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Evaluating Progress in Radon Control Activities for Lung Cancer Prevention in National Comprehensive Cancer Control Program Plans, 2011–2015

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Abstract

Radon is the second leading cause of lung cancer among smokers and the leading cause among nonsmokers. The Centers for Disease Control and Prevention's National Comprehensive Cancer Control Program (NCCCP) funds every state, seven tribes, seven territories and the District of Columbia to develop formal cancer plans that focus efforts in cancer control. A 2010 review of cancer plans identified radon-related activities in 27 (42%) plans. Since then, 37 coalitions have updated their plans with new or revised cancer control objectives. There has also been recent efforts to increase awareness about radon among cancer coalitions. This study assesses NCCCP grantees current radon activities and changes since the 2010 review. We reviewed all 65 NCCCP grantee cancer plans created from 2005 to 2015 for radon related search terms and categorized plans by radon activities. The program's most recent annual progress report to CDC was also reviewed. We then compared the results from the updated plans with the findings from the 2010 review to assess changes in radon activities among cancer coalitions. Changes in state radon laws between 2010 and 2015 were also assessed. While a number of cancer plans have added or expanded radon-specific activities since 2010, approximately one-third of NCCCP grantees still do not include radon in their cancer plans. Cancer programs can consider addressing radon through partnership with existing radon control programs to further reduce the risk of lung cancer, especially among non-smokers.

Keywords

Radon; Lung cancer; Cancer prevention; Comprehensive cancer control

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Disclaimer The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

Introduction

Lung cancer is the leading cause of cancer death in the United States (US), and smoking is the strongest risk factor for the disease [1]. The second greatest risk factor is exposure to radon, which causes approximately 21,000 cases of lung cancer per year [2–8]. High levels of radon exposure in homes have been associated with lung cancer risk, regardless of the patient's smoking status, according to analyses of pooled data from multiple studies in China, Europe, and North America [9–11].

Radon is a ubiquitous, colorless, odorless, radioactive gas that is a decay product of uranium. A dense gas, radon is often found at higher concentrations in the lower levels of buildings than in upper levels. The U.S. Surgeon General and the Environmental Protection Agency (EPA) recommend that every residence be tested for radon. EPA estimates that 1 in 15 residences in the U.S. exceed the 4.0 pCi/L (picocuries per liter of air, the standard U.S. metric for radon) radon level at which they recommend mitigation steps to reduce radon exposure [12, 13]. As of March 2015, 39 states and the District of Columbia had radon-related laws that require testing, mitigation, or disclosure of radon levels in real estate transactions [14]. In addition, EPA funds state and tribal radon control programs to subsidize or encourage radon testing in residences and schools, mitigate residences with high radon levels, encourage radon-resistant building practices, and develop professional licensure programs [15].

The Centers for Disease Control and Prevention (CDC) supports states, tribes, and territories in their efforts to identify and control radon through partnership in the Federal and National Radon Action Plans, technical assistance, and activities to increase awareness of radon control as a public health issue. CDC's National Comprehensive Cancer Control Program (NCCCP) funds 65 cancer control programs in 50 states, the District of Columbia, seven tribes, and seven territories to form cancer coalitions [16]. These coalitions receive additional support from a variety of public and private sources to synergize efforts and develop formal plans to prevent and control cancer in their populations [16]. In 2010, CDC conducted an initial review of cancer plans to assess how many included radon-related activities [17]. Only 27 plans had measureable activities around radon at that time. Since then, CDC has increased knowledge of radon control among NCCCP grantees, and developed a Promising Practices for Radon Control brief for cancer coalitions that highlighted radon-resistant construction practices, state-supported radon professional licensing, and notification of radon results policies during a home sale or lease [18]. Also, 37 cancer coalitions (31 states, Washington D.C., two territories, and three tribes) updated their plans with new or revised cancer control objectives since 2010. This study's objective was to review all 65 current cancer plans to determine if there have been changes in the scope or depth of radon-related activities in the cancer plans for NCCCP states, tribes, and territories since 2010.

Methods

The most recent cancer plans for all NCCCP grantees are available on the CDC website [19]. The search tool on this website was used to search the 65 plans. The search was

conducted in July 2015, during which 28 of the 65 NCCCP-funded programs had Comprehensive Cancer Control plans that started between 2005 and 2010, while 37 programs had cancer plans that had been updated since 2011. Each cancer plan covers activities spanning 5 years with different objectives having specific timeframes within the plan.

