

Evaluating Risk Communication: Narrative vs. Technical Presentations of Information About Radon

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This paper reports on an experiment to test the hypothesis that people respond better to risk communication that reflects more closely the conditions of their social and cultural lives. The experiment used the case of radon to determine whether technical or narrative forms of risk communication were more effective at drawing people's attention, imparting information, and modifying behavior. Two series of articles on radon were placed in the local newspapers of two Massachusetts communities. Homeowner attitudes, knowledge, and responses were monitored in baseline and follow-up telephone surveys. A third community was selected for comparison. The newspaper series were developed on the basis of previous research and six focus groups conducted with homeowners. The *technical* series presented authoritative, factual risk information, in the scientific style of the passive voice with generalized and impersonal language. The *narrative* series consisted of dramatized accounts of individuals making decisions about radon testing and mitigation, written in a more personal style. The findings from the focus groups confirm the results of previous studies, but the small size of the follow-up samples was a limiting factor in drawing definitive conclusions about the relative effectiveness of the two formats. The experiment demonstrates the difficulty of any risk communication effort on radon and underscores the need for good research design. The study illustrates the need for further research on the role of sociological and cultural factors in the public perception and response to risk.

KEY WORDS: Radon; risk communication; cultural theory of risk.

1. INTRODUCTION

Increasingly, expert-based versions of risk communication are coming under critical scrutiny,⁽¹⁻³⁾ especially for their failure to consider the social and cultural context of risk and risk communication. As expressed recently by Otway and Wynne⁽³⁾: "...simplistic models of risk perception have obscured our view of the social interactions and contexts [that] define authentic risk communication. Thus, the risk communication paradigm rests on unexamined and unarticulated assumptions about

who is communicating what, to whom, and in what context." Otway and Wynne⁽³⁾ acknowledge that major advances in research have resulted in excellent risk communication guides, such as Hance *et al.*⁽⁴⁾ and Covello *et al.*,⁽⁵⁾ but they suggest these are little more than "etiquette books for risk communicators"⁽³⁾ that identify with authoritative sources and assume the elitist position that risk communicators are acting in the public interest. Alternative risk communication frameworks adopt broader definitions of risk and stress the importance of social and cultural context and the role of complex interactive networks linking expert and lay audiences.

Recognizing the plurality of goals for risk communication,⁽⁶⁻¹⁰⁾ an experiment was conducted in Massachusetts to determine whether technical or narrative forms of risk communication were more effective at

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drawing people's attention, imparting information, and modifying behavior. The diffusion of risk information through narratives, or story-telling, is a popular, informal way that people learn about risks. Indeed, human societies have developed elaborate myths and rituals that demonstrate the importance and ubiquity of this activity.^(11,12)

2. WHY RADON?

There are many reasons for choosing radon as a case study. Given the emphasis on individual responsibility and personal control, the radon problem would appear to be more akin to personal health issues (such as smoking, high blood pressure, and cholesterol) than to other environmental risks. Logically, this would seem to enhance the need for risk communication efforts that are sensitive to social and cultural contexts. Several other reasons why radon is a good case study for risk communication experiments have been enumerated elsewhere.^(13,14) First, radon is a serious public health problem. The Environmental Protection Agency estimates between 5000 and 20,000 lung cancer deaths per year may be due to radon exposure in the home,⁽¹⁵⁾ and this estimate is corroborated by a National Academy report, which gives a midpoint estimate of 20,000 with a range of 8000 to 40,000 per year.⁽¹⁶⁾ Second, while radon has always been in the natural environment, it has only been recognized as a significant environmental health problem in the past few years. The recency of public attention means it is easier to trace the effects of new information in a sample population. Third, risk communication has been the preferred agency policy, since the nature of the problem rules out conventional regulatory approaches.^(2,14,17) The fourth reason for the focus on radon is that, unlike most technological hazards, there is no villain and, therefore, no one to blame. This simplifies risk communication since it minimizes complicating issues, such as conflict of interest, deceit, and individual, corporate, or institutional liability. Fifth, whereas community action might be appropriate to remediate some nontechnological hazards, such as natural contamination of drinking water supplies, individual responsibility for testing and mitigation is more appropriate for radon, the concentration of which may vary widely from house to house. A sixth reason that radon presents an interesting case is the predominance of public apathy. Judging from the attributes of the radon hazard and our knowledge about individual risk perception, one could predict a wide range of reactions from apathy to extreme anxiety.⁽¹³⁾ Early risk communication efforts⁽¹⁸⁾ were fearful of cre-

