Radon Testing in Johnson County:
Reaching Out to Those Aging In Place

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Description of Goal

Our original goal was to increase the number of radon tests completed by those aged 60 and over in Johnson County by 5% by May 31, 2017. Because Johnson County Public Health has been unable to track the number of kits returned for testing as well as the demographics of who is sending in the kits, we have revised that goal. Our new goal is that by May 31, 2017, our campaign will increase the annual rate of radon test kits purchased from Johnson County Public Health by at least 10% each year through direct sales in the community. In fiscal year 2014, 289 kits were sold, thus the goal is to sell an additional 29 kits in fiscal year 2015 (ending June 30th), an additional 32 kits in fiscal year 2016, and an additional 35 kits in fiscal year 2017 (J. Lacina, personal communication, May 5, 2015). The campaign to increase direct kit sales in the community will be aimed towards our target audience of individuals over 60 years of age who are near retirement or already retired and are aging-in-place. We understand that those outside of our target demographic may purchase some of the kits at public tabling events, but in the end, an increase of radon test kit sales to anyone is a positive for the Johnson County community. In the subsequent segments we will discuss the specifics of our literature review supporting our decision to target older Johnson County homeowners, our formative evaluation and preliminary findings, as well as our implementation plans in influencing their actions regarding radon testing.

Significance of the Problem

Definition of Radon

Radon is a colorless, odorless gas that is released during the decay of uranium found in the soil and groundwater. Radon is a radioactive material that transmits ionizing radiation into the air as it decomposes (Environmental Protection Agency [EPA], 2003). The EPA recommends that living spaces test below the hazardous level of 4 picocuries per liter (pCi/L) (EPA, 2003).
Health Effects of Radon

Although imperceptible in nature, inhaled radon gas particles have significant health impacts on those with prolonged exposure. Hazardous effects have been largely associated with the carcinogenic qualities of radon and are strongly supported by the following literature review. The EPA’s report confirming radon as the second leading cause of lung cancer in the US attributes approximately 21,000 lung cancer deaths annually to the harmful substance (EPA, 2003), which surpasses the death tolls related to drunk driving, falls, drowning, and house fires (Gardyasz, 2000). In a comprehensive historical analysis of the causes of lung cancer, Alberg and Samet (2003) identified radon as a research-validated predisposing occupational exposure and reiterated the EPA’s estimated death rate. Evidenced in mining populations as early as the fifteenth century, fatality due to radon exposure has since been scientifically justified in the older population and has been found to demonstrate a linear dose-response relationship with a latency period of 30-35 years (Vogiannis & Nikolopoulos, 2014). When exposed to radon gas, smokers exhibit a higher prevalence of lung cancer than those who have never smoked, and those who have ever smoked report higher rates than non-smokers (Neuberger, 1994; EPA, 2003). A thoroughly documented and supported claim for the effects of radon on lung cancer risk has been fairly widely disseminated, however, more recent research has identified additional health hazards. A large scale prospective study conducted by Brauner et al. (2013) observed an associated risk and dose-response relationship between prolonged residential radon exposure and the risk of brain tumor development in a Danish population. In Hauri et al.’s (2013) article, a prospective cohort study assessed the association between childhood exposure to indoor radon pollution and juvenile leukemia. Although there was no identified immediate correlation between radon exposure and childhood cancer diagnoses, Hauri et al.’s (2013) findings are consistent
with the latency period mentioned in the previously cited literature. Exposure to radon gas has a significant impact on health outcomes, with an associated evidence supported dose-response relationship.

**Radon in Iowa**

Radon in the United States is reported in variable levels, with higher rates reported in the northern half of the country. The EPA assigns zones to counties based on average indoor screening levels and places all counties in Iowa in Zone 1, which is defined as an average reported rate greater than 4 pCi/L and is linked with the highest rate of associated health risks (EPA, 2003). According to a recent article in The Des Moines Register (2013), as many as 7 in 10 homes in Iowa have problematic levels of radon. Although tested exposure levels may report higher during winter months, high radon levels are still reported independent of the testing season (Villanueva-Whitman, 2013; Barros, Steck, & Field, 2014). A study conducted in 2000 analyzed the effect of residential radon exposure and lung cancer prevalence among Iowa women. Utilizing cancer registry information and radon exposure assessments, the study found a strong correlation between radon exposure and lung cancer risk among Iowa women (Field et al., 2014).

**Radon in Homes**

The harmful health effects imposed by radon exposure are often presented in an undetected manner. As illustrated in Appendix B Figure 2 provided by Vogiannis and Nikolopoulos (2015), radon can be introduced into the residential environment via a multitude of access points including cracks in concrete slabs or blocks, floor-wall joints, water sources, and building materials. Although access points stemming from preliminary ground sources are the most frequent contributors to radon exposure in the home, a Canadian study was conducted to
determine the magnitude of radon exposure attributed to building materials, although no significant findings resulted in the culmination of the assessment (Vogiannis & Nikolopoulos, 2015; Chen, Rahmen, & Atiya, 2010). In addition to building materials utilized during construction, research has analyzed the effect of various housing style models and the level of radon detected on various stories of the home. A study performed in 1998 by Fisher et al. assessed radon concentration in various locations in housing units to determine exposure variation between and within homes. Findings in this study concluded that lower levels of a home generally had higher concentrations of radon than the higher floors, but suggested that testing should be completed in multiple locations in the housing unit. One-story homes may also report higher radon levels on the first floor when compared to same-floor measures completed on a two-story house (Fisher et al., 1998). In our formative research, contact with Iowa City realtors identified a wide variation in housing styles and ages associated with high levels of radon upon professional testing. In a telephone interview with Larry Pickard of Coldwell Banker Real Estate, he stated that there seems to be “no rhyme or reason” differentiating houses with high levels from those that are normal (personal communication, March 13, 2015). Larry explained that two houses could be side by side or across the street and report vastly different exposure levels (personal communication, March 13, 2015). A similar conversation with Jackie Blank of Blank and McCune Realty further emphasized this trend. Jackie explained that people are under the misunderstanding that houses without basements typically have lower exposure levels than those with below-ground living space, however, her experience has revealed that “some of the highest ratings I’ve had are built on slabs” (personal communication, March 13, 2015).

Residential radon exposure in Iowa is a predisposing health risk regardless of the home layout.
Benefits of Testing and Remediation

Disseminating information about the potential danger and health risks associated with residential radon exposure can lead to increased rates of testing which may result in the implementation of remediation and mitigation procedures among housing units reporting high detection rates. Installing mitigation systems in homes with high levels of radon can improve health outcomes and overall quality of life. A study conducted in Sweden discovered that upon implementation of mitigation approaches to lower radon levels, 35-40% of radon-attributed lung cancer cases may be prevented (Axelsson et al., 2015). Informing homeowners of the positive implications of radon testing and mitigation may decrease lung cancer diagnoses related to radon exposure and positively impact long-term health status.

