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Residents' Perception of Radon Health Risk: A Qualitative Study

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Abstract

Background: Radon is a high impact environmental pollutant and is the second leading cause of lung cancer in Canada. Building design, extended winter, and geographical location expose residents of Ottawa-Gatineau (the national capital region in Canada) to an increased risk. It is surprising that residents have an inadequate awareness of the risk - despite its gravity - and have taken minimum preventive actions. This study explores perceptions of radon health risk and examines the factors that enable and hinder the adoption of preventive measures among Ottawa-Gatineau residents.

Methods: We conducted semi-structured interviews with 35 residents from varying educational levels and occupational backgrounds to inquire about their knowledge and perception of radon, and to explore their views of enablers and obstacles to taking action to reduce radon risks. Thematic, inductive data analysis was undertaken.

Results: The results indicate that: 1) Residents obtained information on radon from various sources - the media, self-education or occupation, social network, and home renovation events. Limited references were made to the National Radon Program responsible for testing for radon and informing residents. 2) Awareness of radon risk varies, knowledge retained by some residents is insufficient to protect their health adequately. Residents who had dual perceptions- *cognitive as well as emotional awareness*, motivated enough to act. 3) Enablers for taking protective action: understanding the risk along with health consciousness; caring for family and children; knowing others who had contracted lung cancer and having financial resources. Obstacles included: lack of awareness; cost; lack of home ownership; and potential difficulty in selling the house. 4) Residents attributed primary responsibility to public agencies for disseminating information and incentivizing or mandating action through more stringent regulation.

Conclusion: Risk perceptions are subjective and influenced by the micro and macro level factors. Inducing protective action requires complex interventions considering dual perceptions of the threat by the public health agencies.

Introduction

Radon is a ubiquitous environmental pollutant that poses a significant health risk, especially in cold countries [1]. In Canada, radon kills at least 3,000 people annually, making it the second leading cause of lung cancer [2]. This naturally-emitted soil gas enters buildings, typically by seeping in through foundations [1]. Building design, extended winter, and geographical location expose residents to increased concentrations of radon gas [3, 4]. Radon decay gives off tiny radioactive particles that, when inhaled, can cause mutation in DNA of lung cells eventually resulting in lung cancer [5, 6]. Women and children appear to be more strongly affected [7], and the risk is up to threefold for smokers [8].

The National Radon Program (NRP) of Health Canada is responsible for raising public awareness through disseminating radon health risk messages [9]. Despite multiple efforts, the program lags behind the desired public uptake. According to the latest national survey, 55% of Canadian households heard about radon, but only 6% of them tested for it [2]. Similarly, a recent survey conducted in the national capital region in Canada, which is known for relatively elevated levels of radon, revealed that while 32% of those surveyed expressed some concern about radon health risks, only 12% tested for radon, and 3% took action to reduce radon health risks [10]. The gap between risk awareness and actual testing rates presents a challenge for public health professionals [11, 12].

In Canada, like many other countries, residents are responsible for radon testing and remediation [1, 9]. The guideline issued by the federal government is voluntary; it assumes that residents will act rationally according to the provided information [9]. This assumption, however, has been challenged by previous psychological and preventive health research relating to health risk perception [13, 14]. Further, Spiegel and Krewski [11], in a quantitative study, assessed the health risk perception of residents in high radon areas and concluded that the Canadian residential radon exposure guideline had not been effective at prompting homeowners to take action to reduce exposure.

