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# Japanese university students' attitudes toward the Fukushima nuclear disaster

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ABSTRACT

This study investigated Japanese university students' attitudes about the Fukushima nuclear accident and the relations between their attitudes and their opinions about post-disaster reconstruction policies. Gender and geographical differences were also examined. Attitude components were identified, including nuclear power plant efficiency, trust in institutions, and fear of radioactive contamination. Results revealed that men reported higher perceived nuclear power plant efficiency than women did, whereas women showed slightly higher fear of radioactive contamination than men did. Students in Miyagi had higher levels of trust in institutions than students in Tokyo did. Controlling for the effects of gender and geographical differences, fear of radioactive contamination was revealed as a predictor of opinions about post-disaster policies. In contrast, the cognitive components of attitudes did not predict the opinions.



## 1. Introduction

The largest earthquake on record in Japan, with a magnitude of 9.0 on the Richter scale, struck on March 11, 2011. The earthquake and subsequent tsunami caused extensive and severe damage in Japan, particularly in Miyagi, Iwate, and Fukushima prefectures (Eastern Tohoku region). The National Police Agency of Japan has stated the confirmed dead from the earthquake and tsunami as 15,880 (9535 in Miyagi prefecture, 4673 in Iwate prefecture, and 1606 in Fukushima prefecture) and missing people as 2700 (1314 in Miyagi prefecture, 1171 in Iwate prefecture, and 211 in Fukushima prefecture) (National Police Agency of Japan, 2013). The 2011 East Japan earthquake and tsunami together constitute the most destructive natural disaster in the world in recent years. An important consequence of the earthquake and tsunami was the nuclear accident at the Fukushima Dai-ichi nuclear power plant, where three reactors *melted down*. On March 12, 2011, the Japanese government ordered the evacuation of residents living within 20 km of the stricken nuclear power station. On March 25, 2011, residents living 20–30 km from the plant were also told to evacuate. Approximately 154,000 people have been evacuated from Fukushima prefecture, of whom 109,000 people were residents of the evacuation order area (Reconstruction Agency of Japan, 2013).

The Fukushima nuclear accident, the largest nuclear accident since the 1986 Chernobyl disaster, has given rise to severe social and political problems in Japan. For instance, the disposal of disaster debris in the affected prefectures became a severe problem in Japan because an estimated 22.53 million tons of disaster debris were generated in Iwate, Miyagi, and Fukushima prefectures by the 2011 East Japan earthquake and tsunami. After the March 2011 triple disaster, officials in tsunami-stricken areas reported that increasing mountains of debris are hampering reconstruction efforts (Japan Today, 2011). Therefore, the Ministry of the Environment in Japan has called on local governments outside the three prefectures to accept some debris from Miyagi and Iwate (not Fukushima) on the condition that its radiation levels are confirmed as safe (The Japan Times, 2012). Nevertheless, many prefectures expressed reluctance to accept debris for incineration because of fears that it was radioactive. In fact, the Tokyo metropolitan government received hundreds of complaints from citizens by phone, fax, and email when it announced its agreement to accept rubble (Japan Today, 2011).

One year after the disasters, only 5% of the debris generated by the devastating earthquake and tsunami had undergone incineration or disposal. The Ministry of the Environment called for increased cooperation from local governments nationwide in dealing with this gargantuan effort (The Japan Times, 2012).

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However, local governments outside the affected areas remained reluctant to accept debris because of objections from their own residents. Kitakyushu city, Fukuoka prefecture, eventually accepted disaster debris from Ishinomaki city, Miyagi prefecture, to facilitate its disposal. Nevertheless, although radiation levels of the debris were low and confirmed as safe, protestors blocked the road for 8 h over fears that incinerating the debris would spread radiation to areas that had not been contaminated by the nuclear disaster (McAteer, 2012). These circumstances reflect the fact that fear of radiation from the Fukushima nuclear accident has persisted as an important social issue. It is therefore important to ascertain how Japanese people's attitudes about the Fukushima nuclear accident were related to their opinions about post-disaster reconstruction policies in Japan.

The primary purpose of this study was to examine characteristics of Japanese people's attitudes about the Fukushima nuclear accident. Previous studies were undertaken to assess individuals' attitudes about nuclear power plants multidimensionally (Newcomb, 1986; Peters & Slovic, 1996; Visschers & Siegrist, 2013). For instance, Newcomb (1986) investigated nuclear attitudes associated with the threat of nuclear war and the possibility of accidents at nuclear power plants. Results showed that nuclear attitudes were constructed based on four factors: nuclear concerns, nuclear support, fear of the future, and nuclear denial. In a more recent study, Truelove (2012) demonstrated that emotional and cognitive perceptions about energy sources explained significant amounts of variation in the support of energy sources.

