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First results immaterial damage valuation: value of statistical life (VOSL), value of evacuation (VOE) and value of injury (VOI) in flood risk context, a stated preference study (III)

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Below we report on the results from an internet questionnaire conducted in the October-November 2008 among about 530 respondents located in four regions of the country: coastal areas of dike-ring 14 (Zuid Holland) and dike-rings 28, 29 and 30 (Zeeland); and riverside areas of dike-ring 22 (Dordrecht) and dike-ring 36 (Land van Heusden / de Maaskant). The overall sample as well as regional sub-samples are representative and consisted of TNS-NIPO respondent panel.

In this report we shall concentrate on 3 immaterial damage indicators: 'value of statistical life' (VOSL or VSL), value of evacuation (VOE) and value of injury (VOI). VOSL is one of the essential components entering cost-benefit analyses as a (best available) approximation of value of benefit of an avoided fatality in a particular risk context. It is essentially a trade-off between the welfare and the mortality risk on the margin. In fact, VOSL is not a monetary value of a human live; it is a representation of aggregate willingness to pay of a group of people for a reduction in average mortality risk (in a particular context, place and point in time). Thus, VOSL can be expressed as an amount of money per avoided 'statistical' death.

Survey respondents were asked to state directly their willingness to pay for improvements and decrease in flood safety, as well as to complete 3 choice experiments. Here, we report on the third choice experiment (stated preference method). Results of WTP- and WTA- derived VOSL values (contingent valuation method), as well as on the results of the analysis based on the first two choice experiments (stated preference method) are reported in the preceding papers (part I and II).

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All faults are those of the authors only.

VOSL ESTIMATES: STATED PREFERENCE METHOD
CHOICE EXPERIMENT #3 (HOUSE PURCHASE DECISION)

Stated preference modeling (SP), and in particular choice experiments (or discrete choice modelling), is one of the state-of-the-art techniques that is currently widely used in valuation of intangible goods for which (directly or indirectly) no markets exist. Because of non-existent markets, realized choices of consumers cannot be observed, and therefore their '*revealed preferences*' cannot be measured. Using SP methodology, researcher creates a setting where, depending on the context, (artificial) goods are traded in artificial markets. By asking respondents make choices in such situations, their intended behaviour is obtained, from which '*stated preferences*' can be derived. The areas where SP is widely used are environmental studies, health care, transport and labour economics (see for example de Blaeij et al., 2003; Dekker et al., 2008; Kluve and Schaffner, 2008; Bellavance et al., 2009). VOSL that is derived by means of this technique is often used in cost-benefit analyses as a (best available) approximation of value of an avoided fatality in a particular risk context.

When a choice experimental setting is applied, respondents are usually offered some general information about the nature of risk, as well as some explanation of the present risk level. This is done in an effort to obtain well-informed choices in a clearly defined situation, which is often done by means of so-called choice cards. These cards usually present a number of alternatives provided a situation defined by the researcher (e.g. a choice of 3 cars that respondents would buy provided some specified characteristics). The choice cards are constructed in such a way that there is enough variation in attribute levels to be able to value the choice parameters.

Table 1. Average assumed probabilities per dike-ring area[1]

	Overtopping probability (yearly)	**Probability of dying in an event of flood[2]**	**Probability of fatality due to flooding (yearly)**
dike-ring 14 (Zuid Holland)	1 : 10,000	1%	1 : 1,000,000
dike-rings 28, 29, 30 (Zeeland)	1 : 4,000	1%	1 : 400,000
dike-ring 22 (Dordrecht)	1 : 2,000	0.1%	1 : 2,000,000
dike-ring 36 (Land van Heusden / de Maaskant)	1 : 1,250	0.1%	1 : 1,250,000

[1] While explained probabilities of dying in an event of flooding do vary by dike-ring (1% for the coastal areas and 0.1% for the riverside areas), shown yearly probabilities of dying due to flood in the choice cards are the same for all respondents, and are set fixed in this choice experiment to 1% of the yearly probability of flooding.
[2] While estimates of mortality rate per dike-ring in the Netherlands differ (see for example Klijn et al. (2004) and WL|Delft Hydraulics (2007) for comparison of various methods), recent findings by Jonkman et al. (2009) based on the data on mortality in New Orleans after Hurricane Katrina confirm the historical average mortality rate per flood event of about 1% of exposed population. Thus, in case when preventive evacuation is difficult to perform (as in the coastal areas of Central Holland and Zeeland), assumed average mortality rate of 1% should not appear unrealistic.

In our case, we have provided some information to our respondents about the average yearly probability of flooding, probability of dying in an event of flood and the yearly probability of fatality due to flooding. The probabilities varied depending on the dike-ring (see Table 1).

In addition we have provided a risk ladder where probability of fatality due to flooding was brought in perspective against other average yearly risks of dying in the Netherlands[3]. After that, choice situation was explained and each respondent was presented with 5 choice cards containing two alternatives. The choice situation was described as follows (translation from Dutch):

> Imagine that you have decided to move for some overriding reason, and you are considering buying a house. You have seen two identical houses that suit your requirements in terms of the type of house, number of bedrooms, surface/volume and land, and they have the same price.
>
> Both houses are located in a polder, and these polders are equivalent: equally big, beautiful, accessible, the residential areas have same provisions and comfort, etc. These characteristics should not play a role in your decision which house you will buy.
>
> In one of the polders (A), flood can be predicted in advance and an evacuation arrangement is in place, which means that every inhabitant of the polder is obliged to comply with an evacuation bevel. In this case, the plan will work well and all the inhabitants of the polder will be evacuated on time so that no one runs a risk of dying in a flood if it takes place. Note, that in case evacuation takes place, it will approximately last for 1 week.
>
> On the other hand, in the other polder (B), it is not possible to predict flood enough in advance to carry out preventive evacuation. This means, that evacuation in this polder is not possible, and you, just as every polder resident, are running some risk of dying or getting an injury in a flood. In case of injury, you might think of broken parts, contusions, blunt traumas, lacerations hypothermia, electrical shocks, for which hospitalisation would be necessary.
>
> You also have to pay a water board tax in each polder, which is spent on flood protection.
>
> Answering this question, consider only the probabilities of flood and preventive evacuation, the expected number of flood fatalities and injuries. Please, ignore for a moment the presence of all other risks connected to an event of flood (assume, for example, that government will compensate all your material damages if a flood takes place).
>
> Try to consider all shown characteristics.
> You will see five screens with choice possibilities, where every time the levels of the shown characteristics will change.
>
> In which polder would you prefer to buy a house?

Thus, respondents had to make a choice – a ‘purchase decision’ – between two hypothetical houses that were suggested to be similar in any other respect, yet different flood safety characteristics. These characteristics attributed to the place of residence, which we call choice attributes, depended on the type of alternative. In one of the areas (alternative A) there was a possibility for a timely evacuation from the area before a flood, and thus this alternative was described by a flood risk (in the coming 50 years), *evacuation risk* described by a probability of preventive evacuation (in the coming 50 years) and the level of local tax, or yearly *payment*. The other alternative did not presuppose evacuation (area B) and therefore it was described by a flood risk (in the coming 50 years), *mortality risk* described by a probability of fatality due to flooding (expressed in terms of average number of fatalities per 400.000 inhabitants in the coming 50 years), *risk of injury* (expressed in terms of average number of injured persons per 400.000 inhabitants in the coming 50 years) and *payment* described as the respective level of municipal tax per year in euros. Following numbers of attribute levels were

[3] Before the final version of the questionnaire was administered, it went through a pilot testing in a small focus group. Report on the pilot survey is found in Bockarjova et al. (2008)

considered in this choice experiment: P(evacuation) – 5 levels; P(fatality) attribute – 5 levels; P(injury) – 5 levels; Tax attribute (alternative 1) – 3 levels; Tax attribute (alternative 2) – 3 levels (see Appendix 3A for the levels). Precise wording of the suggested choice situation (in Dutch) and a sample card are found in the Appendix. This was a second experiment in the row, and only a part of respondents took part in this experiment (those respondents who normally commute 5 days a week have completed another choice experiment), so we might expect some 'learning' effect in terms of higher accuracy in choices to be present here.