The key terms “radon,” “radiation,” or “lung,” were used independently to identify plans for further review. Each identified plan was then reviewed by using the Adobe Acrobat Reader version 10.1.0 (Adobe Systems Inc, San Jose, CA) search tool for the corresponding terms within the document. In addition, all sections pertaining to lung cancer or environmental health were reviewed for any possible connection to radon recognition and activities. Each section was then classified as pertaining to one or more of the following categories: recognition of radon as a carcinogen, improving awareness of radon among their population, home testing for radon, mitigating buildings with radon levels ≥4.0 pCi/L, supporting education or implementation of radon policy activities, and efforts to evaluate radon-specific policy activities. Any occurrence of an activity was counted and frequencies were totaled across plans.

The text from 37 new plans was then compared to text from the same grantee’s previous plan used in the previous review [17]. The changes were then categorized into one or more of the following categories: new objectives, changed objectives, or removed objectives. Two investigators (PA and AN) conducted all searches and categorization of terms. Searches were performed independently, and all conflicts were resolved through consensus. NCCCP grantee’s 2014–2015 annual interim progress report, which describes activities during that reporting year of the 5 year cancer plan, were also reviewed to determine whether radon-specific activities identified in plans had been or were being implemented at the time of review.

Finally, the March 2015 Environmental Law Institute compilation [14] of all state radon laws was reviewed to classify each state’s radon law into the following categories: state-based licensing of radon professionals; radon building codes for new residences or schools; radon testing in residences, schools, day-care facilities, and government-owned buildings; signed notification of radon testing in residential sales or leases; and general radon education. We then compared whether states had added, expanded, or rescinded laws, in the context of programs who were involved in radon content according to the 2010 initial review [17].

Results

Forty-two plans (65% of all plans including 35 states, five tribes, and two territories) were identified as having terminology potentially associated with radon (Table 1). Further review found that five plans contained radon related search terms but did not recognize an association between radon and cancer risk, and five additional plans identified radon as a cancer-causing agent but did not discuss radon-related activities. In total, 32 plans with measurable activities related to radon were identified.

Twenty-eight plans (43%) had activities to improve awareness of radon as a risk factor for lung cancer, 21 (32%) had activities to increase residential radon testing, 19 (29%) addressed radon mitigation, 17 (26%) supported education or increased implementation of existing radon policy, and no plans included activities related to evaluation of existing radon policies (Table 1). Compared to the 2010 review, four more plans recognized radon as a carcinogen; one more planned to increase awareness of radon among their population; the same number included activities around home testing of radon; eight additional plans supported radon mitigation; four more supported education or increased implementation of existing policy activities; and one fewer planned to evaluate radon-specific policies.

Seven plans (IL, KY, MN, OH, TN, VA and Cherokee Nation) without any previous radon-related activities added at least one new measurable radon-related activity, seven (IA, MA, ME, NC, ND, NY, and UT) plans added radon-related objectives to those mentioned in previous versions or expanded existing radon-related activities, and two plans (CA and MT) dropped all radon activities from their plans that had been present in the previous review (Fig. 1). Some states from all regions of the US added or maintained radon content, including one tribe. Majority of the states in the Northeast expanded radon activities in their plans, and states that dropped radon content from their plans were predominately located in the West.

A review of the annual progress reports from NCCCP-funded programs for the 2014–2015 report cycle identified radon-related activities by 18 grantees (data not shown). Of the 18, eight contained language specific to radon and five had measurable goals; this was in comparison to three total grantees reporting radon-related activities in the 2010 review of progress reports.

As of March 2015, 32 states (76%) and Washington, DC, had 101 radon-specific laws (Fig. 2). Laws were most often related to disclosure of many environmental hazards including radon in real-estate transactions (31%), followed by laws related to state-based licensing of radon professionals (23%). Other laws included radon building codes for new residences or schools (17%); radon testing in residences, schools, daycare facilities, and government-owned buildings (16%); awareness of radon as a carcinogen (11%); and laws requiring separate and specific disclosure of radon in real estate transactions (2%). Compared to 2010, there were 21 additional laws on radon notification and disclosure, 4 additional radon testing laws, three additional laws on building codes, and two additional laws on professional licensing. One state repealed its radon laws since 2010.

Discussion

We identified an increase in the number of cancer plans that recognized radon as a carcinogen, had measurable radon-related activities, increased awareness around radon, addressed mitigation of radon, and supported radon policy. We also identified an increase in the number of laws specific to radon in the U.S. since 2010 [17].

Although two plans dropped radon activities, seven added radon-related activities to their plans and there was increased attention to radon mitigation in the plans that had been

updated. These have both been focus areas of CDC and stakeholder organization activities since 2010. Including radon in cancer plans is a main component of CDC's contribution to the Federal and National Radon Action Plans to better identify and address radon exposure in the U.S [20]. In addition, 15 more cancer coalitions reported radon-related work or recognition in their annual progress report to CDC than in 2010. These increases in radon-related information and activities in cancer plans from 2010 to 2015 highlight cancer coalitions' increasing awareness of radon exposure cancer risk and how addressing it can support cancer prevention efforts.

