Relationship between death attitude and risk perception of radiation:
A comparison between residents in an evacuation zone and Tokyo

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死生観と放射能に対するリスク認知の関連—避難地域住民と東京住民の比較—

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要約

多くの犠牲者を生んだ東日本大震災とそれによって生じた福島第一原発事故は、他の多くの災害に関して指摘されるように、人びとの死生観に対して一定の影響を及ぼしたと考えられる。しかしこのような死生観の変化がどのようなものであるかはいまだ検討されていない。そこで本研究では、第一原発事故によって避難を余儀なくされた地域の 1 つである福島県飯舘村に勤務する人々と東京都の住民を対象に、彼らの死生観がどのように異なるのかを比較検討することを第一の目的とした。また、リスク認知については、個人の持つ世界観がリスク認知と関連することが指摘されてきた。死生観は人びとの人生観において中心的な役割を果たすとされている。そうであるとすれば、この死生観も世界観と同様に、リスク認知と関連する可能性が想定できる。そこで本研究では、個人の持つ死生観が放射能に対するリスク認知とどのように関連するかを検討することを第二の目的とした。飯舘村の工場の被雇用者 163 名と東京都住民 315 名に質問紙調査を実施した。その結果、①飯舘村群は、東京都群と比べて、人生の目的意識因子の得点が有意に低いこと（目的 1）、②死生観の下位尺度のうち、飯舘村群では放射能に対するリスク認知と死後の世界観および死からの回避が関連する一方、東京群では人生における目的意識および死への関心が関連することが示された。これらの結果は、飯舘村に勤務する人々に対しては、人生における目的意識に焦点を当てた働きかけが有益となりうること、ならびに放射能に対するリスク認知を検討するに際しては、個人の死生観を考慮に入れる必要があることを示唆している。

Key words
death attitude, risk perception of radiation, Fukushima residents, Tokyo residents, comparative study

1. Background of the present study

1.1 Death attitude

The Great East Japan Earthquake (GEJE) and following explosion of the Fukushima Daiichi Nuclear Plant (FDNP) left thousands dead and missing in Japan. An official report (Fire and Disaster Management Agency, 2018) stated that the number of fatalities was 19,630 and the number of people missing was 2,569, as of September 2018.

Neimeiyer, Wittkowski, and Moser (2004) pointed out that the September 11 attacks in the USA influenced people's attitudes toward death. Since the GEJE and FDNP were as catastrophic as the September 11 attacks, it can be expected that these disasters have also changed people's death attitudes (DAs).

Recent studies on DAs have suggested its multidimensionality. Hirai, Sakaguchi, Abe, Morikawa, and Kashiwagi (2000) developed the Death Attitude Inventory (DAI). This inventory has 7 subscales: (1) belief in existence of life after death (*afterlife view*); (2) fear or anxiety about death (*death anxiety/fear*); (3) sensing death as liberation from pain and suffering (*death as release*); (4) avoiding thinking about death (*death avoidance*); (5) a clear sense of purpose in one's life (*sense of purpose in life*); (6) frequently thinking about one's or others' death (*interest in death*); and (7) belief that one's lifespan is pre-determined by a transcendental force (*view on a predestined lifespan*).

In a large-scale comparative study of more than 2,500 physicians, nurses, cancer patients, and the general population, Sekiya et al. (2017) confirmed the validity of the scale and showed that DAs vary across professions.

Considering the suggestions that disaster changes people's DAs (cf., Neimeyer et al., 2004) and findings that DAs differ

depending on respondents' backgrounds (Sekiya et al., 2017), it would be reasonable to assume that the DAs of those heavily affected by disaster differ from those relatively less affected.

In this study, we focused on employees in Iitate village since this village was one of the most seriously affected communities by the disaster. Although Iitate village is located around 37 km northwest of Fukushima Daiichi Nuclear Power Plant, due to temporal wind direction and weather, radiation-contaminated substances traveled to the village (Kamada, Saito, Endo, Kimura, & Shimizu, 2012), resulting in higher radioactive contamination (Sakumi et al., 2016) and compulsory evacuation that lasted from soon after the disaster until 2018.

