Attitudes about Carbon Monoxide Safety in the United States: Results from the 2005 and 2006 *HealthStyles* Survey

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ABSTRACT

Objectives. We sought to identify attitudes and behaviors related to carbon monoxide (CO) safety that can be targeted with public health prevention strategies in the U.S.

Methods. The Centers for Disease Control and Prevention added questions about (*1*) proper placement of gas-powered generators, (*2*) maintenance of fuel-burning appliances, and (*3*) use of CO detectors to the 2005 and 2006 *HealthStyles* national health marketing surveys.

Results. In 2005, 63.3% of *HealthStyles* respondents agreed with or were uncertain about the incorrect statement, "It is safe to run a generator in a garage as long as the door is open," while 43.1% agreed with or were uncertain about the incorrect statement, "It is safe to run a generator in the basement." Most of the 2006 respondents (63.5%) agreed that it is important to have their furnace inspected annually. However, fewer than half of the 2006 respondents (42.0%)—most of whom were homeowners—reported owning a CO detector.

Conclusions. A large proportion of adults in the U.S. reported attitudes and behaviors that may place them at increased risk for unintentional, non-fire-related CO poisoning, suggesting that current safety messages may not be reaching much of the public. Prevention messages should continue to promote proper generator placement, maintenance of fuel-burning appliances, and use of CO detectors. Development of a comprehensive national strategy for CO surveillance and communication may help identify populations at increased risk and prevent future poisonings.

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Unintentional, non-fire-related exposure to carbon monoxide (CO) causes approximately 450 deaths and 20,000 emergency department visits annually in the U.S.[1] Common sources of CO—a colorless, odorless, toxic gas produced by the incomplete combustion of fossil fuels—include household appliances such as furnaces, gas stoves, water heaters, and kerosene heaters, as well as other items found around homes, including automobiles and charcoal or gas grills.[2] Epidemiologic studies have found that unintentional poisonings occur most often due to power outages and severe weather during colder months or in the post-impact phase of disasters.[3–5] In the wake of natural disasters, portable gasoline-powered generators continue to be the primary mechanism of unintentional CO poisoning,[6,7] and the U.S. Consumer Product Safety Commission has reported that the annual frequency of fatal incidents increased from six in 1999 to 94 in 2005.[8]

One primary public health strategy to prevent unintentional CO poisoning is education about the proper use and maintenance of fuel-burning devices.[9] Health agencies have created public service announcements that emphasize the dangers of CO and the importance of installing CO detectors; these messages are distributed seasonally in anticipation of probable natural hazards[5] (Unpublished report, Oak Ridge Institute for Science and Education, January 2005). However, despite increasing efforts to promote public awareness of the dangers of CO,[10,11] each year hundreds of Americans die from CO poisoning during winter months[1] and after ice storms,[4] hurricanes,[6] and floods.[12] To develop more effective communication strategies, theoretical decision-making models[13] used widely to study health-risk behaviors such as substance abuse,[14] speeding,[15] condom use,[16] and food/water safety[17] have been applied recently to CO poisoning.[18,19] In the U.S., community-based studies have begun to investigate environmental factors associated with CO poisoning after natural disasters,[2,4,6,12] yet comparatively little is known about public knowledge or attitudes toward CO on a national scale.

During 2004, four hurricanes made landfall in Florida from August to September.[6] The large number of CO poisonings reported both during and after the hurricanes prompted rapid interventions to educate people in disaster-affected communities about the dangers of CO poisoning.[20,21] Following the 2004 hurricane season, Florida Secretary of Health John Agwunobi recommended adding "surveys assessing behaviors and attitudes toward the dangers of carbon monoxide poisoning" to national public health surveillance activities.[22] To help characterize public attitudes toward the dangers of CO in the U.S. and improve prevention messages, the Centers for Disease Control and Prevention (CDC) added questions about CO safety to a national health marketing survey in 2005 and 2006. These questions, based on a growing body of literature indicating that attitudes are key determinants of behavior,[23] were designed specifically to measure safety-related attitudes about gasoline-powered generators, fuel-burning appliances, and CO detectors. Preliminary findings were shared with public health professionals working to establish a national research agenda for CO prevention (Unpublished report, Maine Bureau of Health, July 2006) and, during subsequent hurricane seasons, used to inform popular and social media-based messaging about the dangers of CO.[24,25] This report summarizes the 2005 and 2006 survey findings that characterize public attitudes and behaviors related to CO safety in the U.S.

