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Right answers and right-wrong answers: Sources of information influencing knowledge of nuclear-related information☆

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ABSTRACT

Surveys in 2008 and 2009 asked almost 6000 United States residents to indicate their knowledge about the use of nuclear and other sources of energy, and the disposition of nuclear waste. Less than 10% of respondents knew where spent commercial nuclear fuel is stored. With regard to knowledge about fuel for electrical energy, respondents overestimated solar and wind use and underestimated coal use. These responses are consistent with mass media coverage of these issues. The mass media were the source of information for the vast majority of respondents. However, the likelihood of right answers to our questions increased as reliance on the mass media decreased, and it increased with use of books, magazines, personal contacts and the web. Educated affluent white males with strong preferences for nuclear energy disproportionately were knowledgeable. These observations demonstrate the daunting challenge of providing information about subjects that are largely distant and disconnected from the public's lives. The Department of Energy, Nuclear Regulatory Commission, state and local health, environmental and energy agencies, and facility owners and operators have huge domestic political, national security and economic stakes in improving the factual grounding of public reactions to energy production and waste management choices.

1. Introduction

The objectives of this paper are to examine public knowledge of certain facts about nuclear energy and waste management, and to assess the correlates of that knowledge. These objectives arise from a long-standing ambivalence about the media's role in shaping the policy agenda [1–6]. Indeed, some have characterized the public as uninformed and overly influenced by the media and emotions, and the media are accused of amplifying relatively small risks into major fears [1–6].

The role of the media in shaping public perceptions and preferences about energy has been highlighted during the last several years by concerns regarding the management of high-level nuclear waste and a so-called renaissance of nuclear power. With regard to waste management, the major controversy has been whether to store high-level nuclear waste from commercial nuclear power plants and the defense industry at Yucca Mountain, which is located about 90 miles north of Las Vegas, Nevada [7,8].

During and after the presidential election of 2008, heated exchanges took place between the candidates for president, as well as the incoming head of the United States Senate who is from Nevada and is opposed to the use of Yucca Mountain [9]. With regard to energy, the major focus has been on the need to become more reliant on solar, wind, and other renewable sources and less on fossil fuels [10]. Meeting these objectives would reduce greenhouse gas emissions and dependence of the United States on foreign sources of fossil fuels. In this regard, nuclear energy has frequently been portrayed as a source of energy that does not create greenhouse gases [11,12].

It is not the purpose of this paper to argue for or against Yucca Mountain, or for or against more nuclear power plants. Rather, given the heightened publicity around these issues, this paper serves as an opportunity to determine what facts the United States public has been taking away from the debates and what perceptions, values, preferences, and sources of information are associated with their knowledge.

The purposes of the research summarized in this paper were to answer three research questions:

1. Knowledge: What proportion of the U.S. population knows where high level nuclear waste from commercial power plants is

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managed? What proportion knows how much the United States relies on nuclear, coal, wind and solar energy for electrical power generation? What proportion knows if there are nuclear power, waste management, laboratory or mining facilities in their state?
2. Sources: What is the association between energy-related knowledge and sources of information such as, mass media, internet, books and magazines, and personal contacts?
3. Correlates: What respondent attributes such as, demographic characteristics, preferences and values about energy and the environment, political, cultural and social identity, and respondent location would increase the likelihood of accurate energy-related knowledge?

Behind this research is our belief that facts about energy policy are mostly unconnected and distant factoids for most people, that is, they have not likely visited Yucca Mountain, a nuclear power plant, a waste management facility, or a uranium mine. Consequently, when they read a news story, listen to a radio news story or watch a television news story, it is not surprising that they do not come away with a clear message. Accordingly in addition to the "right" or correct answers, we believe that many members of the public have learned "right-wrong" knowledge, or media enhanced knowledge, because of their reliance on the media. Their understanding is guided by media presentations, which are limited to selected information with limited time for contextual information.

Distracted by the realities of life, the public, with some exceptions we hoped to discover, does not have the time to verify the reality of facts that are too distant from their lives. While the mass media surely are the main source of information available to the public about energy sources and waste management, some rely on the media less. We sought to examine the attributes of those who are more knowledgeable about energy-related issues and to determine the role of reliance on mass media in this knowledge.

