

RADON PUBLICATION INFORMATION: IMPACT ON READERS' KNOWLEDGE, ATTITUDES AND INTENTIONS

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Abstract

Radon is the second leading cause of lung cancer (National Research Council, 1998). The purpose of this preliminary study is to determine the effectiveness of a radon informational publication in increasing knowledge, changing attitudes about radon, and developing intentions to take action. Female homeowners in a Midwestern university community participated in a study to determine their existing knowledge level about radon, and their willingness to test their homes for radon, before and after reading the radon publication. The data were collected at Family and Community Education group meetings. The 49 participants completed a pre-test questionnaire, reading the publication, and completed the same questionnaire as a post-test. Pre- and post-test responses were compared to determine if the publication had an impact on the level of knowledge, attitude change and the willingness to test their homes. The results of this study indicate that the publication content increased the level of knowledge and willingness to test homes for radon. This study suggests that the publication selected for the study, and widely used in Cooperative Extension and in other public information programs, can change knowledge and attitudes. More studies on the impact of widely used educational publications are needed to discover if they change knowledge, attitudes, intentions, and behavior.

Introduction

Indoor radon gas is reported to increase the potential of developing lung cancer (Kladder, Burkhart, & Jelinek, 1993). Radon is the second leading cause of lung cancer (National Research Council, 1998). Testing of homes for radon levels is a means of

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determining the general radon level and whether the homeowners or occupants should take further action.

Consumers may be unwilling to test their homes for radon (Kennedy, Probart, & Dorman, 1991). However, people who have a greater understanding of radon are more likely to test their homes (Sandman, Weinstein, & Klotz, 1987). The problem of consumers' unwillingness to test and the reasons for not testing have been identified; the latter often relates to lack of knowledge (Kennedy, et al., 1991; Weinstein, Sandman, & Roberts, 1990)

There are information sources and potential remedies available to address the problem of high levels of radon. However, it is not known whether written informational publications change knowledge, attitudes, and intentions about radon leading to testing and/or remediation. This study examines one informational publication (*A citizen's guide to radon*, EPA, 1992), and its short-term impact on the participating readers.

Publications generated by federal agencies provide information about issues such as radon. Do the consumers understand and/or use the information in these publications provided to the masses? The publication selected for this preliminary study of readers' knowledge, attitudes, and intentions to change is made available by the United States Environmental Protection Agency (EPA) to thousands of consumers and has been used by extension educators. The publication also is a component of the nationwide "Healthy Indoor Air for Healthy Americans" packaged program provided by United States Department of Agriculture and EPA.

Hypotheses

The null hypotheses to be tested are that participants' reading *A citizen's guide to radon* will show: 1) no change in their knowledge level about radon; 2) no change in attitudes about the importance of radon; and 3) no change in their intentions to test their homes in the future.

Review of Relevant Literature

The problems associated with indoor radon were not discovered until 1979 (Nero, 1986). This relatively recent awareness of radon problems is one of the reasons why the public knows very little about radon. The need for accurate, useable information is important. Information should communicate the risks of radon to encourage rational concern. A moderate level of concern will get people to monitor the radon levels in their homes (Sandman, Weinstein, & Klotz, 1987).

Kennedy, et al., (1991) identified primary reasons for not testing for radon as either the respondents do not think they have a radon problem or that they "just haven't gotten around to it." Consumers also do not know how to obtain and implement the home test kits (Kennedy, et al., 1991). Other studies document the optimistic bias or belief that "it can't happen to me" as a reason for not testing (Weinstein, et al., 1990; Sandman, et al., 1987).

Designing an effective radon information program and publication is essential to provide consumers with accurate, motivating information. Lack of information, inac-

curate perceptions of risks, or other constraints may prevent people from making decisions about reducing their exposures or mitigating effectively. Added to the problem is the inability to see, feel, or smell radon which may make it easier to ignore or believe it does not exist and thus view the problem as less of a risk. Information distributed through state and federal governments is designed to improve understanding of the risk.

Weinstein et al. (1990) conducted a study to further understanding of self-protective behavior and to develop informational publications that would encourage people to look for radon health hazards in their homes. The results indicate that people are concerned with the health threat, but show only limited willingness to test. However, the study also indicates the difficulty in convincing people of potential radon problems through a publication, concluding that different media should be used to communicate radon information (Weinstein, et al., 1990).

The transfer of the information gained from a publication from short-term memory to long-term memory and to action is also important. Atkinson and Shiffrin (1968, 1971) emphasized the interaction between short-term memory and long-term memory. According to their theory, the components of memory include a sensory store, a short-term memory and a long-term memory. The sensory store preserves information for a few hundred milliseconds for storage of visual information. Short-term memory is the person's second basic component and is regarded as a person's working memory. Information is lost from short-term memory within 15 to 30 seconds if it is not rehearsed. The long-term memory differs in that it contains the information that is relatively permanent. The rate of forgetting from long-term memory varies from a few minutes to many years. This factor is important if participants do not have the publications to refer to again.