Intended Audiences and Why

In the interviews with Dave Powers, the rehabilitation specialist from UniverCity, and Allie Bain from the Iowa Cancer Consortium, both shared their perception that the older population have a low sense of susceptibility to radon (personal communication, March 18, 2015; personal communication, April 13, 2015). They claimed that older adults who have already lived in their home for decades feel that radon testing or mitigation would have little benefit to their prolonged exposure, if any. The idea of approaching older adults who were aging in place was enthusiastically confirmed by James Lacina, the Environmental Health Coordinator of Johnson County Public Health Department (personal communication, March 27, 2015). Furthermore, Denman et al. (2005) supported the idea that people aged 60-75 were the most likely segment to remediate, particularly if they owned and spent a large amount of time in their homes and felt that they could afford it. Therefore, we decided to target people aged 60 or older in Johnson County regarding radon testing as this age range allows for people who may be
retired or soon to be retired and potentially aging in place yet also reflects the target age for many of our potential partners discussed below. While the negative effects of radon might take about 30 years of exposure to create problems, we recognize that this population might be concerned not only about their own health as they age, but about the health of children, grandchildren, and pets in their homes as well (Denman et al., 2005; Vogiannis & Nikolopoulos, 2014).

**Partnerships**

The Iowa City/Johnson County Senior Center agreed to host tabling events at their institution for our radon project. This partnership will help support their mission “to promote optimal aging among older adults by offering programs and services that promote wellness, social interaction, community engagement, and intellectual growth. The Center serves the public through intergenerational programming and community outreach” (City of Iowa City, 2015). They already offer programming that is wellness and science-based, so information on radon testing and mitigation is a natural fit for the themes of their usual offerings. Kristin Kromway, operations assistant at the senior center, enthusiastically welcomed the partnership, and even suggested a Tuesday or Thursday morning as an optimal time because of the increased traffic due to band practices (K. Kromway, personal communication, March 27, 2015). Partnering with the senior center also creates the opportunity for ongoing, sustainable partnerships beyond the timeline of our project. James Lacina, the Environmental Health Coordinator at Johnson County Public Health, will support our work with the senior center. These complementary partnerships both allow us to start with our target population in creating a long-term sustainability program along with instrumental support in providing affordable five dollar radon tests through Johnson County Public Health.
Additional possibilities include partnering with Johnson County community churches. Many of the religious establishments include or host groups attended by older adults. Through personal communication with Mary Merulla (April 20, 2015), Zion Lutheran Church was identified as a partnership. Mary was enthusiastic about improving the health of the Lutheran congregation. She included an electronic message in the weekly bulletin to inform churchgoers of our tabling event, which occurred that Sunday during coffee time following the morning service. Another opportunity to partner with St. Patrick’s Catholic Church was identified. A monthly potluck for adults aged 50 and older and a Needleworkers group of older adults were suggested as possible points of tabling, however, due to the time constraints of the pilot-test period, the potential was left untapped. Future partnerships with inclusive religious congregations should be considered when disseminating the campaign materials.

Once we identified our intended audience of people over 60 who are aging in place, we reached out to partner with the Iowa Center on Aging, but discovered that it was a more research-based organization (N. Darvin, personal communication, March 23, 2015). We also contacted the Johnson County Livable Community for Successful Aging Initiative, whose mission states, “Discover how Johnson County, Iowa is a livable community where everyone can grow up and grow old with maximum independence, safety, and well-being,” but they did not have interest in partnering with us (L. Jacoby, personal communication, March 26, 2015).

Additionally, we met with Susan Blodgett, the executive director of Elder Services, Inc. in Iowa City, in hopes of establishing another partnership. However, there were not any avenues that we could pursue to disseminate information besides sending our materials with the Meals on Wheels volunteers to distribute en route (S. Blodgett, personal communication, March 31, 2015). Similarly, Kellie Elliot-Kapparos with Heritage Agency regrettably shared that they did not offer
“large scale events or health fair similar events” to help execute our project, but did suggest presenting at a “Task Force on Aging or staff” meeting (personal communication, April 6, 2015). Unfortunately, we felt as a group that those options would not help us to achieve our goals since we would not be directly interacting with our target audience. We also reached out to Iola Feldkamp with the Visiting Nurse Association (VNA) in Iowa City, but communication with this organization did not follow through. Nevertheless, the VNA should still be considered as a potential partnership since this organization could be effective in executing a radon campaign through clinics and other public health events in order to reach other members of our target population.

**Relevant Theories**

According to the aforementioned key informants, David Powers and Allie Bain, older adults who are aging in place have a low sense of susceptibility. They do not perceive the benefits of radon testing and mitigation, showing their possible sense of “hopelessness,” an unintended effect we strived to avoid in our campaign messaging (Cho & Salmon, 2006). The Health Belief Model (HBM) contains several constructs that address these variables and can help to effectively influence our target population. Champion and Skinner (2008) discuss concepts of perceived susceptibility and severity, ideas we can use to increase their beliefs about the likelihood of being affected by radon as well as enhance their attitudes about the seriousness of the health effects of radon if nothing is done to minimize exposure. This perceived threat would hopefully move them to action in requesting radon testing and pursuing mitigation in their homes. Our messages would also enable older homeowners to overcome any potential perceived barriers to radon testing, such as cost and time concerns, in order to expand the perceived benefits of decreasing their risk not only to themselves but also to their family members,
especially grandchildren, that may visit and spend time in the home. A final important construct to consider is that of perceived self-efficacy, in which cues to action would assist in individuals attaining a feeling that they can “successfully execute” radon testing (Champion & Skinner, 2008; Witte & Allen, 2000).

Through our tabling events, we would communicate cues to action to increase self-efficacy by providing radon test kits along with a demonstration on how to correctly use them. This offers a way for older homeowners to feel ready and self-sufficient to take action. Messages tailored to this population will empower them and create a feeling of competency and confidence in properly testing their homes for radon, enabling them to achieve a high level of self-efficacy.

Lustria et al.’s article (2013) supports the HBM by explaining that “tailoring works by increasing the personal relevance of health messages” (p.1040). Our campaign would increase their perception of disseminated information to be personally relevant, thus increasing their perceived susceptibility to radon and encouraging them to take action.

Similarly, we can use the Extended Parallel Process Model (EPPM) to help shape our messages. Building off of the HBM’s constructs of perceived susceptibility and perceived severity, using a fear-based message approach about radon would enhance our target population’s perceived threat and lead them to control this threat (danger control) by testing and mitigating (Lewis et al., 2013). Based on the response-efficacy of our radon messages, where one contemplates whether the message offers useful strategies, as well as the message self-efficacy, in which one believes they have the ability and competence to execute such an intervention, older homeowners will hopefully possess a “coping appraisal” that will guide them to actions of danger control in which they test for radon and mitigate appropriately instead of controlling their fear through denial and avoidance (Lewis et al., 2013). Appealing to the emotions, especially
fear, can be very powerful when trying to promote behavioral change, so evoking a high level of threat with a high level of self-efficacy as suggested by the HBM and the EPPM can theoretically move many individuals to accept radon messages and take action to test their homes.