Theoretical Lens: Protection Motivation Theory

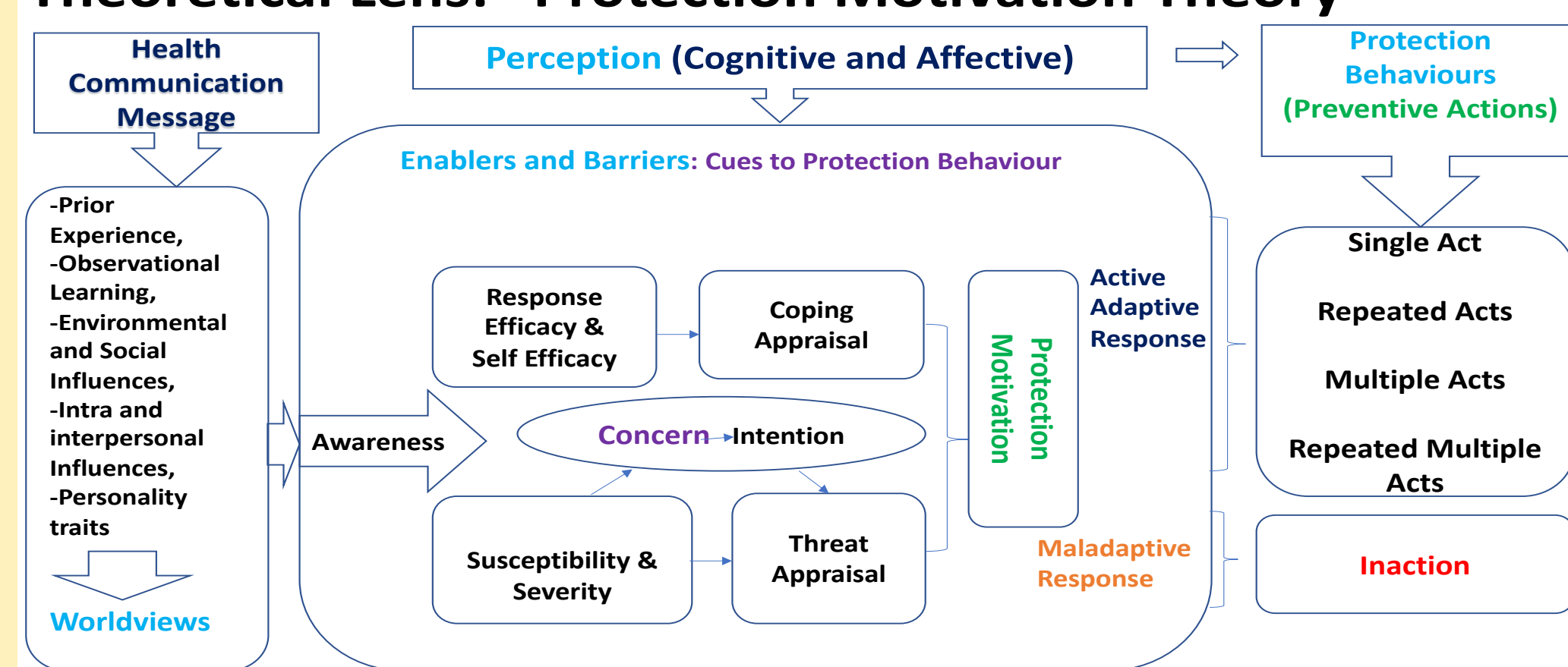


Figure 1. Protection Motivation Theory of Rogers (1983).

Thesis & Research Questions

The term 'risk' denotes the probability of experiencing a dangerous event times the magnitude of the consequences of that event [15]. However, studies over the decades have provided convincing evidence that subjective public perceptions of risk differ significantly from the scientific evaluation of risk [16, 17, 18]. For example, in a high seismic zone, the risk that a resident will die in an earthquake may be mathematically lower than the risk of dying in a car accident. Yet, residents are comfortable with driving but panicked of an earthquake [19]. This is because residents do not mathematically or objectively calculate the risk. Slovic argues that no risk exists independently of human thoughts and culture [20]. Attempts to reduce health risks would benefit from an understanding of people's views. Research has identified that the success of any population-level awareness program is contingent on the views and actions of key decision makers at the household level [21]. Therefore, it is important to understand residents' knowledge and views of radon health risk. Most studies that assess environmental health risk perceptions in Canada adopt quantitative approaches. To our knowledge, no qualitative study has been conducted that examines residents' knowledge and understanding of radon health risks, their views of enablers and obstacles to testing and mitigating, and their suggestions regarding how to improve the public's knowledge and action with respect to radon. Qualitative research enhances understanding of people's perceptions and experiences and is well suited to capture these views and their context in people's own words [22, 23]. It is important to achieve an understanding of residents' views. Therefore, this qualitative study applied the protection motivation theoretical lens and focused on three *research questions*:

- 1) How do residents learn about radon and how do they view the risks associated with it?
- 2) What are the enablers and barriers to mitigation of the risk according to residents?
- 3) What suggestions do they provide to enhance information dissemination and protective action?

