자원 · 환경경제연구 제 16권 제 3호
Environmental and Resource Economics Review
Volume 16, Number 3, Septmber 2007 : pp. 683 ~ 699

Estimating Values of Statistical Lives using Choice Experiment Method

Young Chul Shin*

〈Contents〉

Ⅰ. Introduction

The value of statistical life (VSL) estimates provide governments with a reference point for assessing the benefits of risk reduction. All the government risk policies ultimately involve a balancing of additional risk reduction and incremental costs. The proper value of the risk reduction

* Professor, Dept. of Digital Economics, Daejin University, Korea.

benefits for government policy is society's willingness to pay for the benefits. In the case of mortality risk reduction, the benefit is the value of the reduced probability of death that is experienced by the affected population, not the value of the lives that have been saved ex post.

There are two main ways of deriving VSL values, through revealed preferences (RP), or through stated preference (SP) based on surveys or experiments.[1] While most early work on VSL was based on RP methods, there has over the last 20 years or so been a gradual shift in favor of using SP methods.

Most apply contingent valuation (CV), originally developed for environmental-good valuation. Early such VSL studies are Gerking, de Haan and Schulze (1988) for job safety, and Jones-Lee (1989) for road safety. More recent studies are McDaniels (1992), Jones-Lee, Loomes and Phillips (1995), Beattie *et al.* (1999) and Persson *et al.* (2001) (road safety), Johannesson *et al.* (1993) and Johannesson, Johansson and Löfgren (1997) (clinical measures to prevent heart disease), and Smith and Desvousges (1987), Krupnick and Cropper (1992), Krupnick *et al.* (2000, 2001), Shin *et al.* (2002), Shin and Joh (2003), and Shin (2003) (environmental health risk).

Many researchers today tend to favor of choice experiment (CE) on grounds that this technique facilitates verification of the multi-attribute

1) There is an alternative to using willingness to pay for valuing lives. Human capital approach is based on the assumption that the value of an individual alive is what he or she produces, and that productivity is accurately measured by earnings from labor. This approach has a long tradition; in fact, Landefeld and Seskin (1982) trace the idea back almost three hundred years. It has been the basis of some widely cited estimates of the benefits of air pollution control; see, for example, Lave and Seskin (1971, 1977). But both theoretical reasoning and empirical evidence suggest that human capital measures are a poor proxy for the desired willingness-to-pay measure of value for small changes in the risk of death(Freeman III, 2003).

property of the utility function, where VSL may be one of several attributes valued. Relevant VSL studies involving CE are Viscusi, Magat and Huber (1991) who consider motor vehicle accident risk; Ryan and Hughes (1997) who value antenatal care; Johnson *et al.* (1998) who value general life-extending projects conditional on activity level; and Subramanian and Cropper (2000) who derive relative VSL values tied to different environmental health programmes(Strand, 2001).

In this study, we estimated individual preference for mortality risk reductions in Korea using the Choice Experiment Method (CE). The CE outcomes are often theoretically considered as providing more policy relevant information for example, marginal willingness to pay for attributes of projects and preferences for a set of scenarios.

The rest of this paper is organized as follows: in Section Ⅱ, we briefly introduce the design and the analytical model of CE method; results are presented and discussed in Section Ⅲ; and finally, Section Ⅳ summarizes our findings and presents some policy implications.

Ⅱ. The Choice Experiment Models

1. The Survey Design and Data Collection

CE is a stated preference technique in which respondents choose their most preferred resource use option from a number of alternatives. In a CE method, individuals are given a hypothetical setting and asked to choose their preferred alternative among several alternatives in a choice set, and they are usually asked to do so for several choice sets. Each alternative is described by a number of attributes, which are the subject of analysis, including a monetary attribute(See <Figure 1>.) Thus, individual tradeoff levels of one attribute against levels of other attributes, implicitly weighing and valuing both the attributes within the choice sets. CE allows one to understand and model how individuals evaluate product attributes and choose among competing offerings.

The attributes and levels of attributes were developed using the results from a focus group discussions and a pretest of 90 sample individuals. The focus groups were used to determine the attributes by addressing the following issues: definition of attributes, number of levels for an attribute, levels of monetary attributes, and wordings. The results showed that respondents considered five attributes of an alternative when choosing a hypothetical commodity which reduce specific mortality risk: cause of death, voluntariness of mortality risk,[2] timing of death, magnitude of mortality risk reduction, WTP for the commodity which reduce specific mortality risk. Levels of these attributes were qualitative or quantitative expressions, decided on by the focus groups(See <Table 1>).