**Theory-Driven Process**

In order to develop our messages, we combined constructs of the HBM and EPPM with a fear-based message and imaging approach. With the aid of our trifold poster and handout flyers in addition to verbal interrogations, we appealed to their perception of susceptibility by first asking them “Is radon lurking in your home?” which intrigued many to participate in our project. Although an “aversive element” and threatening term, many were receptive to the word *lurking*, and in combination with self-efficacy messages, “positive feelings” were generated about the campaign, a successfully intended effect (Slater, 2006, p. 154). We then invited them to ask themselves “Are you at risk?” questions- “Spend a lot of time in your home? Children or grandchildren that visit you? Pets that spend time in the lower parts of your home?” These questions prompted the reflection of the amount of time spent at home and of the exposure visitors may encounter in their house. Many of the participants answered “Yes” to at least one of the questions, which opened communication and increased their receptiveness to the rest of our messaging.

When conducting formative evaluation with our initial target audience and even with interactions with older homeowners, both populations seemed to have a sense of threat from radon, but did not know the severity of the health effects of this odorless gas. They often mentioned that they “know it’s bad” and that radon is “bad for you” (T. Sanders and R. Gage, personal communication, March 13, 2015). Therefore, we aimed to clarify the health threat with statistics to increase perceived severity by specifying that radon is the “2nd leading cause of lung
cancer” and that radon “contributes to 3,000 lung cancer deaths in non-smokers.” Our post-survey showed an increase in perceived severity after listening to our presentation, showing that these messages were indeed effective.

To describe the mechanics of radon exposure, we used terminology such as “creeps” and “trapped” to explain how radon enters a home and accumulates without adequate ventilation. Cho & Salmon (2006) warn in their article that an unintended effect of fear appeals is that individuals who perceive the threat as greater than their perceived self-efficacy tend to “control the unpleasant feeling of fear... and avoid thinking about the threat” (p. 92). Therefore, we did not want to instill too much fear that it would cause our audience to avoid the messages as Lewis et al. (2013) also warn in their article. So, we immediately transitioned from fear to positive self-efficacy messaging with the notion that testing and mitigation is “easy” and “relatively inexpensive.” Some shared with us the cumbersome testing process they used before which involved a larger box and was a long-term process. By physically demonstrating the ease of use of the cheap, newer test kits, we offered cues to action to appeal to their sense of self-efficacy. We explained that this small kit only needs to be hung for a maximum of a week and all that was required was to send the pre-stamped package in the mail. Many were inclined to obtain a test kit especially after learning that we were offering immediate sale of the kits. By providing our audience with step by step instructions, this approach successfully increased their sense of self-efficacy and belief that they do indeed possess the capability of correctly testing, which moved people to “control the danger” of radon by purchasing a radon test kit (Lewis et al., 2013).

Although not originally included when developing our messaging, another theory quickly recognized as we completed our pilot testing was the Transtheoretical Model developed by Prochaska and Velicer (1997). As described by Cho and Salmon (2006), we interacted with
participants who were in all five stages of this model from precontemplation to maintenance. Some had never thought about testing for radon (precontemplation), some had considered it but never actually tested (contemplation), some already had test kits purchased but have not yet used them (preparation), while others had already tested and mitigated as necessary (maintenance). The actions that they took in accepting our materials and purchasing a test kit directly reflected the stage in which they were. This theory should be taken into consideration when developing implementation plans in the future.

Figure 1. Activities
Logic Model

SITUATION -Many older homeowners live in old homes with basements that are not properly mitigated -Older homeowners are unaware of the health effects of radon and the testing and mitigation process -Family members (grandchildren) are also at risk for radon exposure especially if the basement is used

PRIORITIES -Increase awareness and provide radon education -Increase rates of kit sales to ultimately encourage proper mitigation

INPUTS -College of Public Health -Johnson County Public Health -Iowa City/Johnson County Senior Center -Paper materials (poster, flyers, brochures) -Radon test kits -Time -Money -Other community partners -Student volunteer interns

OUTPUTS Activities -Table/present at Johnson County Senior Center/Zion Lutheran Church -Create informational poster, hand out take home flyers -Sell radon testing kits and provide demonstration on how to properly use kits
Participants -Senior citizens -Student volunteer interns -Johnson County Senior Center Staff -Zion Lutheran Church Staff -Coordinators of other potential partnering organizations

OUTCOMES Short-term -Students successfully disseminate information to older homeowners -Senior citizens aware of dangers of radon and buy radon test kits
Intermediate -Older homeowners have positive attitude about radon testing and demonstrate intentions to test -Seniors properly use radon test kits and mail to lab for results
Long-term -All older homeowners test their home for radon -Mitigation is installed in all affected homes -Retesting completed after mitigation system installed -Homeowners educate others and spread awareness about radon
### AUDIENCE
Homeowners in Iowa City aged 60 years and older

### POTENTIAL SEGMENTS
- Homeowners with young children/pets
- Living in older homes vs newer/remodeled homes
- Homeowners with a basement
- Homeowners living in a house vs condo/townhouse
- Retired vs. still working
- Length of time living in current home
- Demographics: sex, ethnicity

### KNOWLEDGE OF CHANGES
- Increase awareness about health risks of radon exposure
- Increase knowledge about radon testing and mitigation process
- Educate about the science of radon

### CHANGES IN HBM VARIABLES
- **Perceived susceptibility**: create personally relevant messages to increase beliefs about likelihood of being affected by radon
- **Perceived severity**: depict radon as the second leading cause of lung cancer; explain that it is a colorless, odorless gas so harm can be done without obvious knowledge
- **Perceived benefits**: describe simplicity and cost efficient way to test for radon, and mitigation process to reduce exposure and thus the risk for developing lung cancer; appeal to benefits to family members and grandchildren that visit and spend time in the home
- **Perceived barriers**: reassure that testing and mitigation are cost effective actions and timing for installing a remediation system is minimal (a few hours)

### CHANGES IN EPPM VARIABLES
- **Threat appraisal**: design messages to induce a feeling of vulnerability and fear about the harmful effects of radon exposure
- **Coping appraisal**: shape messages to guide individuals towards a danger control attitude by purchasing a test kit versus a fear control attitude in which people just ignore and avoid the situation
- **Response efficacy**: demonstrate the proper use of radon testing kits to increase feelings of competency of adopting behavior
- **Message self-efficacy**: clearly depict the simple method of testing and easy solution of mitigating to increase feelings of competency of adopting behavior

### ULTIMATE OUTCOMES
- Older homeowners express interest in minimizing radon exposure by requesting and buying radon test kits
- Those with high levels mitigate appropriately
- Increase in purchase rates of radon test kits by older homeowners in Johnson County
- Homeowners spread awareness and encourage others to test for radon