ating public panic about radon, and designed protocols and materials carefully to create sufficient concern to motivate public response without creating unnecessary anxiety.⁽¹⁹⁾ In actuality these researchers need not have been so fearful. Denial, apathy, and calm concern have been the predominant public reactions.⁽²⁰⁾ Finally, radon is an attractive case study since the effectiveness of alternative risk communication strategies can be readily assessed using testing and mitigation as objective measures of responses. We recognize, however, that risk communication may enhance public knowledge and encourage informed consent without resulting in changes in behavior.

3. METHODOLOGY

The experiment builds on previous research comparing the relative effectiveness of different information formats.^(8,14,21) It employs a methodological approach modeled on a clinical trial study, and similar to that used in the evaluation of risk communication programs in Maryland.^(7,22,23) The experiment involved:

- six *focus groups* with homeowners from the test locale;
- the development of *technical and narrative newspaper series*³; and,
- the evaluation of these two formats in two communities using telephone surveys.

Six focus groups were conducted with local homeowners to identify public concerns and perspectives on radon in particular and risk communication in general. The findings from the focus groups were used to develop the *narrative series* of newspaper articles. The *technical series* ran in the *Clinton Daily Item* from March 7–10, 1987, and the *narrative series* ran in the *Fitchburg Sentinel and Enterprise* over the same period. Telephone surveys of residents in these communities were conducted before and after publication of the two series to evaluate their relative effectiveness in terms of readership, awareness, knowledge, attitudes, and testing and mitigation behavior. A third city, Worcester, was used as a comparison group and received no information from the research group.

Clinton, Fitchburg, and Worcester were selected for study because they share similar socioeconomic profiles. All are located in Worcester County, which has the highest proportion of households in Massachusetts with el-

³ Copies of the technical and narrative series of newspaper articles are available from the authors.

evated radon levels. An EPA/state survey conducted in the winter of 1987/88 and released in September 1988 found 38% of households exceeded 4 pCi/l in basement screening tests⁴

3.1. The Focus Groups

Six focus groups were conducted in Worcester, Massachusetts, from December 5–13, 1988. The participants were screened on several criteria including: home ownership; testing status; income; gender; and location of residence. All the participants were homeowners and residents of Worcester County. Two groups involved residents who had tested for radon, and four groups of residents who had not. The themes identified in the focus groups provided an important base of information on local attitudes about risk and the environment, which was used in developing a culture-based risk communication format.

3.2. The Risk Communication Materials

Effective radon risk communication requires, *inter alia*, extensive multimedia efforts with clear, concise, credible, and repeated messages. While recognizing this, the research group opted to compare the technical and narrative presentations of information in local newspapers. Newspapers were chosen as the medium of communication because they have been shown to be the major source for information about radon.⁽⁷⁾ The decision was also a pragmatic one, given the constraints of time, personnel, and funding necessary for a more extensive media campaign.

The research group negotiated with two local newspaper editors about the style, content, length, placement, and other considerations in the design and implementation of the risk communication materials. Agreements were made that the narrative series of four articles would run in the *Fitchburg Sentinel and Enterprise* from Tuesday March 7 to Friday March 10, and the technical series would run in the *Clinton Daily Item* on the same days. The editors also agreed that the articles would have approximately the same placement each day, and no editorial changes would be made without the consent of the

research group.⁵ To draw attention to the radon articles, each issue carried a "call-out" on the front page. There were several reasons for running a series rather than a single article. The amount of information would have necessitated a large article, which would have been difficult to place in the local papers, and might overwhelm readers. A series of shorter articles would be less intimidating and would underline the importance of the radon problem. Running a series of articles would also increase the likelihood that survey participants would read one or more of the articles.