2. The origin of right and wrong knowledge

The environmental psychology, risk perception and communication, and more generally, the social science literatures are sources for understanding factors that influence people's knowledge of energy-related issues. However, before summarizing elements of the literature, we note that the psychology, communications, risk and environmental literatures have examined the role of knowledge as (1) a variable to be predicted, (2) a cause of perception, and (3) as a mediating factor in perception and behavior. For example, Siegrist and Cvetkovich [13] found that people who were knowledgeable about risks did not rely on trust to assess a hazard. Those who were unfamiliar with the hazard relied heavily on their trust of the operators and mangers of the hazard. Knight [14] examined the influence of knowledge, morality, trust, and benefits on public support for biotechnology. He observed that knowledge was an indirect predictor, mediated by trust, which in turn was a weaker predictor than morality and benefits. Sjoberg [15] focused on public perception of scientists' knowledge of risk. He observed that there is only a relatively weak association between perception and trust because people believe that scientists do not adequately understand all the impacts of technology. In another paper Sjoberg et al. [16] noted that knowledge of radiation risks was a good predictor of concern about nuclear risks among nuclear power plant workers. Vandermoere [17] examined how people perceived the need to remediate contaminated soil. He found that the public's direct knowledge and their estimate of how much experts knew were both predictive factors. Grasmuck and Scholz [18] also examined soil pollution, finding that those who believed that they were knowledgeable did not want additional information, but overall emotional reaction was the strongest predictor.

The authors of this paper divided the explanatory factors for variation in knowledge into five groups: (1) demographic characteristics; (2) political, cultural and social identity; (3) preferences and values about energy and the environment; (4) respondent location-related attributes; and (5) information sources.

First, we investigated the effect of demographic characteristics on energy-related knowledge. The authors anticipated a so-called "white male effect," in other words, affluent and college educated white males were expected to be the most knowledgeable about energy-related issues. This group as a whole has had more formal education, access to information and power, and a vested interest in maintaining a grasp on factors that will strongly influence the economy of the United States. They tend to trust technology more than their counterparts and to be relatively less concerned about many hazards [19–24]. It follows that less educated and less affluent African and Latino American women and men were expected to be less knowledgeable.

Second, we evaluated the role of political, cultural and social identity in explaining energy-related knowledge. Political party identification has been found to be a predictor of environmental risk perceptions and political orientation has been found to lead to attitudes about nuclear power [25–27]. As such, we expected political identity to predict energy-related knowledge. In addition to political identity, cultural identity, part of cultural orientation, has also been shown to be an important predictor of environmental risk perception and may at least partly explain the white male effect [25].

The white male effect has been challenged by proponents of an explanation that demographic characteristics are one element of cultural identity, part of cultural orientation. Specifically, Kahan et al. [25] characterize white males as tending to be individualistic (rather than communitarian), and hierarchical (rather than egalitarian). White males should be expected to be more aggressive than their counterparts about actions that will rapidly achieve their objectives. Hence, they are likely to be aware of facts that influence the direction of the economy. Anything that threatens the U.S. market system that U.S. white males have largely controlled, such as not having a place to store spent nuclear fuel or insufficient electrical energy, should be disproportionately important to individualistic and hierarchical people. The authors added indicators of political identification (self identify as Democrat, Republican, and Independent) and several questions about perceptions about discrimination, constraints that should be posed on how individuals spend their wealth, and the implications of the decline of the traditional family from Kahan et al.'s [25] research.

Third, we investigated the effect of preferences and values about energy and the environment on energy-related knowledge. More accurate knowledge was expected from respondents who noted a strong commitment to environmental protection issues and those who were concerned about the overall quality of the environment in the future as those who value the environment have been known to seek out information about threats to the environment [28]. Trust of private and public authorities that manage energy facilities was also expected to be associated with more knowledge of facts about those facilities [22–24,29].

Fourth, we evaluated the effect of respondent location on energy-related knowledge. Studies show that the public focuses on hazards that affect them, their family and friends [30–32]. Consequently, many people living near nuclear waste management sites, nuclear laboratory facilities, and nuclear power plants should be expected to be motivated to learn more about facilities. Further, respondents who have worked at an energy production or waste management site or who have a friend, neighbor or other family member who has worked at a site are expected to have more energy-related knowledge. Additionally, if the site contributes to