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Figure 2. Theory-based Logic Model
Planned Methods

With a confirmed partnership for our project, we planned on setting up a table at the Iowa City/Johnson County Senior Center where we would facilitate five to ten minute discussions over the science of radon, its health implications, acceptable levels and levels required for mitigation, and how to properly test one’s home for radon. Posters would display this information, but we also wanted to provide printed take-home materials to be distributed to our audience. According to the operations assistant at the senior center, the best times to exhibit are at peak traffic hours at the senior center: Tuesday and Thursday mornings 9:30am-12:00 or 11am-1pm (K. Kromway, personal conversation, March 27, 2015). Therefore, we decided to table on a Thursday morning from 8:00am to 12:45pm to reach the largest number of individuals. Furthermore, the center suggested the opportunity to present in one of their thirty-minute educational sessions, which are utilized to inform the older population of various health and environmental topics. Although this did not fit in our immediate timeline, creating a class about radon to be offered at the senior center would establish a potential sustainable method that should be strongly considered when developing future implementation plans. In collaboration with the Johnson County Public Health, we also plan to sell test kits at the cost of five dollars and use an opened kit to provide a demonstration on how to properly use the kits to test for radon.

To ideally shape our health campaign messages, we utilized a fear-based approach to create a loss frame. Witte and Allen (2000) discuss that appealing to the human emotion of fear will result in a greater message acceptance to produce the behavior change. Just as Cho & Boster (2008) explain, there are “losses to be suffered with nonadoption” of radon testing and mitigation (p.429). In our messages, we will depict radon as dangerous with statistics and messages of
severe health consequences if no action is taken to minimize exposure, thus motivating our target audience to action. According to Poortinga et al. (2011), these types of risk-awareness campaigns have been effective in raising radon awareness and testing rates.

**Preliminary Findings**

When developing our project, we initially decided that we would address the needs of prospective homebuyers, who we thought might not be well educated about the risks of radon and the need for mitigation. However, as we talked to initial potential partners such as real estate companies, we realized that radon testing and mitigation is part of the conversation that realtors are legally bound to have with prospective buyers, and we were surprised to learn how this seldom presented a barrier (C. Bough, personal communication, March 18, 2015; M. Karjalahti, personal communication, February 28, 2015; J. Blank, personal communication, March 13, 2015; L. Pickard, personal communication, March 13, 2015; J. Marshek, personal communication; March 13, 2015, United States Environmental Protection Agency, 2014). All realtors are required to present radon information to homebuyers; however, some realtors insist on testing, regardless of the presence of a mitigation system (J. Blank, personal communication, March 13, 2015). We also found that many prospective or recent homeowners were at least generally aware of radon and risks, but this may not be true for individuals who may have moved from a state where the radon risk is lower (M. and S. Bogard, personal communication, March 12, 2015; R. Gage, personal communication, March 13, 2015; T. Sanders, personal communication, March 13, 2015; M. Behounek, personal communication, March 19, 2015; M. Marzell, personal communication, March 17, 2015; B. Casey, personal communication, March 2015).
When searching for potential partners for our initial target audience of prospective homebuyers, we had considered partnering with the Iowa Valley Habitat for Humanity. However, we discovered that Habitat already mitigates for radon using a passive system when they build homes (M. Patton, personal communication, March 20, 2015). Lastly, we looked to partner with the UniverCity home rehabilitation project sponsored by the City of Iowa City, but learned that they already test every home that they rehabilitate and mitigate radon when the levels exceed 4 pCi/L (D. Powers, personal communication, March 18, 2015). David Powers, who works for UniverCity as their house rehabilitation specialist, made the significant observation that when houses change hands, radon comes into the discussion, so he was much more concerned about people “aging in place” and living in the same home for 20 or 30 years. This population of older adults most likely did not test for radon when they purchased it as it was not yet routine and would not be prompted to do so unless perhaps they were preparing to sell their home (D. Powers, personal communication, March 18, 2015). This meeting changed our perspective on who we should target in this radon campaign.

Mr. Powers along with Johnson County Health Department Environmental Specialist James Lacina expressed concern about the high exposure to radon in the older adult population (personal communication, March 28, 2015). Older adults should be able to live in an environment that is sustainable and safe in all aspects of human health while continuing to maintain low injury and disease risks that are influenced by environmental factors (Srinivasan et al., 2003). The term environmental health has evolved over decades due to new research on how environmental toxins affect our daily lives. “This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing and urban
development” (Srinivasan et al., 2003). One effective method in achieving optimal environmental health in an urban development such as Johnson County is to conduct radon testing and install mitigation systems when indicated. Whether homeowners may or may not see a $1500 mitigation system as a financial burden, we must use our messaging to persuade our target that this upfront cost is nevertheless an investment for an opportunity to prevent the health consequences and associated expenses from radon. The idea of a sustainable and healthy environment is not only intended for older adults, but also for their loved ones. Health education on radon along with testing and mitigation of one’s home is a powerful way to achieve a healthy community for all.

**Formative Evaluation Findings**

Our formative evaluation gave us strong feedback that our original proposal of prospective homebuyers as an intended audience was not a good fit. Realtors already had required communication about radon testing and mitigation with their clients, and many of the prospective homebuyers that we interviewed had a general knowledge about radon and had already tested and/or mitigated. Additionally, we discovered when we reached out to Habitat for Humanity and UniverCity that they already were proactive about radon testing and mitigation. After Dave Powers helped us identify older homeowners who were aging in place as a target audience, our next step was to locate potential partners. Of those we contacted, the Iowa City/Johnson County Senior Center and Zion Lutheran Church were the most willing and flexible to collaborate with given our limited timeframe.

We developed a survey that we used during our pilot-testing phase, which consisted of a 14-question pre-questionnaire to be filled out before we engaged in specific communication about radon and a 7-question post-questionnaire. The survey was intentionally structured to
capture any changes in knowledge about radon, perceived severity, perceived susceptibility, response-efficacy, and self-efficacy, which provides insights into the use of the Health Belief Model and the Extended Parallel Process Model. Through the 55 people who either partially or completely filled out the surveys, we discovered significant self-reported changes in a better understanding of radon (increase in knowledge), the ease and inexpensiveness to test a home (low perceived barriers), and ability to change levels of radon in one’s home (self- and response-efficacy). Interestingly, there was no significant correlation between attitude changes and the purchasing of test kits. Demographically, women were disproportionately likely to buy test kits, so future implementation plans could be modified to engage more men or build on the likelihood of women’s interest.