METHODS

Survey sample

Respondents to the 2005 and 2006 *HealthStyles* surveys comprised the study population. *HealthStyles* is a mailed panel survey administered by Porter Novelli (Washington, D.C.) annually to measure health knowledge, attitudes, and behaviors of adults in the U.S. A stratified random sample, based on region, household income, population density, age, and household size, was combined with a low-income/minority supplement to create a nationally representative sample; a detailed description of the *HealthStyles* methodology is provided elsewhere.[26,27] A total of 6,168 *HealthStyles* surveys were mailed in 2005, and 6,600 surveys were mailed in 2006, with 4,819 households (78.0%) and 5,251 households (79.6%) returning complete questionnaires eligible for inclusion in this study, respectively. Respondents with missing data for CO questions were excluded; there was no pattern to item nonresponse, and people with missing CO data tended to be similar demographically to the overall sample.

Attitude measures

For this study, an attitude toward CO safety was defined as an enduring, learned belief about or predisposition to behave in a certain way toward a type of object or situation,[23] as measured by questions about gasoline-powered generators, fuel-burning appliances, and CO detectors included in the *HealthStyles* surveys; these items are presented in Figure 1. Two questions about safe generator use were included in the 2005 *HealthStyles*. Six questions concerning the maintenance and placement of fuel-burning appliances and attitudes toward the use of CO detectors were included in the

Figure 1. Carbon monoxide safety questions included in the *HealthStyles* survey—United States, 2005 and 2006

In this section, there are a number of statements with which you may or may not agree. For each statement listed, please indicate whether you personally agree or disagree with it.	Likert scale response (1 = strongly disagree and 5 = strongly agree)
2005 items	
It is safe to run a generator in a basement as long as a window is open.	1 2 3[a] 4[a] 5[a]
It is safe to run a generator in a garage as long as the door is open.	1 2 3[a] 4[a] 5[a]
2006 items	
If you use a gas-powered generator, you should also use a carbon monoxide detector.	1[a] 2[a] 3[a] 4 5
It is safe to run a generator in a garage that is not attached to the home.	1[a] 2[a] 3[a] 4 5
I don't need a carbon monoxide detector in my house if I have a new furnace.	1 2 3[a] 4[a] 5[a]
It is safe to run a generator in a garage as long as the door is open.[b]	1 2 3[a] 4[a] 5[a]
It is important to have fuel-burning appliances inspected professionally at the beginning of each heating season.	1[a] 2[a] 3[a] 4 5
How often do you check the battery in your CO detector? ("X" all that apply)	
❑ Do not have a CO detector ❑ Every six months	
❑ It beeps when the battery needs to be changed ❑ Once a year	

[a]Likert-scaled item responses that represent at-risk attitudes

[b]Question asked in both 2005 and 2006 surveys

CO = carbon monoxide

2006 survey. To adjust for response-set bias, questions in 2005 and two of the 2006 questions were worded such that positive responses (e.g., agree or uncertain) suggested "at-risk" attitudes—that is, inaccurate knowledge about CO or beliefs likely to place people at greater risk of poisoning. For each item, respondents indicated their agreement on a Likert-type scale ranging from 1 for "strongly disagree" to 5 for "strongly agree." For this analysis, respondents who answered with a 1 or 2 were considered to "disagree" with the statement, those answering 3 were "uncertain," and those answering with a 4 or 5 were considered to "agree." For each Likert-scaled item, response categories that reflect "at-risk" attitudes are identified in Figure 1.

Statistical analysis

Data from the 2005 and 2006 *HealthStyles* surveys were weighted to reflect the U.S. census population (weights were provided by Porter Novelli).[26,27] We calculated univariate statistics to describe the sample population for each year and conducted bivariate analyses to compare the percent agreement with survey items to demographic factors. We used Chi-square tests with an a priori significance level of $p<0.05$ (two-sided) to determine the association between demographic and all Likert-scaled study outcomes. Responses to the question about CO detector batteries were analyzed by frequency and stratified by home-ownership status. All analyses were conducted using SAS version 9.1.[28]

RESULTS

Of the total number of 2005 *HealthStyles* respondents (n=4,819), 4,647 responses to generator-related questions were included in the analysis after accounting for missing data. Respondents to generator items in 2005 tended to be women (51.7%) and non-Hispanic white (70.5%), with some college (63.9%), and an annual household income >$25,000 (72.3%). We analyzed data from all 2006 *HealthStyles* respondents (n=5,251) for the question related to CO detector batteries. The number of responses analyzed for all items ranged from 4,917 to 5,055; the demographic characteristics of respondents in 2006 did not differ significantly from those in 2005.