In the survey, respondents were presented with three choice sets showing various options for their commodities which have effect of reducing specific mortality risks(See <Figure 1> for a sample choice set).[3] The

2) While the mortality risk from air pollution is an example of involuntary mortality risk, the mortality risk from smoking is related to voluntary mortality risk.

3) The specific mortality risks are designed to have the combination of a specific level in each attribute (i.e. cause of death, voluntariness to mortality risk, timing of death, magnitude of mortality risk, WTP) using the experimental design method.

〈Table 1〉 Brief Description of the Attributes and Their Levels

Attribute	Description	Levels	
Cause of death	Cause of death	Level 1	Illness except for cancer
		Level 2	Cancer
Voluntariness	Voluntariness of mortality risk	Level 1	Voluntary mortality risk
		Level 2	Involuntary mortality risk
Timing of death	Timing of death	Level 1	Old person (over 60 years old)
		Level 2	Adult (beteween 18~59 years old)
		Level 3	Infant · Child, Young Adult (under 18 years old)
Magnitude of mortality risk reduction	Magnitude of mortality risk reduction for 10 years	Level 1	$\frac{1}{1,000}$
		Level 2	$\frac{2}{1,000}$
		Level 3	$\frac{3}{1,000}$
WTP(won)	WTP for the commodity which reduce the specific mortality risk	Level 1	Annual 30,000 won (total 300,000 won for 10 years)
		Level 2	Annual 60,000 won (total 600,000 won for 10 years)
		Level 3	Annual 120,000 won (total 1,200,000 won for 10 years)

third alternative was always baseline or opt-out alternative, i.e. no improvements and no extra costs. The 27 choice sets in total were created by the main effect orthogonal design method, using ORTHOPLAN procedure in SPSS and were blocked into 3 grouped of 9 sets each.

〈Figure 1〉 An Example of a Choice Set

Question 10 Choose only one?

The Attributes of New Commodity (Identification number 1)	□ New Commodity A	□ New Commodity B	□ Neither
Cause of death	Illness except for cancer	Cancer	-
Voluntariness of mortality risk	Involuntary mortality risk	Involuntary mortality risk	
Timing of death	Infant · Child · Young Adult	Old person	
Magnitude of mortality risk	$\frac{2}{1,000}$ risk reduction for 10 years	$\frac{3}{1,000}$ risk reduction for 10 years	
WTP(won)	Annual 30,000 won (total 300,000 won for 10 years)	Annual 30,000 won (total 300,000 won for 10 years)	0 won

The questionnaires consisted of four sections. The first section introduced the background of the survey to the respondents. Section Ⅱ asked about health status, life expectancy, and explanation of mortality risks in Korea. Section Ⅲ was on stated preference exercises. Section Ⅳ covered the socio-economic profile of the household such as number of persons, household size, age, gender, education, occupation, and household income.

The survey was conducted in the summer of 2006 by the Internet survey firm.[4] The 300 individual was sampled from the panel of Internet

4) This mode has many advantages. The time needed to administer the survey to the entire sample is much shorter than with other modes, especially for large samples. Administering the survey at a website (i.e. Internet survey mode) provides control

survey firm. Stratified random sampling was thus applied to obtain a representative sample of the entire national people.

2. Econometric Specification 5)

Choice modeling shares a common theoretical framework (i.e., the use of the indirect utility function) with other environmental valuation approaches in the random utility model (McFadden, 1973). Facing alternatives that present trade-offs among attribute levels, each individual seeks to maximize her own utility:

$$U_j = \max V(A_{j,}\ y - p_j c_j) \quad (1)$$

where max V is maximum utility V; c_j is an alternative combination j (profile j) as a function of its generic and alternative specific attributes, the vector A_j, p_j is the price of each profile; and y is the household's income.

The individual chooses (on behalf of his household) the profile j if and only if:

$$V_j(A_{j,}\ y - p_j c_j) > V_i(A_{i,}\ y - p_i c_i) \quad \forall\, i \neq j \quad (2)$$

---

over how the survey is administered. Questions can appear one at a time or in groups thus allowing for automatic implementation of skip patterns and control over the order in which question answered. Though the survey population of a web-based survey is not likely to be representative of a general population, the remarkable Internet use rate with 70.2% of the total population age 6 or over in Korea at 2005 enables us to overcome the drawback of sample coverage in Internet survey mode.