The survey results emphasize the need to reframe messaging to increase perceived susceptibility and perceived severity, since those elements did not change much after interacting with our campaign messaging. While people responded strongly to the map of Iowa that indicated the high prevalence of radon in Johnson County, more emphasis could be placed on the statistic relating to 7 of every 10 homes in Iowa having elevated levels of radon. Our initial development of the campaign materials intentionally moderated fear-based messaging around radon, but perhaps in the future it could be adapted to increase perceptions of severity, particularly in emphasizing rates of lung cancer in nonsmokers. Anecdotally, we heard multiple positive responses to the use of the word “lurking,” which could be featured more prominently in our other print materials. The high reports of knowledge increase as well as self- and response-efficacy indicate that the campaign should continue with similar messaging in these areas.

Additionally, our survey was titled “Pre-test” and “Post-test” which sometimes discouraged individuals as they felt that they had to answer correctly, although we were simply
aiming to assess their beliefs and attitudes about radon. Thus, people skipped some questions and commented that they would have liked to see a “I don’t know” option, an item that could be included in a revised version of future surveys. Individuals responded differently and were more inclined to take the test when we referred to the test as a “survey,” so future considerations should include using different terminology to relieve possible feelings of pressure and anxiety associated with test taking. Lastly, we received multiple requests from both pilot sites that they would have liked cookies to be offered at the events, so we have taken this into consideration when discussing our implementation plans and budget justifications.

**Channel and Pilot Materials Development**

To collect information about the individuals that we interacted with at our pilot testing sites, the aforementioned two-sided pre- and post-test comprised of demographic questions as well as questions assessing the Health Belief Model and the Extended Parallel Process Model constructs of perceived susceptibility, perceived severity, and self-efficacy via a Likert scale. We eliminated the neutral option in hopes that it would encourage individuals to lean towards either agree or disagree. For message dissemination, we pursued the use of print materials as our primary channel of communication. We created take home flyers that highlighted our main messages and talking points and included simple diagrams of radon entry, a sample mitigation system, as well as a bar graph comparing rates of radon related deaths to other causes in order to stress the severity of radon health consequences. For our tabling event, we created a black table banner with contrasting yellow text that read “Help Keep Your Home Safe. Ask us how” with a large image of a caution sign in the middle to attract attention. We chose a phrase that encourages a feeling of self-efficacy instead of fear so as to avoid deterring our audience. Additionally, we created a tri-fold poster for our table, which not only displayed our messages
but also magnified the pictures featured on the handouts for better visibility. Titled “Home is Where the Radon is: Is radon lurking in your home?” along with the message of our table banner, we wanted to attract attention by prompting the feeling of possible uncertainty of safety in their own home and how to control this threat. Our trifold included a map of the radon levels in Iowa, which was well received, a diagram of radon entry, a simple diagram of the mechanics of a mitigation system, as well as the University of Iowa College of Public Health logo to establish credibility. All of our materials used a yellow, orange, and red color scheme to indicate danger and to also mirror the color scheme already used in many of the radon maps made available to the public.

In addition, to these materials that we have created and developed, the Iowa Cancer Consortium granted permission to use the brochures that they distributed during their own radon project conducted in Polk County. We offered these bilingual brochures to those who wanted more detailed take home information about radon. The Johnson County Health Department also provided half sheets with additional, more detailed instructions on how to properly use the radon test kits, which we offered to those who desired this information.

**Pilot Testing**

Our first pilot-testing event took place at the Iowa City/Johnson County Senior Center in Downtown Iowa City one Thursday morning. Over the span of four hours, we interacted with individuals as they were arriving for or leaving from various classes asking them to help us with a school project. Because “awareness is an important proximal campaign effect,” one of our intended effects was to simply raise awareness about the dangers of radon exposure (Leavy et al., 2014). We first-handedly saw awareness being spread by word of mouth from one individual to another while some even commented about sharing the information with family members.
However, we experienced an unintended effect with one individual who clearly displayed a boomerang effect since she commented that she felt “overwhelmed” by the threat of radon after listening to our presentation (Cho & Salmon, 2007). Others were eager to learn more information as soon as they approached our table, but to avoid priming effects, we urged them to take our survey before hearing the details of our messages (Whittingam et al., 2008). Many only partially completed the survey, making our collection data inaccurate to analyze. However, we did attempt to make notes of their gender, direct quotes, and basement use to paint a better picture of the dynamics of our target population.

Our second pilot-testing site occurred at the Zion Lutheran Church also located in Downtown Iowa City. Presentation of materials followed the same format as the presentation at the senior center. For one hour, we interacted with individuals during coffee time in between services, and as expected, we interacted with individuals outside of our target population. Although we reached an unintended audience, we still achieved a short-term goal of increasing awareness about radon (Cho & Salmon, 2007). Interestingly enough, more people approached our table at their own accord, and there was some overlap between those who were at the senior center and the church.

**Implementation Plan**

In order to continue to bring radon education to our target population of older adults living in Johnson County, the developed materials will need to be further disseminated through the continued use of tabling events at the pre-established partnership sites. To increase the reach of our message, additional sites such as the Visiting Nurse Association and other local churches will be targeted for the potential implementation of future tabling events. All events will be advertised in advance in an effort to notify and prepare individuals of the necessary cost of
purchasing a radon test kit. Campaign leaders will also ensure to carry monetary change for individuals who do not carry the exact $5 amount.

In May of 2015, a listing will be posted through the University of Iowa College of Public Health to advertise for the hiring of two student interns. The interns will be selected from the pool of applicants to begin working on the dissemination of this radon project. The interns will initially be responsible for editing the campaign materials to address the findings of the formative evaluation completed through the surveying conducted at the tabling events. The interns will then be responsible for maintaining contact with established partnerships, creating new partnerships, and scheduling and attending all tabling events.

Sustained contact with the established partnerships throughout the two-year implementation period is crucial in scheduling tabling events. At the senior center, one student intern will schedule tabling events every three months, preferably on a variety of days and times to reach the most people, post promotional materials in the senior center advertising the event one week prior to tabling, and ensure that our event is included on the senior center’s official schedule, just as was done for our pilot test. On the day of the event, the student intern will transport all educational materials, reference materials, and the radon test kits to the organization and present the information to individuals in our target audience as well as sell test kits. In addition, the student intern will help establish a sustainable program by collaborating with program coordinators at the senior center in creating an educational session to be offered quarterly.

One student intern will also take responsibility in scheduling repeat tabling events at Zion Lutheran Church. Tabling at this site will be a bi-annual event, and the student intern will coordinate the dates of the tabling events with the church’s contact, Mary Merulla. One week
prior to the tabling event, the student intern will send Mary a brief description and promotional message concerning the tabling event to advertise in the electronic weekly bulletin viewed by the congregation. The tabling event will be carried out in the same fashion as at the senior center.

The student interns will also be responsible for identifying new partnerships for the implementation of tabling events or other larger scale affairs. The student intern will contact additional churches, such as St. Patrick’s Catholic Church, to establish partnerships and create opportunities for tabling events. The student interns will also search for events and/or groups that are particularly designed for older adults such as the monthly potluck at St. Patrick’s church and the Needleworkers group. The student workers will also contact potential partnerships such as the University of Iowa retirees and other identified groups of older adults in Johnson County.