Methodology

This qualitative study follows a quantitative study we previously conducted with residents of the Ottawa-Gatineau area [10]. From that study, we purposefully selected 32 who had shown at least some background knowledge of radon. They were homeowners and tenants; individuals tested and not tested homes for radon; with various educational and occupational backgrounds. We included three interviews conveniently sampled for a pilot study on the same topic. In total, we conducted thirty-five interviews.

Table 1. Presents study participants' sociodemographic characteristics

Characteristics	Numbers	Percentage
Gender		
Female	8	23%
Male	27	77%
Age Groups		
18-44	7	20%
45-64	15	43%
65+	13	37%
Level of Education		
High School	3	9%
College	9	26%
Bachelor	11	31%
Graduate	12	34%
Total Household Income		
Less than \$40,000	3	9%
Between \$41,000-75,000	7	20%
Between \$76,000-100,000	9	26%
Between \$101,000-150,000	11	31%
Between \$151,000 and Above	2	5%
Prefer Not to Answer	3	9%
Homeownership		
Homeowner	29	83%
Tenant	6	17%

Analysis

We adopted an inductive approach to the analysis and focused on understanding issues from the perspective of residents. Following Braun and Clarke [22] and Miles et al. [23], after familiarization with the transcripts, initial codes that were close to the data were applied. The first author initially coded seven interviews, using descriptive codes. The process of coding was iterative: as this coding progressed, new codes were added, and some codes were modified. Following this step, the second author reviewed the coded interviews, and the two researchers developed a code list [22] that was used to recode the interviews. The first author then continued coding the other transcripts, while also convening with the second author on a regular basis to discuss emerging patterns in the data. These patterns or themes were developed in answer to the research questions. For example, initial descriptive coding indicated that some participants had learned about radon from newspapers, radio, TV and/or the internet. Each of these four had its own code, and these codes were then combined under the theme of "media sources," which was one of the themes helping us to answer the research question on sources of information on radon. Our final themes and sub-themes are presented in Table 2.

Results

In this section, we report the results of our analysis in four overarching themes and associated sub-theme. These are the 'sources of information' and 'level of knowledge or risk awareness' of participants. Followed by participants' views of enablers and obstacles to testing and mitigation. Finally, a summary of participants' suggestions regarding the ways to improve disseminating information and taking action to reduce radon harm.

Table 2. Themes and sub-themes obtained from qualitative data

	Themes	Sub-themes
1	Source of knowledge	Media Social network Education and occupation Home renovation shows Home inspectors The current study National Radon Program
2	Knowledge-risk awareness	Advanced Basic Deficient Faulty
3	Enablers	Understanding health risk (cognitive awareness) Concern for children and oneself (emotional awareness) Social influence (knowledge of significant others) Personalizing the risk Financial capability
	Barriers	Lack of awareness of health risk Cumbersome procedures Cost of remediation Tenancy Reduced property value (assumed) Voluntary nature of the guidelines
4	Suggestions to improve knowledge dissemination and protective action	Role of public agencies Individual responsibility Shared responsibility Role of citizenry Incentivizing Mandating and legislating