Methodology

The publication used in the study provided information that addresses many common misconceptions about radon and health risks associated with radon gas. The publication is widely distributed to consumers asking for radon information and was selected for this reason. The questions (composite scales and single item questions) measured the level of radon knowledge, attitudes about radon and testing, and intentions toward radon testing before and after the homeowners read the publication containing information about radon, the health risks, and how to test and mitigate radon problems. This instrument was adapted with permission from a list of questions obtained from Neil D. Weinstein, primary investigator in a radon risk perception study (personal communication, January 1994). Additional questions and scales were developed by the investigators.

The investigators conducted a pre-test to determine the homeowner's previous knowledge, attitudes about radon, and willingness to test for radon. Fifteen minutes was then allowed for reading the selected publication. The subject's knowledge, attitude about radon, and willingness to test were measured again in the post-test to determine if

changes had occurred. The participants had fifteen minutes to complete the questionnaire.

The sample was derived from members at five meetings of Lancaster County, Nebraska Family and Community Education Clubs. The study surveyed 49 participants; six of the participants' results were not utilized in the study due to missing information or not qualifying as a homeowner. The data collection took place in April 1994.

The pre-test and post-test included 11 true and false questions used as a composite scale for the radon knowledge variable. Nine additional questions were asked to determine level of radon knowledge before and after reading the publication. The pre- and post-tests also included questions to identify why participants had not tested the present home, knowledge of health risks associated with radon and radon reduction methods, knowledge about radon, the nature of radon, and about potential levels of radon that may exist in a home.

The study measured intent to test the present home for radon through questions using Likert and Guttman scales. Questions about testing within the next year and the likelihood of testing a home being purchased were asked. Questions assessed the individuals' attitudes toward radon and health risks. Demographic questions included length of residence in the current home, age, education level, own or rent home, and the number of persons including ages of children in the household.

Analysis and Results

The data were analyzed using descriptive information, a paired *t* test, and the McNemar's non-parametric test. The data were identified as dichotomous, nominal or ordinal scales to determine the analysis method. The McNemar test was used for the dichotomous variables, as it tests differences in change for dichotomous variables and is especially useful in pre-test/post-test designs (SPSS Inc., 1988). Matched paired-samples *t* tests were used to determine if there was a significant difference between pre- and post-test scores on each question asked. The scores provide an estimate of statistical significance. Nominal and ordinal data, in some circumstances, are assumed to be interval data and can be used legitimately with interval- and ratio-level scales (Nie, Hull, Jenkins, Steinbender, & Bent, 1975).

The mean age of the sample was 64 and the mean number of years in their existing home was 25 years. The mean level of education was "completed high school with some college."

The results of the matched pair *t* test indicated differences between the pre-test and post-test results. The results of the *t* test show that there is a significant difference at the .05 level in pre- and post-knowledge (see Table 1). The respondents had a higher level of knowledge of basic facts about radon after the publication was read than before ($t(43) = 7.33, p < .05$).

The pre-test indicated that 39% ($n = 17$) of the respondents felt there was a moderate chance of a fatal illness (health risks associated with radon). After reading the publication, 42% ($n = 18$) believed a radon associated illness would likely be fatal, and 30% ($n = 13$) very likely or certain. The *t* test analysis (see Table 1) illustrates that the

Table 1. Radon Knowledge, Attitudes and Intentions Paired *t* - tests

Variable	<i>n</i>	Mean Pre-test	Mean Post-test	<i>t</i> Value
Level of knowledge	43	2.36	2.75	7.33*
Perception of illness risk	29	3.17	3.90	4.42*
Seriousness of health risks	35	3.49	3.97	3.02*
Increased knowledge about radon reduction recommendations	33	3.03	3.36	2.15*
Intention to test for radon	39	2.49	3.03	5.60*
Intention to test for radon if buying another home	40	2.80	3.23	3.60*
Feel radon a problem	41	3.19	3.65	2.89*
Likelihood existing home above recommended levels	33	3.03	3.36	2.15*

*significant at level of $p < 0.05$

respondents had a significantly higher level of felt health risks associated with radon after they read the publication ($t(29) = 4.42, p < .05$). The increase in knowledge about health risks associated with radon is confirmed by similar questions used in the pre- and post-test assessing their beliefs about the seriousness of health effects from radon (see Table 2). The *t* test indicates ($t(35) = 3.02, p < .05$) that after reading the publication the participants perceived the health risks associated with radon to be higher (see Table 1).

A significant change in pre- and post-test scores (see Table 1) indicated that the participants increased their knowledge about government recommendations, and their perception of risk also changed ($t(33) = 2.15, p < .05$). Respondents were more likely to believe that their home could be above the recommendations for radon levels after reading the publication.