5) Pham Khan Nam and Tran Vo Hung Son (2004).

Suppose that the choice experiment consists of M choice sets, where each choice set, S_m, consists of K_m alternatives, such that $S_m = \{A_{1m}, \cdots, A_{Km}\}$, where A_i is a vector of attributes. From equation (2) we can then write the choice probability for alternative j from a choice set S_m as:

$$\begin{aligned} P\{j|S_m\} &= P\{V_j(A_{jm,}\ y - p_j c_j) + \varepsilon_j > V_i(A_{im,}\ y - p_i c_i) + \varepsilon_i\} \\ &= P\{V_j(\cdots) + \varepsilon_j - V_i(\cdots) > \varepsilon_i;\ \forall_i \in S_m\} \end{aligned} \tag{3}$$

McFadden (1973) argued that if the error terms in the above equation are independently and identically distributed with a type I extreme value distribution (a Gumbel distribution), the choice probability for alternative j is as follows:

$$P(j) = \frac{e^{\lambda Vj}}{\sum_{i \in S} e^{\lambda Vi}} \tag{4}$$

the conditional logit model in equation (4) is the most common model used in applied work (Adamowicz, Louviere and Swait, 1998).

In this study, the estimated utility function V_j takes the form as follows:

$$V_j = \Sigma \beta_k X_k \tag{5}$$

where β is a coefficient and X is a variable representing an attribute.

Once the parameter estimates have been obtained through equation (5), welfare estimates are obtained through the equation (6), which is described by Adamovic *et al.* (1994):

$$CS = -\frac{1}{\beta_M}\left[\ln \sum_j e^{V_{j0}} - \ln \sum_j e^{V_{j1}}\right] \tag{6}$$

where M is the coefficient of the money attribute (marginal utility of income), and V_{j0} and V_{j1} represent the initial and subsequent states.

The marginal willingness to pay for a change in attribute is given by the equation:

$$MWTP_j = -\frac{\beta_j}{\beta_M} \tag{7}$$

Ⅲ. Results

<Table 2> presents the results for the multinomial logit model estimation.[6] The estimated mean and t-value are reported for each parameter.

All attribute coefficients have the expected signs. The sign of all but the price attribute are positive, as consumer preference theory predicts, as these attributes are coded to show an decrease in mortality risk reduction which should lead to increased utility. Price is negative and therefore also in accord with standard economic theory. All of the attributes are significant at 95% significance level. However, cause of death(C_CA) and old person dummy(C_AG3) are not significant attributes. For each 10

6) There are 3 dummy variables of time of death because the level of opt-out alternative (i.e. status quo) is considered as the reference point of this attribute. The same is true to the variable of voluntariness of mortality risk.

〈Table 2〉 Estimation Results of the Multinomial Logit Model

Variable	Description	Estimate	*t*-value
C_CA	cause of dealth (cancer=2, illness except for cancer=1, otherwise 0)	0.041515	0.73
C_VA1	involuntariness dummy (involuntary mortality risk=1, otherwise 0)	0.396837	1.98**
C_VA2	voluntariness dummy (voluntary mortality risk=1, otherwise 0)	0.501896	2.74***
C_AG1	infant · child · young adult dummy associated with death timing (infant · child · young adult=1, otherwise 0)	0.262204	1.65**
C_AG2	adult dummy associated with death timing (adult=1, otherwise 0)	0.599989	3.76***
C_AG3	old person dummy realated to death timing (old person=1, otherwise 0)	0.235489	1.36
C_SC	magnitude of mortality risk reduction for 10 years (unit : $\frac{1}{1,000}$)	0.143505	4.40***
C_WTP	annual WTP for 10 yeares(unit : 10 thousand won)	-0.000005	-6.87***
Number of observation		2,700	
Log-likelihood		-2757.3	

Note : *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

thousand won increase in a individual's WTP, the probability of choosing the new commodity over the status quo decreases by 0.000005 (0.0005%).