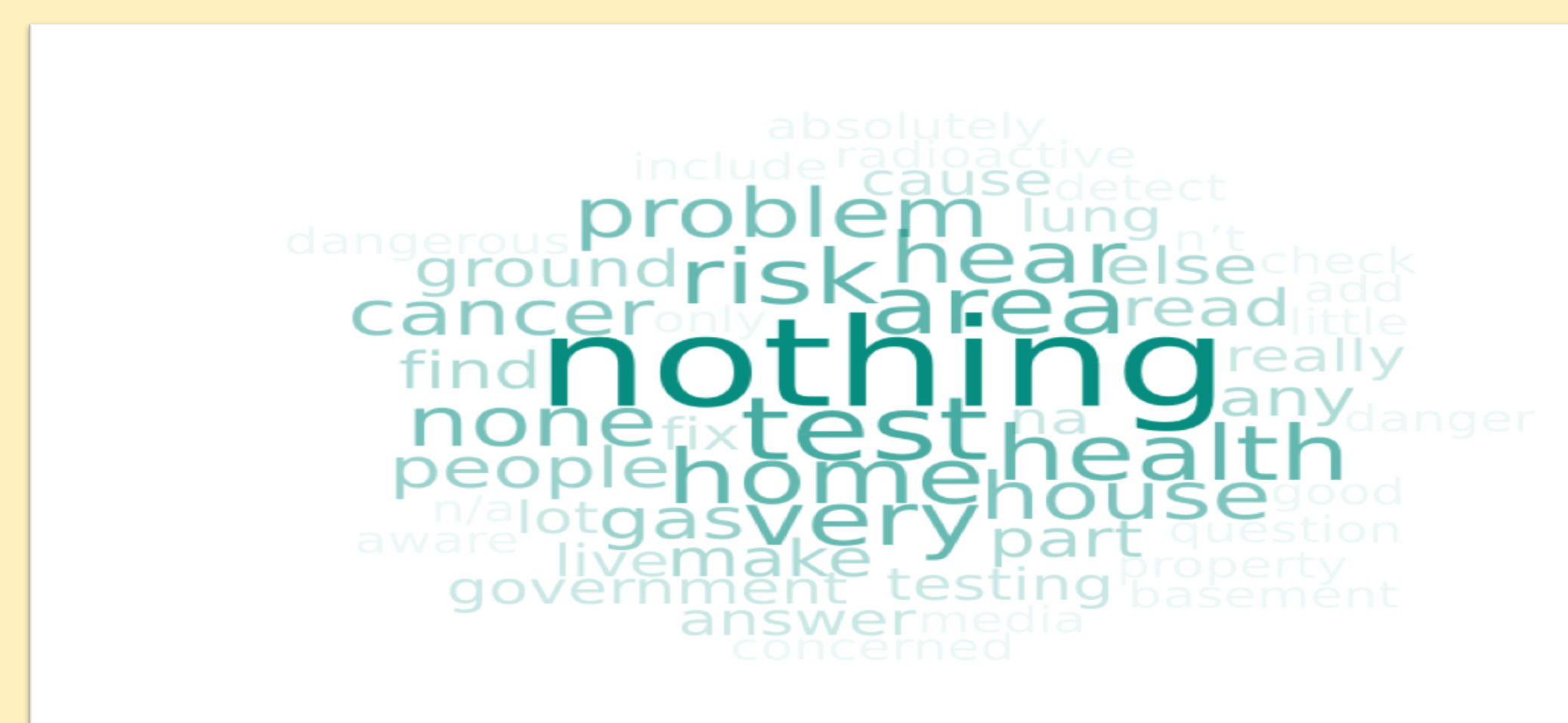


Fig 2. Word cloud out of responses to question 'what else you know about radon?'

Conclusion

This study sheds light on the vital topic of residents' knowledge and views of radon and its risks. To date, studies on views of radon risk in Canada have tended to adopt quantitative approaches. The value of the qualitative approach is that it provides a deeper look into participants' experiences, thus providing information to complement quantitative results. Our study showed that many people do not get the crucial information on radon and some retain misconceptions about the health risks of radon even after being exposed to information. Many residents report barriers in testing and engaging in protective action, even after receiving the pertinent information.

Our study underscores the importance of seriously considering how radon risk is understood and dealt with by residents. We identified that mere cognitive risk awareness is not enough; additional emotional awareness motivates residents to take action regarding testing and mitigating their homes for radon. Therefore, radon health communication will be more effective when programs address both these aspects of risk perception along with plausible regulations and incentives, where necessary. Future research can explore the dual aspects of risk perception and thus help to develop tailored risk communication messages capable of motivating residents to mitigate their homes for radon health risk.

Limitations and Future Research Direction

A limitation of this study is our inability to generalize from the current study to the population at large; however, this is a typical feature of qualitative studies [23]. In fact, exploratory qualitative studies are not intended to provide generalizable data, but to enhance understandings that can be further tested in broader-based quantitative studies. Our study was also limited in number of participants and locations.

Future research would benefit from interviewing more participants and in other cities to generate additional insights. We believe that studies in cities where there have been condensed and concerted efforts to communicate with residents and incentivize action would provide an interesting extension of or counterpoint to this study.

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