Published in final edited form as:
J Sch Nurs. 2019 December ; 35(6): 442–448. doi:10.1177/1059840518785441.

Radon Testing Status in Schools by Radon Zone and School Location and Demographic Characteristics: United States, 2014

Jones Sherry Everett, PhD, MPH, JD[1], **Stephanie Foster, MPH, MA**[2], **Andrew S. Berens, MS**[2]

[1]Division of Adolescent and School Health, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, GA, USA

[2]Division of Toxicology and Human Health Studies, National Center for Environmental Health, Agency for Toxic Substances and Disease Registry, Atlanta, GA, USA

Abstract

Radon is a naturally occurring, radioactive, colorless, odorless gas, and the second leading cause of lung cancer. The 1990–1991 National School Radon Survey estimated that more than 70,000 schoolrooms nationwide had "high short-term radon levels." Using data from a nationally representative survey of schools in the United States ($N = 568$; response rate = 69%), we examined the location and demographic characteristics of U.S. schools that had ever been tested for radon and whether having been tested varied by radon zone, which predicts average indoor radon levels in U.S. counties. Overall, 46.0% (95% confidence interval [39.8%, 52.4%]) of schools reported that they had ever been tested for radon. Testing significantly varied by region, percentage of minority students, and radon zone. These findings highlight the need for improved awareness of radon testing in schools, as testing is the only way to identify when remediation is needed.

Keywords

chronic diseases; environmental health/safety; cancer; radon

In 2005, the U.S. Surgeon General issued a "National Health Advisory on Radon" (U.S. Department of Health and Human Services, 2005). Radon "is a colorless, odorless, radioactive, gas [that] comes from the natural decay of uranium that is found in nearly all soils" (U.S. Environmental Protection Agency [U.S. EPA], 1993, p. I-1). It is the second leading cause of lung cancer, causing an estimated 21,000 lung cancer deaths in 2003 (U.S. EPA, 2018). Radon-related lung cancer risk is influenced by age, time since initiation of exposure, duration of exposure, concentration of radon in the home, and cigarette smoking

Corresponding Author: Sherry Everett Jones, PhD, MPH, JD, Division of Adolescent and School Health, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, 1600 Clifton Rd, NE, MS E75, Atlanta, GA 30329, USA. sce2@cdc.gov.

Authors Contribution
SEJ conducted all data analysis. SEJ, SF, and ASB contributed to interpretation, drafting, and editing of the manuscript.

The findings and conclusions on this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the Agency for Toxic Substances and Disease Registry.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

(Tarrago, 2010). Assessing indoor radon levels in schools and mitigating exposure when levels are high could be an important means of reducing radon exposure among youth but also among the more than 6 million adults for whom elementary and secondary school buildings are a workplace (National Center for Educational Statistics, 2016).

During the 1990s, the EPA categorized all U.S. counties into one of three radon zones (Figure 1). These zones were based on multiple factors, depending upon available data, including geology, soil parameters, aerial radioactivity, residential foundation types, and residential indoor tests to predict an average indoor radon level in that county, although not for any specific property (U.S. EPA, 1993). According to the EPA, "zone 1 counties have a predicted average indoor screening level > 4 pCi/L" (picocuries per liter), which the EPA considers actionable (U.S. EPA, 1993, p. I-2). "Zone 2 counties have a predicted average indoor screening level ≥ 2 and ≤ 4 pCi/L," and "zone 3 counties have a predicted average indoor screening level < 2 pCi/L (U.S. EPA, 1993, p. I-2). Although school-building characteristics and school radon tests were not used to determine radon zones, the EPA has estimated that more than 70,000 schoolrooms have "high short-term radon levels" and recommends all schools test for radon because elevated indoor radon levels have been found in all three zones (U.S. EPA, 1993, 2017). Other than EPA's initial work to map radon zones and ongoing guidance documents for school radon testing and mitigation, no study has examined whether school location or demographic characteristics are associated with school radon testing. Thus, the purpose of this study was to conduct a secondary analysis of the 2014 School Health Policies and Practices Study data to examine the location and demographic characteristics of schools that had ever been tested for radon and whether the prevalence of radon testing in U.S. schools varied by EPA-designated radon zone.

