# Pulmonary Diagnostics: Hypoxic Challenge (Altitude Simulation Test)

## Site Applicability

St. Paul's Hospital

## Practice Level

Respiratory Therapist

## Requirements

Hypoxic challenge testing (HCT) is used to help determine whether a person with respiratory disease needs in-flight oxygen; it does not assess fitness for air travel.

Persons currently requiring long term oxygen therapy will not be assessed for in flight oxygen.

A respiratory therapist must directly observe the patient spontaneously breathing 15% $O_2$ gas mixture for the entire duration of testing.

## Need to Know

HCT uses an inspired gas mixture containing 15% oxygen. This hypoxic gas mixture gives an approximate similar inspired oxygen tension ($PO_2$) to breathing air at the maximum allowable cabin pressure altitude (8000 feet).

**Indications:**

Possible indications include the following, although need for testing is assessed in the specific patient context:

- Resting $SpO_2$ 88% to 95% on room air
- Exercise induced hypoxemia
- Previous respiratory related air travel intolerance
- Chronic lung disease at risk of in-flight hypoxemia
- Recent respiratory exacerbation or respiratory related discharge from hospital
- Severe respiratory muscle weakness or chest wall deformity in whom FVC is less than 1 L

**Contraindications:**

- Resting $SpO_2$ less than 88% on room air

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## Equipment and Supplies

- Pulse oximeter
- Hypoxic challenge worksheet
- Hypoxic challenge gas cylinder containing 15% oxygen, balance nitrogen
- Hans Rudolph one-way valve
- Silicone mouthpiece
- Microgard filter
- Nose clips
- Small bore $O_2$ tubing
- Reservoir bag

## Procedure

### Steps

1. Measure the patient's $SpO_2$ on room air while resting. Monitor pulse oximetry for a minimum of 2 minutes to obtain an accurate measurement.
2. Use large reservoir bag set up with $O_2$ tubing attached directly to 15% oxygen gas. Open the tank, and allow reservoir bag to fully inflate with 15% oxygen gas mixture.
3. Ensure nose clips are secure by instructing the patient to perform a sniff test. Coach the patient to form a tight lip seal on the mouthpiece of the Hans Rudolph valve system and encourage them to breathe normally from the hypoxic gas mixture.
4. Using HCT worksheet, record $SpO_2$ each minute for 15 minutes. If $SpO_2$ is above 92% by the end of 15 minutes, conclude the test. If $SpO_2$ is not stable by the end of 15 minutes, extend the test duration to 20 minutes and record $SpO_2$ at each additional minute.
5. If $SpO_2$ remains below 88% for greater than 2 minutes, stop the test and record the recovery time.
6. If $SpO_2$ remains between 88% to 92% after 15 minutes, obtain an arterial blood gas sample while the patient is still breathing the hypoxic challenge gas. See: B-00-12-12002 – Arterial Blood Gas Puncture (Respiratory Therapy).
7. Remove patient from the reservoir system, discard nose clips, and monitor the resting $SpO_2$ on room air to ensure the patient's $SpO_2$ is greater than 89%.

### Documentation

- Complete "Hypoxic Altitude Simulation Test" PowerForm within CST PowerChart. Print one copy for interpretation.
- If an ABG sample was obtained, complete the "RT Blood Gas Puncture Collection" PowerForm within CST PowerChart. Print one copy of ABG lab results for interpretation.

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## References

2022 BTS Clinical Statement on air travel for passengers with respiratory disease

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| | Respiratory Therapy |

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