Since DA has been related to a variety of outcomes such as worsened mental health (e.g., physical symptoms, anxiety, depression; Gibbons, Lee, Fehr, Wilson, & Marshall, 2018; Hirai et al., 2000; Thiemann, Quince, Benson, Wood, & Barclay, 2015) and attitude toward health care (Tomizuka & Fuji, 2017), it is of great importance to understand how the DAs of those heavily affected (Iitate employees) differ from those relatively less affected (Tokyo residents).

1.2 DA and risk perception of radiation

DA has also been reportedly related to the risk perception of radiation (RPR). Numerous researchers have observed that fear of radiation is widespread among Fukushima prefecture residents (e.g., McCurry, 2011; Suzuki et al., 2015); hence, the importance of solid information about the determinants of RPR has been noted by various scholars (e.g., Goodwin, Takahashi, Sun, & Gaines, 2012; Tamari et al., 2016).

Dake (1991, 1992; Wildavsky & Dake, 1990) argued that risk perception (RP) is determined by people's deeply held worldviews. In an empirical test of his theorization, Dake (1991) showed that while respondents who had egalitarian worldviews tend to have concern about risks such as dangers associated with nuclear energy, environmental pollution, and technology, those who had hierarchical worldviews were less likely to have concerns about these risks. Since DA has been conceptualized as a factor playing a central role in people's worldviews (Neimeyer et al., 2004; Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 2017; Solomon, Greenberg, & Pyszczynski, 2015), it may also affect people's RPR. However, no study in Japan has empirically tested this possibility.

Taking these arguments together, the present study explored (1) differences in DAs between Iitate employees and Tokyo residents and (2) the effect of DA on RPR in Iitate employees using a questionnaire-based study.

2. Methods

2.1 Participants

A questionnaire was completed by 164 employees (42 females and 122 males) of a factory located in Iitate village and 315 Tokyo residents (121 females and 194 males). Mean ages were 39.0 years (SD = 12.24) for Iitate employees and 48.83 years (SD = 11.74) for Tokyo residents.

For the Iitate employees, the questionnaire was distributed by a manager of the factory in March 2018, and the respondents received monetary compensation of 1,000 Yen. Respondents lived in radiation–affected areas in or near Iitate village when the research was conducted.

For the Tokyo residents, web-based research was conducted. A questionnaire was distributed to monitors registered to a web-survey company and, once they completed the questionnaire, they received web-points that could be converted into cash or a gift certificate.

To compare the DAs of those heavily affected by the disaster and those relatively less affected, 15 Tokyo residents who answered that they "were heavily affected by the GEJE" were excluded from the analysis.

2.2 Measures

2.2.1 Death attitude inventory

The scale developed by Hirai et al. (2000) was used. This scale consists of a total of 24 items with 7 subscales.(1) All items were rated on a 7-point Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree."

2.2.2 Risk perception of radiation

As a measure of RPR, 3 items were adopted from Lindell and Barnes (1986). An exemplary item is "what do you think is the likelihood of having immediate health damage (e.g., dying within one month) as a result of your current level of radiation exposure?" These items have also been used in related studies in Japanese contexts (e.g., Miura et al., 2017; Suzuki et al., 2015). All items were rated on a 4-point Likert scale ranging from 1 = "strongly disagree" to 4 = "strongly agree."

3. Results

3.1 Multi–group confirmatory factory analysis (MGCFA)

MGCFA (Hirschfeld & von Brachel, 2014) was conducted of the DAI and RPR, with Iitate employees and Tokyo residents as two distinct groups. Fits for both the DAI (CFI = .882, RMSEA = .077) and RPR (CFI = 1.000, RMSEA = .000) were adequately high.

3.2 Descriptive statistics

We first calculated the means, standard deviations (SD), Cronbach's αs, and Pearson's correlations for all measured scales (Table 1). All subscales showed adequately high internal consistency (αs > .81).

