Letters to the Editor

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Carbon Monoxide Poisoning from Gasoline-Powered Engines: Risk Perception among Midwest Flood Victims

Improper use of gasoline-powered engines indoors can result in injurious outcomes from the generated carbon monoxide. The 1993 Midwest flood offered an opportunity to assess an at-risk population's risk perceptions related to carbon monoxide hazards resulting from indoor flood-related cleanup efforts. We administered a questionnaire to convenience samples at several locations in St. Genevieve, Mo, one of the flood-damaged cities. Respondent's risk perception was measured by asking whether he or she believed it was safe to operate small gasoline engines indoors: (a) with closed windows and doors; (b) with a window open; or (c) with open windows and open doors and a running exhaust fan. Respondents answering "no" to all three options were considered to have an accurate risk perception.

TABLE 1—Accuracy of Flood Victims' Risk Perception of Small Gasoline Engines

	Yes	No	No Response	Total
Question 1. Small gasoline engines (5–15 horsepower) are often used to power generators, pressure washers, and lawn mowers. Would it be safe to operate a small gasoline engine indoors:				
(a) With closed windows and doors?	5 (1%)[a]	344 (83%)	67 (16%)	416[b]
(b) With a window open?	107 (26%)	237 (57%)	72 (17%)	416
(c) With open windows and open doors and a running exhaust fan?	225 (54%)	130 (31%)	61 (15%)	416

[a]Percent of total responses by each question a, b, or c.
[b]57% female and 42% male respondents; 68% ages 31 to 70, 2% ages 81 or older, 7% ages 12 to 20, 7% ages 21 to 30.

The overall response rate of 67% was relatively high, even when compared to traditional procedures for maximizing response rates.[1] Higher response rates were obtained at a senior citizen center and at churches, places where people were already congregated and were perhaps experiencing a brief respite from their stressful situation.

As Table 1 shows, 83% of respondents correctly replied that it would be unsafe to use a gasoline-powered engine inside with closed windows and doors. However, despite public information warning of the dangers of indoor carbon monoxide exposure,[2–4] 26% incorrectly replied that it would be safe if a window were open. Finally, 54% incorrectly replied that it would be safe if windows and doors were open and an exhaust fan was running.

Nearly all (92%) of the respondents between ages 12 and 20, and more than 50% of respondents in all other age categories, incorrectly answered that it was safe to use a gasoline-powered engine indoors as long as windows and doors were open and an exhaust fan was running. A statistical test of homogeneity indicated that younger participants had a greater likelihood of having more inaccurate risk perceptions regarding the exposure to carbon monoxide when using gasoline-powered engines than did the older age groups ($x^2 = 16.6$, $p = .011$).

These findings suggest that a majority of our sample understood that carbon monoxide is hazardous. However, they did not accurately perceive the hazards associated with using gasoline-powered engines indoors. Younger individuals may be at even greater risk for carbon monoxide poisoning than older people, perhaps due in part to a lack of experience with using gasoline-powered equipment or to inadequate or improper training from an overseeing adult. More attention should be paid to providing age-appropriate risk

information to inexperienced audiences likely to experience carbon monoxide exposure when using gasoline-powered equipment.

Disaster investigators argue that the aftermath of a natural disaster is most dangerous because victims perform unaccustomed cleanup and repair tasks for which they are untrained.[5] Thus, quick dissemination of accurate information about risks associated with cleanup activities is important. The message needs to be understandable, accepted, and persuasive using a medium obtainable by the audience (personal communication, Dr Alan Kristal, Fred Hutchinson Cancer Research Center). This may be particularly true for people who are displaced from their homes, as happens in a natural disaster.

In the survey we also asked respondents if they had heard any of the state and local health departments' public service announcements about how to use gasoline-powered equipment safely. Seventy-two percent of respondents had not heard or seen the announcements. Of those that did, the majority stated that radio and television were their primary sources for obtaining information regarding carbon monoxide hazards, followed by newspapers and then magazines. These findings suggest that, in disaster circumstances, radio and TV public service announcements would be more effective than other information sources.

This study has several limitations. It is possible that the survey format itself created wrong responses simply because respondents expected one of the options to be the right one. Secondly, a convenience rather than a random sample was used, presenting some selection bias as well as a lack of generalizability. However, our findings document and help clarify the apparent inaccurate risk perception of many individuals. The findings are consistent with reports of carbon monoxide poisonings occurring in farming and other settings[2-4] which have suggested that individuals often inaccurately perceive carbon monoxide risks associated with using gasoline-powered equipment in enclosed spaces. □

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The Duration of the Effect of Vitamin A Supplementation

The recent article by Ross et al.[1] further analyzes data from the carefully conducted vitamin A intervention trials to garner *evidence* for whether large dose supplementation at 4-month intervals provides optimal protection against excess morbidity and mortality associated with vitamin A deficiency. Finding no significant decrement in impact in relation to either the duration between last dose or cumulative number of doses and subsequent mortality, the authors, and an accompanying editorial,[2] suggest the 4-month interval may be optimally effective.

On the face of it, the results are indeed reassuring. However, they raise another question. If a 4-month interval is maximally effective, and if the impact of supplements occurs by improving vitamin A status that is initially suboptimal, why does repeated periodic dosing work at all? Either there really is room for further improvement in vitamin A status and therefore its impact on morbidity and mortality (which seems most likely, since a host of biochemical studies clearly demonstrate the transient impact of periodic supplements on biochemical indices of improved status),[3] or the large dose is exerting its impact through a bolus effect by "spiking" vitamin A status. The latter seems equally unlikely given the brief period of "normal status" enjoyed by supplemented children versus the prolonged benefit that ensues.

These considerations suggest that just as in prevention of xerophthalmia,[4] a periodic large dose is protective longer than measures of "biochemical indices" would suggest.[5] Hence the 4-month interval provides a sustained rate of protection, but probably one that is not as great as it would be if the child were truly vitamin A replete.

The editorial[2] misses this important point and compounds the problem by suggesting that the 4-month interval is highly protective, while a 6-month interval probably is not. The evidence presented to support this conclusion rests on the absence of observed protection in two trials using a 6-month interval in comparison with one in which a 34% (to 70%)[6,7] protection was observed. A number of alternative explanations have been offered to explain the absence of an observable impact (at any interval following supplementation) in the two aforementioned studies.[3,8] The simplest reasoning, however, belies the editorialist's explanation: if 4 months is accepted as an effective interval, then even if 6 months were less optimal, one would expect two-thirds the benefit of the 4-month interval rather than no benefit at all! Expressed differently, the expected benefit during months 1 through 4 would need to be cancelled by a negative impact, of greater magnitude, during months 5 and 6.

In conclusion, it is reassuring to learn that in the Ghana studies no diminution occurred in protection from excess morbidity and mortality with increasing duration from dosing. Four-month (or shorter) intervals between doses (the optimal being daily, smaller doses) over 6 months seems self-evident. While this analysis does not demonstrate that, it does raise the question why the vitamin A recipients exhibited any benefit from sequential dosing if 4-month intervals were optimal. □

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References

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