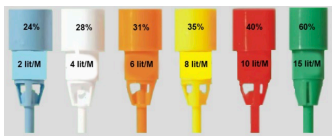
# OXYGEN DELIVERY DEVICES

Minute Ventilation (MV) = $V_T$ × RR
Peak Inspiratory **Flow Rate** (PIFR) = how fast you draw your breath in  PIFR is influenced by MV (↑RR → ↑PIFR)

$O_2$ delivery devices are either variable or fixed, indicating how they're affected by PIFR

If $O_2$ delivery device's flow rate does not meet PIFR (or there is an inappropriate seal) → room air entrainment → $FiO_2$ < expected

High flow rates (eg, HFNC) & sealed systems deliver more predictable $FiO_2$ because the flow rate ≥ PIFR & decreases entrained room air

| DEVICE | | $F_iO_2$ | NOTES |
|---|---|---|---|
| **Low Flow Devices** | | | Quick estimate: Every 1L of flow provides an additional ~3% of $FiO_2$ |
| **Nasal cannula (NC)** |  | ~24-40% | • Easy to administer<br>• Variable flow/$F_iO_2$ relationship<br>• Keep flow ≤ 6 L/min<br>*(Flow > 6 L/min is irritating and provides no increase in $FiO_2$)*<br>• Humidify if > 4 L/min |
| **Simple Facemask** |  | ~24-50% | • Better for patients that breath through their mouth<br>• Often mistaken for NRB; not to be used for resuscitation<br>• Keep flow > 5 L/min to avoid rebreathing trapped $CO_2$<br>• Max flow 10L/min |
| **Reservoir Systems** | | | |
| **Oxymizer** |  | ~24-45% | • Small reservoir stores O2 and delivers 'push' of high $FiO_2$ oxygen with inspiration<br>• Delivers slightly higher $FiO_2$ than NC at same L/min flow |
| **Non-Rebreather mask (NRB)** |  | Theoretical: 100%<br>Realistic: ~60-90%<br>(due to entrainment of room air) | • Easy way to deliver high FiO2 quickly & non-invasively<br>• Go-to for acute hypoxemia (ie, rapid response)<br>• Keep flow > 10-15 L/min<br>• Tachypnea → ↑ room air entrainment |
| *NRBs are designed to capture the first 150mL of exhaled breath into a reservoir bag for inhalation during the subsequent breath. This portion of the breath was initially delivered to the deadspace anatomy at the end of inhalation, so gas exchange did not occur. Therefore, there would be no depletion of oxygen nor gain of $CO_2$ during rebreathing.* | | | |
| **High Flow Devices** | | | |
| **Venturi mask** |  | ~24-60%<br>  | • Consider in patients with specific $SpO_2$ goals (eg, COPD)<br>• Specific valves allow you to administer fixed $F_iO_2$, independent of RR or $V_T$<br>• The higher the $FiO_2$, the lower the flow rates |
| *Originally thought to operate on the Venturi effect, however, Venturi masks actually utilize **jet mixing**, a corollary to **Bernoulli's Principle**, which states that fluids (air/$O_2$) moving at higher speeds exert less outward pressure. Venturi masks deliver a high flow of $O_2$ through a small input nozzle in the mask; openings in the mask adjacent to the inflow of delivered $O_2$ allow for room air to be drawn in (entrained) due to the lower outward pressure exerted by the $O_2$ jet. The flow of room air drawn in is predictable based on the set flow of the $O_2$ jet, producing an accurate and fixed $FiO_2$ regardless of RR or $V_T$.* | | | |
| **High-flow nasal cannula (HFNC)** |  | ~21-100%<br>10-60 L/min of flow | • Provides small amount of PEEP<br>• Flow rate and $FiO_2$ can be titrated separately<br>• High flows minimize $O_2$ dilution (even in mouth breathers)<br>• Aids in $CO_2$ washout and ↓ dead space |