2005 generator items

In 2005, 63.3% of respondents reported that they agreed with (25.6%) or were uncertain about (37.7%) the statement, "It is safe to run a generator in a garage as long as the door is open," and 43.1% of respondents agreed with (9.0%) or were uncertain about (34.1%) the statement, "It is safe to run a generator in the basement" (Table 1). For each item, and across all demographic subcategories, a higher proportion of respondents reported uncertainty about safe generator use compared with those in agreement. All demographic characteristics were significantly associated with responses to the 2005 survey items (Chi-square, $p<0.05$) with the exception of education for the generator-in-garage item. Respondents who agreed with or were uncertain about the generator-in-garage item tended

Table 1. Attitudes toward generator use among adults aged ≥18 years by gender, age, race/ethnicity, income, education, and region—*HealthStyles* survey, United States, 2005[a]

	Generator safe in open garage (n=4,647)[b]		*Generator safe in basement (n=4,634)[c]*	
Characteristic	*Percent agree*	*Percent uncertain*	*Percent agree*	*Percent uncertain*
Total	25.6	37.7	9.0	34.1
Gender[d]				
Male	29.4	32.5	10.1	30.5
Female	21.9	42.7	7.8	37.6
Age (in years)[d]				
18–34	23.5	42.4	8.9	39.2
35–64	25.5	36.3	9.1	32.7
≥65	30.2	32.7	8.8	28.6
Race/ethnicity[d]				
White, non-Hispanic	27.9	36.3	8.6	31.6
Black, non-Hispanic	18.7	44.0	11.0	42.3
Other, non-Hispanic	23.7	41.3	8.8	41.6
Hispanic	19.6	34.6	9.9	33.4
Annual household income[d]				
<$25,000	28.2	39.3	11.2	37.0
≥$25,000	24.6	37.1	8.1	33.1
Education[e]				
≤High school	24.7	38.1	9.3	34.2
Some college	26.3	38.2	9.8	35.2
≥College graduate	22.9	40.0	7.0	33.2
Region[d]				
Northeast	28.9	37.3	11.9	32.9
Midwest	29.7	35.6	6.7	31.3
South	22.3	35.5	9.2	33.6
West	24.1	43.8	8.6	38.9

[a]Note: Weighted *n* is different from actual number of respondents. Percent agree category includes respondents who "strongly agree" and "moderately agree." Percent uncertain category includes those who "neither agree nor disagree."

[b]Item 1: It is safe to run a generator in a garage as long as the door is open.

[c]Item 2: It is safe to run a generator in a basement as long as a window is open.

[d]Demographic characteristic significantly associated with percent response to survey items 1 and 2 by Chi-square test, $p<0.05$

[e]Demographic characteristic significantly associated with percent response to survey item 2 by Chi-square test, $p<0.05$

to be male, older than aged 65 years, non-Hispanic white, and from the Midwest, with an annual income <$25,000. Those who agreed with or were uncertain about the generator-in-basement item tended to be male, aged 35–64 years, non-Hispanic black, and from the Northeast, with an annual income <$25,000 and some college.

2006 generator and CO safety items

Table 2 shows the proportion of respondents who agreed with or were uncertain about generator and CO safety questions in the 2006 *HeathStyles* survey. In 2006, 60.9% of respondents were uncertain about running a generator in an open garage (36.0%) or agreed that it was safe (24.9%). Similarly, more than half (51.9%) of respondents reported agreement with or uncertainty about the statement, "It is safe to run a generator in a garage that is not attached to a house." Most respondents (69.8%) agreed that a CO detector should be used with a generator, and only a small proportion (23.3%) of respondents believed that a CO detector was not needed with a new furnace. While most respondents (63.5%) agreed with the importance of an annual inspection for fuel-burning appliances, 26.1% remained uncertain.