3.2.1. Narrative Format

The narrative series of articles comprised a set of fictional, personalized accounts of individuals making decisions about how to deal with the radon problem. In writing the narrative series, we drew on the focus group discussions, previous research on the cultural aspects of risk communication, and a review of the literature on radon and risk communication.^(1-3,12) The focus group discussions conducted in Massachusetts, and those conducted in Maryland,⁽²²⁾ indicate several areas for improvement in radon risk communication efforts. The narrative series emphasized several of these, including:

- the need to personalize the risk;
- the need to emphasize that radon is a serious problem, but one that can be handled relatively easily;
- the fact that many homes may not have a problem, but without testing there is no way to know which ones do and which ones do not;
- the fact that testing is easy and relatively inexpensive;
- the need to involve local references, officials, and personalities, and credible sources of information to help personalize the risks; and,
- ways to minimize the risks of unscrupulous testing and mitigation companies.

In an attempt to encourage people to personalize the risk, the narrative series of articles was written as a dramatized account of one individual's attempts to understand and cope with the radon problem. The concept of culture-centered risk communication is rather new and

⁴ Personal communication with William Bell (Massachusetts Department of Public Health, September 1989).

⁵ It should be noted that even with the greatest cooperation of the editors, the availability of space and choice of location for articles such as these cannot be guaranteed, and other stories may take precedence over them. The research group was successful in getting a high degree of cooperation from the editors, excellent column space, and a quality presentation for the series.

thus we were operating in uncharted territory. We chose story-telling as a mode of transmitting risk information because it provides the flexibility and creative opportunity to build in cultural references, and the format necessary to emphasize the "personal experiences" of others in responding to risk information. The focus group discussions clearly illustrated the powerful influence of such personal stories.

Given the heightened concern among women and parents with children, the leading figure of the story was described as a mother of two young children. The strong influence that neighbors have on individual perceptions, attitudes, and behavior has been well documented, and was a dominant theme in the Massachusetts focus groups. To incorporate this factor, the story's principal character, Mary, developed a dialogue with her neighbor, Tom, who was given credibility not only by virtue of having tested for radon already, but also by being a retired professor from the local college. Mary also sought information from her doctor. Some studies have shown that doctors apparently have less credibility than other information sources,⁽⁷⁾ but other studies⁽²⁴⁾ and the Massachusetts focus groups indicated that a local doctor would be a credible and logical source for health-related information.

3.2.2. Technical Format

The second series of articles was run in the *Clinton Daily Item* over the same period of time. This series presented essentially the same material as the EPA *Citizens' Guide to Radon*⁽²⁵⁾ with minor changes mostly to ensure consistency between the two series and to enhance the readability of the material as newspaper articles⁶ Written in the scientific style of the passive voice, the technical format provides authoritative, factual information in a generalized and impersonal language.

3.2.3. Both Formats

Each of the four articles in both series focused on a particular aspect of the radon problem, addressing in

⁶ References to working levels were removed from the text and the figures to maintain consistency, and because such references seemed unnecessary and confusing. Two figures and one table appear in the technical series that were not in the *Citizens' Guide*. These include the illustrations of radon entry points, the Massachusetts radon survey results, and the table of mitigation methods. The "head chart" and the table of mitigation methods were not included in the narrative series due to space limitations and last-minute editorial changes.

turn: the source and nature of radon; radon testing; the health effects of radon exposure; and mitigation.

To enhance the credibility of the message, an editorial note was carried in each article indicating that the series was prepared at Tufts University in cooperation with federal, state, and local officials. Each article also included a quiz, a coupon, and the telephone number of the State Department of Public Health, for those wanting additional information. The quiz was included as a means to encourage people to think about what they had read and to internalize the message. The coupon was included as part of an agreement with the University of Lowell. Those mailing the coupon would receive a carbon canister test kit at the reduced rate of \$10. In total, 200 canisters were returned, with 171 from Fitchburg (171/24,500 circulation = 0.70%), and 29 from Clinton (29/4,500 = 0.69%). The University of Lowell was selected to distribute and analyze the canisters to emphasize that the information was being presented as a public service, and to avoid the impression that the series were elaborate advertising ploys for commercial testing companies.