Basic logit model (MNL)

In discrete choice modeling respondent's *m* utility of alternative *i* is defined as:

$$U_{im} = V_{im} + \varepsilon_{im} \qquad [1]$$

Where V_{im} part is observed (and thus can be measured) by the researcher via the predefined attributes of the alternative, and ε_{im} is the unobserved part of respondent's utility of alternative i, which accounts for all other properties of the alternative not included by the researcher.

In this choice experiment we offered respondents a choice between two houses similar otherwise, but different in terms of flood safety: one is located in an area where preventive evacuation is possible, and another area where no evacuation is possible, and therefore all inhabitants run some risk of being injured a flood or dying in a flood. Thus, we have two labeled alternatives different in 4 attributes: the first one with probability of evacuation in a polder - x_{Pev} and municipal tax level, $x_{T.}$ The second one with probability of injury - $x_{Pinj.}$; probability of fatality due to flooding (expressed in terms of number of fatalities per 400.000 inhabitants in the coming 50 years) – x_{Pf}; and the respective level of local tax per year in euros – x_T. Each respondent was shown 5 cards with 2 labelled alternatives.[4] After the attribute levels are transformed into the respective yearly risk levels of fatality, evacuation and injury, and payments, respondent's m utility function can be written for each alternative:

$$V_m \text{ (evacuation)} = ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T \qquad [2a]$$

$$V_m \text{ (no evacuation)} = \beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T \qquad [2b]$$

The observed utility equations are alternative-specific. So, ASC in equation [2a] is the alternative specific constant that captures the average difference in individual utility between the two labeled alternatives (in our case, the alternative that provides a possibility for evacuation compared to the one that does not). This will mean that we are more interested in the individual valuation of *changes* in risk levels, and less so in the absolute levels of VOSL, VOE and VOI, which is also more policy-relevant in the context valuation of improvements in flood protection in the Netherlands. [5] Finally, because part of the risk valuation will be captured by the constant term, we should also expect somewhat lower values for the estimated indicators.

Next, the utility in [2a] is described by the probability of evacuation and a payment. Utility of the second alternative includes the fatality risk, risk of getting an injury and payment. The

[4] For the reasons of ease of explicability, also P(flood) was shown on the card for each alternative, which was 100 times greater than P(fatality), corresponding to 1% fatality rate at the event of a flood.
[5] Looking ahead, we have estimated a basic model for this experiment without a constant term, but the values of the immaterial damage indicators obtained and the statistical significance of the evacuation risk attribute were far from expected.

monetary attribute in the two utility equations has the same beta to be estimated, β_T, which presumes the same marginal utility of money for all respondents across both alternatives.

VOSL, which is a trade-off between the money and the level of risk at the margin, is then determined as the marginal utility of fatality risk divided by the marginal utility of money to the respondents, so that:

$$VOSL = \frac{\partial U / \partial x_{Pf}}{\partial U / \partial x_T} = \frac{\beta_{Pf}}{\beta_T} \qquad [3]$$

In addition to estimation of VOSL, this experiment offers an opportunity to compute the value of evacuation, VOE, which is a trade-off between the money and the evacuation risk at the margin. It is determined as the marginal utility of evacuation inconvenience divided by the marginal utility of money to respondents, so that:

$$VOE = \frac{\partial U / \partial x_{Pev.}}{\partial U / \partial x_T} = \frac{\beta_{Pev.}}{\beta_T} \qquad [4]$$

Furthermore, this experiment allows computing value of injury, VOI, which is a trade-off between the money and the risk of injury at the margin. It is determined as the marginal utility of inconvenience due to injury divided by the marginal utility of money to respondents, so that:

$$VOI = \frac{\partial U / \partial x_{Pinj.}}{\partial U / \partial x_T} = \frac{\beta_{Pinj.}}{\beta_T} \qquad [5]$$

This means, that the goal of running model [2a,b] is the estimation of respective attribute beta's, where the ratios (β_{Pf} / β_T , $\beta_{Pev.}$ / β_T and $\beta_{Pinj.}$ / β_T) provide an estimate of the indicators in question, VOSL, VOE and VOI, respectively, as given in equations [3], [4] and [5].

The results of the basic model estimation as described above are provided in Table 2.

Table 2. Basic model choice experiment 3.

	coeff.	std.error	P-value	sign.
ASC (evacuation)	1.1091	0.16270	0.0000	***
P(evacuation)	-35.91	8.61296	0.0000	***
P(fatality)	-97506	12985	0.0000	***
P(injury)	-1315.1	867	0.1294	not sign.
TAX	-0.014266	0.00217	0.0000	***
N observations	2685			
Log likelihood function	-1600.033			
R2	0.14028			
Adjusted R2	0.13867			
VOE	**2,517 €**			
VOSL	**6,834,756 €**			
VOI	**92,183 €**	not sign.		

*** - statistical significance at 1% level.

We can observe that all the estimated coefficients are have expected negative signs, that is, the risk of evacuation, the fatality risk, risk of injury and tax are 'disliked' by the respondents. Statistical significance of the beta's means that in our experimental setting the trade-off between two presented options was governed by the presented level of evacuation risk, payment and fatality risk of the alternatives. Coefficient of risk of injury is the only insignificant one; this attribute, evidently, had little influence on individual choices among the alternatives. However, another explanation for statistical insignificance might be correlations between the included choice attributes, which should be checked when estimating mixed logit models.

Pseudo R^2 of the model is about 14% showing a not high, yet an acceptable improvement in likelihood. The resulting VOSL (the ratio of the fatality risk beta to the tax beta) is 6.8 million euros per additional statistical life saved, or fatality avoided; value of evacuation inconvenience, VOE, (the ratio of the risk of evacuation beta to the tax beta) is 2,500 euros per evacuation; value of inconvenience associated with injury, VOI, (the ratio of the risk of injury beta to the tax beta) is 92,200 euros per injury. All these results can be considered as plausible: in principle the reported VOSL is within the accepted range of 2 to 14 mln € values found in the literature (as reported by Kluve and Schaffner, 2008, for European studies). Value of injury (although insignificant) is between the estimated values for light injury and severe injury, 15,600 Dfl and 500,000 Dfl, respectively, found in de Blaeij (2003) (amounts in 2008 euros are about 7,800 € and 251,100 €, respectively).

However, this value is somewhat higher than the reported range of VOSLs estimated in the context of road safety by de Blaeij (2003). There is a number of causes that may explain this difference: i) later point in time: simply accounting for inflation a higher VOSL is to be expected (VOSL in transport inflation-adjusted for 2009 - 2.5 mln €); ii) different context of risk; i.e. a lower degree of personal control with respect to flood risk might be a trigger behind a higher stated VOSL; iii) money-risk trade-off involves unusually small changes in probability used in our experiment (in the order of $1.5*10^{-6}$ to $9*10^{-6}$) – as found by de Blaeij et al. (2003), VOSL decreases under-proportionally as the valuated change in risk decreases, so that smaller valuated risk change lead to a higher willingness to pay per statistical life; iv) as is also being confirmed in recent discrete choice literature, choice complexity (which can be expressed in terms of number of alternatives, number of choice cards, number of attributes and small changes in attribute levels between the alternatives) might contribute to more anomalies in reported VOSL.

