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SC Environmental Public Health Tracking

South Carolina Environmental Public Health Tracking Program

Putting Tracking to Work for You

Carbon Monoxide Awareness

Most people have come in contact with sources of carbon monoxide (CO). As a result, potential exposure to CO at harmful levels can pose a serious health risk. The objective of this report was to examine if knowledge of CO sources varied in South Carolina (SC) by region of the state.

Introduction

Carbon monoxide (CO) is a colorless, odorless and toxic gas, and is one of the leading causes of unintentional poisoning deaths in the United States (CDC, 2011). CO can be produced by any device or appliance (e.g., generator, gas stove and gas-fired furnaces) that burns fuel like gasoline, kerosene, wood or natural gas. CO can build up rapidly in enclosed and partially enclosed spaces. Often called a "silent killer," inhalation of CO can cause sudden illness and death. Recognizing the health risks associated with CO exposure, the South Carolina Environmental Public Health Tracking (SC EPHT) Program partnered with the Palmetto Poison Center (PPC) in 2009 to increase awareness and prevention of CO poisoning. S.C. EPHT tracks CO-related exposure, mortality, hospitalizations and emergency room visits in South Carolina. According to the PPC, most CO inquiries received pertain to whether or not heating, ventilating and air conditioning (HVAC)-type appliances are potential sources of CO. In 2011, S.C. EPHT included questions related to CO sources in the home on the S.C. Behavioral Risk Factor Surveillance System (SC BRFSS) survey to gauge awareness across the state. The S.C. BRFSS is an annual random-digit dialing telephone survey of S.C. adults. S.C. EPHT analyzed the CO source questions from the 2011 S.C. BRFSS. It was hypothesized that responses to CO source questions differed by region because of geographical variations in SC's climate.

Methods

SC BRFSS data contained individuals' responses to CO source questions along with demographic information. Preliminary review of the data indicated that the question, "Are household gas appliances sources of carbon monoxide?" drew a higher percent (20%) of incorrect responses ("No") than any other CO source question (Table 1). S.C. EPHT evaluated responses to this particular question (n=10,330) as the main outcome, because HVAC-type appliances fit into this category, and more importantly, incorrect knowledge of actual CO sources could be potentially harmful. S.C. Department of Health and Environmental Control regions (Figure 1) were the main predictor of interest. At the time the survey was completed, S.C. DHEC had eight regions. Demographic variables examined included gender, age at time of survey, education, race, ethnicity, employment status and marital status. Percent of responses by region was calculated, and survey logistic regression analysis was conducted to evaluate if there was a difference in response to this question by region. Each demographic variable of interest was then examined in separate models additionally adjusted for region. A final model was also examined that was adjusted for all significant demographic variables from the initial adjusted analysis. A p-value of <0.05 was used to determine statistical significance.

Table 1. Percent of incorrect responses to actual CO source type questions from S.C. 2011 BRFSS survey

2011 S.C. BRFSS Question	Incorrect Response of "No"
Is a gas or wood burning fireplace a source of carbon monoxide?	10%
Is a gas or diesel powered generator a source of carbon monoxide?	5%
Is a propane or kerosene space heater a source of carbon monoxide?	8%
Are household gas appliances sources of carbon monoxide?	20%

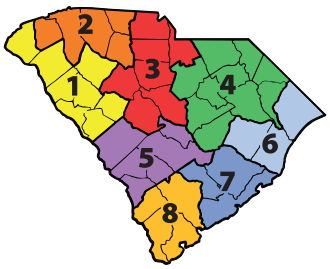

Figure 1. 2011 S.C. DHEC health regions

Results

Region 2 yielded (Figure 2) the greatest percent (23%) of incorrect responses ("No") to the question, "Are household gas appliances sources of carbon monoxide?" from the 2011 S.C. BRFSS survey. However, no significant differences (all CI overlap) in responses to this question were detected among the regions.