EPA, state, and local health officials, and the newspaper editors were consulted at all stages in the development of these materials. Preliminary drafts of all the articles were circulated to selected experts and six members of the focus groups for their comments and suggestions.

3.3. Telephone Surveys

3.3.1. Design

To evaluate the relative effectiveness of the narrative and technical series of articles, baseline and follow-up telephone surveys were conducted in Clinton, Fitchburg, and Worcester. Individuals were surveyed in Clinton and Fitchburg before (baseline) and after (dependent follow-up) the publication of the articles to identify any changes in knowledge, awareness, and attitudes that might be due to the experimental intervention. Individuals in the baseline survey were contacted after the articles ran. Those who had read one or more of the articles and who were willing to be interviewed again comprise the dependent follow-up samples in Clinton and Fitchburg. These individuals together comprise panel samples, which are a subset of the baseline sample. Those comprising the residual of the baseline survey were questioned only once prior to publication of the articles.

A panel sample in Worcester (comparison group) was interviewed before (baseline) and after (dependent

follow-up) the articles appeared, although no articles were published in Worcester. This panel sample served to identify any changes in awareness, attitudes, and knowledge, that might be due to events extraneous to the experimental interventions, such as other TV or newspaper stories on radon. This sample, therefore, serves as a comparison group for other activities that might distort or mask the effects of the experimental intervention. After publication of the articles, additional surveys were conducted with people in Clinton and Fitchburg (independent follow-up) who had *not* been questioned in the baseline survey. This sample served as a comparison group for the effects of prompting. Comparing the dependent and independent follow-up samples in Clinton and Fitchburg would indicate whether or not participation in the baseline survey had sensitized individuals to the issues of radon, so they might be more likely to read the subsequent articles or search elsewhere for more information. Since no newspaper series ran in Worcester, no comparison group was selected to control for prompting.

3.3.2. Questionnaires

Several questionnaires were developed to accommodate the differences between the various sample groups. The baseline questionnaire included a series of screening questions to determine entry into the baseline sample. Homeowners in Worcester, Clinton, and Fitchburg were included only if their living space incorporated a ground floor (to exclude, for example, owners of fifth-floor condominiums), and if they had not previously tested for radon. Additionally, the baseline sample included only those people in Clinton and Fitchburg who said they read their local newspaper at least three times per week, and those in Worcester who said they read neither the Clinton nor the Fitchburg papers. In addition to the screening questions, the baseline survey had a series of questions concerning: awareness of radon; attitudes to radon; knowledge about radon; and some basic socioeconomic indicators.

Three slightly different follow-up questionnaires were developed—each one tailored to the specific follow-up sample. The screening questions and those concerning socioeconomic status were dropped from the dependent follow-up panel questionnaires for Worcester, since the information had been collected on the baseline survey. The knowledge and attitudinal questions were repeated, and additional questions about testing and mitigation efforts were incorporated.

The dependent follow-up (panel) questionnaires for

Clinton and Fitchburg were modified to incorporate an additional set of screening questions, so that only those from the baseline sample who had read one or more of the articles were included in the follow-up. The series of questions concerning knowledge about and attitudes to radon were repeated, and new sections were added, concerning evaluation of the articles, and testing and mitigation efforts.

Finally, the questionnaire for the independent follow-up samples in Clinton and Fitchburg was the longest and most complicated. It incorporated a series of screening questions to determine entry into the sample. The sample included only homeowners with groundfloor living space who had not tested for radon, or who had purchased kits after March 7, when the first articles were published. Only those who had read one or more of the articles were selected. In addition to the baseline questions about knowledge and attitudes, the questionnaire included questions concerning the articles, testing and mitigation, and socioeconomic status.

3.3.3. Data Collection

Baseline and follow-up telephone surveys were conducted by experienced professional interviewers using random dialing techniques in the selected towns. The baseline surveys were conducted between February 28 and March 3, prior to the publication of the articles. The follow-up surveys were conducted between March 20 and March 24, shortly after the articles appeared. This delay was intended to allow people enough time to consider and discuss the issues with their friends and neighbors, to send off for test kits, and seek further information if necessary, but without impairing recall.