VOSL, VOE and VOI values per sub-group

Based on the basic logit specification, the model was extended to test for significant differences between sub-groups of respondents within our sample in socio-economic variables. Because not the absolute level of attributes, but rather differences between the attributes among the alternatives are important in the estimation of a logit choice model, we need to interact those additional respondent characteristics (which clearly stay the same across the alternatives for the same respondent) with one or more of the choice experiment attributes, which in this case is either tax or fatality risk level. For example, basic model [2a,b] can be extended so that estimated model can take the following form if interaction between the high income dummy(x_Y) and tax attributes (x_{T1} and x_{T2}) is included:

V_m (evacuation) = $ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T + \beta_Y * (x_Y * x_T)$ [6a]

V_m (no evacuation) = $\beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T + \beta_Y * (x_Y * x_T)$ [6b]

We have thus assumed that respondents with various levels of income, age, education and health condition might have differing marginal utility of money, and therefore these variables are interacted with the tax attribute (similarly as shown in [6a] and [6b]).

Alternatively, respondents facing various levels of risk might rather have a differing marginal utility of fatality risk, therefore location dummies (regional ones, as well as urban/rural dummies) and the dummy for prior experience with either flood, water nuisance or evacuation were interacted with the risk attribute (as shown in [7a] and [7b]).

V_m (evacuation) = $ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T$ [7a]

V_m (no evacuation) = $\beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T + \beta_Z * (x_Z * x_{Pf})$ [7b]

The resulting VOSLs and significance levels are found in Table 3.

For the interpretation of results it is important to recall that those respondents who usually commute to work 5 days a week were excluded from taking part in this choice experiment, as they have done another one. This means that, by construction, respondents who work part-time, older respondents and those with lower income are overrepresented in this experiment. Thus our sub-sample consists mainly of respondents with lower level of income, and on average with somewhat lower level of education.

In this section we shall report on the results of univariate models. We should note that in all models the coefficient of risk of injury turned to be statistically insignificant. Therefore, while we do report the VOI per sub-group, we shall not pay particular attention to these differences.

We shall start with the variable that is of prior interest for us – income. We have three groups of respondents according to the level of income: high, middle and low income (and a group of respondents who did not state their income level). We can see that there are *no* statistically significant differences between the main three income groups in terms of risk valuation (VOSL for the low, mid and high-income groups are 8.4 mln €, 7.1 mln € and 8 mln €, respectively). Only respondents who rejected to state their income are different from the rest of this sample: they have the lowest WTP (VOSL = 5.6 mln €); this outcome, however, does not offer any further implications. The differences between groups in value of evacuation inconvenience follow the same pattern, which is due to the same variation in betas of respective income groups that are added to the tax beta when calculating VOSL, VOE and VOI, so that the change in the denominator for each of the indicators is the same.

The next variable is education, and here we arrive at an unexpected inverse U-shape relationship for WTP. So, respondents in the mid-educated group are willing to pay the most (stat.significance at 1% level) of all respondents per additional avoided fatality (VOSL = 10.1 mln €); thus, the low- and high-educated respondents do not differ significantly from each other in their flood risk valuation (VOSL = 6.6 and 5.6 mln €, respectively).

Table 3. VOSL, VOE and VOI per subgroups: significant effects (choice experiment 3)

Sub-groups	VOSL (€)	VOE (€ per evacuation)	VOI ‡ (€ per injury)	Significance of variable beta's	N resp.
INCOME low (deciles 1-4)	8,445,726	3,120	110,726	No statistically significant differences between the low, mid and high income groups	118
INCOME mid (deciles 5-7)	7,078,900	2,615	92,807		164
INCOME high (deciles 8-10)	8,031,168	2,967	105,291		90
No income stated	5,595,245	2,067	73,355	*** significantly different from the 3 other income groups	165
Education low (LO-LBO-MBO)	6,628,308	2,438	90,238		225
Education mid (MAVO-HAVO-VWO)	10,109,603	3,718	137,633	*** significantly different from the low and high education levels	154
Education high (HBO-WO)	5,608,091	2,063	76,349	No statistically significant differences between the low and high education levels	156
Age (18-34)	3,548,499	1,296	48,376	*** statistically significant differences between all age groups	74
Age (35-64)	6,775,561	2,475	92,369	***	305
Age (65 and older)	14,648,197	5,352	199,694	***	158
good HEALTH (8 to 10)	5,968,874	2,210	80,622	*** statistically significant differences between the two health condition groups	316
HEALTH (1 to 7)	8,583,161	3,178	115,933	***	221
Coastal regions					
Central Holland	5,688,141	---	---	** significant w.r.t. Zeeland	135
Zeeland	8,125,453	---	---	** significant w.r.t. Central Holland	151
Riverside					
Land van Heusden / de Maaskant	6,972,845	---	---	Not significantly different from any other region	141
Dordrecht	6,622,815	---	---	Not significantly different from any other region	110

Sub-groups	VOSL (€)	VOE (€ per evacuation)	VOI ‡ (€ per injury)	Significance of variable beta's	N resp.
Entire sample	**6,834,756**	**2,517**	**92,183**		537

*, **, *** - statistical significance at respectively 10%, 5% and 1% level.

‡ VOI, value of inconvenience associated with injury, remained insignificant through all models, so statistical significance of beta reported in the last column of the Table does not attribute to this indicator.

Contrary to the surprising effect of education, the influence of age is smoothly increasing through the three categories. The valuation of mortality risk here also significantly differs between all three sub-groups. So, the youngest respondents (18 to 34 years old) are willing to pay the least of all, namely 3.5 mln €; middle-aged group – 6.8 mln € (just about the sample average); and elderly respondents are ready to contribute the most to each avoided fatality due to flooding, namely 14.6 mln €. We can see that the differences in valuation are clearly diverging. (the same is of course true for the valuation of evacuation inconvenience, which is 1300 €, 2475 € and 5350 €, respectively, for young, middle- and elderly groups).

Health condition is another factor determining significant differences in flood risk valuation between the sample sub-groups. Respondents in a very good self-estimated health condition (measured 8 to 10 on a 10-point scale) are willing to pay less for the marginal decrease in personal mortality rate relative to other respondents. Respective VOSL values are 6.0 mln € and 8.6 mln €.

Finally, regional effects are not that pronounced in this choice experiment: we only arrive at statistically significant differences in flood risk valuation between respondents residing in Zeeland and Central Holland: the former are willing to pay 8.1 mln € per avoided fatality, while the latter just 5.7 mln €. We do not therefore find any significant disparity in WTP between inhabitants of the coast and the riverside.

Results duo-models MNL (choice experiment 3)

We have also run a number of what we may call duo-models where we have tested the effects of two variables simultaneously. For the case when both variables are interacted with the same attribute, say, Tax, the model takes the form:

$$V_m \text{ (evacuation)} = ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T + \Sigma_i \beta_{Yi} * (x_{Yi} * x_T) \quad [8a]$$

$$V_m \text{ (no evacuation)} = \beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T + \Sigma_i \beta_{Yi} * (x_{Yi} * x_T) \quad [8b]$$

Where x_{Yi} stand for independent variables such as income, age, or education. For the case when one of the variables is interacted with one choice attribute (say, regional dummy with P(fatal)), and another variable is interacted with another attribute (say, income dummy with Tax attribute), a model takes the following form:

$$V_m \text{ (evacuation)} = ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T + \beta_Y * (x_Y * x_T) \quad [9a]$$

$$V_m \text{ (no evacuation)} = \beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T + \beta_Y * (x_Y * x_T) + \beta_Z * (x_Z * x_{Pf}) \quad [9b]$$

In fact, only a few of those models which provide additional insight into the relationship between socio-demographic variables and VOSL turned to be statistically significant (which we interpret as significant betas for both variables in addition to attribute betas). The models were run for the whole sample (N = (537 respondents) * (5 cards) = 2685 observations).

