A DLCO simulator creates a precisely known target DLCO value by drawing in a known volume and injecting known concentrations of gases into a DLCO instrument. DLCO simulations were performed weekly on each of three instrument models used in our pulmonary laboratory. High precision test gases (±1%) were used for both the simulator and for the instruments. An inspired volume of 4.5 L was used for all tests. At each test session eight simulations were done on each device, four each with mid-level and low-level simulated alveolar gas samples. The first trial of each set was discarded as a system flush. The remaining three trials were analyzed. A difference from target of ±2 DLCO units (mL/CO/min/mmHg) was set as the threshold to initiate an investigation into possible causes of error. In addition, two bio-control subjects were concurrently tested to study it missed all but one of the equipment failures, found to be out of compliance.

Background Most labs use biological controls to monitor lab test quality for both spirometry and DLCO are measured. Three forced vital capacity (FVC) maneuvers and two DLCO maneuvers that meet ATS criteria are performed.

Study Design In our laboratory, DLCO simulations are performed once a week on each of three instruments. Simulations are also performed when a test gas tank is changed, when the equipment is serviced, and if there are any significant changes to the equipment (valves, sensors, etc.). Each instrument is calibrated daily with a standard 3.0 liter syringe. All gases used for patient testing are ordered to be gravimetrically mixed and labeled as "Primary" standards with accuracies of ±1% of the concentrations reported on the analysis certificate. DLCO simulator test gases are typically gravimetrically mixed into small ED cylinders by Parnian Bennett for Hans Rudolph, Inc.

Bio-controls are also performed weekly on each DLCO instrument. Both standard and DLCO maneuvers are measured. Three forced vital capacity (FVC) maneuvers and two DLCO maneuvers that meet ATS criteria are performed.

Protocol For each simulation, the DLCO instrument is calibrated prior to beginning a DLCO maneuver. The large inspiratory volume syringe is used to perform tidal breathing (simulating a patient). At the end of the inhalation the DLCO maneuver is initiated. Again using the large syringe, 4.5 L of test gas is "inhaled" and held for two seconds. As the end of the two second breath hold time (BHT) approaches the two-way valve is turned to allow "exhalation" using the simulated alveolar gases in the small gas syringe. The reported DLCO, inspired volume, breath-hold time, and the simulated gas concentrations are entered into the simulator’s software (EasyLab QC). The EasyLab QC software calculates a simulator target value for each trial based on device specifications, daily lab barometric pressure and temperature, the simulator inspired volume, and the breath hold time. Each target value was compared to the DLCO value reported by the DLCO instrument by subtracting the two to create a difference.

Most labs use biological controls to monitor lab test quality for both spirometry and DLCO. Recent DLCO studies were introduced as another means to check devices and maintain lab quality. With a simulator, known volumes and concentrations of gas are injected and removed from a DLCO instrument simulating patient tests with a precisely known target value. The accuracy and precision of DLCO measurements can be tracked for each device in a Pulmonary lab to ensure proper instrument performance.