

## CORRESPONDENCE

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**Commentary on Jumbelic MI.** Open air carbon monoxide poisoning. *J Forensic Sci* 1998 Jan;43(1):228-30.

Sir:

There is a misapprehension expressed in this article which bears on the mechanism by which CO is inhaled by the victim inside a land motor vehicle, specifically, "blockage of the muffler by mud."

The internal combustion (IC) engine, whether gasoline- or diesel-fueled, must take in air in order to burn its fuel and run. For example, an IC engine of 4 liter displacement with a volumetric efficiency of 70% idling at 600 rpm takes in approximately 210 litres (7.6 cubic ft) of air per minute. This volume must also be expelled through the exhaust system or the engine cannot "breathe" and continue to run.

When the tailpipe is blocked, absent a significant leak in the exhaust system upstream of the "blockage" the engine will either: a. stall (stop running) and consequently stop emitting exhaust gases including CO or, b. blow the obstruction clear by the pressure of the exhaust stream.

Carbon monoxide itself is, indeed, odorless. It is, however, merely one component of IC engine exhaust. While incomplete combustion of, say, natural gas in a space heater inside a residence does not produce fumes with a particularly objectionable smell the exhaust from an IC engine just plain stinks, especially when running at idle.

Therefore, the mechanism of open air CO poisoning involves firstly, obstruction of free air flow at the exhaust outlet such that the exhaust is a) retained near or b) redirected toward the victim and secondly, that the victim chooses to ignore the testimony of his/her own senses and continues to inhale the engine exhaust.

Exhaust gases can also be introduced into the interior of a moving vehicle by a parallel form of redirection at the exhaust outlet. It occurs in vehicles being driven with their trunk lids ajar or by

station wagons/minivans with their tail- or lift-gates open; the turbulence developed at the rear of the moving vehicle redirects the exhaust stream into the interior of the vehicle. Introduction of exhaust into the interior of the vehicle, moving or stationary, can also result from leakage from the exhaust system upstream of the outlet, most commonly in vehicles with corresponding breaches in their floor pan structures.

I can attest from personal experience as well as from theoretical considerations that the above-described phenomena occur.

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### Author's Response:

Sir:

I appreciate Mr. Davidson's comments and agree with his statements. The intent of the article "Open Air Carbon Monoxide Poisoning" was to enlighten those of us who deal with death investigation. Carbon monoxide intoxication may go unrecognized in the circumstances I have described. I cannot comment on the victims' perception of the fumes or their cognitive abilities to remove themselves from a dangerous environment. Unfortunately, this is a situation all too familiar to those of us who encounter casualties due to the many modalities of accidental injury.

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