The majority of lung cancers are linked to smoking. However, lung cancer among non-smokers still accounts for 10–15% of all lung cancer cases, which would make lung cancer among nonsmokers one of the most common cancers in the U.S. if they were considered separately from cases caused by smoking [21]. Radon is the leading cause of lung cancer among non-smokers. It is often undetected because it has no color or odor and screening for lung cancers is not recommended among nonsmokers. These factors make it essential to focus on prevention strategies, like those that reduce radon exposure, to address lung cancer risk in this population [22]. A third of NCCCP grantees do not currently have radon related activities in their cancer plans, and grantees can bolster their lung cancer prevention efforts, particularly for nonsmokers, by working with partners such as local environmental protection divisions, lung cancer organizations, and radon professional groups in their communities that have existing knowledge of radon reduction efforts and incorporating strategies that reduce radon exposure into cancer plans.

The rate of construction of new homes without radon tests or high-quality mitigation systems continues to outpace those with tests and systems [23]. EPA continues to support the State Indoor Radon Grant program. Connecting the radon and cancer programs in many states has resulted in a synergistic relationship that furthers radon control. Comprehensive cancer control efforts that focus on the continued identification of and implementation of activities among local populations that may be more in need of radon mitigation (e.g., lower-income families and those that live in multi-unit housing) may yield continued progress in this area. Additional efforts that support long-term sustainability of the radon initiatives already undertaken by the NCCCP would help ensure radon mitigation remains a priority in future cancer plans. Interestingly, there was also little correlation between the presence of radon activities in cancer plans and radon laws in a given state. States with existing radon laws could incorporate support of these policies into their cancer plans to promote radon reduction work already happening in their states.

This review is subject to some limitations. Classification of radon-related activities can be subjective and so it is possible that some objectives were misclassified. Yet, the approach was simple and straightforward; having two reviewers likely also decreased any misclassification. Another limitation is that cancer plans are static and represent the priorities during the period of time they were written and may not reflect the most up-to-date or complete view of grantee activities.

In summary, this review notes progress in radon-specific awareness and activities in NCCCP-funded programs. NCCCP grantees must assess the needs of their specific

populations and the resources available to them to determine how best to approach cancer control in their region. Programs looking to increase their radon-related activities can also focus on increasing awareness of the risks of radon exposure and supporting existing local radon policies, including those around radon-resistant new construction and radon testing and mitigation. CDC is an active participant in the Federal and National Radon Action Plans and will continue to support radon control by synthesizing and disseminating information, building the evidence-base for radon-control interventions, evaluating the efficacy of its activities, and partnering with other agencies. Continued, routine assessments of program initiatives can help improve radon control activities in the U.S.

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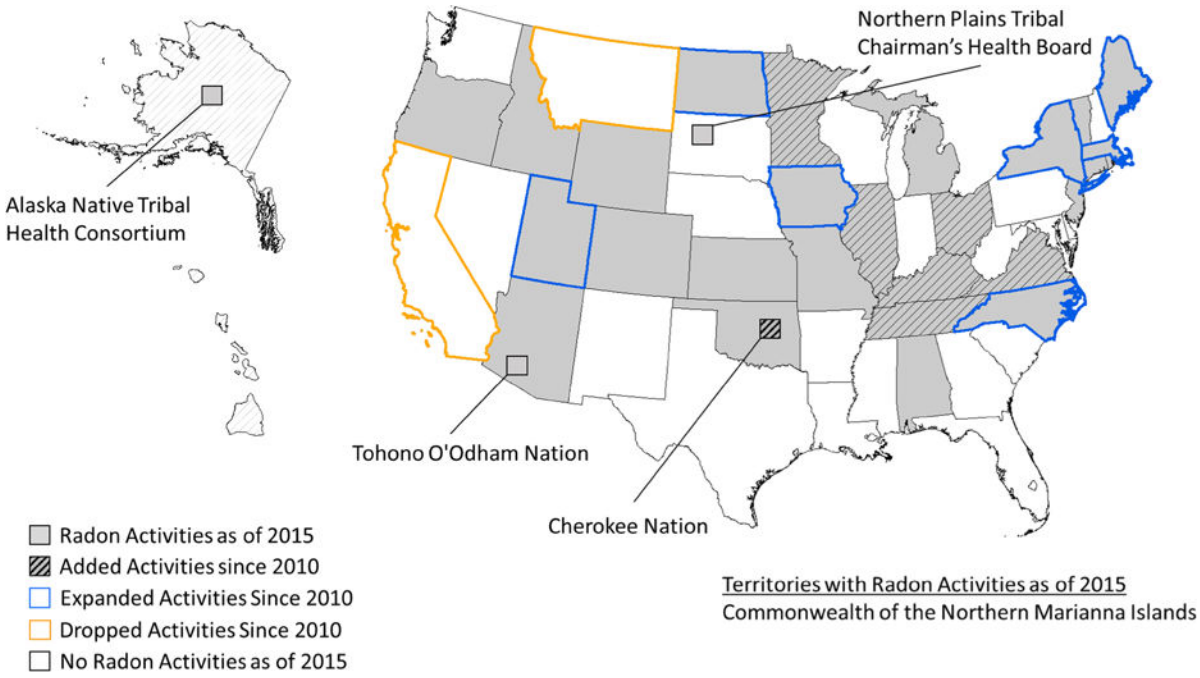