Through communication with the gatekeepers of the organizations mentioned above, the student interns will inquire about potential opinion leaders within the community of the church, senior center, and other partnership locations that will be helpful in increasing awareness of the tabling events. Employing a staff-selected method of opinion leader identification will facilitate the establishment of credibility and reflect positively on community perception of tabling events (Valente & Pumpuang, 2007). To monitor the progress of our campaign and materials, the student interns will track the number of test kits sold as well as conduct evaluations every six months. Campaign leaders will then revise the messaging or implementation methods to reflect feedback from the evaluations. A final presentation outlining the cumulative results and impact of the project will be given to the community partners at the culmination of the project in May 2017.
Outcome Evaluation Plan

The outcome evaluation plan has two parts. The simple, straightforward outcome evaluation is tracking the number of test kits sold at intentional outreach efforts. 17 test kits were sold at the senior center and 22 were sold at Zion Lutheran Church for a total of 39. This exceeds our revised goal of 29 by the end of fiscal year 2015 on June 30. Our efforts surpassed our targeted 10% annual increase from the 289 test kits sold in fiscal year 2014. Attaining our goal of continued increases in test kit sales of 10% per year through this campaign may get more challenging as the easiest-to-reach people among our target demographic will have already been reached. However, our efforts have already created a bigger pool of opinion leaders who have bought kits and may have completed testing and, if necessary, had mitigated as well. Student interns leading future campaign efforts will track the number of test kits sold to track progress towards the fiscal year goal.

The second outcome evaluation method is the use of a survey. While our initial pre- and post-test gave us good formative evaluation, in the future, an outcome evaluation-oriented survey would be simplified into just a post-questionnaire that would capture demographics (age range, gender, retirement status, home ownership, intent to stay in place), self-report of increase in knowledge about radon, perceived severity, perceived susceptibility, perceived self-efficacy, perceived response-efficacy, whether they have tested and/or mitigated, and, the intent to test and mitigate (if appropriate), and whether or not they purchased a test kit. These surveys should be considered after every campaign opportunity in a monitoring capacity, in both site-specific terms as well as aggregate, to determine if there are any noticeable trends in demographics or attitudes regarding the purchase of kits. This would also help campaign leaders understand if there needs to be message adjustments based on any part of the theoretical models (e.g. people who self-
report low susceptibility are not purchasing test kits, so adjust the message to increase perceived susceptibility) (Kotler & Lee, 2008). At repeat visits to a site, such as the senior center and Zion Lutheran Church, it may be possible that individuals who previously interacted with the campaign would respond to the surveys, so it would be important to note that an increase in respondents who are knowledgeable about radon and who have tested and/or mitigated may be due to repeat participants.

### Proposed Timeline

| May 2015                      | • Advertise for 2 student intern positions through the College of Public Health and other similar disciplines within the University of Iowa Graduate College  
|                              | • Community partners of the campaign pick new sites in the Johnson County community to carry out the campaign  
|                              | • Search for additional partnerships  
|                              | • Revise campaign materials to reflect formative evaluation and address severity and susceptibility |
| June - December 2015          | • Hire and train 2 student interns  
|                              | • Interns will gather all necessary supplies- surveys, flyers, trifold display, radon test kits, brochures, and cookies from set up at the implementation site  
|                              | • Interns will collect and return test kits to Johnson County Public Health after every event  
|                              | • Interns will advertise the campaign to participating sites and table every 3 months at each location  
|                              | • Interns will keep track of budget and report their initial observations to community partners after 6 months  
|                              | • Intern will suggest possible changes to improve and maintain quality of the campaign to community partners after 3 months  
|                              | • Campaign evaluations will be conducted at the 6 month mark to monitor the progress of the campaign |
| December 2015 - April 2017    | • Interns will carry out same duties as described above  
|                              | • Campaign evaluations will be conducted at six month intervals to monitor the progress of the campaign  
|                              | • Intern will again suggest possible changes quarterly to improve and maintain quality of the campaign to community partners |
| May 2017                      | • The final findings of the radon awareness campaign will be reported to the community partners |
## Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Costs (*All costs are an estimate. Actual costs of items may vary on location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johnson County Health Department Radon Test Kits</td>
<td>$5.00 per test kit</td>
</tr>
<tr>
<td>8”X 11”Flyers on standard paper printing (Both front and back)</td>
<td>*$0.30 per flyer</td>
</tr>
<tr>
<td>Black and White</td>
<td>*$1.26 per flyer</td>
</tr>
<tr>
<td>Johnson County Public Health Radon Testing Instruction Sheets</td>
<td>Free of charge</td>
</tr>
<tr>
<td>Iowa Cancer Consortium Radon Brochures</td>
<td>Free of charge</td>
</tr>
<tr>
<td>Surveys on standard paper printing</td>
<td>*$.10 per survey</td>
</tr>
<tr>
<td>24” X 36” Table banner on laminated paper</td>
<td>*$30.00</td>
</tr>
<tr>
<td>Color</td>
<td>*$10.00</td>
</tr>
<tr>
<td>Trifold display</td>
<td>$5.00</td>
</tr>
<tr>
<td>Miscellaneous Supplies (art materials)</td>
<td>*$25.00</td>
</tr>
<tr>
<td>Dozen Cookies</td>
<td>*$6.00</td>
</tr>
<tr>
<td>Radon Campaign Intern</td>
<td>Volunteer (no cost)</td>
</tr>
</tbody>
</table>

## Budget Justification

The budget logistics that we considered consisted of a grand total of $800. Most of the prices in the budget table are estimated because various businesses charge different prices for each item or service. Printing costs vary depending if being printed either in color or black and white along with quantity of that particular item. The various printing venues in Iowa City referenced for our budget justification include Zephyr, FEDEX, and Copyworks. The radon test
kits and trifold display were the only two items in the budget list that included actual costs since Johnson County Public Health provided the test kits, and our group members had already created the trifold display. In addition, some items were free of charge since the Iowa Cancer Consortium and the Johnson County Public Health generously donated their brochures and instruction sheets, respectively. In addition, a volunteer student intern would be hired to serve as a project coordinator who would also carry out the campaign. This volunteer intern would ideally involve a Master’s of Public Health student or closely related discipline that would enable them to use their skills they learned in the classroom and apply it to a real life public health initiative. The miscellaneous supplies category includes art materials needed for the trifold display, extra printing of flyers and surveys, and any other supplies that would carry out the campaign successfully. Lastly, cookies will be distributed to participants who complete the survey as an incentive to participate or an appreciation gesture. With all this planning and budgeting in mind, we are confident that our radon campaign can be successfully implemented in the community to increase awareness and radon testing.
References


City of Iowa City/Johnson County Senior Center.  http://www.icgov.org/?id=1216


http://eds.a.ebscohost.com.proxy.lib.uiowa.edu/ehost/pdfviewer/pdfviewer?sid=765325ada-5883-44a1-ba6d-1145d9e6a%40sessionmgr4004&vid=1&hid=4202


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milk consumption in older, low-income women. *Journal of Nutrition Education and Behavior, 46*(6), 554-559. doi: 10.1177/109019819802500305


Sandman, P.M., & Weinstein, N.D. (1993). Predictors of home radon testing and


Appendix A
Personal Communication

Realtor Questions

1. Do you know what radon is and what it can do to a homeowner’s health?
2. Do you address radon at all with your clients? How/what specifically do you discuss?
3. If clients ask about radon, do you have/know about the available resources that provide radon information?
4. Are you aware of the pricing of mitigation systems?
5. How often, if ever, do clients ask about radon and/or testing? What are the characteristics of these clients? (family situation [kids, etc.], price range)
6. At what point in the process do clients ask? When looking, during inspection, etc.?
7. If high levels are found after testing, what is the typical negotiation process between buyer and seller?
8. Are there any sellers that have tested but not properly mitigated?