Estimates of implicit prices for each of the non-monetary attributes are shown in <Table 3> We obtain confidence intervals using the Krinsky-Robb Monte Carlo simulation method (Krinsky and Robb, 1986) with 5,000 replications.[7] These estimates indicate that, for example, individuals were

〈Table 3〉 Marginal WTP with a Change in Each Attribute

Attribute	Levels		Marginal WTP (won) (t-value)	95% C.I. (won)
Cause of death	Level 1	illness except for cancer	8,080 (0.70)	-14,489~30,669
	Level 2	cancer	16,160 (0.70)	-28,979~61,338
Voluntariness	Level 1	voluntary mortality risk	97,682 (2.62)***	27,194~173,196
	Level 2	involuntary mortality risk	77,234 (1.93)***	-177~156,349
Timing of death	Level 1	old person	45,832 (1.27)	-19,833~122,068
	Level 2	adult	116,773 (3.14)***	54,860~200,415
	Level 3	infant · child · young adult	51,032 (1.52)	-9,032~122,468
Magnitude of mortality risk reduction	magnitude of mortality risk reduction for 10 years (unit: $\frac{1}{1,000}$)		27,930 (3.71)***	14,954~44,434

Note : *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

willing to pay 27,930 won(95% confidence interval 14,954~44,434 won) per year for a change from the status quo to a $\frac{1}{1,000}$ mortality risk reduction for 10 years, 116,773 won(95% confidence interval 54,860~200,415 won) per year for mortality risk reduction associated with adults, 97,682 won(95% confidence interval 27,194~173,196 won) per year for voluntary

7) Using this method we randomly draw the coefficients a number of times from the asymptotic normal distribution of the parameter estimates, and calculate the fare equivalents for each of these draws.

〈Table 4〉 Estimates of VSLs

(Unit : million won)

Attributes of Mortality Risk			VSL(Million Won) (*t*-vlaue)	95% C. I. (Million Won)
Timing of Death	Cause of Death	Voluntariness		
Iinfant · child · young adult	non-cancer illness	voluntary	1,309 (7.37)***	1,029～1,726
		involuntary	1,165 (7.45)***	913～1,526
	cancer	voluntary	1,367 (7.74)***	1,092～1,784
		involuntary	1,222 (7.49)***	951～1,590
Adult	non-cancer illness	voluntary	1,775 (7.31)***	1,414～2,366
		involuntary	1,631 (7.65)***	1,308～2,144
	cancer	voluntary	1,833 (7.67)***	1,476～2,412
		involuntary	1,688 (7.68)***	1,353～2,214
Old person	non-cancer illness	voluntary	1,273 (6.60)***	975～1,731
		involuntary	1,128 (6.89)***	874～1,516
	cancer	voluntary	1,330 (6.97)***	1,032～1,780
		involuntary	1,185 (7.17)***	923～1,570

mortality risk reduction, 77,234 won (95% confidence interval -177~156,349 won) per year for involuntary mortality risk reduction.

However, these implicit prices do not provide welfare estimates of compensating surplus. The array of compensating surplus can be estimated by setting up multiple alternative scenarios. One of the strengths of choice experiments is that estimated coefficient of the attributes maybe used to estimate the economic value of different ways in which the attributes can be combined. <Table 4> presents the current state and twelve scenarios for reducing the specific mortality risk and the corresponding estimated VSL for each scenario.

Estimates of compensating surplus (CS) are calculated using the following equation:

$$CS = -\frac{1}{\beta_M}(V_C - V_P) \tag{8}$$

where M is the marginal utility of income; V_C represents the utility of the current situation, and V_P represents the utility of specific mortality risk reduction. The each VSL was estimated through dividing total WTP for 10 years by magnitude of mortality risk reduction.

There were several different estimates of VSL in <Table 4> related to different attributes of mortality risk. The mean VSLs of infant/child/young adult ranged from 1,165 million won to 1,367 million won. In the case of adult, the mean VSLs were between 1,631 million won and 1,833 million won for adult, between 1,128 million won and 1,330 million won for old person. These VSLs of adult are not much different from the estimated VSL 1,150 million won (Shin, 2003). But these VSLs of the old person are about two times bigger than the VSL estimate, i.e. 521 million won (Shin and Joh, 2003) calculated from future mortality risk reduction.

Ⅳ. Conclusion

This study applied the choice experiment (CE) method to measure values of statistical lives from multi-attributed mortality risk reduction policies. We calculate willingness to pay (WTP) for changes in the attributes, which are presented with estimated confidence intervals using the Krinsky-Robb Monte Carlo simulation method.

The estimation results for the multinomial logit model showed that individuals were willing to pay 27,930 won per year for a change from the status quo to a $\frac{1}{1,000}$ mortality risk reduction for 10 years, 116,773 won per year for mortality risk reduction associated with adults, 97,682 won per year for voluntary mortality risk reduction, 77,234 won per year for involuntary mortality risk reduction.