Also in Japan, several researchers have examined attitudes and acceptance related to nuclear power. Their results indicated that Japanese residents' attitudes about nuclear power plants were constructed by risk perception, benefit perception, and trust in the government and electric utility companies (Katsuya, 2001; Shimooka, 1993; Tanaka, 2004). For example, Tanaka (2004) examined major psychological factors determining public acceptance of the location of nuclear facilities. He found, under generally prevailing circumstances, that both perceived risk and perceived benefit were important for public acceptance of nuclear facilities. Furthermore, in terms of location, perceived risk was extremely important for the public acceptance of nuclear facilities, although perceived benefit had little effect. Results also showed that trust in institutions was important for public acceptance of the location of nuclear power plants, but not for public acceptance of the location of high-level radioactive waste repositories (Tanaka, 2004). Nevertheless, little is known about how the Fukushima nuclear accident affected Japanese people's attitudes related to nuclear power.

Recently, several reports have described how the Fukushima nuclear power plant accident changed public attitudes about nuclear power among citizens in many countries (Hartmann, Apaolaza, D'Souza, Echebarria, & Barrutia, 2013; Prati & Zani, 2012; Visschers & Siegrist, 2013). For instance, Prati and Zani (2012) investigated Italian people's perceptions of nuclear power and values one month before and after the Fukushima nuclear accident. They reported that the Fukushima nuclear accident reduced trust in nuclear power, reduced trust in environmental organizations, and altered pronuclear attitudes in Italy. Visschers and Siegrist (2013) examined how the Fukushima nuclear accident changed people's trust, their perceptions of benefits and risks, and their acceptance of nuclear power in German-speaking areas of Switzerland. They reported that the perceived benefits and risks determined the acceptance of nuclear power stations, both before and after the Fukushima nuclear accident. Moreover, the results showed that trust strongly affected the perceptions of benefits and risks (Visschers & Siegrist, 2013). Furthermore, Hartmann et al. (2013) found, one year after the Fukushima nuclear accident, that Spanish people's emotional fear arousal motivated their nuclear opposition and green electricity. These findings suggest that popular attitudes about nuclear power were constructed from cognitive and emotional components after the Fukushima nuclear accident. However, because all of those studies were conducted in countries other than Japan, the characteristics of Japanese people's attitudes about nuclear power after the Fukushima nuclear accident remain poorly understood. Therefore, this study investigated Japanese people's multidimensional attitudes about the Fukushima nuclear accident. Particularly, Japanese university students' attitudes about the Fukushima nuclear accident are hypothesized as having been constructed not only from cognitive components such as risk perception of nuclear power or trust in institutions. The attitudes were also based on emotional components such as fear of radioactive contamination. The theoretical framework is derived from well-known dual-process models that posit two systems of information processing (Chaiken & Trope, 1999; Epstein, 1994; Sloman, 1996), but which have not been applied to Japanese attitudes related to the Fukushima nuclear accident.

The second purpose of this study is to examine whether gender and geographical differences can be observed in Japanese people's attitudes about the Fukushima nuclear accident and in the opinions about post-disaster reconstruction policies in Japan. Previous studies have revealed that men and women had different attitudes, beliefs, and emotional reactions related to nuclear disasters and environmental pollution. For example, Newcomb (1986) reported that women expressed significantly more nuclear concern, less nuclear support, greater fear of the future, and less nuclear denial than men did. Rabow, Hernandez, and Newcomb (1990) reported similar nuclear attitudes with gender differences observed in American, British, and Swedish students. A recent study by Keller, Visschers, and Siegrist (2012) investigated affective imagery related to nuclear power and the acceptance of replacing nuclear power plants. They found that men had a higher acceptance of replacing nuclear power plants than women did. Moreover, the affective image association related to nuclear power plants differed between men and women.

However, some reports have described that patterns of gender differences of concern about technology and the environment are not universal (Davidson & Freudenburg, 1996; Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Flynn, Slovic, & Mertz, 1994). For example, Flynn et al. (1994) reported that white men in the U.S. judged risk as less than women did, but this gender difference was not found between non-white men and white women. In a more recent study, Finucane, Slovic, et al. (2000) obtained replicate findings from those reported by Flynn et al. (1994) and pointed it out as a white male effect. They found also that Asian men in the U. S. assigned lower risk ratings to six risk items, including contaminated foods, than white men did. Whitfield, Rosa, Dan, and Dietz (2009) reported that nuclear attitudes did not vary by gender, age, education, income, or political orientation, although non-white people were found to be generally more supportive than white people were. In light of the results of the studies described above, gender differences in risk judgments require further research. Therefore, we investigated Japanese attitudes about the Fukushima nuclear accident along with gender differences. We hypothesized that Japanese women had their own attitudes about the Fukushima nuclear accident and that their opinions about policies were more negative than those of men.

Some reports have described the effects of geographical differences in residents' attitudes about nuclear power (Greenberg, 2009; Venables, Pidgeon, Parkhill, Henwood, & Simmons, 2012). For instance, Greenberg (2009) investigated public preferences for energy sources in the U.S., including residents living within 50 miles of a major nuclear facility. Results showed that those who