Demographic characteristics associated with responses to the five Likert-scaled questions about CO safety in the 2006 *HealthStyles* are also presented in Table 2. Region was the only demographic variable significantly associated (Chi-square, $p<0.05$) with response to the statement about operating a generator in an open garage, with fewer respondents from the South reporting agreement and uncertainty. Race/ethnicity and region were both significantly associated with the statement about using a CO detector with a generator. Specifically, a higher proportion of

Table 2. Attitudes toward generator use and carbon monoxide safety among adults aged ≥18 years by gender, age, race/ethnicity, income, education, and region—*HealthStyles* survey, United States, 2006[a]

	Generator safe in open garage (n=4,927)[b]		*Use CO detector with generator (n=4,938)*[c]		*Generator safe in unattached garage (n=4,917)*[d]		*No CO detector needed with new furnace (n=5,033)*[e]		*Annual appliance inspection important (n=5,055)*[f]	
Characteristic	*Percent agree*	*Percent uncertain*	*Percent agree*	*Percent uncertain*	*Percent agree*	*Percent uncertain*	*Percent agree*	*Percent uncertain*	*Percent agree*	*Percent uncertain*
Total	24.9	36.0	69.8	22.8	19.5	32.4	8.0	15.3	63.5	26.1
Gender[g]										
Male	26.7	34.0	70.3	21.6	21.2	29.2	8.8	15.1	62.8	26.3
Female	23.0	38.0	69.3	23.9	17.8	35.6	7.2	15.4	64.2	25.9
Age (in years)[h]										
18–34	20.2	41.6	67.2	26.6	16.2	40.5	8.1	17.7	53.5	32.5
35–64	26.3	34.6	70.1	22.0	20.4	29.7	7.1	14.3	64.5	25.8
≥65	29.3	29.2	74.4	17.7	23.1	25.1	10.6	13.7	79.6	14.6
Race/ethnicity[i]										
White, non-Hispanic	25.5	35.0	71.3	22.4	19.7	31.8	7.0	14.4	63.5	26.9
Black, non-Hispanic	22.2	37.7	67.5	22.2	20.0	33.3	11.2	13.2	70.5	20.5
Other, non-Hispanic	26.9	32.8	60.6	60.6	17.5	31.6	14.1	20.7	61.4	25.5
Hispanic	22.7	41.5	68.7	68.7	18.9	35.4	7.4	19.3	59.0	27.0
Annual household income[j]										
<$25,000	24.3	38.4	69.3	22.1	21.1	35.8	7.9	18.5	66.4	24.6
≥$25,000	25.1	35.2	70.0	23.0	18.9	31.3	8.0	14.1	62.5	26.6
Education										
≤High school	26.3	35.8	66.8	24.9	21.4	32.7	8.5	14.5	65.0	25.0
Some college	25.9	35.3	70.6	22.7	18.9	32.5	6.7	15.7	62.6	26.7
≥College graduate	22.3	37.1	72.2	20.4	17.7	32.6	8.6	15.5	63.3	26.3
Region[k]										
Northeast	26.1	35.9	74.5	20.0	21.2	34.1	6.0	11.4	67.9	24.5
Midwest	29.2	36.5	71.5	21.5	24.1	34.2	7.9	10.7	63.1	27.0
South	22.1	33.2	73.1	19.2	18.2	28.9	9.2	15.7	67.0	22.2
West	23.5	40.3	58.3	32.8	15.1	35.1	7.8	23.3	54.5	33.0

[a]Note: Weighted *n* is different from actual number of respondents. Percent agree category includes respondents who "strongly agree" and "moderately agree." Percent uncertain category includes those who "neither agree nor disagree."

[b]Item 1: It is safe to run a generator in a garage as long as the door is open.

[c]Item 2: If you use a gas-powered generator, you should also use a carbon monoxide detector.

[d]Item 3: It is safe to run a generator in a garage that is not attached to the home.

[e]Item 4: I don't need a carbon monoxide detector in my house if I have a new furnace.

[f] Item 5: It is important to have fuel-burning appliances inspected professionally at the beginning of each heating season.

[g]Demographic characteristic significantly associated with percent response to survey item 3 by Chi-square test, $p<0.05$

[h]Demographic characteristic significantly associated with percent response to survey items 3, 4, and 5 by Chi-square test, $p<0.05$

[i]Demographic characteristic significantly associated with percent response to survey items 2, 4, and 5 by Chi-square test, $p<0.05$

[j]Demographic characteristic significantly associated with percent response to survey items 3 and 4 by Chi-square test, $p<0.05$

[k]Demographic characteristic significantly associated with percent response to survey items 1, 2, 3, 4, and 5 by Chi-square test, $p<0.05$

CO = carbon monoxide

non-Hispanic white respondents and those living in the Northeast agreed that a CO detector should be used. Likewise, a higher proportion of respondents who were women, aged 18–34 years, with an annual household income <$25,000, and living in the Midwest agreed with or were uncertain about the safety of operating a generator in an unattached garage.

