Stated-preference study to examine the economic value of benefits of avoiding selected adverse human health outcomes due to exposure to chemicals in the European Union

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FD7. Final Report

Part III: Carcinogens

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0   Executive Summary

The primary objective of this stated-preference study is to estimate willingness to pay to avoid selected adverse human health outcomes due to exposure to chemicals in the European Union, and to derive representative EU-wide benefit estimates reference values that ECHA and other bodies can use when carrying out economic analyses (cost-benefit analysis) or health impact assessment in connection to REACH Regulation. This report focuses on health outcomes linked to **carcinogens**, particularly to **cancer risks**.

A novel valuation scenario was developed basing valuation on anxiety and effects of one gets a cancer. In close cooperation with ECHA, the following health outcomes and cancer attributes were selected for our valuation study:

  i.   chance of getting cancer within the next 5 years

  ii.   chance of survival at 5 years from the diagnosis

  iii. effects on everyday activities

  iv.   pain

Willingness to pay for reducing the chance of getting cancer can be translated into a *Value of Statistical Case of Cancer (VSCC)*. Using information about changes in two probabilities, we can compute the unconditional probability of dying that allows us deriving a *Value of a Statistical Life (VSL)*.

Respective willingness-to-pay values were elicited from a sample of adult population of age 45 to 60 in four EU Member States: the Czech Republic, the United Kingdom, the Netherlands and Italy using a series of discrete choice questions. In total 3 888 respondents were interviewed, providing us 3 407 valid observations.

The mean values of WTP for the pooled sample of four countries are estimated from the random effects probit model. A value of a statistical case of a cancer is EUR 335,000 and a value of a Statistical Life for cancer is about EUR 4.27 million, both expressed in Euro$_{2014}$ PPS.

The recommended set of the EU-wide WTP values is based on the population-weighted WTP values that we computed for each EU Member State based on the purchasing power adjusted unit value benefit transfer of the WTP values as estimated in this study, and assuming the income elasticity of WTP as 0.7. Next table reports the EU-wide values of cancer-specific VSL and VSC in Euro$_{2014}$ PPS.

	WTP
Value of a statistical case of a cancer (VSCC)	396 000
Value of a Statistical Life for cancer	5 000 000

Impact on quality of life, if one gets a cancer, does not change a value neither of VSL or VSCC. Even in a few model specifications in that the coefficients for quality of life impacts are significant, it would imply no significant change in the magnitudes of VSLs or VSSC. We found that VSL and VSCC values would be a bit smaller when it was anticipated surviving in poor rather than relatively good health. This seems to be in a contradiction with one's intuition, but still theoretically possible due to possible effect of anticipated poor health condition on utility of wealth (Hammitt, 2005).

Pain impacts, if one gets cancer, do not have effect on probability to choose the risk-reducing program either.

Among the four EU countries, the respondents from Italy have the largest and the Czech respondents have the lowest willingness to pay for reducing risk of getting a cancer, implying the highest and the lowest values of VSCCs and VSLs.

Other main findings from this study, which also documents the validity of the WTP values, include:

- The results show that in each country, respondents are willing to pay more for larger reductions in the chance of getting cancer and for larger improvements in the chance of surviving it. The coefficients on these regressors are positive and significant. The likelihood of accepting a risk-reducing alternative decreases, all else the same, with the price of that alternative.

- By contrast, the coefficients on the quality of life dummies are not always monotonic or statistically significant, and likewise for the moderate pain dummy. These mixed results are surprising, but they disappear when we pool the data and fit a single model that controls for the country of origin of the responses. The attributes of the illness and of the risk-reducing alternatives are important.

- We excluded the speeders, defined by time length of the survey completion less than 13 minutes, and in some models also those who failed the probability quiz. We however did not excluded potential protesters from analysis, and as a result, our results provide a conservative, lower bound of WTPs, and hence of VSCC and VSL values.

- There are considerable differences in WTP between countries. Willingness to pay is consistently higher in Italy than the remaining countries across all illnesses and in the most of models.

