P/F Ratio Calculations – Supplement to CDI Pocket Guide

The P/F ratio is a powerful objective tool to identify acute hypoxemic respiratory failure at any time while the patient is receiving supplemental oxygen, a frequent problem faced by documentation specialists where no room air ABG is available or pulse ox readings seem equivocal.

The P/F ratio equals the arterial pO_2 ("P") from the ABG divided by the FIO_2 ("F") – the fraction (percent) of inspired oxygen that the patient is receiving expressed as a decimal (40% oxygen = FIO_2 of 0.40).

A P/F Ratio less than 300 indicates acute respiratory failure.

Many physicians are unfamiliar with the P/F ratio, but it has been validated and used in the context of ARDS for many years, where acute respiratory failure is called "acute lung injury." A P/F ratio < 300 indicates mild ARDS, < 200 is consistent with moderate ARDS and < 100 is severe ARDS. The P/F ratio indicates what the pO2 would be on room air:

P/F ratio **< 300** is equivalent to a **pO_2 < 60 mm Hg** on room air
P/F ratio **< 250** is equivalent to a **pO_2 < 50 mm Hg** on room air
P/F ratio **< 200** is equivalent to a **pO_2 < 40 mm Hg** on room air

Example: Suppose the pO_2 is 90mmHg on 40% oxygen (FIO_2 = .40). The P/F ratio = 90 divided by .40 = 225. The pO_2 on room air in this case would have been about 45 mmHg (well below the "cut-off" of 60mmHg).

The P/F ratio should not be used to diagnose acute-on-chronic respiratory failure since many patients with chronic respiratory failure already have a P/F ratio <300 (pO2 <60 mmHG) in their baseline stable state. That's the reason they are treated with chronic supplemental home oxygen.

SpO2 translated to PO2

The arterial pO_2 measured by arterial blood gas (ABG) is the definitive method for calculating the P/F ratio. However, when the pO_2 is unknown because an ABG is not available, the **SpO_2 measured by pulse oximetry** can be used to approximate the pO_2, as shown in the Table below. It is important to note that estimating the pO_2 from the SpO_2 becomes unreliable when the SpO_2 is 98% - 100%.

Conversion of SpO2 to pO2

SpO2 (percent)	pO2 (mm Hg)
86	51
87	52
88	54
89	56
90`	58
91	60
92	64
93	68
94	73
95	80
96	90
97	110

The SpO2/pO2 conversion becomes unreliable when SpO2 is $\geq$ 98%.

Example: Suppose a patient on 40% oxygen has a pulse oximetry SpO_2 of 95%. Referring to the Table above, SpO_2 of 95% is equal to a pO_2 of 80mmHg. The P/F ratio = 80 divided by 0.40 = 200. The patient may be stable receiving 40% oxygen, but still has severe acute respiratory failure. If oxygen were withdrawn leaving her on room air, the pO_2 would only be 40 mmHg (much less than the cut-off for acute respiratory failure of 60 mmHg on room air).

Translating Supplemental Oxygen: FIO_2 (percent) and liters per minute

Supplemental oxygen may be administered either by mask or by nasal cannula ("NC"). A **Venturi mask** (Venti-mask) delivers a controlled flow of oxygen at a specific fixed concentration (FIO_2): 24%, 28%, 31%, 35%, 40%, and 50%. The **non-rebreather ("NRB") mask** is designed to deliver approximately 100% oxygen. Providing 40% or more supplemental oxygen implies that the physician is treating acute respiratory failure since only a patient with acute respiratory failure would need that much oxygen.

A **nasal cannula** provides oxygen at adjustable flow rates in liters of oxygen per minute (L/min or "LPM"). The actual FIO_2 (percent oxygen) delivered by nasal cannula is somewhat variable and less reliable than with a mask, but can be estimated as shown in the Table below. The FIO_2 derived from nasal cannula flow rates can then be used to calculate the P/F ratio.

Flow Rate	FIO2
1 L/min	24%
2 L/min	28%
3 L/min	32%
4 L/min	36%
5 L/min	40%
6 L/min	44%

Assumes room air is 20% and each L/min of oxygen = +4%.

Example: A patient has a pO_2 of 85mmHg on ABG while receiving 5 L/min of oxygen. Since 5 L/min is equal to 40% oxygen (an FIO_2 of 0.40), the P/F ratio = 85 divided by 0.40 = 212.5.