Age, race/ethnicity, income, and region were associated with the statement, "No CO detector is needed with a new furnace." Although the majority

of respondents reported "disagreement," suggesting that most believe a CO detector is needed with a new furnace, those at risk (e.g., who reported agreement/uncertainty with the item) tended to be younger (aged 18–43 years), of non-Hispanic other race/ethnicity, with a household income <$25,000, and living in the West. Age, race/ethnicity, and region were also associated with the statement "an annual inspection for fuel-burning appliances is important." Those who agreed or were uncertain tended to be older (aged ≥65 years), non-Hispanic black, and living in the Northeast.

Of respondents who answered the question about checking the battery in their CO detector (n=5,251), more than half (51%) reported that they did not own a detector. Most of the remainder (24%) reported checking the battery when it beeps, 11% reported checking the battery every six months, and 7% reported checking it once annually; 7% could not specify how often they check. Among those who reported that they did not own a CO detector (n=2,691), the majority (71%) were homeowners, while 25% reported renting, and 4% occupied a residence without rent or did not specify.

DISCUSSION

The results of this study indicate that a large proportion of adults in the U.S. believe that it is safe to operate a gas-powered generator in an enclosed space, such as a garage, and that most of the respondents surveyed in 2005 and 2006—the majority of whom were homeowners—did not own a CO detector. These nationally representative findings are consistent with those of previous studies based on smaller samples and suggest some barriers exist to effective public health prevention of CO poisoning that might be addressed through improved health communication.

Our goal was to describe attitudes that might place the public at increased risk for poisoning or death from CO that can be targeted with public health prevention strategies. Specifically, we measured attitudes about (*a*) placement of gas-powered generators, (*b*) maintenance of fuel-burning appliances, and (*c*) use of CO detectors. In both survey years, more than 60% of adults believed it safe to run a generator in an open garage (or were uncertain about safe placement) and, regardless of location, the proportion reporting uncertainty about safe generator use was substantial. Extrapolated to the July 2008 U.S. population estimate,[29] our study indicates that more than 144 million adults may be unaware of the dangers of operating a gasoline-powered generator in an enclosed space. Other smaller, community-based surveys have reported similar findings. For example, only 2.4% of community members surveyed after four major hurricanes in Florida recognized CO poisoning as a major health concern.[30,31] Taken together, our nationally representative findings and those of previous studies suggest that prevention messages may not be reaching large segments of the public and that opportunities for primary prevention of CO poisoning remain.

Notably, although most respondents in 2006 were aware of the need to use a CO detector with a generator and a new furnace, fewer than half reported owning a CO detector. Of those respondents, most reported checking the battery only when it beeps. In other words, even for the minority who do have a CO detector, more than half effectively do not have one because the battery could dead. This finding is of concern because fuel-burning home heating systems continue to be a leading source of fatal CO poisonings each year.[32] Research has indicated that more than half of all CO-related deaths could be prevented by use of a CO detector,[33] and evidence is emerging that state and local policies mandating use of CO detectors in residential settings can reduce poisonings and deaths.[31] However, most respondents in our study were private homeowners who would not be affected by legislation requiring CO detectors in rental properties. Regardless, secondary prevention efforts promoting CO detector use should remain an important component of CO-related interventions because CO detectors are inexpensive—usually less than $25—and widely available.

Another goal of this study was to identify populations that may be at increased risk for CO poisoning. A review of CO-specific surveillance in the U.S. reported people at risk of non-fatal poisoning tend to be members of racial/ethnic minority groups and middle-aged, while those who die from CO poisoning are more likely to be non-Hispanic white or black, aged ≥65 years, and men.[9] Our analysis of 2005 *HealthStyles* data indicated that men aged ≥65 years of non-Hispanic white race/ethnicity, with an income <$25,000 a year, and residing in the Midwest may be at greatest risk, based on their belief that using a generator in an attached garage was safe. In 2006, however, the only factor associated with attitudes was Midwest residence. Level of education was only associated with the generator-in-basement question in 2005 and was not associated with any of the 2006 questions. It is interesting to note that we found few demographic differences overall that were statistically significant and little geographic variation in attitudes, suggesting that additional extrinsic factors may influence public attitudes about CO safety.[2] For example, the non-weatherproof design of portable generators or lack of a sufficiently long power cord

may cause people to keep generators indoors, despite knowledge of the dangers of CO.

