Diffusion capacity (DLCO) measures the factors that affect the movement of a diffusion-limited gas across the alveolar-capillary membrane. Carbon monoxide combines with hemoglobin about 210 times more readily than oxygen, but is otherwise similar to oxygen. In the presence of normal amounts of hemoglobin and normal ventilatory function, the main limiting factor to diffusion is the status of the alveolar-capillary membrane. Because of the high binding affinity, small concentrations of carbon monoxide in inspired gas produce measurable changes in the concentration of inspired versus expired gas. Different pulmonary function labs use different techniques to measure diffusion, but all methods measure diffusion capacity according to the general equation:

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DLCO = \frac{\text{ml CO transferred/min}}{P_{ACO} - P_{cCO}}
\]

The average value for resting adults is 25 mlCO/min/mmHg. Females show slightly lower normal DLCO, due to lower lung size. DLCO in the normal subject can increase 2-3 times during exercise. The normal values are derived through a regression equation taking into account sex, age, and height.

Numerous factors can influence the observed DLCO.

1. Hemoglobin and hematocrit - Decreased hemoglobin and hematocrit decrease the observed DLCO. Thus the PFT lab may “correct” the DLCO for the low hemoglobin. This will be denoted on the report if done.

2. Carboxyhemoglobin – Elevated carboxyhemoglobin levels, as found in heavy smokers, reduce CO diffusion causing significant CO “back pressure” to diffusion across the membrane. There is no correction factor for this problem. Just know that elevated carboxyhemoglobin levels will artificially reduce the DLCO.

3. Pulmonary capillary blood volume – Increased blood flow increases the DLCO. Increased amounts of hemoglobin are coming in contact with the CO, so more diffusion.

4. Body position – Supine position increases DLCO. Changes in body position affect the volume of capillary blood flow.
In general, diffusion capacity is decreased in alveolar fibrosis associated with sarcoidosis, asbestosis, berylliosis, oxygen toxicity, or pulmonary edema. These states are sometimes referred to as “diffusion defects”, although they are probably more closely related to the loss of lung volume or capillary bed (restrictive lung disease with decreased TLC). It would take a significant increase in the alveolar-capillary membrane thickness to cause a measurable abnormality in the diffusion through the membrane. DLCO is decreased in emphysema due to loss of capillary bed, increased distance from the terminal bronchiole to the alveolar-capillary membrane and mismatching of ventilation and blood flow. DLCO is also decreased by parenchymal loss or replacement (space occupying lesions or lung resection).