmit than their predecessors.<sup>4</sup> However, despite acute COVID-19 illness being less severe and of shorter duration, persistent symptoms remain prevalent.

Acute illness with the Omicron variant has had a different set of presenting features than the variants which preceded it, with less involvement of the lower respiratory tract.<sup>5</sup> It also had lower risk of hospitalization when compared with illness with the Delta variant.<sup>6</sup>

Those with Omicron were also seen to have a shorter period of illness and were twice as likely to recover within a week. However, importantly for a working-age cohort, those who were hospitalized, were typically younger, with shorter stays in hospital and reduced oxygen requirements (though some of these effects might be attributable to be higher levels of natural and vaccine-induced immunity).<sup>6</sup>

Omicron often presents as a more ‘flu-like’ condition, with less emphasis on the original cardinal symptoms, such as anosmia, and breathlessness, therefore the flowchart (*Figure 1*) has been updated from the

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	COVID-19 symptoms			Action for Employer	Clinical and Occupational Advice
	1 Jan 20	4 weeks ago	Present		
1.	Critical care hospitalisation (ITU/HDU/CPAP) at any time			Refer employee for initial telephone assessment with primary care provider.	May return to work after medical assessment, but remain on limited duties with <b>no strenuous physical exertion</b> until reviewed.
2.	Other HOSPITALISATION/SEVERE cardiorespiratory symptoms at any time			Refer employee for initial telephone assessment with primary care provider.	May return to work after medical assessment, but remain on limited duties with <b>no strenuous physical exertion</b> until reviewed.
3.			Symptoms now	Ensure employee has accessed appropriate medical care.	Manage as per clinical guidelines. Reassess when symptom-free for 4 wks. <b>If symptoms persist &gt;4 weeks from onset of the acute illness: use COVID-19 assessment tool.</b>
4.	MODERATE cardiorespiratory symptoms			Refer employee for initial telephone assessment with primary care provider.	Use COVID-19 assessment tool / assess need for further tests and referral for specialist assessment.
5.	MILD cardiorespiratory symptoms			4 week graduated return to fitness, prior to commencing work	Graduated return to exercise/employment.
6.	Flu-like symptoms only (no cardiorespiratory symptoms)			≤5 days – self certified return >5 days – refer for assessment and consider graduated return to fitness	≤5 days of symptoms - Unrestricted. >5 days of symptoms – consider graduated return to exercise / employment
7.	NO symptoms at any time			No action required.	No exercise/employment limitations, no need for investigation*.

**Symptom Severity**  
Judgement by patient-facing clinician. Predominantly based on **breathlessness**.

- **Mild** – breathlessness on significant exertion (2-3 flights of stairs)
- **Moderate** – breathlessness on minimal exertion/ADLs or history of chest pain/fast palpitations or pre-syncope.
- **Severe** – breathlessness at rest, persistent chest pain, syncope.

**Notes**

1. No strenuous physical exertion should be undertaken until symptom free for 4 weeks.
2. Specialist occupations may require additional specialist advice (i.e. flying/diving).

\* **If employee becomes symptomatic - re-enter pathway**

**Figure 1** An example flowchart for post-COVID-19 risk-assessment for high-hazard employers to use for their employees.

one published previously,<sup>1</sup> to reflect this, adding a specific category for 'Flu-like symptoms only, in the absence cardiorespiratory symptoms'.

## Vaccinations

A global vaccination programme against COVID-19 was commenced at the end of 2020, with over 12 billion doses administered globally by June 2022. These vaccines, based on traditional vaccine development techniques or novel mRNA techniques, have successfully reduced mortality and hospital admissions, slowed transmission, and reduced prolonged morbidity.<sup>6</sup> From an occupational point of view, two important questions remain; what the effect of vaccination on the disease process is and what are the potential side effects following vaccination.

Vaccine effectiveness against symptomatic infection is as high as 94%, with an effect against severe disease remaining for up to 6 months<sup>7</sup> including for prevention of hospitalization.<sup>6</sup> For transmission or symptomatic disease, there is a significant drop in protection at 6 months, suggesting the potential need for repeat immunizations.<sup>7</sup> As a result, it has been national guidance in many countries for individuals to undergo scheduled vaccinations, with certain organizations also recommending or mandating this for their employees.

Given this, it is important that the safety profile for this intervention is understood. Myo-pericarditis has been one of the most described adverse effects, especially following administration of Pfizer-BioNTech (BNT162b2) or Moderna (mRNA-1273) vaccines. In the UK, the MHRA reported nine cases per million of myocarditis

and 6 per million of pericarditis, with 17 per million and 10 per million following the use of the Moderna vaccine.<sup>8</sup> Whilst the risk of myo-pericarditis was mildly increased, especially following the second dose, the overall incidence of myo-pericarditis remained low, and the risk-benefit profile continues to support vaccination, and boosters.<sup>9</sup>

The rate of 'breakthrough' infection in vaccinated individuals is ~10%, with this rate increasing as time from vaccination increases,<sup>10</sup> meaning it is important to not exclude SARS-CoV-2 as the aetiology in individuals who have been vaccinated, and to manage them in a similar manner to those who are unvaccinated.

## Conclusion

Coronavirus disease 2019 and its associated sequelae continue to evolve with new variants and widespread vaccination. Those undertaking high-hazard occupations remain an increased risk cohort, often because of the cardiopulmonary stressors arising from their working environment. It remains imperative that organizations fulfil their duty of care to their employees and wider society to ensure a safe return to full duty for those employed in high-hazard occupations. The proposed updated flowchart offers one such pathway.

## Author contributions

All authors contributed to the conception of the work. O.O'. and E.N. drafted the manuscript. C.H.D. and D.H. critically revised the

manuscript. All authors gave final approval and agreed to be accountable for all aspects of work ensuring integrity and accuracy.

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