In the pre-test, 46% ($n = 20$) of the respondents felt that they probably would not test their homes. After reading the publication, 39% ($n = 17$) believed there was a 50-50 chance they would test and 26% ($n = 11$) said they would probably test (see Table 3). The *t* test score ($t(39) = 5.60, p < .05$) indicates that the sample reported that they were significantly more likely to test their home within the next year than they had reported before reading the publication (see Table 1). The main reasons that the participants

Table 2. Attitude about seriousness of health risk

Variable	Pre-test Frequency	Post-test Frequency
Seriousness of radon health risk		
1 Very minor	0	0
2 Minor	5	1
3 Somewhat serious	15	14
4 Serious	9	13
5 Very Serious	8	12
. Missing or no opinion	6	3
	n = 43	n = 43
	Mean = 3.54	Mean = 3.90

reported for not having tested their home for radon were they “just hadn’t gotten around to it,” “don’t think they have a problem,” and they “didn’t know how to get a test carried out.” Prior to reading the publication, respondents were more likely to report that they would wait to see what others in the community found in their tests. After reading the publications, respondents were less likely to indicate they would wait to test their homes than before reading.

The results of the question about buying a house in the future and having it tested for radon affirm the increase in willingness to test (see Table 3). Forty-two percent of the respondents ($n = 18$) in the pre-test felt that they probably would not test a home they were considering buying. After reading the publication, 53% ($n = 23$) stated they probably would test and 33% ($n = 14$) definitely would test a home they were buying. The t test score (see Table 1) indicates the significance of these results ($t(40) = 3.60$, $p < .05$). The sample was more willing to test a home they were buying after reading the publication.

Respondents were more likely to feel radon was a serious problem after reading the publication than before. The t test indicates $t(41) = 2.89$, $p < .05$ (see Table 1). Respondents reported a greater likelihood that their existing homes could be above the recommended radon level and that radon was a problem after reading than before reading the publication $t(33) = 2.15$, $p < .05$ (see Table 1).

Summary and Implications

The first null hypothesis (that there will be no change in the level of knowledge) was rejected. The general knowledge of radon increased after reading the publication (at least for short-term memory). The increase in knowledge of health risks and gov-

Table 3. Likelihood of testing for radon

Variable	Pre-test Frequency	Post-test Frequency
Likelihood to test existing home for radon in next year		
1 Definitely not test	2	0
2 Probably not test	20	11
3 50-50 chance	13	17
4 Probably will test	4	11
5 Definitely will test	1	2
. Missing	3	2
	n = 43 Mean = 2.55	n = 43 Mean = 3.10
Likelihood to test home if were buying		
1 Definitely would not test	0	0
2 Probably would not test	18	5
3 Probably would test	12	23
4 Definitely would test	10	14
. No opinion	3	1
	n = 43 Mean = 2.80	n = 43 Mean = 3.21

ernment recommendations support this rejection of the first null hypothesis based on this limited pilot study. The second null hypothesis was not supported. Reported feelings about the seriousness of health risks and about radon as a problem did indicate attitude changes for these items as measured by the questionnaire and as reported by the participants in this preliminary study. The *t* test scores provided evidence to reject the third null hypothesis. There was a significant difference in willingness to test the home for radon after reading the publication. This preliminary study indicates that this widely used publication has an impact on the knowledge level and short term attitudes and intentions of the participants.

This preliminary study should be repeated with a larger random sample of the population and to attempt to replicate the study's findings. A longitudinal study of this same population would determine the effects of the publication on behavior, behavior changes and knowledge retention. The questionnaire could be used to conduct pre- and post-test impact studies of reading other radon publications.

Discussion

The purpose of this study was to determine if the selected publication would result in a change in level of knowledge (at least over a short time) about radon and a change in willingness to test the home for radon. The analysis of the data indicated that these changes did occur in this study limited to a selected population group. The findings of this study advance the pool of knowledge on the use of publications in educational programs and it reaffirms some of the findings in previous studies.

The increase in level of knowledge is important in determining the effectiveness of the publication. The study by Kennedy, et al. (1991) indicates that the people who have a greater understanding of radon are the ones who test their home. By increasing the homeowners' knowledge, it is hoped those with a better understanding of radon will test. Testing is especially important, as it is the only way to determine if there is a radon problem within the home. In addition to the increase in knowledge, there was an increase in the willingness to test. However, the question remains as to the amount of knowledge retained and whether an intention to test leads to an actual test and mitigation if radon levels are high. This preliminary study serves as a basis for further radon sample studies and longitudinal studies of whether intentions to test, based on knowledge gained, result in actual testing for radon.

Limitations

The population sample is limited to older female homeowners with a mean age of 64. The study applies to the publication tested and cannot be generalized to other publications. Although sample size limits the interpretations and conclusions that can be drawn from the data, the method used to assess an educational publication for its potential impact is important and provides the basis for studies of other publications with targeted population groups. The pre- and post-test questionnaire provides an instrument for additional studies.

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