Implications for health messaging

Unintentional CO poisoning is almost entirely preventable, given appropriate installation, use, and maintenance of fuel-burning appliances and CO detectors.[1] Therefore, it is important to consider communication factors that facilitate attitude change (e.g., audience characteristics and message content) when exploring the implications of this study for health messaging.[34,35] Overall, we found that a large proportion of the public remains unaware of the potential risk of CO poisoning. Together with qualitative evidence suggesting that community members may have different levels of CO awareness and knowledge,[36,37] this finding supports communication strategies based on the assessment of multiple audience factors.[5,38,39] Our findings also have practical implications for the content of health messaging. Assessment of baseline knowledge regarding the existence and propagation of CO remains an important component of any health-communication strategy. Generator-related messages need to emphasize the minimum safe-placement distance from a dwelling (now recognized as 25 feet[40]), avoidance of use in an attached garage, and avoidance of use in a basement. For furnaces and other appliances, promoting the practice of regular, professional maintenance is indicated, although the financial cost of this practice may prove to be a barrier to widespread adoption. Future health messaging could also emphasize the use of CO detectors because this is less costly, in both dollars and effort, than primary prevention behaviors and, therefore, more likely to be adopted by consumers.

The analysis described in this article is the first step in the development of a targeted, national communication strategy for CO-poisoning prevention. CDC is developing this strategy to enhance public perception of the risk of CO, encourage CO detector use, and raise awareness of behaviors that can help reduce the risk of unintentional poisoning.[36,37] Figure 2 shows guidelines from CDC on preventing CO exposure.

Limitations

This study is subject to several limitations. *HealthStyles* data are influenced by selection bias because panel surveys solicit responses from a population willing to participate in research; data from this sample may not be representative of the attitudes and behaviors of the U.S. adult population. *HeathStyles* data reflect self-reported knowledge, attitudes, or behaviors measured at one point in time and are not linked to actual behaviors or health outcomes via longitudinal follow-up or direct observation. Furthermore, assessment of attitudes was context-neutral due to limited survey space, CO items were presented alongside other unrelated items in *HealthStyles*, and item content was developed rapidly as part of a public health emergency response; these factors may have resulted in inaccurate or biased responses. Specifically, results may be subject to recall bias based on respondent characteristics (e.g., men might recall generator or detector information differently from women) or information bias due to confusion between smoke and CO detectors.

Figure 2. Guidelines to prevent carbon monoxide exposure[a]

Do have your heating system, water heater, and any other gas-, oil-, or coal-burning appliances serviced by a qualified technician every year.

Do install a battery-operated CO detector in your home and check or replace the battery when you change the time on your clocks each spring and fall. If the detector sounds, leave your home immediately and call 911.

Do seek prompt medical attention if you suspect CO poisoning and are feeling dizzy, light-headed, or nauseous.

Do not use a generator, charcoal grill, camp stove, or other gasoline- or charcoal-burning device inside your home, basement, or garage, or near a window.

Do not run a car or truck inside a garage attached to your house, even if you leave the door open.

Do not burn anything in a stove or fireplace that is not vented.

Do not heat your house with a gas oven.

[a]Source: Unintentional non-fire-related carbon monoxide exposures—United States, 2001–2003. MMWR Morb Mortal Wkly Rep 2005;54(2):36-9.

CO = carbon monoxide

CONCLUSIONS

The results of this study—the first to assess public attitudes toward CO safety in the U.S. on a national level—indicate that most adults report attitudes consisting of inaccurate knowledge, beliefs, or behaviors that may place them at increased risk for unintentional CO poisoning. The proportion of adults who reported uncertainty about safe generator use was substantial, regardless of location, and most people do not own a CO detector. This finding suggests that current safety messages related to generator operation may not be reaching large segments of the public and opportunities for the primary prevention of CO poisoning remain. Public health prevention messaging should continue to focus on promoting proper generator placement, maintenance of fuel-burning appliances, and use of CO detectors. Development of a comprehensive national

strategy for CO surveillance and communication may help identify populations at increased risk of CO exposure and prevent future poisonings.

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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