Ambient Carbon Monoxide Levels Measured During 13 Days of Travel in Vietnam and 13 Days in the United States

Hampson NB, Courtney TG, Holm JR. Virginia Mason Center for Hyperbaric Medicine, Seattle, Washington.

Virginia Mason™

I BACKGROUND

China's air pollution problems are well publicized. It might seem that other countries in Asia should not have similar problems because they are largely agrarian, with lower population density and less industrialization. However, a recent report placed Vietnam 123rd of 132 countries in terms of air quality. Travelers on major routes in Hanoi are exposed to significantly elevated levels of both particulate matter and carbon monoxide (CO). Exposures are greatest during rush hour and while riding motorbikes, the country's primary mode of transportation. The present study was conducted to determine levels of personal exposure to CO in both urban and rural areas of Vietnam. If, as has been suspected, motorbikes are the major source of air pollution, elevated CO levels should be found wherever they are in common use.

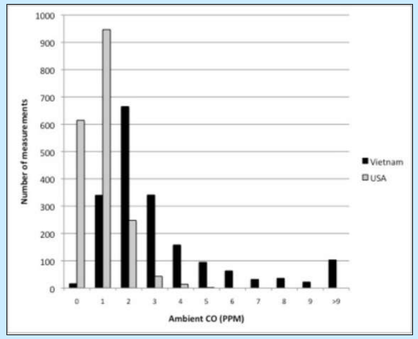
II METHODS

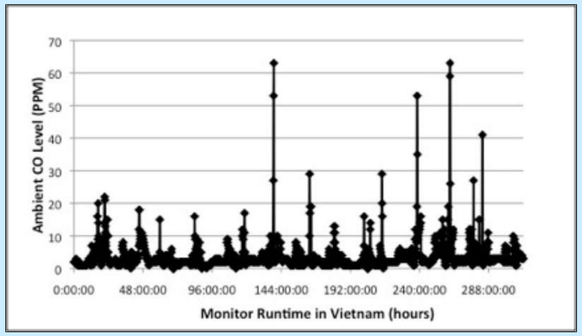
Author NBH traveled to Vietnam in December 2013. He carried an industrial CO gas monitor (Biosystems Toxipro-Single-Sensor Gas Monitor, Model 54-45-01D, Honeywell Inc., Morristown, New Jersey) to continuously measure and record CO levels. This device has a resolution for CO of 1 PPM, a range of 0-999 PPM, and is capable of logging 8,000 data points. The device was gas calibrated prior to the study and set to log CO measurements every 10 minutes. Simultaneously, the traveler recorded his location and activity at all times in a journal.

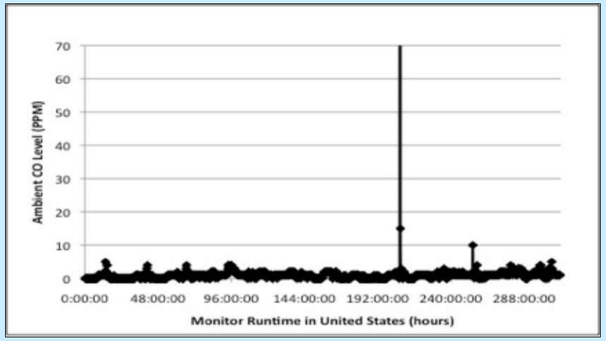
The 13-day travel itinerary in Vietnam included Hanoi, HaLong Bay, DaNang, Hoi An, a rural farming community, ue, the MeKong River Delta, Ho Chi Minh City, and Chu Chi. For comparison, a similar 13-day protocol was performed in the US in late January to early February 2014. Monitoring was performed during travel from Phoenix to Seattle, rural Puget Sound, Phoenix, Newark, New Jersey, and downtown New York City .

Average ambient CO concentration for both of the 13-day periods were calculated (mean ± SD), as was distribution of individual CO levels measured every 10 minutes. Finally, the written journal was consulted to determine the activity and location for every CO measurement of 15 PPM or greater.

III RESULTS







Average ambient [CO]: Vietnam 3.5 ± 4.4 PPM
US 0.9 ± 0.8 PPM

	Walking beside street congested with traffic	Riding on bus in congested traffic	Riding in taxi in congested traffic	Riding pedicab through traffic	Miscellaneous
Hanoi	15, 20, 15 PPM	22, 21, 18, 18 PPM			Hotel room at 21:15 PM 15 PPM. Etiology ?
Hoi An	16, 17 PPM				
Hue	29, 17, 19 PPM		19 PPM	21, 53, 63 PPM	
Can Tho	29, 20, 19 PPM				On boat next to Mekong River floating market at 7:30 AM. 16 PPM
Ho Chi Minh City	19, 53, 35, 16, 15, 41 PPM	15, 15, 19, 59, 63, 26 PPM	15, 15 PPM		
Chu Chi					Rural area at 11:30 AM. 27 PPM. ? etiology

IV CONCLUSIONS

1. Mean ambient CO levels in Vietnam are significantly greater than in the US, despite the paucity of industrialization.
2. Almost all instances with ambient CO > 15 PPM in Vietnam were associated with travel on or adjacent to roadways clogged with motorbikes..
3. The 125 cc, 4 cycle motorbike is the main form of travel in Vietnam, accounting for 60% of excursions.
4. Public transportation planning is needed now before the developing economy replaces motorbikes with automobiles, resulting in urban pollution similar to that seen in China currently.