First a short note on the calculation of respective VOSL per sub-group (calculations of respective VOE and VOI values per sub-group follow the same principle). We shall use the duo-model of age and health condition as an example (Table 4). In this specification, both age and health condition variables are interacted with the tax attribute.

Table 4. VOSL formulas for age-health condition duo-model (choice experiment 3)

	VOSL formula
Older respondents not in an excellent health condition (*reference group*)	$VOSL = \frac{\beta_{Pf}}{\beta_T}$
Older respondents in an excellent health condition	$VOSL = \frac{\beta_{Pf}}{\beta_T + \beta_{Health}}$
Young respondents not in an excellent health condition	$VOSL = \frac{\beta_{Pf}}{\beta_T + \beta_{Young}}$
Young respondents in an excellent health condition	$VOSL = \frac{\beta_{Pf}}{\beta_T + \beta_{Health} + \beta_{Young}}$

For the own experience-age duo-model VOSL and VOE (calculations of VOI follow the calculations of VOE) are calculated in a similar manner. In this case, where age is interacted with the tax attribute and the dummy for prior water calamity experience is interacted with risk attribute, it is only possible to calculate VOE and VOI for the two age groups, and not for the two experience groups (see Table 5).

Table 5. VOSL and VOE formulas for age-own experience duo-model (choice experiment 3)

	VOSL formula	**VOE formula**
Older respondents without prior calamity experience (*reference group*)	$VOSL = \frac{\beta_{Pf}}{\beta_T}$	$VOE = \frac{\beta_{Pevac.}}{\beta_T}$
Older respondents with prior calamity experience	$VOSL = \frac{\beta_{Pf} + \beta_{Exp}}{\beta_T}$	
Young respondents without prior calamity experience	$VOSL = \frac{\beta_{Pf}}{\beta_T + \beta_{Age}}$	$VOE = \frac{\beta_{Pevac.}}{\beta_T + \beta_{Age}}$
Young respondents with prior calamity experience	$VOSL = \frac{\beta_{Pf} + \beta_{Exp}}{\beta_T + \beta_{Age}}$	

Looking at the results of the duo-models, we see two combinations of age groups: with prior experience with flooding or evacuation, and health condition (Tables 6 and 7). The first model provides somewhat unexpected results on the combination of age and experience characteristics. First of all, experience did not turn to be statistically significant on its own in the univariate model (see previous section for the description of results). Next, the effect of prior calamity experience is in fact counter-intuitive: respondents with such past experience show a lower WTP for flood safety than their counterparts (while age effects are conform univariate model outcomes: older respondents are willing to pay more than younger ones). This adverse experience effect that instead of acting as an ‘availability heuristics’, may possibly be rather attributed to a negative weighting of probability that follows a reasoning: a calamity has already happened to me, it is quite improbable that I'll experience it again. Another possible explanation is the discounting of experienced event in a way that it was not as bad as initially expected so that these respondents value the consequences of a calamity differently than those without prior experience.

Table 6. Age & Experience (choice experiment 3)

	Age 18-34	Age 35+
Prior experience with evacuation / flood VOSL (€)	2,335,724	5,603,471
No prior experience with evacuation / flood VOSL (€)	3,769,024	9,042,000
Value of evacuation, VOE (€)	1,249	2,995
Value of injury, VOI (€)	48,387	116,082

The second duo-model with significant effects is a combination of age and health condition. Here, the effects are of expected direction: a positive age effect and a negative health condition effect. We can see, for example, that young respondents in a good health condition are willing to pay the least for improvements in flood safety at the margin (VOSL = 3.4 mln €), while older respondents in with less good self-estimated health condition are willing to contribute almost 3 times as much, namely 10.2 mln € per statistical life saved. A notable observation is in place: age effect is clearly dominating in this model, so that younger respondents are having a substantially lower WTP compared to the older respondents: VOSL's for the same health condition are more than doubling.

Table 7. Age & Health condition (choice experiment 3)

	Age 18-34	Age 35+
Good health (8-10)		
VOSL (€)	3,352,669	7,139,727
VOE (€)	1,224	2,608
VOI (€)	46,887	99,848
No good health (1-7)		
VOSL (€)	3,904,344	10,212,780
VOE (€)	1,426	3,730
VOI (€)	54,602	142,825

Results multivariate model (MNL)

Finally, a multivariate model was run to test the main effects of the independent variables of our interest. The model then takes the form:

$$V_m \text{ (evacuation)} = ASC + \beta_{Pev.} * x_{Pev.} + \beta_T * x_T + \Sigma\beta_{Yi} * (x_{Yi} * x_T) \qquad [9a]$$

$$V_m \text{ (no evacuation)} = \beta_{Pf} * x_{Pf} + \beta_{Pinj.} * x_{Pinj.} + \beta_T * x_T + \Sigma\beta_{Yi} * (x_{Yi} * x_T) + \Sigma\beta_{Zi} * (x_{Zi} * x_{Pf}) \qquad [9b]$$

Where the two summation blocks represent independent variable interaction terms with one of the experiment attributes: $\Sigma\beta_{Zi} * (x_{Zi} * x_{Pf})$ stands for interaction terms of variables x_{Zi} with P(fatality) attribute and $\Sigma\beta_{Yi} * (x_{Yi} * x_{Tj})$ stands for interaction terms of variables x_{Yi} with the Tax attributes.

As an aside, it is important to notice here that the signs of betas for interaction terms with P(fatality) attribute is different from 'conventional' interpretation of betas for variables that are interacted with Tax attribute. In case an independent variable x_{Yi} is interacted with Tax attribute, we test whether the defined groups of respondents have varying marginal utility of money (which is β_{Yi} from equations [10a] and [10b]). Therefore VOSL is calculated as follows:

$$VOSL = \frac{\beta_{Pf}}{\beta_T + \beta_{Yi}} \qquad [11]$$

Similarly, in case an independent variable x_{Zi} is interacted with P(fatality) attribute, we test whether the defined groups of respondents have varying marginal utility of risk (which is β_{Zi} from equation [10b]). Therefore VOSL is calculated as follows

$$VOSL = \frac{\beta_{Pf} + \beta_{Zi}}{\beta_T} \qquad [12]$$

With the help of formulas [11] and [12] it is easy to show that, essentially, negative betas for variables interacted with P(fatality) attribute, β_{Zi} 's, would mean an increase in absolute value of the numerator in formula [12] ($\beta_{Zi} + \beta_{Pf}$), since as β_{Zi} as β_{Pf} are negative signaling a disutility from a higher risk of dying. A bigger numerator subsequently leads to a higher positive value of VOSL in [12], provided beta Tax is also negative signaling a disutility of payment. With beta's for the variables interacted with tax attribute, β_{Yi} 's, a straightforward interpretation applies as a negative β_{Yi} would increase a denominator in formula [11] ($\beta_{Yi} + \beta_T$) leading to a lower VOSL.

For covariates that are interacted with P(fatality) attribute, no VOE or VOI can be calculated per sub-group. For covariates interacted with the monetary attribute, formula [11] applies for calculations of VOE and VOI.

The model results are significant; the pseudo R2 is 15%. VOSL of the model is 7 mln € (weighted at attribute average values), value of evacuation is on average 2,550 € and value of inconvenience due to injury is 95,700 €, and all of these values are about the same as reported in the basic model.

As in the basic model on which we reported in the beginning of this paper, also here we can see that all coefficients of alternative attributes have expected signs so that both risk (evacuation, fatality and injury) and payment are disliked by the respondents. However, not all of these coefficients are equally prominent: risk of injury attribute is not statistically significant; Tax attribute is significant at 5%, the rest of the risk coefficients are significant at 1% level. We can also notice the positive sign and statistical significance of the alternative-specific constant, which attests a higher average utility of the alternative allowing a possibility for preventive evacuation.

