Context effects on the Willingness to Pay for Mortality Risk Reductions from a Nuclear Accident: An analysis before the Fukushima Daiichi Nuclear Power Plant Accident

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Introduction

Objectives

◆To clarify "context effects" on the WTP-based monetary values for reducing risks of radiation exposure in nuclear power plant accidents.

Background

◆Willingness to pay (WTP) approach is one of the useful method for estimating the monetary values of risk reductions.

◆The monetary values based on the WTP approach are subjected to people's perceptions. Such effects resulting in the uncertainties in the monetary values are called "context effects."

The risk concerned is (or is not)
- under their own control.
- their own responsibility.
- voluntarily assumed.

Method and Implementation of Survey

Method

◆A contingent valuation method (CVM) was conducted in emergency planning zone (EPZ) of Japanese nuclear power plant site.

Survey design and Analysis

◆**Structure of the questionnaire**

➢ "**Payment card CVM**" was adopted

➢ The questionnaire was constructed of questions related to the WTPs for the mortality risks caused by:

(a) Fatal Cancer.
(b) Fatal Cancer induced by radiation exposures from naturally occurring radioactive materials(NORMs).
(c) Fatal Cancer induced by radiation exposures in a nuclear accident.

➢ Respondents were asked to monetary values for two size of the risk reductions over their lifetime.

(i) A risk reduction of 6 of 10000.
(ii) A risk reduction of 12 of 10000.

➢ In order to verify whether the relationships between the WTPs and the size of the risk reductions are accordance with the economic logic, **Scope tests** were implemented.

◆**Analysis**

"WTP x " means the WTP for a risk reduction of x of 10000.

(1) Scope test

The test was involved comparing WTP6 with WTP12 in the same sample group.

Are the results meet the following equation ?

$$WTP6 \leq WTP12$$

⬇ At this point, two type questionnaires were prepared.

The causes of the mortality risks	Fatal Cancer	Fatal Cancer due to NORMs	Fatal Cancer due to radiation exposure in a nuclear accident
Type 1	WTP6	WTP6 and WTP12	WTP6 and WTP12
Type 2	WTP12	WTP6 and WTP12	WTP6 and WTP12

(2) The WTPs for the reduction of mortality risks are compared each other and identify their magnitude relation.

(3) In order to explain the magnitude relation in terms or "Context effects", further considerations were implemented using the responses of the respondents who protest to pay for reducing risks from a nuclear accident.

Conclusion

◆ CVM survey was conducted in vicinity areas of Japanese nuclear power plant sites before the Fukushima Daiichi Nuclear Power Plant Accident.

◆ The WTP for the reduction of the mortality risks by radiation exposures in a nuclear accident was found to be subjected to the context effects in terms of the responsibility for reducing risks

◆ To determine the monetary values for use in valuing reductions of mortality risks by radiation exposures in a nuclear accident, further considerations and surveys will be needed.

Results

Implementation of surveys

◆**Characteristics of Respondents**

➢ The survey was conducted for three Japanese Nuclear Power Plant (NPP) sites. The number of respondents for each site were 500.

site	City / Town	Collection rate
Kashiwazaki-Kariwa	Kashiwazaki city	591 % (n=468)
	Kariwa village	62.5 % (n=32)
Ohi	Ohi town	60.0 % (n=110)
	Obama city	53.1 % (n=390)
Shimane	Matsue city	47.2 % (n=500)

➢ The difference of the personal attributes (age and sex) between respondents of the study and the census was not significant at the 5 % significance level (χ^2-test of goodness of fit).

Results

(1) Internal scope test

The results of t-test for pair sample

	t-value	Degree of freedom	p-value
Fatal Cancer due to NORMs	-5.230	553	<0.001
Fatal Cancer due to radiation exposure in a nuclear accident	-4.947	419	<0.001

➡ The structure of the questionnaire was validated by the internal scope test.

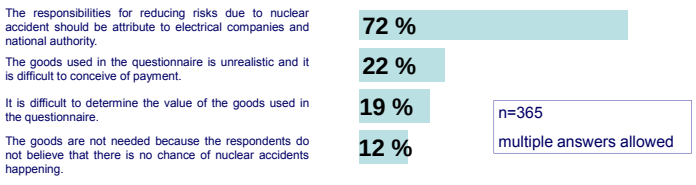
(2) Comparison of the WTPs for mortality risks

The results of t-test for pair sample

	t-value	Degree of freedom	p-value
$WTP_{cancer} - WTP_{NORMs}$	-1.679	391	0.094
$WTP_{NORMS} - WTP_{accident\_rad}$	6.472	391	<0.001
$WTP_{cancer} - WTP_{accident\_rad}$	3.322	391	<0.001

➡ The mean value of the WTPs for reducing risks due to a nuclear accident were lower than that for the reduction of the other two risks.

(3) The reason why that the respondents protest to pay for reducing risks due to a nuclear accident.



➡ The respondents believe that the responsibilities for reducing risks from a nuclear accident should be attributed to electrical company and national authorities.