Prospective homebuyers/recent home purchasers questions

(We asked the questions in a manner that they lead up to radon. We began with general questions such as why are you moving, where from, what are you looking for, etc. then asked questions about children and eventually to radon).

1. Where are you moving from?
2. Why are you moving to Iowa City?
3. How long do you plan to stay in your new home?
4. Do you know where to buy a test kit?
5. What style of home do you prefer?
6. Do you prefer a finished basement?
7. How do you plan to utilize your basement? Will it be a frequently used living space?

8. What do you look for in a home (neighborhood, house itself)? Where (city area) are you looking?

9. What is your price range?

10. Do you have small children or plan on having children?

11. Do you have a basement that you (will) utilize?

12. Do you know what radon is and what it does to your health?

13. Are you aware that you can test your home? If so, have you?

14. Do you know how to fix a radon problem?

Interview Responses

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Married couple (30 &amp; 32 yr old) Megan and Scott Bogard March 12, 2015</td>
<td>-Looking for a house in a good location, walking community, no significant updates, good school district, garage, low maintenance, move in ready, basement -Looking from Cedar Falls to Solon -$150-190K</td>
<td>5 yr old girl and 2 yr old boy</td>
<td>Activity, play room, storm shelter, storage, finished basement not necessary</td>
<td>Gas, bad for you, undetectable, causes cancer (lung), public buildings require and home inspections now require it</td>
<td>Aware can test but never have; knows that mitigation is how to fix it</td>
</tr>
<tr>
<td>Single woman (25 yr old)- just purchased townhouse in east side of</td>
<td>-# bedrooms, reselling potential, low maintenance, minimal</td>
<td>Someday</td>
<td>Crafts room, entry way from garage, laundry room, basement is</td>
<td>“I know it’s bad”</td>
<td>Yes, paid extra during inspection ($100);</td>
</tr>
<tr>
<td>Location</td>
<td>Details</td>
<td>Results</td>
<td>Expected</td>
<td>Notes</td>
<td></td>
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<tr>
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<tr>
<td>Iowa City</td>
<td>Rachel Gage</td>
<td>finished</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 13, 2015</td>
<td>repairs, move in ready, condos only -looking from Iowa City to Coralville, or North Liberty -$150-$170</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dating Couple</td>
<td>(24 &amp; 25 yr old)- just purchased house in east side of Iowa City, built in 2005 Tanya Sanders provided answers March 15, 2015 -close to work for both, 2 car garage, already done, 3 bedrooms -looking from E. side to Coralville/E.side -&lt;~$250K</td>
<td>Someday</td>
<td>Bedroom already in it, recreational area, basement is finished</td>
<td>Can cause cancer, “don’t really know”</td>
<td></td>
</tr>
<tr>
<td>Married Woman</td>
<td>(29 yrs old) Maggie Behounek March 19, 2015 -3 bed, close to stuff (grocery/nature trail), good neighborhood, 2 story homes, ranch style homes -looking in iowa city, coralville 1 yr old girl Yes- 2nd family room</td>
<td></td>
<td>it’s a gas, dont remember/ know its not good</td>
<td>tested it-low levels in current house, will test new house when purchased, houses that they’re looking at now already have a mitigation system</td>
<td></td>
</tr>
<tr>
<td>Single Woman</td>
<td>(32 year old) with 3 roommates Bridget Casey March 16, 2015 Longfellow Neighborhood in East Iowa City area, 1 garage, 1905 home, 4 nope, can’t have children, young lawyer, does not use it daily, still going on repairs, mostly for storage and laundry work</td>
<td></td>
<td>not sure of the specific health implications but know they do exist, and can be fatal in some</td>
<td>Realtor did speak to her about Radon and her home</td>
<td></td>
</tr>
<tr>
<td>Bedrooms, 134K, working on remodeling home, needs lot of repair,</td>
<td>Focused on career, might move again soon, not sure how long she will stay in house</td>
<td>Cases</td>
<td>Got tested. “My home was tested for radon as a condition of my offer to purchase. The result of the test was 9.7pCi/l and I required them to put in a radon mitigation system before closing.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late 30s/early 40s married couple with a 3 year old child Miesha Marzell and family March 17, 2015</td>
<td>1905 home, 190,000 dollars, lived in this house for one year now, not planning to move soon, Goosetown neighborhood</td>
<td>Have one child for now, maybe more in the future</td>
<td>Husband uses for art and crafts, guitar playing use, smokes occasionally, still somewhat of a unfinished basement, hope to do more repair in near future</td>
<td>Yes heard of radon and knows the serious health implications, did research when brought home</td>
<td>Got it tested, realtor did talk about radon, their home radon levels were not high, but the grandmothers home was a tad higher. not sure of specific numbers, no mitigation system was put into place,</td>
</tr>
</tbody>
</table>
Interviewee | How you address radon | Available resources? | Pricing/Process | Testing Frequency/demos | Timing | Negotiation | Other/Key quotes
---|---|---|---|---|---|---|---
Lepic & Kroeger Agent (Jill Marshek) 3/13/2015 | Information packet handout | Testers, Mitigators (certified) | 1200-1500 Mitigation after testing | No specific trends, but overall on the rise | During inspections | Typically buyer pays, can be negotiated | L&K Recommend all inspections, including radon
Coldwell Banker Real Estate Agent (Larry Pickard) 3/13/2015 | Required information materials | Testers, Mitigators (certified) "We have people who are qualified to do that" Recomendations, but clients have final decision on choice of professional | 100 for hired testing (specify in purchase agreement), choice of client to test, 3.9 is testable level at lowest level/crawl space/etc., may use home test kits, | No specific trends | During writing of purchase agreement | Buyer pays for any inspection | "Two houses side by side" can have different radon levels. There is "no rhyme or reason."
<table>
<thead>
<tr>
<th>Elite First Realty Agent (Joel Baker) 3/13/2015</th>
<th>Required federal forms presented</th>
<th>A list of state certified third party testers and mitigators is available</th>
<th>100 for hired testing</th>
<th>No trending</th>
<th>During purchase agreement</th>
<th>Transaction negotiations/settlement</th>
<th>Testing is the buyer's choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank &amp; McCune Agent (Jackie Blank) 3/13/2015</td>
<td>Really emphasize/insist that they have a test &quot;even if a system is installed&quot; &quot;Always have it done&quot; &quot;some people are very misinformed&quot;</td>
<td>Professional electronic certified testers/certified mitigators</td>
<td>100-150 2 day electronic testing, paid by buyer, must be less than 3.99, mitigation follows, then same 2 day retest</td>
<td>Everyone should test and mitigate. They emphasize testing every year with a home test kit</td>
<td>Testing during purchase agreement. If tests high--the cost will be negotiated along with remedies, usually crossed off (almost always paid by seller)</td>
<td>Buyer pays inspection, typically seller pays mitigation</td>
<td>&quot;Some of the highest ratings I've had are built on slabs&quot; Some (apt) refuse because mitigation systems are &quot;uncomplimentary to the look of the building&quot; Work with homeowners to build</td>
</tr>
<tr>
<td>Team Partners Realty Agent (Matt Karjalahti) 2/28/2015</td>
<td>As part of the federal requirements along with other standard materials such as lead paint info</td>
<td>Referrals for testing and mitigation</td>
<td>~$100 for testing and ~$1500 for mitigation</td>
<td>Most homes</td>
<td>During inspections</td>
<td>Seller usually covers cost of mitigation; sometimes it is shared</td>
<td>Not a big barrier unless it is a contentious negotiation</td>
</tr>
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</tr>
<tr>
<td>The Laura Soride Team Agent (Chuck Bogh) 3/18/15</td>
<td>Gives several brochures and documents</td>
<td>Local referrals</td>
<td>Testing costs vary, provided an example of a typical radon mitigation bid at $1000</td>
<td>Most homes</td>
<td>Varies in the process</td>
<td>Varies</td>
<td>Very important!</td>
</tr>
</tbody>
</table>
Appendix B
Figures and Visual Representations