A total of 729 questionnaires were completed in all baseline and follow-up surveys in all three towns (Table I). The baseline survey included 491 people in total, comprising 208 from Clinton, 202 from Fitchburg, and 81 in Worcester. Entry rates (i.e., the proportion of those from the baseline survey “qualified” for inclusion in the follow-up) for the dependent follow-up (panel) sample were quite low: Clinton 21.6% (45/208); Fitchburg 18.8% (38/202); Worcester 62.9% (51/81). All those in the baseline surveys for Clinton and Fitchburg were contacted again for the follow-up. Only those who had read one or more of the articles and agreed to be interviewed a second time were included in the follow-up survey. A recruitment goal of 50 had been previously established for the Worcester follow-up, so recruitment beyond this limit was not attempted.

Table 1. Number of Interviews by Town

| Town | Group | No. of interviews |
|---------------------------------|-------------|-------------------|
| Clinton (Technical) | Baseline | 208 |
| | Dependent | 45 |
| | Independent | 49 |
| Fitchburg (Narrative) | Baseline | 202 |
| | Dependent | 38 |
| | Independent | 55 |
| Worcester (Comparison group) | Baseline | 81 |
| | Dependent | 51 |
| | TOTAL | 729 |

4. RESULTS

The results of the study divide into three parts. First, we highlight what we learned from the focus groups. Second, we report on the outcome of the baseline survey of the three communities. Third, we discuss the use of the "clinical trials" methodology as a means of evaluating different forms of risk communication.

4.1. Focus Groups

The focus groups were conducted to elicit qualitative information from ordinary citizens about their perceptions of the radon problem, their responses to different kinds of risk information, their notions of credible sources of information, and the special ways individuals modify their behavior toward hazards such as radon.

While focus groups are not large statistically representative samples from which one can extrapolate to the general population, they are useful as qualitative indicators of public issues and concerns.^(26,27) The Massachusetts focus groups illustrated several recurring themes and "myths" of significance to risk communication efforts, but no discernible differences between testers and nontesters. Generally, the participants were well aware of radon, and had a good knowledge of its nature, causes, and consequences. The most dominant recurring theme among focus group participants was the perceived enigma that if radon is such an important problem, why has there been so little visible government attention? If the government (both state and federal) is so concerned, why are the testing and mitigation companies unregulated? This concern is closely tied to another dominant theme—a severe distrust of private testing and mitigation companies and the fear of being misinformed or even hoodwinked. Similarly, participants asked if radon is such an

important problem, why has it surfaced only recently? The sudden and recent concern over radon reinforced the belief that the whole affair was brought about by media sensationalism and promoted by unscrupulous testing and mitigation companies "out to make a fast buck." On the other hand, both testers and nontester groups felt a genuine concern for the safety of their children, but struggled to put radon in the appropriate place on their growing list of worries. To many radon was just another worry on an already long and bemusing list of environmental concerns. The focus groups therefore confirm the findings from previous studies.^(7,8,14,22)

Thus, the focus groups were a useful way of identifying obstacles to effective risk communication revealing local concerns about: (1) the regulation of testing and mitigation companies; (2) disreputable contractors with quick-fix solutions; (3) the exposure of children; (4) apparent media sensationalism; and, (5) the perceived lack of state and federal agency involvement. The focus groups also helped us identify prevailing regional conceptions about the radon problem, such as *a priori* determinations based on home characteristics like age, type of construction, and location, that function as rationalizations for *not* testing.

Underlying these feelings of disinterest and distrust, is a strong current of denial and a certain amount of fatalism.⁽⁹⁾ Radon is viewed as a natural hazard for which no one is to blame and about which little can be done. It is seen as just another new worry in a long and growing list of environmental and lifestyle hazards. One explanation for the public apathy about radon is that people cannot respond to all of these worries, and so must de-personalize and deny some of them. What they choose to emphasize among their "worry budgets" is determined by reinforcing conditions around them, and the particular relevance of the risk in their lives.