Among other covariates, dummy for respondents who have not stated their income is significant and its beta is negative, which implies that this group has a significantly lower WTP relative to mid- and low-income groups. High-income dummy is positive, yet statistically insignificant.

Table 9. Multivariate model (choice experiment 3)

Variable	Coeff.	std.error	P-value	Sign.
CE ATTRIBUTES				
ASC (evacuation alternative)	1.10	0.16428	0.0000	***
P(evacuation)	-36.13	8.72495	0.0000	***
P(fatality)	-104760	16001	0.0000	***
P(injury)	-1354	878	0.1229	
TAX	-0.00689	0.00295	0.0197	**
COVARIATES				
Interaction with Tax attribute				
INCOME high (8-10 deciles)	0.00303	0.00267	0.2557	
No INCOME stated	-0.00367	0.00207	0.0764	*
University degree (HBO+)	-0.00277	0.00206	0.1782	
AGE 18-34	-0.01577	0.00263	0.0000	***
Good HEALTH (8 to 10)	-0.00376	0.00190	0.0470	**
GENDER (male)	0.00047	0.00190	0.8037	
Own PROPERTY	-0.00237	0.00207	0.2539	
Interaction with P(fatality) attribute				
RURAL	-39297	26247	0.1343	
Coastal area	-315	14953	0.9832	
OWN experience (flood / evacuation)	44074	17952	0.0141	**
N observations	2685			
Log likelihood function	-1861.1002			
Pseudo R2	0.15683			
Adjusted R2	0.15209			
VOSL ‡	**7,040,145 €**			
VOE (value of evacuation)‡	**2,554 €**			
VOI (value of injury)‡	**95,689 €**			

*, **, *** - statistical significance at respectively 10%, 5% and 1% level.
‡ - weighted at explanatory variable sample means

Dummy for higher education (HBO+) is insignificant as well (although in univariate model against the rest of respondents, not reported here, it was significant at 5% level).

Dummy standing for young respondents is in fact the only one from the socio-economic covariates that is highly significant (at 1% level), and has a negative effect. This means that younger respondents are willing to pay less to decrease their fatality risk compared to older respondents.

The effect of good health condition is negative as expected and is significant at 5% level. So, respondents who estimate own health condition as very good, all other things held constant, would value flood risk lower than other respondents.

The last significant coefficient in this model is own experience with water calamity, which unexpectedly turns significant (5%) and positive, which implies in this case a negative association with utility (Experience dummy is interacted with P(fatality) attribute, and therefore the signs have the opposite interpretation; we have made a note on that in a previous section). We have already noted by the analysis of duo-models that the own experience dummy has an adverse effect on WTP, which might in the first instance seem counterintuitive. Yet, a possible explanation for this might be an 'adverse availability heuristics', which makes people who already experienced flood or evacuation underestimate their future probability of getting repeatedly involved in a similar event. Alternatively, based on the previous experience, respondents are better able to assess the real impacts of a calamity.

Effects of gender, property ownership, as well as regional effects (dummies for respondents residing in rural areas and at the coast) remain insignificant.

Summary of results of MNL models based on CE3

The choice experiment on which we have reported in this paper was phrased in terms of making a dwelling purchase decision and attempts to elicit individual preferences with regard to flood risk in the Netherlands. It has two labeled alternatives: one with the possibility for precautionary evacuation, and another without such a possibility. The first alternative thus includes two attributes: risk of evacuation and payment; the second one includes three attributes: risk of flood, risk of getting an injury and payment (local tax).

The simple multinomial logit models run for this experiment showed that respondents' choices between the suggested alternatives were governed by the level of risk of evacuation, risk of flooding and tax level; risk of injury was more trivial as it remained statistically insignificant in all estimations. Moreover, the alternative-specific constant testifies of systematic preferences of respondents toward the alternative with evacuation possibility.

The average value of statistical life, VOSL, in our estimations is about 6.8 mln €; the average value of evacuation inconvenience, VOE, is 2,500 €; the average value of injury, VOI, is 92,200 €, yet this last indicator is not statistically significant. We could observe that valuation of this item differs substantially among respondents (for example, respondents in Zeeland valued it on average at 183.4 thousand €, while respondents in Central Holland – on average at 21.3 thousand €). The insignificance of risk of injury attribute might also be due to variations in individual interpretations of the 'injury', which was not described as light or heavy injury, but rather something in between. Another possibility is correlations with other experiment attributes.

Further, our MNL models revealed significant differences in valuation of flood risk among respondents with various education level, age and health condition (univariate models). However, in the multivariate model where multiple covariates were included, only effects of age and health condition prevailed, and the effect of own prior experience with flood or evacuation gained prominence. While age and health condition relation to willingness to pay for the decrease in risk at the margin were not unexpected (WTP increases with age, and decreases as individual estimation of health condition improves), the association of prior experience with WTP turned to be somewhat surprising, i.e. negative, which we suggest is due to either 'adverse availability heuristic' of 'calamity impact discounting'.

COMPARISON BETWEEN THE THREE CHOICE EXPERIMENTS: MNL ESTIMATIONS

Before starting a comparison between the three choice experiments, it is important to make a note that respondent (sub-)samples vary by experiment. So, the first experiment was done by all respondents (N=836), the second one was only offered to respondents who commute 5 days a week (N=299), and the rest of the respondents in the sample have participated in the third choice experiment. This means that heterogeneity in personal characteristics among the respondents in the sub-samples is different; so, respondents in CE2 sub-sample are on average younger and better educated.

Another point is the number of attributes and the number of attribute levels that determine the complexity of an experiment. Also, experiments 1 and 2 had both two generic alternatives per choice card, while the third one had two labeled alternatives. All this can lead to the varying absolute level of utility associated with alternatives, and therefore we shall compare only ratio indicators across the experiments, which is VOSL.

Basic logit models (MNL) based on the three experiments have resulted in VOSL values that in fact do not diverge substantially (see table 10): in the first experiment VOSL = 8.7 mln €, in the second one – 11.7 mln € and in the third one somewhat lower, namely 6.8 mln €. It appears quite plausible that VOSL, while measured as change in personal fatality risk, in the second experiment is yet somewhat higher than in the first one, as it was measured in the context of a private good in terms of a payment vehicle (local owner tax in a decision to purchase a house) rather than a public good (water board tax for maintenance of dikes). Literature points at higher valuation of private goods compared to public goods (de Blaeij, 2003). The lower value of VOSL in the third experiment was also pretty expected, as in this experiment we have distinguished between the risk of dying and the risk of injury connected to a flooding, both of which might latently be included in the valuation of VOSL otherwise. If we assume that in a case of flood an approximate ratio of fatal incidents to injuries is 1 to 10, then the implicit VOSL that includes the valuation of mortality risk together with the risk of injury would be around 7.7 mln €. Yet another reason for somewhat lower VOSL in the third experiment is the inclusion of alternative specific constant in the model that might capture a part of valuation of choice alternative that includes a possibility for evacuation (which was found to be positive and statistically significant).

As an aside, we have run split-sample models for the two sub-groups of respondents who have done the second and the third choice experiments valuating the first model. Thus, we could compare the valuation of the same good (i.e. change in mortality risk based on CE1) by the two respondent groups (from CE2 and CE3). We could see that respondents who have done CE2 had a *lower* WTP than respondents who have done CE3. This means that the differences found in VOSL between choice experiments 2 and 3 (respectively, 11.7 mln € and 6.8 mln €) are rather due to the differences in context than differences between the sub-groups.