Method

"The School Health Policies and Practices Study (SHPPS) is a national survey periodically conducted [by the Centers for Disease Control and Prevention] to assess school health policies and practices at the state, district, school, and classroom levels" (Centers for Disease Control and Prevention [CDC], 2017). The 2014 SHPPS, conducted from February through June 2014 (CDC, 2015), examined 10 components of school health identified in the whole school, whole community, whole child model (ASCD & CDC, 2014). The 2014 study was reviewed by the institutional review boards at both the CDC and ICF International (contractor who conducted fieldwork for the study) and determined to be exempt.

The SHPPS data are publicly available with documentation that provides a detailed description of the 2014 study methods (CDC, 2015). A summary is provided here. To develop the 2014 questionnaires, all of the 2006 SHPPS questionnaires were reviewed to determine whether questions needed to be added or revised. New questions added for the 2014 study, and questions that were modified substantially from the 2006 study, were cognitively tested using in-person interviews. Reviewers from federal agencies, national associations, foundations, universities, and businesses nationwide evaluated the draft questionnaires.

Sampling Design and Survey Administration

The 2014 SHPPS used a two-stage sampling design to select a nationally representative sample of schools. In the first stage of sampling, primary sampling units (which were school districts or groups of school districts) were selected with probability proportional to size. At the second stage of sampling, two schools per level per primary sampling unit were selected. All public, state-administered, Catholic, and non-Catholic private schools with any of grades K–12 were eligible, but alternative schools, schools providing services to a "pullout" population who were provided services at another eligible school, schools run by the Department of Defense or Bureau of Indian Education, and schools with fewer than 30 students were excluded. The number of sampled schools was 828. This report examined school-level data from the Healthy and Safe School Environment questionnaire, which was comprised of three modules that grouped related items so schools could identify a respondent who was responsible for or most knowledgeable about the items covered in that module. This also allowed for different respondents for each module. For the module containing the question about radon testing, the response rate was 69% ($N = 568$). Most (89%) of the data were collected via computer-assisted interviews; the remaining respondents used paper questionnaires.

Study Measures

The study questionnaire asked, "Has [the school] ever been tested for radon" (response options were yes or no). For this question, 166 respondents did not answer either yes or no; that is, skipped the question though they had answered other questions in the module. Responses for which there was no answer were set to "missing." Neither verification of radon testing nor radon test results were collected. Based on the data from the National Center for Education Statistics, schools were classified by metropolitan status (city, suburb, town, and rural), region (West, Midwest, Northeast, and South), and school type (public [including state-administered schools] and private [Catholic and non-Catholic private schools]).

The CDC linked the 2014 SHPPS data with data from the Market Data Retrieval (Shelton, CT) database which is updated yearly and provides information about schools and school districts. The Market Data Retrieval database allowed us to identify the county and, therefore, the EPA radon zone in which the school was located. Other Market Data Retrieval variables included in this analysis, but available only for public schools, were percentage of non-White students (range: 0–99%; hereafter referred to as "percentage of minority students") and the percentage of students eligible for free or reduced-price meals (range: 0–100%). The percentage of students eligible for free or reduced-price meals was based on the Market Data Retrieval database definition "the percent of students receiving free or reduced-price lunch attending a school or district and who qualify for the title 1 program." The analytic sample is described in Table 1.

Statistical Methods

Data were weighted to produce national estimates, and analyses were conducted using SUDAAN statistical software (version 11.0.1) to account for the complex sampling design. The main purpose of this analysis was to examine whether radon zone was associated with school radon testing, but also whether the association between radon zone and school radon testing was moderated by school location and demographic characteristics. Further, it was important to determine whether the characteristics of schools that did not answer the radon testing question were systematically different than those that did answer the radon testing question. First, χ^2 tests were used to assess whether schools that did not answer the radon testing question differed by school location and demographic characteristics. Second, among schools that did answer the radon testing question, χ^2 tests assessed whether schools that had ever been tested for radon differed by school location and demographic characteristics. Then, logistic regression analyses examined whether radon zone was associated with radon testing, controlling for school characteristics found to be associated with school radon testing via the χ^2 tests.