There were several different estimates of VSL related to different attributes of mortality risk. The mean VSLs of infant/child/young adult ranged from 1,165 million won to 1,367 million won. The mean VSLs ranged from 1,631 million won to 1,833 million won for adult, and were between 1,128 million won and 1,330 million won for old person.

A key policy implication of the results of this study is that policymakers can choose from a set of scenarios, which includes different levels of attributes and WTP estimates for each attribute, to design an mortality risk reduction policy in Korea.

◎ References ◎

1. Adamowicz, W., J. Louviere and J. Swait, Introduction to Attribute-based Stated Choice Methods, Report to the National Oceanic and Atmospheric Administration (NOAA) Purchase Order 43AANC601388 Advanis, Alberta, Canada, 1998.
2. Beattie, J. *et al.*, On the Contingent Valuation of Safety and the Safety of Contingent Valuation: Part 1- Caveat Investigator, *Journal of Risk and Uncertainty*, 17, 1999, pp. 5~25.
3. Freeman Ⅲ, A. Myrick, *The Measurement of Environmental and Resource Values: Theory and Methods*, (2nd ed.), Washington D.C., Resources for the Future, 2003.
4. Gerking, S., M. de Haan and W. D. Schulze, The Marginal Value of Job Safety: A Contingent Valuation Study, *Journal of Risk and Uncertainty*, 1, 1998, pp. 185~200.
5. Johannesson, M., P. O. Johansson and K. Löfgren, On the Value of Changes in Life Expectancy: Blips Versus Parametric Changes, *Journal of Risk and Uncertainty*, 15, 1997, pp. 221~239.
6. Johannesson, M., P. O. Johansson, B. Kriström and U. G. Gerdtam, Willingness to pay for Antihypertensive Therapy : Further Results, *Journal of Health Economics*, 12-95-108, 1993.
7. Johnson, F. R. *et al.*, Eliciting Stated Health Preferences: An Application to Willingness to Pay for Longevity, Working paper, Triangle Economic Research, 1998.
8. Jon Strand, Public-and Private-Good Values of Statistical Lives: Results from a Combined Choice-experiment and Contingent-aluation Survey, Working paper, Department of Economics, University of Oslo, 2001.
9. Jones-Lee, M. W., *The Economics of Safety and Physical Risks*, Oxford: Brasil Blackwell, 1989.
10. __________, G. Loomes and P. Phillips, Valuing the Prevention of Non-fatal Road Injuries: Contingent Valuation Versus Standard Gambles, Oxford Economic Papers, 47,

1995, pp. 676～695.

11. Landefeld, J. Steven and Eugene P. Seskin, The Economic Value of Life: Linking Theory to Practice, *American Journal of Public Health*, 72, 6, 1982, pp. 555～566.

12. Lave, Lester B. and Eugene P. Seskin, Air Pollution and Human Health, *Science*, 169, August 21, 1971, pp. 723～731.

13. __________, *Air Pollution and Human Health*, Baltimore, Md.: Johns Hopkins University Press for Resources for the Future, 1977.

14. Krinsky, I. and A. Robb, On Approximating the Statistical Properties of Elasticities, *Review of Economics and Statistics*, 68, 1986, pp. 715～719.

15. Krupnick, A. J., How Much will People Pay for Longevity? *Resources*, 142, 2001, pp. 14～17.

16. __________ and M. Cropper, The Effect of Iinformation on Health Risk Valuations, *Journal of Risk and Uncertainty*, 5, 1992, pp. 29～48.

17. Krupnick, A. J. *et al.*, Age, Health and Willingness to Pay for Mortality Risk Reductions: A Contingent Valuation Survey of Ontario Residents, Discussion Paper, 2000, pp. 00～37, 2000, Resources For the Future.

18. McDaniels, T. L., Reference Points, Loss Aversion and Contingent Values for Auto Safety, *Journal of Risk and Uncertainty*, 5, 1992, pp. 187～200.

19. McFadden, D.. Conditional Logit Analysis of Discrete Choice Behaviour In P. Zarembka (ed.), *Frontiers in Econometrics*, Academic Press, New York.

20. Persson, U., A. Norinder, K. Hjalte and K. Gralén, The Value of a Statistical Life in Transport: Finding a New Contingent Valuation Study in Sweden, *Journal of Risk and Uncertainty*, 2001.