Fig. 1.

Radon content in National Comprehensive Cancer Control Program plans, by year of review and state, tribe, or territory

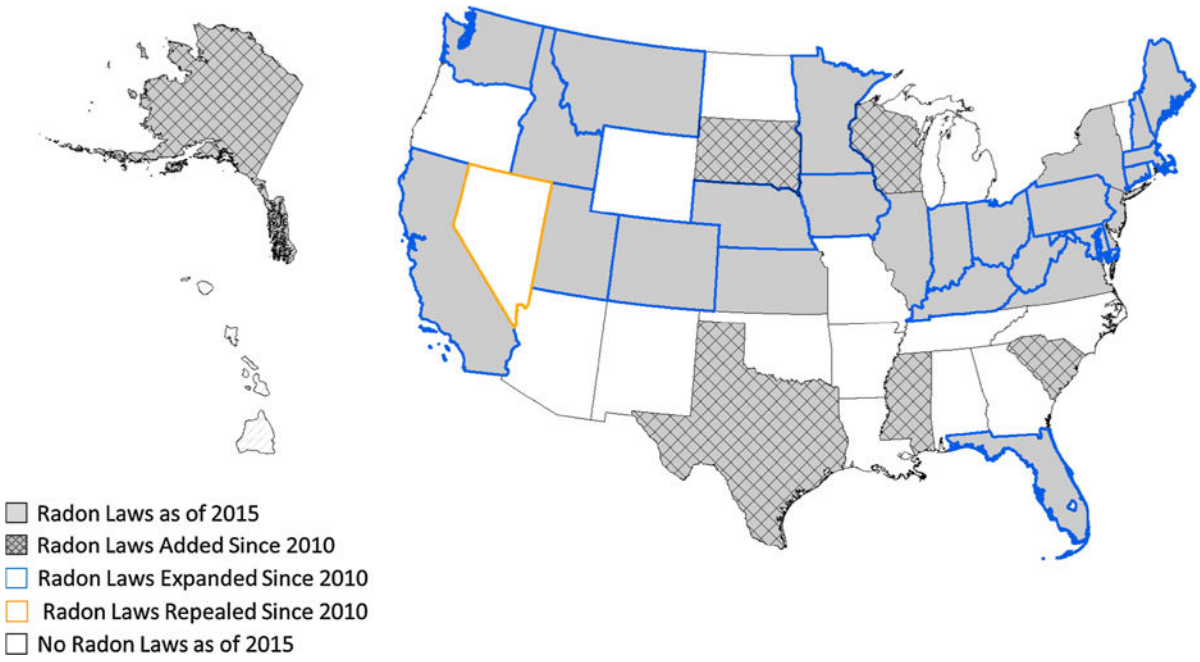

Fig. 2.
Existing radon-specific laws in the United States, by year and state

Table 1

Radon content in National Comprehensive Cancer Control Program plans, by year of review and type of content

	Radon-related terms	Recognition	Measurable activities	Awareness	Home testing (identification)	Mitigation	Supporting radon policy activities	Policy evaluation
2015 plan review N (%)*	42 (65%)	37 (57%)	32 (49%)	28 (43%)	21 (32%)	19 (29%)	17 (26%)	0 (0%)
2010 plan review N (%)*	42 (64%)	33 (51%)	27 (42%)	27 (42%)	21 (32%)	11 (17%)	13 (20%)	1 (2%)
Change	0	4	5	1	0	8	4	−1

Recognition -any information related to radon exposure and cancer risk. Measurable activities -any activities related to radon exposure that could be quantified. Awareness—any activities related to increasing awareness of radon exposure and cancer risk. Home testing (identification)—any activities related to increasing radon testing in homes. Mitigation—any activities related to mitigated homes with radon levels above 4 pCi/L. Supporting radon policy activities—any activities related to helping promote the use of existing radon policies. Policy evaluation—any activities related to evaluating the effects of existing radon policies

*Percents are calculated using the total number of plans (65) as the denominator