Results

Overall, 32.4% (95% confidence interval [CI] = [27.3%, 37.9%] of schools reported that they had ever tested for radon, 37.9% (CI [33.2%, 43.0%]) reported they had not ever tested for radon, and 29.7% (CI [24.8%, 35.0%]) did not answer the radon testing question. An analysis of the location and demographic characteristics of schools that had not answered the radon question, but had answered other questions in the module, suggests schools that did not answer the question did not differ significantly by radon zone, metropolitan status, percentage of students eligible for free or reduced-price meals, or percentage of minority students. Not having answered the radon question, however, was significantly associated with school type and region: Public schools (34.8%) were more likely than private schools (12.5%), schools in the South (37.9%) and West (35.2%) were more likely than schools in the Northeast (16.4%), and schools in the South (37.9%) were more likely than schools in the Midwest (24.0%) to have not answered or skipped the radon question.

Because schools with missing data did not vary significantly across most of the school location and demographic characteristics, or by radon zone, all further analyses were conducted among schools that had answered the radon testing question (unweighted N = 402; Table 2). Among these schools, 46.0% (CI [39.8%, 52.4%]) reported having had ever been tested for radon. Bivariate analyses found that having ever tested for radon did not significantly vary by school type, metropolitan status, or percentage of students eligible for free or reduced-price meals; however, radon testing was associated with region (χ^2 p value = .002) and percentage of minority students (χ^2 p value = .03). Schools in the Northeast and Midwest were more likely than schools in the South and West, and schools with 0–32% minority students were more likely than schools with 33–65% and with 66–100% minority students to report having ever been tested for radon.

Bivariate analysis found that radon testing varied by radon zone: 61.6% (CI [49.3%, 72.6%]) of schools in Zone 1, 46.5% (CI [36.9%, 56.3%]) of schools in Zone 2, and 28.8% (CI [19.9%, 39.6%]) of schools in Zone 3 reported having ever been tested for radon (χ^2 p = value .001). Two logistic regression models examining the association between radon zone and radon testing were used (Table 3). The first model controlled for region and percentage of minority students (as previously mentioned, this analysis included only public schools because percentage of minority students was not available for private schools) and found that compared to schools in Zone 3, schools in Zone 1 (adjusted odds ratio [*AOR*] = 3.5; CI [1.4, 9.1]) and Zone 2 (*AOR* = 2.2; CI [1.1, 4.7]) had significantly higher odds of having ever been tested for radon. In the second model, controlling only for region (thus including both public and private schools), the association remained significant: Compared to schools in Zone 3, schools in Zone 1 (*AOR* = 3.5; CI [1.6, 7.7]) and Zone 2 (*AOR* = 2.5; CI [1.3, 4.8]) had significantly higher odds of having ever been tested for radon.

Discussion

Schools located in a county identified by the EPA as a zone with the highest potential for elevated indoor radon levels were most likely to have tested for radon; yet, almost 40% of those schools had not ever been tested. Further, even though elevated levels of radon are found in all three zones, almost half of schools in Zone 2 and more than two thirds of schools in Zone 3 had not been tested. The findings may reflect the U.S. congressional directives to the EPA to prioritize funding and assistance for "diagnostic and remedial efforts to reduce the levels of radon" in school buildings in "high-risk areas" (15 USCS §2667, 2001). These data also mirror, in part, the findings of a study examining the association between radon zone and school district policies requiring schools to test for radon and addressing radon-resistant new construction practices (Foster & Everett Jones, 2016). That study found that the percentage of school districts requiring schools be tested for radon was highest in Zone 1 (42%) and lowest in Zone 3 (28%). In contrast, that study found radon zone was not associated with a school district policy addressing radon-resistant new construction practices for schools, the prevalence of which ranged from 30% to 38% across radon zones.