4.2. Telephone Surveys

The goals of this segment of the study were to evaluate the level of public knowledge about radon, and to evaluate two risk communication formats.

4.2.1. Baseline Survey

Consistent with previous surveys in New Jersey, New York, and Maryland, our results show that the public is quite aware of the radon problem, with more than 80% of the baseline sample having heard of, or read about, radon in the preceding 3 months. Also consistent

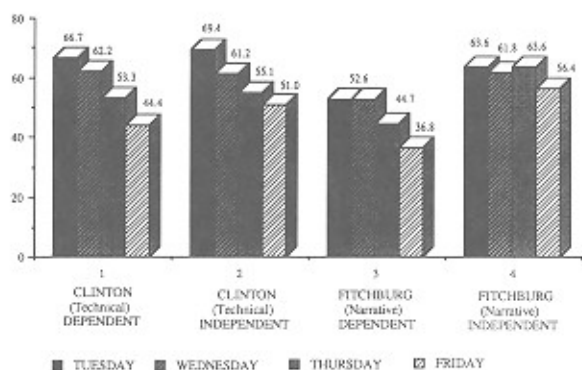


Fig. 1. Level of readership over the series.

with other surveys, the public has a good general knowledge about the origin and nature of the radon problem. In the baseline survey, 75% or more of the respondents knew that:

- radon is a colorless, odorless, tasteless gas;
- radon comes from the natural breakdown of uranium;
- exposure to radon can cause lung cancer;
- radon levels are generally higher indoors;
- the amount of radon depends largely on soil composition;
- radon levels tend to be higher in basements;
- elevated levels can be reduced by various forms of ventilation; and,
- radon can be measured by inexpensive screening techniques.

Respondents had more difficulty with the three other knowledge questions, concerning:

- how smoking affects the risk of radon exposure;
- variations in radon levels over the year; and,
- the effects of operating furnaces and appliances on indoor radon levels.

In spite of this general awareness of the radon problem, and a good general knowledge of the causes and consequences of radon exposure, the vast majority of the public has not shown a willingness to test for radon. As noted by Weinstein *et al.*⁽²⁰⁾ the public response to the risks of radon can be characterized as one of "apathy and calm concern."

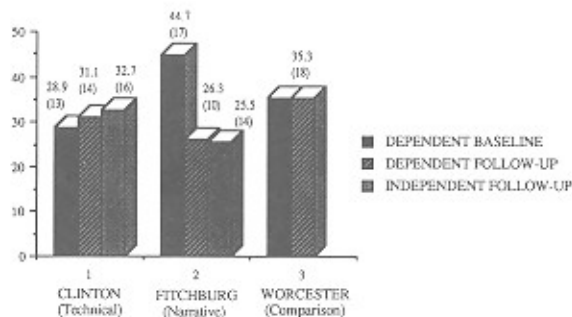


Fig. 2. Proportion of respondents believing radon is a serious concern in their neighborhood.

4.2.2. Follow-Up Survey

A careful experimental design was drawn up, to evaluate the two risk communication formats—one based on a traditional expert model and the second based on story-telling. The experiment ran flawlessly with one previously cited exception, only 19–22% of the participants in the baseline survey read at least one of the published articles, in spite of the fact that they were prescreened as regular readers of their local newspaper. Thus, the panel sample, drawn from the baseline survey on the basis of readership, was smaller than expected.

Given the small size of the panel samples, we were unable to draw definitive conclusions about the relative effectiveness of the two risk communication formats. With this caveat in mind, however, the experiment did yield a number of important findings.

While the overall proportions of people from the baseline survey who read the articles were low, readership levels over the week (Fig. 1) declined less rapidly in Fitchburg (narrative series) than in Clinton (technical series). This suggests that the narrative series might be better at retaining the attention of readers. On the other hand, the initial levels of readership were higher for the technical series and declined more rapidly thereafter.