Table 10. Comparison of estimated immaterial damage indicators based on outcomes basic MNL models (choice experiments 1, 2 and 3)

	Choice experiment 1	Choice experiment 2	Choice experiment 3
VOSL (value of statistical life)	8.7 mln €	11.7 mln €	6.8 mln €
VOT (value of time savings)	---	5.6 €/h	---
VOE (value of evacuation)	---	---	2,500 €
VOI (value of injury)	---	---	92,200 € (not significant)
N respondents	836 (all respondents)	299 (only full-time commuters)	537

Another comparison between the three experiments that can be done would be to look at multivariate models (MNL) and consider the effects of various covariates on the height of the willingness to pay for flood safety, their statistical significance and the relative importance of each covariate.

Weighted VOSL values based on the multivariate MNL models from the three choice experiments are even more converging: 9 mln € for CE1, 11.7 mln € for CE2 and 7 mln € for CE3 (the latter would increase to about 8 mln € if injury costs are implicitly included).

Looking at Table 11 we can see that coefficients of most of covariates have the same signs in all three models, meaning they have a stable direction of influence on individual WTP. For example, high income has a stable positive effect on the height of flood risk valuation, while high education, young age, good health condition and property ownership have a negative effect throughout the models. Regional dummies are positive (one standing for residence in rural areas, another for residence in coastal areas), but not always significant. Both are statistically significant in CE2; the coastal dummy is highly significant in CE1; none of them have a substantial effect in CE3.

Gender effect is negative in CE1, but positive in CE2 and CE3; at the same time it is statistically significant (at 10%) only in CE2. The effect of prior experience with flood or evacuation also changes from positive (in CE1 and CE2) to negative in CE3, which is also then significant (at 5% level).

The strength of influence of the covariates does vary substantially between the models. So, willingness to pay for improvements in flood safety for high income group, all other things held constant, is only 16.4% higher than the average in CE1; it increases to 78.6% in CE3, and up to 142.2% in CE2, and only in the latter model it is statistically significant. Highly educated respondents have, on the other hand a lower than average WTP, which varies from -2.4% (CE1), -28.7% (CE3) to -40.4% in CE2, where again it is statistically significant only in CE2. The effect of age ceteris paribus, on the other hand, is the lowest in CE2 (-13.3% for the young respondent group of 18 to 35 years old) – and insignificant; the influence of age on average VOSL is stronger in CE1 and CE3 (-47.4% and -69.6%, respectively), where it is also significant at 5% level.

Summary of comparison of MNL models from the three experiments

While we should take into account a number of differences in the experimental settings and sub-samples among the three choice experiments, we can report on fairly comparable estimates of resulting VOSL values ranging from 6.8 mln € to 11.7 mln € for the basic models and from 7.0 mln € to 11.7 mln € for the multivariate models. If we adjust the VOSL value from the third experiment for the inclusion of value of injury, then the two ranges will converge further to 7.7 to 11.7 mln € and 8.8 to 11.7 mln, respectively. All these values are found within expected ranges for VOSL estimates found in the literature (among others, de Blaeij, 2003; Kluve and Schaffner, 2008; Bellavance et al. 2009).

We can further conclude that VOSL predictors among the socio-economic covariates are stable throughout the experiments. Although the statistical significance is not the same for the three models, the signs of the covariate coefficients remain in most cases stable. So, we can observe a consistent positive effect of high income on the height of VOSL; the effects of high education, young age and good self-estimated health condition are consistently negative. The effect of prior experience with water-related calamities is positive in CE1 and CE2, but negative (and significant) in CE3.

The overall patterns of prediction of the height of VOSL varies across the experiments: in the first experiment, income, age and residence in a coastal area are the most significant predictors (all at 1% level), while in the second experiment it is education level (at 1% level) and income, health condition and regional dummies (at 5% level). In the third experiment, age goes first followed by health condition and prior calamity experience.

Table 11. Comparison of multivariate MNL models (choice experiments 1, 2 and 3)

	CHOICE EXPERIMENT 1			CHOICE EXPERIMENT 2			CHOICE EXPERIMENT 3		
Variable	Effect on WTP	Difference from average VOSL in %	Signifi-cance of beta	Effect on WTP	Difference from average VOSL in %	Signifi-cance of beta	Effect on WTP	Difference from average VOSL in %	Signifi-cance of beta
CE ATTRIBUTES									
ASC (evacuation alternative)	---	---		---	---		positive	---	***
P(evacuation)	---	---		---	---		negative	---	***
P(injury)	---	---		---	---		negative	---	not sign.
P(fatality)	negative	---	***	negative	---	***	negative	---	***
TAX	negative	---	***	negative	---	***	negative	---	**
Travelling time	---	---		negative	---	***	---	---	
COVARIATES									
Interaction with Tax attribute									
INCOME high (8-10 deciles)	positive	16.39%		positive	142.20%	**	positive	78.61%	
No INCOME stated	negative	-41.02%	***	positive	-0.04%		negative	-34.78%	*
University degree (HBO+)	negative	-2.39%		negative	-40.35%	***	negative	-28.69%	
AGE 18-34	negative	-47.41%	***	negative	-13.26%		negative	-69.60%	***
Good HEALTH (8 to 10)	negative	-11.66%		negative	-32.78%	**	negative	-35.33%	**
GENDER (male)	negative	-9.20%		positive	46.73%	*	positive	7.35%	
Own PROPERTY	negative	-26.03%		negative	-26.13%	*	negative	-25.56%	
Interaction with P(fatality) attribute									
RURAL	positive	19.09%		positive	72.80%	**	positive	37.51%	
Coastal area	positive	19.50%	***	positive	38.26%	**	positive	0.30%	
OWN experience (with flood / evacuation)	positive	12.16%		positive	16.09%		negative	-42.07%	**
N observations	4180			1495			2685		

	(836 resp. * 5 cards)	(299 resp. * 5 cards)	(537 resp. * 5 cards)
VOSL ‡	**9.0 mln €**	**11.7 mln €**	**7.0 mln €**
VOT ‡ **(value of time)**	**---**	**5.78 €/h**	**---**
VOE ‡ **(value of evac-n)**	**---**	**---**	**2,550 €**
VOI ‡ **(value of injury)**	**---**	**---**	**95,700 € not sign.**

*, **, *** - statistical significance at respectively 10%, 5% and 1% level.
‡ - weighted at explanatory variable sample means

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APPENDIX 1A

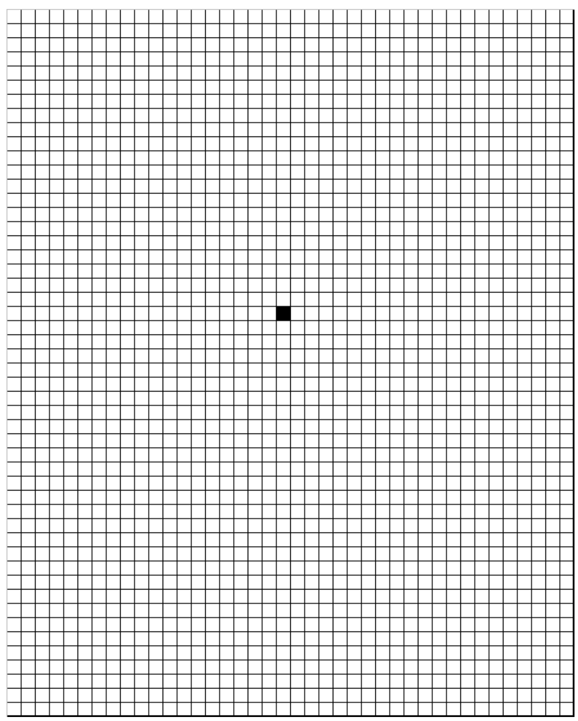
Risk explanation and description of choice experiment 1 from questionnaire version for dike-ring areas 28, 29 and 30 in Zeeland:

Nu vragen wij uw aandacht voor de kans op een overstroming. Het helpt u om overstromingsrisico's beter te begrijpen en de vragen uit Deel II gemakkelijker te beantwoorden.