- The coefficients of interaction term in the joint estimation of WTP for reducing chance of getting cancer and quality of life effects are positive in pooled data suggesting that WTP for more severe effects is increasing. This is however not a case for the chance of survival and in neither case also for moderate pain effect.

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The objectives of this report are following:

1) to summarize the selection process of the most relevant outcomes and descriptions of the health outcomes related to carcinogens related endpoints that were presented to respondents (Chapter 1);

2) to provide a review of empirical literature on valuation of benefits of improving cancer risks (Chapter 2);

3) to describe valuation and econometric methods utilized in this study (Chapter 3), the questionnaire development and its structure (Chapter 4), an original stated preference survey (Chapter 5), data gathering and datasets by descriptive statistics (Chapter 6);

4) to estimate willingness to pay for cancer risks (Chapter 7); and

5) to perform benefit transfer and to provide EU-wide WTP values (Chapter 8 and 9).

1   Introduction: Description of health outcomes

Carcinogen is generally understood as an agent that causes or induces cancer (neoplasia).

The term **"cancer"** refers to diseases in which abnormal cells divide without control, losing their ability to regulate their own growth, control cell division, and communicate with other cells (neoplasm). If left unchecked, cancer cells can invade nearby tissues and can spread through the bloodstream and lymphatic system to other parts of the body. The cellular changes caused by cancer cells are complex and occur over a period of time.

Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are *malignant tumours* and *neoplasms*. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer.

Cancer arises from one single cell. The transformation from a normal cell into a tumour cell is a multistage process, typically a progression from a pre-cancerous lesion to malignant tumours. These changes are the result of the interaction between a person's genetic factors and three categories of external agents, including:

- physical carcinogens, such as ultraviolet and ionizing radiation;
- chemical carcinogens, such as asbestos, components of tobacco smoke, aflatoxin (a food contaminant) and arsenic (a drinking water contaminant); and
- biological carcinogens, such as infections from certain viruses, bacteria or parasites.

The nomenclature of cancers depends primarily on whether the neoplasm is benign or malignant and in the latter case whether it is derived from epithelial or mesenchymal tissue.

Since 1900s growing number of studies in animals and humans showed that environmental and chemical agents are causative factors in the development of cancer, including organic compounds such as tars, azo dyes, aflatoxin B and aromatic amines, inorganic chemicals like metals (arsenic, cadmium, chromium and nickel compounds), fibres and hormones.

In real life it is relatively unusual for an individual to be exposed to a single carcinogenic agent. Most common environmental mixtures of carcinogenic chemicals are tobacco smoke and other combustion products (engine and stove exhausts, air pollution). Though many types of cancer are suspected of being related to ambient environmental exposures, associations are not always clear because the etiology of cancer is complex and influenced by a wide range of factors. Many factors

can increase individual cancer risk, such as age, genetics, existence of infectious diseases and socioeconomic factors that can affect exposure and susceptibility.

Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths (around 13 % of all deaths) in 2008. Lung, stomach, liver, colon and breast cancer cause the most cancer deaths each year.

1.1 Cancer incidence, prevalence and mortality

In 2012, age standardized cancer incidence rate in the EU 27 was 494 cases per 100 000 persons, prevalence over 1 year was 1 691 or 446 over 5 years per 100 000, respectively, and cancer mortality rate was 175 per 100 000 (WHO IARC) (see Table 1)**.**

There are four types of cancer that contributed to the total incidence the most: *breast* cancer and *prostate* cancer contribute both by 22 % to overall incidence, while *large bowl* cancer and *lung* cancer represented 9 % each. These four types were also by major part responsible for mortality: 22 % of cancer-related deaths were due to lung cancer, 13 % and 11 % due to breast and prostate cancers respectively, and 10 % due to large bowl.