Figure 1

Retrieved from http://www.epa.gov/radon/pdfs/zonemapcolor.pdf, presents a visual representation of the geography of average indoor radon levels by county. Iowa is categorized into Zone 1, which is the highest risk associated with radon and represents an average rate greater than 4 pCi/L.
Figure 2

Adopted from Vogiannis & Nikolopoulos, 2014, is a visual depiction of the various access points through which radon enters the home. “A, cracks in concrete slabs; B, spaces behind brick veneer walls that rest on hollow – block foundation; C, pores and cracks in concrete blocks; D, floor–wall joints; E, exposed soil, as in a sump; F, weeping (drain) tile, if drained to popen sump; G, mortar joints; J, building materials, such as some rock; K, water (from some wells) (Vogiannis & Nikolopoulos, 2014).”
Figure 3

Home is where the radon is.

What is Radon?
- It's a gas: you can't see it or smell it, BUT it's the second leading cause of lung cancer.
- It rises from rocks and soil and creeps in through cracks in your house and gets trapped in your basement.
- If you smoke, radon exposure significantly increases your chance of lung cancer.
- Radon contributes to almost 3,000 lung cancer deaths in non-smokers every year, according to the EPA.

Radon Health Risk Compared to Other Common Causes of Death

- Radon
- Drunk Driving
- Home Accidents
- Drowning
- Home Fires

According to the EPA, Radon Causes 21,000 lung cancer deaths each year

Am I at Risk?

Risk
- Iowa is one of the states with the highest radon levels in the country
- Johnson County has higher levels of radon than most counties in Iowa
- Do you spend a lot of time at home?
- Do you have children or grandchildren that visit you in your home?
- Do you have a pet that is often in the lower levels of your home?

Protect Yourself and Your Family in Two Easy Steps!

- It's Best to Test!
The only way to detect radon is to test for it.
Test kits are available from the Johnson County Department of Public Health for just $5.00

- Don't Hesitate, Mitigate!
There is an easy, permanent solution.
Mitigation systems are relatively inexpensive and can be installed in just a few hours

Questions?: Contact JAMES LACINA, Johnson County Environmental Health Coordinator
319-356-6040 or email: jlacina@co.johnson.ia.us

Take home flyer that our group developed to distribute at tabling events

Figure 4

HELP KEEP YOUR HOME SAFE
CAUTION
Ask Us How
Table banner that our group developed, which was placed at the front of our table

**Figure 5**

Trifold display that we created to exhibit at tabling events
Figure 6

Brochure from Iowa Cancer Consortium that was distributed at tabling event

Figure 7

1. What is your age range?
   - under 60 years
   - 60-70 years
   - over 70 years

2. Do you plan on retiring in the next
   - I am currently retired
   - Retiring in the next 2 years
   - Retiring in 3+ years

3. Gender
   - Male
   - Female
   - Prefer not to respond

4. My home has been tested for radon.
   - Yes
   - No
   - Uncertain

5. My home currently has a radon mitigation system in place.
   - Yes
   - No
   - Uncertain

6. I plan to move within the next 5 years.
   - Yes
   - No
   - Uncertain
7. I own my own home.
   Yes          No

8. I know what radon is.
   Strongly Disagree    Disagree    Agree    Strongly Agree

9. I am at risk for radon exposure in my home.
   Strongly Disagree    Disagree    Agree    Strongly Agree

10. Radon exposure is dangerous to my health.
    Strongly Disagree    Disagree    Agree    Strongly Agree

11. It is easy and inexpensive to test my home for radon.
    Strongly Disagree    Disagree    Agree    Strongly Agree

12. It is easy and relatively inexpensive to install a mitigation system in my home.
    Strongly Disagree    Disagree    Agree    Strongly Agree

13. I can do something to change the radon levels in my home.
    Strongly Disagree    Disagree    Agree    Strongly Agree

14. I can greatly benefit from testing my home for radon and mitigating if indicated.
    Strongly Disagree    Disagree    Agree    Strongly Agree

Post Test

1. I know what radon is.
   Strongly Disagree    Disagree    Agree    Strongly Agree

2. I am at risk for radon exposure in my home.
   Strongly Disagree    Disagree    Agree    Strongly Agree

3. Radon exposure is dangerous to my health.
Strongly Disagree  Disagree  Agree  Strongly Agree

4. It is easy and inexpensive to test my home for radon.

Strongly Disagree  Disagree  Agree  Strongly Agree

5. It is easy and relatively inexpensive to install a mitigation system in my home.

Strongly Disagree  Disagree  Agree  Strongly Agree

6. I can do something to change the radon levels in my home.

Strongly Disagree  Disagree  Agree  Strongly Agree

7. I can greatly benefit from testing my home for radon and mitigating if indicated.

Strongly Disagree  Disagree  Agree  Strongly Agree

Pre- and post-test handed to participants at tabling events