More than half of the schools in the Northeast and Midwest reported having ever been tested for radon compared to about one third of schools in the South and West. These regional differences may reflect the higher proportion of counties in the Northeast and Midwest in Zones 1 and 2 (U.S. EPA, 1993). These areas were a focus of congressional and EPA assistance and funding to develop state radon programs; however, additional investigation would elucidate what factors account for higher radon testing rates in some areas. Likewise, it is unclear why schools with the lowest percentage of minority students were more likely than schools with more than one-third minority students to have ever tested for radon. This relationship did not hold in the adjusted logistic regression model, suggesting region mitigates this relationship. Nonetheless, it is important that radon testing is addressed in disenfranchised communities to ensure environmental justice issues are not exacerbated by a lack of attention to radon.

This study should be considered in light of some limitations. First, the EPA-designated radon zones do not indicate the actual indoor radon levels or identify the risk of high indoor radon levels for any individual school or property (U.S. EPA, 1993). Second, radon testing status was based on self-report and neither verification of radon testing nor radon test results were collected. Third, a large number of survey respondents did not answer the radon testing question; however, these schools did not differ by radon zone, metropolitan status, percentage of students eligible for free or reduced-price meals, or percentage of minority students which suggests that not answering the radon testing question was unlikely to have biased the findings. Fourth, factors not measured in this study may confound or explain the relationship between radon zone and radon testing, such as state or local laws, policies, programs, or funding related to radon testing and mitigation that may be more prevalent in areas more likely to have higher indoor radon levels. Future research could explore the reasons why many schools failed to answer the radon testing question, whether school staff are aware of the issue of radon, and the important barriers (including, but not limited to, financial) and facilitators to school radon testing.

It is possible that the large number of respondents who did not answer the radon testing question was a function of respondents being unsure: “don’t know” or “unsure” were not response options. For some schools, testing may have occurred many years ago and current staff may be unaware of previous radon testing. For other schools, the emphasis on radon testing following U.S. congressional directives to the EPA in the 1990s may have predated the school’s construction and mean that there was limited awareness of the importance of radon testing and mitigation when the school was built.

For schools unaware of their testing status, it could be useful for school staff to search their records for radon test results and inform their staff and students of the results if any are identified. A lack of knowledge of the school’s radon testing history suggests an opportunity to inform school administration and staff about the importance of radon testing and grant funding opportunities for schools because indoor radon levels can be elevated in any radon zone and testing is the only way to identify when remediation is needed.

Implications for School Nurses

School nurses are the health experts in the school setting and understand the importance of a healthy school environment (McDowell, Bryner, & Chau, 2014). The health risks associated with radon may not be well understood by school personnel but can be explained by school nurses who are respected health advocates with the educational and clinical background to translate the science of environmental hazards (McDowell et al., 2014; Neumann et al., 2017). Indeed, school nurses are uniquely positioned to access the school community, including external stakeholders, to address the potential long-term risks to the health of students and staff associated with radon exposure. Because any health effects of radon are not an immediate threat to students’ ability to learn, and any health effects will not be realized until students reach adulthood, schools may not prioritize testing and remediation.

In keeping with the vision of the National Radon Action Plan (U.S. EPA, 2015), the low rates of testing highlight the need for increased rates of radon testing in schools. Even in the absence of funding for radon testing, both the American Association of Radon Scientists and Technologists and the National Radon Proficiency Program (http://aarst-nrpp.com/wp/) have a number of resources related to reducing radon exposure in schools through the use of radon-resistant design and construction of school buildings, radon testing, and radon management and mitigation.