3.3 Comparison of DAI

Next, we conducted Welch's t-tests to compare the differences in the subscale scores of the DAI between the Iitate employees and Tokyo residents (Table 2). The analysis revealed

Table 1: Means, Standard Deviations (*SD*), Cronbach's *α*s, and correlations

	RPR	Afterlife view	Death anxiety/fear	Death as release	Death avoidance	Sense of purpose in life	Interest in death	View on a predestined lifespan	Gender	Age
RPR		.044	.113*	.054	.061	.012	.162**	.118*	–.137*	–.086
Afterlife view	–.039		.194**	.469**	.326**	.363**	.401**	.539**	–.180**	–.103†
Death anxiety/fear	.303**	.194*		.053	.703**	.053	.146**	.200**	–.029	–.090
Death as release	.161*	.476**	.205**		.155**	.170**	.385**	.419**	–.120*	–.113*
Death avoidance	.334**	.226**	.640**	.352**		.199**	.054	.331**	–.008	–.093†
Sense of purpose in life	.024	.313**	.240**	.180*	.324**		.267**	.238**	–.035	–.031
Interest in death	.172*	.511**	.369**	.632**	.347**	.213**		.200**	–.099†	.010
View on a predestined lifespan	.093	.498**	.202**	.515**	.343**	.229**	.437**		–.109†	.009
Gender (0: Female, 1: Male)	–.028	–.143†	–.057	–.035	–.020	–.075	–.010	–.058		.295**
Age	–.012	–.067	.024	–.003	.109	.053	–.005	.139†	–.211**	
Iitate										
Mean	2.47	3.75	4.05	3.35	3.33	3.39	3.37	3.64	0.62	48.83
SD	.89	1.37	1.38	1.19	1.15	1.09	1.11	1.32	0.49	11.74
Cronbach's α	.83	.84	.83	.82	.80	.81	.81	.85	—	—
Tokyo										
Mean	2.23	3.56	3.91	3.56	3.55	3.67	3.60	3.80	0.62	48.83
SD	.89	1.37	1.38	1.19	1.15	1.09	1.11	1.32	0.49	11.74
Cronbach's α	.87	.91	.88	.85	.83	.75	.83	.91	—	—

Note: ** $p < .01$, * $p < .05$, † $p < .10$. Correlations in the Iitate employees are shown below the diagonal; correlations in the Tokyo residents are shown above the diagonal.

Table 2: Comparison of differences in subscales of DAI between the Iitate employees and Tokyo residents

	Iitate (n = 163)		Tokyo (n = 315)		t–test	p–value	Hedges' d
	Mean	*SD*	*Mean*	*SD*			
Afterlife view	3.75	1.44	3.56	1.37	t (313.14) = 1.43	.150	.140
Death anxiety/fear	4.05	1.49	3.91	1.38	t (307.31) = 1.00	.320	.098
Death as release	3.35	1.41	3.56	1.19	t (286.41) = –1.78	.075 †	–.181
Death avoidance	3.33	1.35	3.55	1.15	t (284.28) = –1.76	.080 †	–.178
Sense of purpose in life	3.39	1.22	3.67	1.09	t (297.50) = –2.54	.012 *	–.253
Interest in death	3.37	1.39	3.60	1.11	t (271.71) = –1.85	.065	–.191
View on a predestined lifespan	3.64	1.52	3.80	1.32	t (290.13) = –1.09	.278	–.110

Note: * $p < .05$, † $p < .10$.

that the Iitate employees scored lower in purpose of life compared to Tokyo residents (t (297.50) = –2.54, p = .012, d = –.253).

3.4 Regression analysis

The ordinary least square method was used to estimate the effects of the DAI on RPR (Table 3). It showed that while afterlife view had a negative effect (β = –.212, p = .030) and death avoidance had a positive effect (β = .240, p = .022) on RPR in Iitate employees, interest in death (β = .182, p = .006) and view on a predestined lifespan (β = .143, p = .040) had positive effects in Tokyo residents. In other words, the result indicated that while Fukushima employees who believed in an afterlife were less likely to evaluate the risk of radiation as higher, and while those who avoided thinking about death were more likely to evaluate it higher, Tokyo residents who were interested in death and believed that their lifespans were predetermined were more likely to evaluate it higher. The VIFs of all variables were lower than 2.367, suggesting that the above results were not due to multicollinearity.