OVERSTROMINGSKANS

De huidige overstromingsbescherming in Nederland is zo vastgesteld dat de dijken **in úw woonplaats** gemiddeld eenmaal per 4.000 jaar doorbreken. Dus, elk jaar is er een kans op overstroming van 1 op 4.000 voor het gebied waarin u woont.

Om u zich een kans van 1 op 4.000 (één op 4 duizend) voor te stellen, kunt u kijken naar de rechthoek hieronder, verdeeld in 4.000 hokjes (80 x 50). 1 hokje is gekleurd.

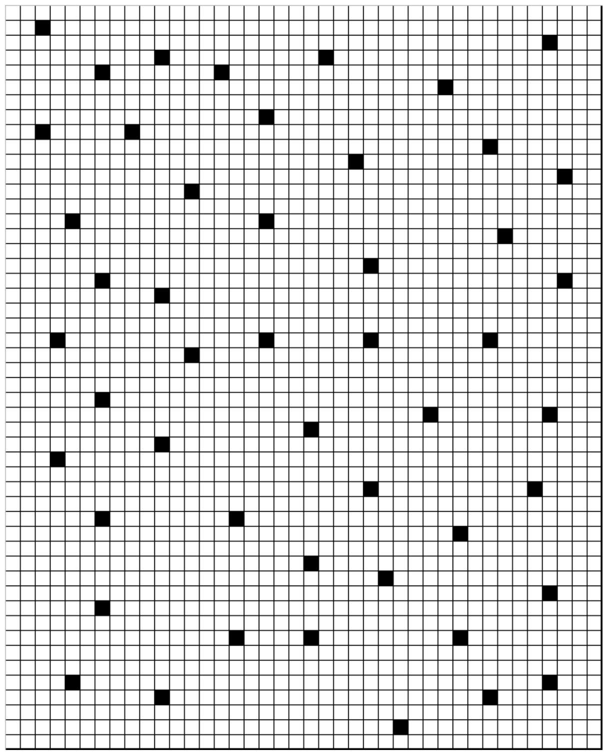


110. Stelt u zich voor dat u, zonder te kijken en zonder te weten waar het hokje zit, met een speld ergens in het vierkant zou prikken. De kans dat u het gekleurde hokje raakt is gelijk aan de kans dat een overstroming in uw woonplaats dit jaar plaatsvindt.
Hoe groot is volgens u de kans dat **u in één keer** het gekleurde hokje raakt?

5□ heel groot
4□ redelijk groot
3□ matig
2□ redelijk klein
1□ heel klein
-4□ anders, namelijk ____________________

Over een langere periode, bijv. de komende 50 jaar, is de kans op een overstroming of dijkdoorbraak natuurlijk groter. Voor de komende 50 jaar is het gemiddeld 50 op 4.000, oftewel 1:80 in uw woonplaats.

Kijk eens naar dezelfde grote rechthoek hieronder van 4.000 hokjes, waar nu 50 hokjes gekleurd zijn om u zich een kans van 50 op 4.000 (50 op vierduizend) te laten voorstellen.



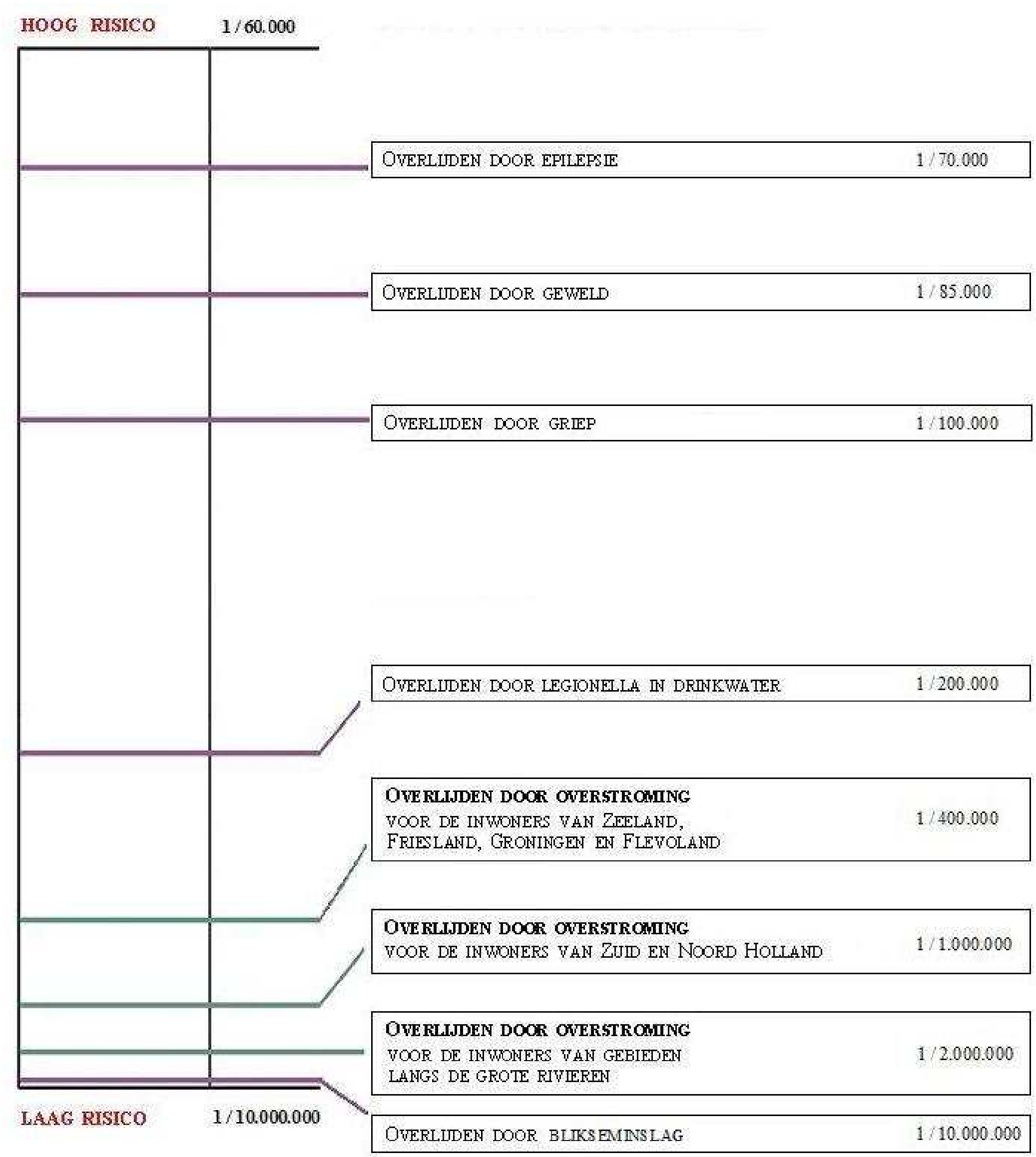
111. Stelt u zich voor dat u weer, zonder te kijken en zonder te weten waar de hokjes zitten, met een speld ergens in het vierkant zou prikken. De kans dat u een gekleurde hokje raakt is gelijk aan de kans dat een overstroming in uw woonplaats plaatsvindt in de komende 50 jaar.
Hoe groot is volgens u de kans dat **u in één keer** een gekleurd hokje raakt?