In addition, EPA has a number of resources to address school indoor air quality, such as Indoor Air Quality Tools for Schools guidance (https://www.epa.gov/iaq-schools). This guidance addresses an array of issues related to school indoor air quality, including documentation for why indoor air quality, including radon, is so important for health and academic success. Specifically, this guidance provides information for school nurses who aim to "maintain student health; educate students on IAQ, health and hygiene; [and] keep a clean, properly ventilated office or clinic" (https://www.epa.gov/iaq-schools/health-officer-and-school-nurse-checklist-indoor-air-quality-tools-schools). EPA also provides guidance specific to the unique nature of school buildings needing radon testing and mitigation (http://www.epa.gov/radon/radon-schools and https://www.epa.gov/iaq-schools/managing-radon-schools). Using these resources, school nurses, as well as school administrators, families, and the community can play an important role in garnering local support for increased radon testing and mitigation as a way to reduce radon-induced lung cancer in the United States.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Biographies

Sherry Everett Jones, PhD, MPH, JD, is a Health Scientist at Centers for Disease Control and Prevention, Atlanta, GA, USA.

Stephanie Foster, MPH, MA, is an epidemiologist at National Center for Environmental Health, Atlanta, GA, USA.

Andrew S. Berens, MS, is a GIS Analyst at National Center for Environmental Health, Atlanta, GA, USA.

References

ASCD & Centers for Disease Control and Prevention. (2014). Whole school, whole community, whole child: A collaborative approach to learning and health.Alexandria, VA:ASCD. Retrieved from http://www.ascd.org/ASCD/pdf/siteASCD/publications/wholechild/wscc-a-collaborative-approach.pdf

Centers for Disease Control and Prevention. (2015). School health policies and practices study 2014.Atlanta, GA:U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Retrieved from http://www.cdc.gov/healthyyouth/data/shpps/pdf/shpps-508-final_101315.pdf

Centers for Disease Control and Prevention. (2017). School health policies and practices study (SHPPS).Atlanta, GA:U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/healthyyouth/data/shpps/index.htm

Foster S, & Everett Jones S (2016).Association of school district policies for radon testing and radon-resistant new construction practices with indoor radon zones. International Journal of Environmental Research and Public Health, 13, 1234. [PubMed: 27983613]

McDowell BM, Bryner J, & Chau EA (2014, January).Position statement. Environmental health in the school setting: The role of the school nurseSilver Spring, MD:National Association of School Nurses. Retrieved from https://www.nasn.org/nasn/advocacy/professional-practice-documents/position-statements/ps-environmental-health

National Center for Educational Statistics. (2016, August).Digest of educational statistics. Tables 213.10. Staff employed in public elementary and secondary school systems, by type of assignment: Selected years, 1949–50 through fall 2014 Retrieved from https://nces.ed.gov/programs/digest/d16/tables/dt16_213.10.asp?current=yes

Neumann L, Combe L, Lambert P, Bartholomew K, Morgan S, & Bobo N (2017, June). Position statement. Whole school, whole community, whole childe: Implications for 21st century school nursesSilver Spring, MD:National Association of School Nurses. Retrieved from https://www.nasn.org/nasn/advocacy/professional-practice-documents/position-statements/ps-wscc

Radon in Schools, 15 USCS §2667. (2001).

Tarrago O (2010). ATSDR case studies in environmental medicine: Radon toxicity.Atlanta, GA:U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry.

U.S. Department of Health and Human Services. (2005, January 13).Surgeon general releases national health advisory on radon. Retrieved from http://www.adph.org/radon/assets/surgeon_general_radon.pdf

U.S. Environmental Protection Agency. (1993, September).EPA’s map of radon zones national summary. Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi/0000098R.PDF?Dockey=0000098R.PDF. Interactive Internet version of EPA’s radon map available at https://www.epa.gov/radon/epa-map-radon-zones

U.S. Environmental Protection Agency. (2015, November 10).The national radon action plan: A strategy for saving lives. Retrieved from https://www.epa.gov/sites/production/files/2015-11/documents/nrap_guide_2015_final.pdf

U.S. Environmental Protection Agency. (2017, August 17).Radon in schools. Retrieved from https://www.epa.gov/radon/radon-schools

U.S. Environmental Protection Agency. (2018, February 23). Health risk of radon. Retrieved from https://www.epa.gov/radon/health-risk-radon