Curiously, as illustrated in Fig. 2, reading the technical series (Clinton) appeared to enhance concerns about radon in the neighborhood, while the narrative series appeared to reduce concern. One plausible explanation for this phenomenon is that the narrative series emphasized that most houses do *not* have high radon levels, and for those that do mitigation is often relatively straightforward. This emphasis may have encouraged people to assume that radon was therefore not a problem in their neighborhood.

Both risk communication formats enhanced the levels of knowledge about radon, but neither format en-

couraged a significant increase in testing and/or mitigation. Neither format proved to be more effective than the other in motivating people to test or mitigate. There are three plausible explanations for this:

- the panel sample was too small to indicate differences;
- the intervention needs to be more extensive, using multimedia approaches over prolonged periods, to increase public response and highlight any differences in effect; or
- there is no actual difference in effectiveness between the technical and narrative formats. Either it is too difficult to make the narrative and technical formats sufficiently different to elicit measurable public responses, without sacrificing authenticity, or people truly do not respond differentially to technical and narrative formats.

4.3. Methodology

The experiment incorporated an elegant methodology developed elsewhere to test the relative effectiveness of different types of risk communication.^(7,22,23) The focus groups were particularly useful in developing the risk communication materials and the survey questionnaires. Independent of any particular findings, the process of conducting a series of focus groups is an invaluable experience for researchers engaging in this kind of work. Surprisingly, the editors of the local newspapers were more than willing to cooperate with the research group, perhaps in part because they view risk communication as a public service. The comparison group in Worcester indicated that no extraneous events or news stories influenced the experiment. The independent follow-up groups in Clinton and Fitchburg indicated that there was no measurable prompting by the initial baseline telephone survey. This lack of prompting may reflect the general public's disinterest in the radon problem. Nonetheless, any future experiment using this methodology should incorporate both types of comparison groups.

We have several suggestions about how to improve the methodology. Drawing the samples from the subscriber lists for each paper might have reduced the number of people falsely claiming to be regular readers. Alternatively, if one expects only 20% of the baseline sample to read such risk communication materials, enlarging the baseline sample proportionately would ensure sufficient numbers in the follow-up sample to allow more definitive conclusions to be drawn. Given sufficient funding, expanding the risk communication effort to

multimedia interventions over a more extended period of time would enhance the potential to discover differences in the relative effectiveness of alternative risk communication formats. At the same time, the channels chosen should be those that would be appropriate and feasible for use by an agency or other relevant groups. Finally, it would be worthwhile to extend the methodology to examine the relative effectiveness of the different types of risk communication for other environmental hazards. While radon is a particularly interesting case, for the reasons given above, it is also apparent that public apathy can be a major stumbling block in fully evaluating the effectiveness of different risk communication formats. It might be particularly instructive to run a similar experiment in regard to a hazard with high *outrage*^(28,29) to test whether the narrative-style of presentation is more effective in allaying public anxiety.

5. CONCLUSIONS

The experiment demonstrates the difficulty of any risk communication effort on radon, and the need for a more extensive, multimedia campaign to test the relative effectiveness of the two formats. The experiment reveals that some areas of knowledge, such as the relationship between radon and smoking could be improved by focused risk communication efforts, but this is unlikely to increase significantly the number of people testing. We agree with Doyle *et al.*⁽³⁰⁾ that solving the radon problem will require more than risk communication alone. A mix of risk communication, incentives, and regulation will be required, and these might most effectively focus on the point of sale in the private housing market.

This study underscores the importance of good research design in comparing risk communication formats and evaluating their relative effectiveness. In cases like radon, where the public does not respond well to risk messages, large sample sizes and strong signals are required to improve the sensitivity of the experiments.

The study demonstrates that the lack of knowledge about radon risks is not a significant factor in accounting for public apathy. The more relevant factors are the absence of state and federal regulations, the competition of radon with other environmental concerns presented daily in the media, skepticism about radon detectors, concerns about home values, and distrust of testing and mitigation companies. These contextual factors may vary from region to region, and there is little guarantee that a risk communication strategy in one region will necessarily prove equally effective elsewhere. Further studies in risk communication are needed that emphasize

social and cultural factors underlying public perceptions and responses to risk.

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