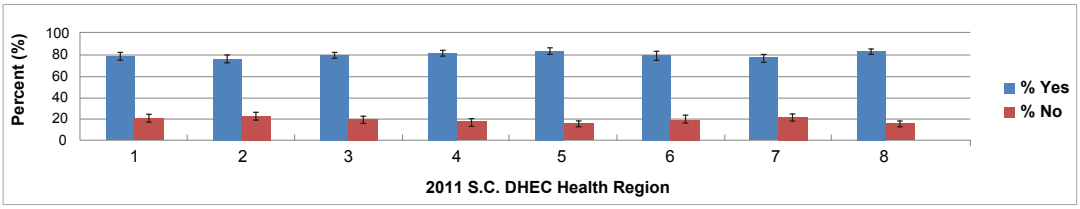

Figure 2. Percent of responses (95% CI) to CO source question across all regions

Table 2. Significant odds ratio (OR) estimates for CO source question from 2011 S.C. BRFSS survey from crude (region only) and initial adjusted analysis for each demographic variable

Category	Odds ratio	95% Confidence interval		Category	Odds ratio	95% Confidence interval	
Region 5	0.65	0.49	0.86	Widowed*	1.41	1.14	1.75
Region 8	0.64	0.48	0.85	Hispanic*	1.90	1.20	3.03
Age Group (45-54)*	0.73	0.59	0.91	Age Group (18-24)*	1.41	1.05	1.91
Never married/partnered*	1.32	1.07	1.62				

**Models additionally adjusted for region*

The odds of responding incorrectly were significantly lower among those living in Regions 5 and 8 as compared to Region 2 in the crude analysis. In individual demographic adjusted models, odds of responding incorrectly were lower among individuals aged 45-54 as compared to those 65+. Those never married or partnered, widowed, Hispanic and aged 18-24 had significantly higher odds of responding incorrectly when compared to married, non-Hispanics and those 65+, respectively. No significant differences in CO source question responses were observed for race, gender, education or employment categories (data not shown).

Table 3. Significant odds ratio (OR) estimates from final adjusted model* of CO source question from 2011 S.C. BRFSS survey

Category	Odds ratio	95% Confidence interval	
Region (Region 8 vs. Region 2)	0.73	0.55	0.97
Age group (45-54 vs. 65+)	0.76	0.57	0.99
Hispanic (yes vs. no)	1.79	1.12	2.86
Marital (widowed vs. married)	1.32	1.05	1.67

**Model was additionally adjusted for age, ethnicity, marital status and employment status*

The OR estimates in the final adjusted model were comparable to the results in Table 2. The wide 95% confidence interval for Hispanics (Tables 2 and 3) indicates a less precise estimate, most likely due to the small sample size of this ethnic group in the study population (n=200, or 2%).

Conclusions

Many unintentional CO poisonings in the home are the result of lack of knowledge about potential sources of CO (HUD, 2005). Per the current study, the odds of incorrectly responding to household gas appliances being a source of CO were significantly different in adjusted analyses for region, marital status, ethnicity and age. Hispanics and those widowed were 1.79 and 1.32 times, respectively, more likely to respond incorrectly than non-Hispanics and those married in adjusted models. Middle-aged individuals and those living in Region 8 were more likely to answer correctly versus those aged 65+ and those in Region 2, respectively, in the adjusted model.

It is well documented that socioeconomic factors, such as income and education, are strongly associated with most measures of health and health-related behaviors (RWJF, 2009). These factors may impact Hispanics' knowledge of sources of CO due to their disparities in income and education when compared to non-Hispanics in the study population. Additionally, those widowed may be missing health information that married individuals possess due to spousal involvement (Jin and Chrisatakis, 2009). Although the results demonstrate some variability in response among regions, the hypothesis that people living in warmer regions of South Carolina would be more likely to render an incorrect response to this CO source question was not supported. However, since the largest percentage of 2011 S.C. BRFSS respondents incorrectly identified household gas appliances as sources of CO within the home, these results do corroborate the majority type of inquiries received by the PCC. For additional information about this fact sheet, please contact H. Reed Corley, S.C. EPHT Program, at corleyhr@dhec.sc.gov or (803) 898-1422.

References

Centers for Disease Control and Prevention (CDC). Carbon Monoxide Exposures --- United States, 2000-2009. MMWR 2011; 60(No. 30): 1014-1017. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6030a2.htm>.

Jin, L., Chrisatakis, N.A. 2009. Investigating the Mechanism of Marital Mortality Reduction: The Transition to Widowhood and Quality of Health Care. Demography 46(3), 605-625.

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More Information

Indoor Carbon Monoxide (S.C. DHEC)
Carbon Monoxide Fact Sheet /Spanish (S.C. DHEC)
CO Poisoning (CDC)

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CR-011774 6/16