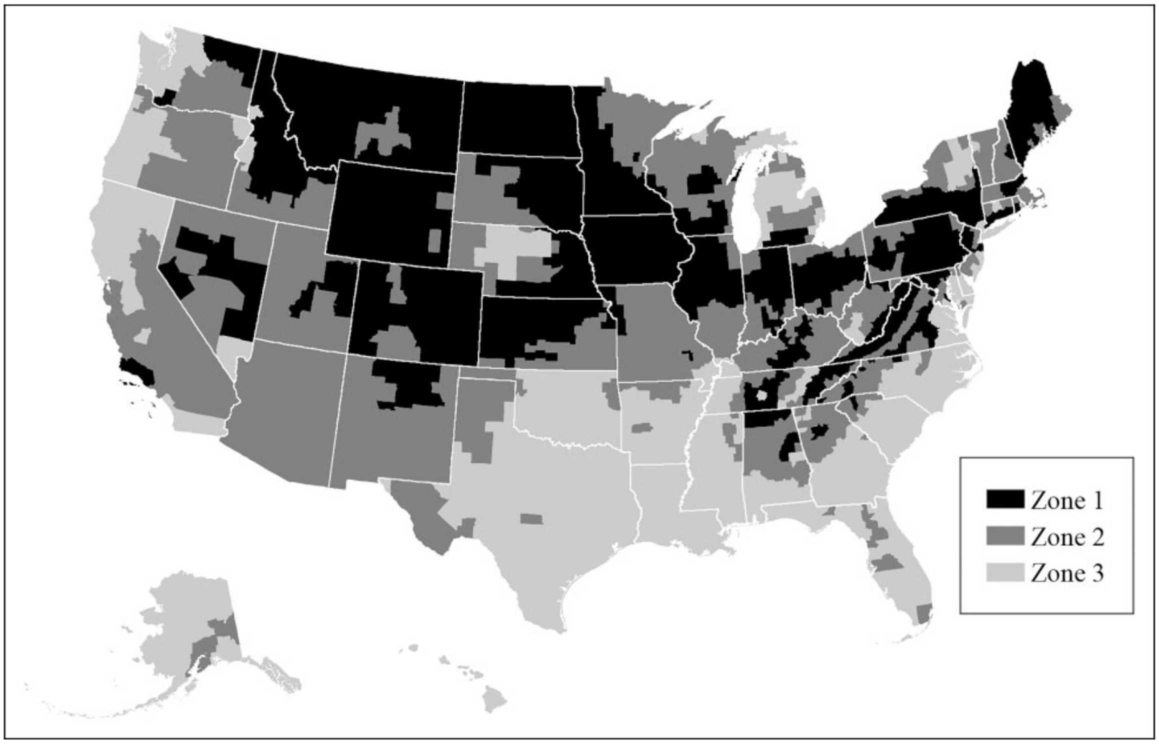

Figure 1.

Environmental Protection Agency map of radon zones by U.S. county. Zone 1 counties have predicted average indoor radon levels greater than 4 pCi/L (picocuries per liter), which the environmental protection agency considers actionable. Zone 2 counties have predicted average indoor radon levels from 2 to 4 pCi/L. Zone 3 counties have predicted average indoor radon levels less than 2 pCi/L.

Table 1.

Description of Schools Responding to the Healthy and Safe School Environment Questionnaire—School Health Policies and Practices Study, 2014.

School Location and Demographic Characteristics	Unweighted *N* (Weighted %)
Radon zone: Predicted average indoor radon levels	
Zone 1: >4 pCi/L	145 (26.7)
Zone 2: 2–4 pCi/L	237 (42.1)
Zone 3: <2 pCi/L	170 (31.3)
School type	
Public	488 (76.8)
Private[a]	98 (23.2)
Metropolitan status	
City	160 (32.1)
Suburb	173 (29.4)
Town	72 (11.6)
Rural	181 (26.8)
Region	
Northeast	101 (18.7)
Midwest	161 (25.2)
South	193 (31.4)
West	131 (24.7)
Percentage of students eligible for free or reduced-price meals[b]	
0–32%	129 (29.4)
33–65%	170 (38.5)
66–100%	129 (32.1)
Percentage of minority students[b]	
0–32%	222 (50.7)
33–65%	86 (21.0)
66–100%	l09 (28.3)

Note. pCi/L = picocuries per liter.