4. Discussions

The present study examined the differences in DAs between Iitate employees and Tokyo residents and the effects of DA on RPR. The analyses indicated that Iitate employees tended to fear death and reported less purpose in their lives compared to Tokyo residents. Evacuation zone residents, including Iitate employees, were seriously affected by the GEJE, FDNP, and resulting social/personal confusion from lifestyle changes such as evacuation (Hasegawa et al., 2015; Zhang et al., 2017). This fact may explain the differences in DAs.

Table 3: Standardized coefficients of OLS regression equations predicting RPR in the Iitate employees and Tokyo residents

	Iitate		Tokyo	
	β	*95% CI*	*β*	*95% CI*
Afterlife view	–.212 *	[–.403 – –.021]	–.114	[–.264 – .036]
Death anxiety/fear	.144	[–.055 – .342]	.083	[–.077 – .242]
Death as release	.083	[–.122 – .288]	–.040	[–.173 – .092]
Death avoidance	.240 *	[.034 – .445]	–.012	[–.179 – .155]
Sense of purpose in life	–.071	[–.231 – .088]	–.030	[–.151 – .090]
Interest in death	.080	[–.128 – .287]	.182 **	[.053 – .310]
View on a predestined lifespan	.019	[–.168 – .206]	.143 *	[.006 – .280]
Gender (0 = Female, 1 = Male)	–.065	[–.223 – .092]	–.069	[–.185 – .047]
Age	–.059	[–.214 – .095]	–.107 †	[–.223 – .009]
R^2	.158		.068	

Note: ** $p < .01$, * $p < .05$, † $p < .10$.

Previous research has reported that those who are more afraid of death and have less purpose in life are more likely to be unsatisfied with life and show higher rates of social activity disorders and depression (Hirai et al., 2000). In light of this previous finding, Iitate employees showed higher risks of such mental problems. The importance of mental and psychological factors is widely recognized among scholars (e.g., Hasegawa, Ohira, Maeda, Yasumura, & Tanigawa, 2016; Kunii et al., 2016; Yabe et al., 2014). In this context, approaching Iitate employees' DAs may be key for maintaining their health.

Moreover, the present study found that Iitate employees who avoid thinking about death and do not believe in the existence of an afterlife, along with Tokyo residents who have an interest in death and believe that one's lifespan is predestined, tended to evaluate the risk of radiation as being higher. In line with prior theorization stating that people's worldviews determine the risks they are afraid of (Dake, 1991; 1992), the present study showed that DA, which can be considered a central aspect of worldview (Neimeyer et al., 2014; Solomon et al., 2015), plays a role in determining RP.

Previous researches have investigated conditions of successful risk communications (Karasawa & Todayama, 2013; Plough & Krimsky, 1987; Slovic, 1996). In this context, the finding of the present study suggests that if RPR is to be reduced, risk communicators should not just focus on RPR itself or the proximal factors, such as knowledge about risk, but also take respondents' underlying worldviews (i.e., DA) into consideration.

Although the present research has demonstrated some implicative, if preliminary, findings, there are at least two limitations. First, the present research did not control for demographic variables such as place of residence in comparison with DA. It is possible that residents of towns and villages on the coast, where more people have been killed and injured by the tsunami experienced the disaster differently than those living inland. Thus, investigating how respondents' locations influence their DAs would be an interesting future research direction. Second, the questionnaire was distributed in different ways in the two samples: a paper-based questionnaire for the Iitate employees and a web-based one for the Tokyo residents. This difference might have slightly influenced the responses. Third, prior researches have investigated DAs focusing on respondents' developmental stages (Ardelt, 2008; Parker, 2013). Taking these research results into account, follow-up studies exploring how Iitate employees' DAs change over time may be needed.

5. Conclusion

The present study was designed to investigate (1) how death attitudes differ between Iitate employees and Tokyo residents and (2) how death attitudes relate to the risk perception of radiation. The results indicated that (1) the scores for sense of purpose in life were lower in Iitate employees than in Tokyo residents and (2) the risk perception of radiation was related to views of the afterlife and death avoidance in Iitate employees, as well as interest in death and views of a predestined lifespan in Tokyo residents. These results suggest that successful risk communication needs to take underlying worldview (i.e., death attitude) into consideration.

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Conflicts of Interest Disclose: We declare no conflict of interest.

Note

(1) Items in English are shown in Sekiya et al. (2017).

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