21. Pham Khan Nam and Tran Vo Hung Son, Household Demand For Improved Water Services in Ho Chi Minh City: A Comparison of Contingent Valuation And Choice Modelling Estimates, Research Report No 2005-RR3, Economy and Environment Program for Southeast Asia, 2004.

22. Ryan, M. and J. Hughes, Using Conjoint Analysis to Assess Women's Preference for

Miscarrage Management, *Health Economics*, 6, 1997, pp. 261～273.

23. Shin, Y. C., *Economic Valuation of Health Effects due to Air Pollution Control In Korea, 2000 to 2020*, KSI, 2003.

24. __________, A. Krupnick and S. Joh, Estimating the Value of Mortality Risk Reduction for Environmental Policy in South Korea: A Benefit Transfer Test, Paper Presented at the 2nd World Congress of Environmental and Resource Economist, Monterey, CA. U.S.A, 2002.

25. Shin, Y. C. and S. Joh, Estimating WTP and VSL for Future Mortality Risk Reduction, *Environmental and Resource Economics Review*, 12, 1, 2003, pp. 49～74.

26. Smith, V. K. and W. H. Desvousges, An Empirical Analysis of the Economic Value of Risk Changes, *Journal of Political Economy*, 95, 1987, pp. 89～114.

27. Strand, Jon, Public-and Private-good Values of Statistical Lives: Results from a Combined Choice-experiment and Contingent-Valuation Survey, Department of Economics, University of Oslo, 2001.

28. Subramanian, U. and M. Cropper, Public Choices Between Life Saving Programs: The Tradeoff between Qualitative Factors and Lives Saved, *Journal of Risk and Uncertainty*, 21, 2000, pp. 117～149.

29. Viscusi, W. K., W. A. Magat and J. Huber, Pricing Environmental Health Risks: Survey Assessments of Risk-risk and Risk-dollar Tradeoffs, *Journal of Environmental Economics and Management*, 201, 1991, pp. 32～57.

요 약

선택실험법을 이용한 확률적 인간생명가치의 추정

신 영 철

이 연구는 선택실험법(CE)을 이용하여 다속성 사망 위험 감소와 관련된 선택들로부터 확률적 인간생명 가치(VSL)를 추정하였다. 사망 위험의 네 가지 속성들(사망 원인, 사망 위험의 자발성, 사망 시기, 사망 위험 감소의 크기)을 이용하여 선택 대안들의 집합을 설계하였다. 다항 로짓모형의 추정 결과는 10년 동안 1/1,000의 사망 위험을 감소하기 위해 연간 27,930원, 성인의 사망 위험 감소를 위해 연간 116,773원, 자발적 사망 위험 감소를 위해 연간 97,682원, 비자발적 사망 위험 감소를 위해 연간 77,234원을 지불하려고 하였다. 이로부터 얻어진 다양한 확률적 인간생명가치로는 청소년 이하(18세 미만)인 경우 11.65~13.67억 원, 성인(18~59세)은 16.31~18.33억 원, 노인(60세 이상)의 경우는 11.28~13.30억 원으로 추정되었다.

주제어 : 확률적 인강생명 가치, 선택 실험, 조건부 로짓 모형, 몬테카를로 시뮬레이션, 사망 위험, 진술 선호

Estimating Values of Statistical Lives using Choice Experiment Method

Young Chul Shin

This study applied the choice experiment (CE) method to measure values of statistical lives from multi-attributed mortality risk reduction choices. The four characteristics of mortality risk (i.e. cause of death, voluntariness of mortality risk, timing of death, magnitude of mortality risk reduction) are utilized to design the alternatives of choice sets. The estimation results for the multinomial logit model show that individuals are willing to pay 27,930 won per year for a change from the status quo to a $\frac{1}{100}$ mortality risk reduction for 10 years, 116,773 won per year for mortality risk reduction associated with adults, 97,682 won per year for voluntary mortality risk reduction, 77,234 won per year for involuntary mortality risk reduction. There were several estimates of VSL related to different attributes of mortality risk. The mean VSLs of infant/child/young adult ranged from 1,165 million won to 1,367 million won. The mean VSLs ranged from 1,631 million won to 1,833 million won for adult, and were between 1,128 million won and 1,330 million won for old person.

Keywords : value of statistical life (VSL), choice experiment (CE), conditional logit model, Monte Carlo simulation, mortality risk, stated preference (SP)