5□ heel groot
4□ redelijk groot
3□ matig
2□ redelijk klein
1□ heel klein
-4□ anders, namelijk ____________________

OVERLIJDENSKANS IN OVERSTROMING

Op basis van eerdere grote overstromingen mag verwacht worden dat in een gebied zoals waar u woont, 1% van de inwoners zal overlijden in geval van een overstroming.
De jaarlijkse overstromingskans in uw woonplaats is 1 op 4.000.
Dit betekent voor u dat uw *jaarlijkse* kans op **overlijden door een overstroming** overeenkomt met ongeveer 1 op 400.000 (één op 400 duizend).

U kunt dit soort kansen met behulp van een zogenaamde risicoladder vergelijken.
De jaarlijkse kans op overlijden in een overstroming en de sterftekansen door een aantal andere risico's die **een gemiddelde Nederlander loopt**, zijn weergegeven op de hieronder afgebeelde risicoladder.
Rechts van de ladder ziet u de jaarlijkse sterftekans door een bepaald risico, die oploopt van 1 op 10 miljoen tot 1 op 60 duizend. De kansen boven aan de ladder zijn dus hoger, en de kansen onder aan de ladder zijn lager.



Ter vergelijking, de kans op overlijden door een blikseminslag is in Nederland jaarlijks 1 op 10.000.000 (één op tien miljoen) personen. De *jaarlijkse* kans op overlijden door een overstroming in uw woonplaats is dus ongeveer 25 keer zo groot als de *jaarlijkse* kans op overlijden door een blikseminslag voor een gemiddelde Nederlander.

112.

De jaarlijkse kans om te overlijden door een overstroming is 1 op 1.000.000 (één op één miljoen) in uw woonplaats. Hoe zou u dit risico beoordelen, rekening houdend met andere risico's in de risicoladder hierboven?

Kies het antwoord dat het beste *uw mening* weergeeft.

1☐ De kans dat ik in een overstroming overlijd is heel groot
2☐ De kans dat ik in een overstroming overlijd is redelijk groot
3☐ De kans dat ik in een overstroming overlijd is matig
4☐ De kans is redelijk klein, maar toch is het mogelijk dat ik overlijd door een overstroming
5☐ De kans dat ik in een overstroming overlijd is bijna verwaarloosbaar
6 De kans dat ik in een overstroming overlijd is nihil
-4☐ Andere mening, namelijk ____

DEEL II

Wij gaan nu over naar een aantal vragen waarin risico een belangrijke rol speelt. Probeert u bij de beantwoording van deze vragen om u de risico's voor te stellen op de manier zoals we die net besproken hebben. Daarom is bij elke vraag de overstromingskans grafisch weergeven.

In de nu volgende vragen willen wij u verzoeken om voor verschillende situaties aan te geven welke keuze u zou maken. Voor alle vragen is het van belang dat u zich probeert voor te stellen dat u inderdaad voor de keuze in kwestie geplaatst wordt, ook als dat op dit moment misschien wat minder waarschijnlijk lijkt.

Let op: Behandel de keuzes die u voorgelegd krijgt als onafhankelijke situaties, d.w.z. denk *niet* aan het antwoord op de vorige vraag bij het maken van een keuze.

<u>APPENDIX 2A</u>

Description choice experiment 3.

KEUZE-EXPERIMENT 3

Stelt u zich voor dat u, om wat voor reden dan ook, besloten heeft te verhuizen en overweegt een woning te kopen. U hebt twee identieke woningen gezien, die beide aan uw eisen voldoen, qua type woning, aantal slaapkamers, oppervlakte, inhoud en perceelsgrootte, Bovendien hebben ze dezelfde prijs. Hierdoor beinvloeden deze eigenschappen uw keuze van aankoop niet.

Beide woningen staan in een polder en beide polders zijn, *behalve wat betreft overstromingsgevaar*, identiek: even groot, mooi, toegankelijk, de woonomgeving beschikt over dezelfde voorzieningen en comfort, etc.
In één van de polders (**A**) kan een overstroming echter tijdig voorspeld worden en is er een evacuatieregeling van kracht: iedere inwoner van de polder dient het evacuatiebevel op te volgen. Het plan zal gegarandeerd goed werken: alle inwoners zullen bij een verwachte overstroming dus tijdig geëvacueerd worden, zodat niemand het gevaar loopt te overlijden. Bij evacuatie moet u er echter rekening mee houden dat u ongeveer een week van huis weg bent.

In de andere polder (**B**) is het juist niet mogelijk een overstroming voldoende tijdig te voorspellen. Evacuatie in deze polder is niet mogelijk: u loopt, net als iedere andere polderbewoner, een zeker gevaar te overlijden of gewond te raken door een overstroming. Bij een verwonding kunt u denken aan bijvoorbeeld breuken, kneuzingen, weefselverscheuring, onderkoeling, of een elektrische schok, waarvoor medische behandeling in een ziekenhuis nodig is.

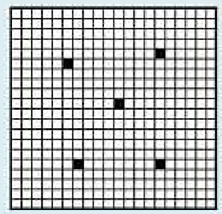
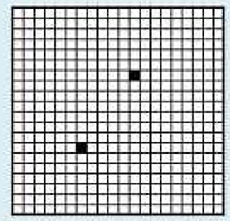
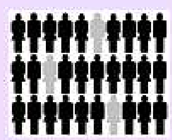
U dient in beide polders waterschapsbelasting te betalen.

Houdt u bij het beantwoorden van deze vraag alleen rekening met de kans op overstroming en op preventieve evacuatie, en met *uw kans* slachtoffer te worden of gewond te raken door een overstroming. Met andere woorden, negeert u nu alle andere eventuele risico’s die met een overstromingssituatie samenhangen. Ga er bijvoorbeeld vanuit dat de regering alle door overstroming opgelopen materiële schade zal vergoeden.

Probeert u bij uw keuze <u>alle getoonde kenmerken</u> mee te nemen.
U krijgt vijf schermen te zien, waar elke keer de kenmerken van de twee polders variëren.

Geeft u aan in welke polder u zou willen wonen.

VOORBEELD KEUZEKAART

	POLDER A	***POLDER B***
	Wel mogelijkheid tot evacuatie	**Geen mogelijkheid tot evacuatie**
Kans op **overstroming** in de polder (*in de komende 50 jaar*) 	**5 : 400** (5 op vierhonderd) 	**2 : 400** (2 op vierhonderd) 
Kans op **evacuatie** in de polder (*in de komende 50 jaar*) 	**20 : 400** (20 op vierhonderd)	**0** (geen)
Kans op **overlijden** door een overstroming (*in de komende 50 jaar*) 	**0** (geen)	**2 : 40.000** (2 op 40 duizend)
Kans op **verwonding** door een overstroming (*in de komende 50 jaar*) 	**0** (geen)	**10 : 40.000** (tien op 40 duizend)
Waterschapsbelasting (*jaarlijks*) 	**€ 25**	**€ 55**
Voorkeur (*kruis **één** blokje aan*)	☐	☐

APPENDIX 3A

ATTRIBUTE LEVELS USED IN THE CHOICE EXPERIMENT 2:

Alternative with a possibility for evacuation:

P(evacuation) in the coming 50 years – 5 levels:

10 : 400	25 : 400	50 : 400	100 : 400	200 : 400

Local community Tax per year – 3 levels:

60€	80€	100€

Alternative without a possibility for evacuation:

P(fatality) in the coming 50 years – 5 levels:

2 : 40.000	5 : 40.000	10 : 40.000	15 : 40.000	20 : 40.000

P(injury) in the coming 50 years – 5 levels:

20 : 40.000	50 : 40.000	100 : 40.000	150 : 40.000	200 : 40.000

Local community Tax per year – 3 levels:

30€	40€	45€