[a] Includes Catholic and non-Catholic private schools.

[b] Percentage of students eligible for free or reduced-price meals and percentage of minority students are available only for public schools.

Table 2.

Percentage of Schools that had Ever Been Tested for Radon, by Radon Zone and School Characteristics, School Health Policies and Practices Study, 2014.

	School Had Ever Been Tested for Radon[a] % [95% CI]
Radon zone: Predicted average indoor radon levels	
Zone 1: >4 pCi/L	61.6 [49.3, 72.6]
Zone 2: 2–4 pCi/L	46.5 [36.9, 56.3]
Zone 3: <2 pCi/L	28.8 [19.9, 39.6]
χ^2 p value	.001
School type	
Public	49.1 [42.0, 56.3]
Private[b]	38.3 [27.2, 50.8]
χ^2 p value	.12
Metropolitan status	
City	39.0 [27.5, 51.7]
Suburb	51.5 [40.3, 62.5]
Town	47.6 [31.2, 64.7]
Rural	47.2 [36.3, 58.4]
χ^2 p value	.53
Region	
Northeast	64.0 [50.5, 75.6]
Midwest	52.7 [40.8, 64.3]
South	34.3 [24.8, 45.2]
West	34.7 [24.4, 46.6]
χ^2 p value	.002
Percentage of students eligible for free or reduced-price meals[c]	
0–32%	56.8 [45.5, 67.4]
33–65%	45.3 [33.2, 58.1]
66–100%	46.3 [33.4, 59.7]
χ^2 p value	.34
Percentage of minority students[c]	
0–32%	57.2 [47.9, 66.0]
33–65%	38.8 [25.1, 54.6]
66–100%	38.8 [25.0, 54.7]
χ^2 p value	.03

Note. N = 402. CI = confidence interval; pCi/L = picocuries per liter.

[a] Among schools that had answered the radon testing question.

[b] Includes Catholic and non-Catholic private schools.

[c] Data for percentage of students eligible for free or reduced-price meals and percentage of minority students are available only for public schools.

Table 3.

Adjusted Odds of School Radon Testing, by Radon Zone and School Characteristics, School Health Policies and Practices Study, 2014.

	Model 1		Model 2	
	Adjusted *OR* [95% CI][a]	***p* value**	**Adjusted *OR* [95% CI][b]**	***p* value**
Radon zone: Predicted average indoor radon levels				
Zone 1: >4 pCi/L	3.5 [1.3, 9.3]	.01	3.5 [1.6, 7.7]	.002
Zone 2: 2–4 pCi/L	2.2 [1.0, 4.7]	.04	2.5 [1.3, 4.8]	.006
Zone 3: <2 pCi/L	Ref	Ref	Ref	Ref
Region				
Northeast	5.2 [1.9, 14.0]	.001	4.5 [2.0, 10.2]	< .001
Midwest	2.4 [1.0, 5.7]	.06	2.4 [1.1, 5.4]	.03
South	1.3 [0.6, 3.0]	.50	1.8 [0.9, 3.8]	.11
West	Ref	Ref	Ref	Ref
Percentage of minority students				
0–32%	1.5 [0.7, 3.0]	.30	NA	NA
33–65%	1.3 [0.5, 3.3]	.61	NA	NA
66–100%	Ref	Ref	NA	NA

Note. Variable was not included in the model. *OR* = odds ratio; CI = confidence interval; pCi/L = picocuries per liter; Ref = referent; NA = not applicable, variable was not included in the model.

[a]Controlling for region and percentage of minority students. Because data for percentage of minority students were available for public schools but not available for private schools, this model was conducted among public schools only.

[b]Controlling for region. This model includes data from public and private schools.