Noninvasive Carboxyhemoglobin Monitoring: Screening Emergency Department Patients for Carbon Monoxide Exposure.
Partridge R., Chee K.J., Suner S., Sucov A., Jay G.D.   *Respir Care.* 2006; 51(11):1332.

Background
Carbon monoxide (CO) poisoning is a significant cause of mortality and morbidity. Symptoms of CO poisoning can be non-specific, so the clinician must have sufficient suspicion to order a venous carboxyhemoglobin (COHb) level. Assessing COHb levels noninvasively on all emergency department (ED) patients provides an opportunity to identify CO poisoning and determine the prevalence of occult cases. Objectives: Assess baseline COHb levels in ED patients using a non-invasive device and correlate these levels with known clinical and demographic data.

Methods
A retrospective chart review was conducted on all adult patients presenting to an urban academic ED (annual adult census 95,000 patients). One month prior to chart review, noninvasive Pulse CO-Oximeters (Rad-57, Masimo,Corp.) were placed at ED triage to assess baseline COHb levels as part of the standard ED triage process. Baseline COHb levels were correlated with age, gender, smoking history, mode of transportation, and vital signs. Wilcoxon Rank Sum tests and ANOVAs were used to analyze correlation data with $p < 0.05$ considered significant.

Results
Of 6861consecutive ED patients over a 39 day period, 4955 (72.2%) had COHb levels documented at triage. Mean age was 44.6 (19.4 SD) years, 49.5% were female, and 31.7% were smokers. Mean COHb level was 3.59% (3.26% SD) with a range of 0-22%. Males had higher COHb levels than females [3.81% (3.35% SD) vs. 3.37% (3.16% SD)], but there was a greater proportion of males smokers than female smokers (36.3% vs. 26.9%). Smokers exhibited higher COHb levels [5.10% (3.70% SD) vs. 2.88% (2.76% SD)]. 28.4% arrived at the ED by ambulance. The mean COHb level was lower for ambulance patients [3.16% (3.12% SD)], vs. for patients arriving by private vehicle [3.77% (3.25% SD)] and for patients arriving on foot [4.54% (3.74% SD)]. However, there were fewer smokers among patients arriving by ambulance (27.4%) than those arriving by private car (30.7%) or by foot (49.2%). There was no correlation between COHb level and heart rate (r=0.02), respiratory rate (r=0.01), SpO2 (r=-0.002) and MAP (r=-0.001). In a larger cohort over 3 months, there were 9 cases of unsuspected CO toxicity (COT) identified in patients with non-specific symptoms or unrelated chief complaints. Toxic COHb levels ranged from 16-33% and were confirmed with serum values. The source of CO exposure in patients with COT was later identified, and was usually in the home. All patients with presumed COT (e.g. smoke inhalation) were also identified with the non-invasive device. 13 patients were identified with false positive values, however, no false negatives were observed.

Conclusions
Noninvasive testing for COT can be performed at ED triage. There is no correlation between age, vital signs and non-invasive COHb levels. Smokers had significantly elevated COHb levels compared to nonsmokers. Males had higher levels than females,

possibly due to a higher proportion of male smokers. Ambulance patients had lower COHb levels, possibly due to a lower proportion of smokers arriving by ambulance. Unsuspected COT may be identified using non-invasive COHb screening, and the prevalence of COT may be higher than previously recognized.