Table 1 – Incidence and mortality for both sexes in EU (27), 2012

	Incidence	Mortality	Prevalence (5-year)	Prevalence (3-year)	Prevalence (1-year)
All sites but non-melanoma skin	493.9	175.3	445.7	1139.7	1 690.7
Bladder	16.3	4.7	24.1	63.9	96.4
Brain & central nervous system	6.9	4.9	3.7	7.8	10.3
Breast	108.8	22.4	149.8	423.4	665.6
Cervix uteri	11.3	3.7	12.8	34.3	52.2
Corpus uteri	17.9	3.3	26.2	71.8	110.6
Gallbladder & biliary tract	3	2	2	4.2	5.4
Hodgkin lymphoma	2.3	0.4	2.1	6.1	9.7
Kidney incl renal pelvis & urether	12.4	4.5	14.6	38.3	58
Large bowel	46.3	18.4	60.2	151.7	222.1
Larynx	4.4	1.8	5.7	14.7	21.8
Leukaemias	9.2	5.2	8.8	22	32.1
Lip oral cavity & pharynx	11.6	4.3	13.1	32.3	46.2
Liver & intraheptic bile ducts	7	6.2	4.8	8.9	10.9
Lung incl trachea & bronchus	44.1	36.5	32.5	63.4	79.1
Malignant melanoma of skin	13	2.2	16.8	48	76.1
Multiple myeloma	4.5	2.5	5.9	13.5	18.1
Non-Hodgkin lymphomas	11.6	3.8	12.9	33.2	49.5
Oesophagus	5	4.1	3.6	7.1	8.9
Ovary	12.6	7.4	14.1	33.8	47.4
Pancreas	10.5	10.1	4.9	8.5	10.2
Prostate	110.8	18.9	164.1	434.8	648.1
Stomach	10.7	7.3	9.1	20.3	27.7
Testis	7.2	0.3	7.6	22.9	38
Thyroid	6.5	0.4	7.4	21.2	34.5

Source: European Cancer Observatory project that is developed at the International Agency for Research on Cancer (IARC) in partnership with the European Network of Cancer Registries; downloaded from http://eco.iarc.fr/EUCAN/Country.aspx?ISOCountryCd=930.

WHO's IARC data on incidence, mortality and 5-year prevalence for selected cancers for the Czech Republic, Italy, the Netherlands, the UK and WHO Europe region are shown in the next two figures.

Figure 1- Age-standardized incidence rate (per 100 000 persons)
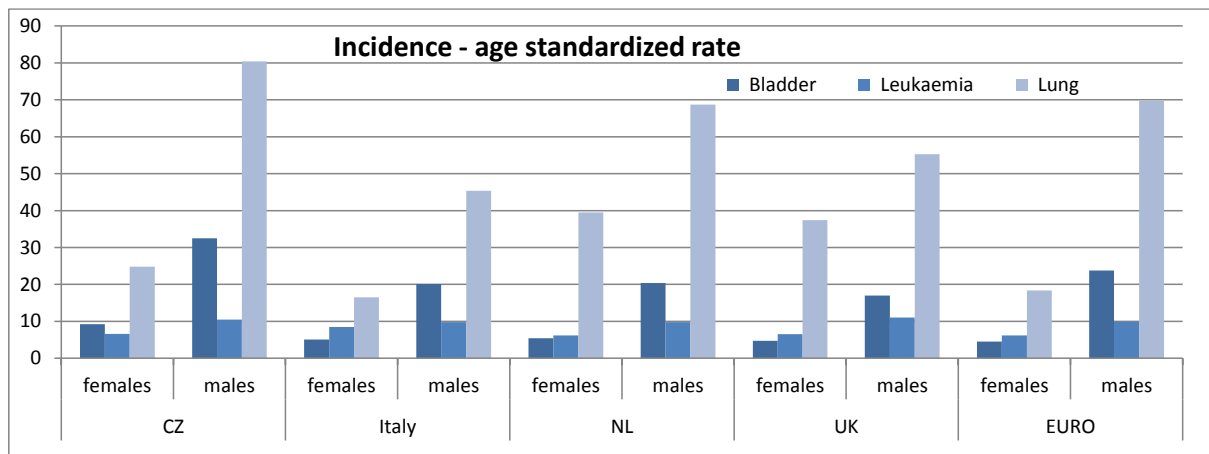
Source: Ferlay (2010)

Figure 2 – 5-year prevalence (proportions per 100 000 persons)
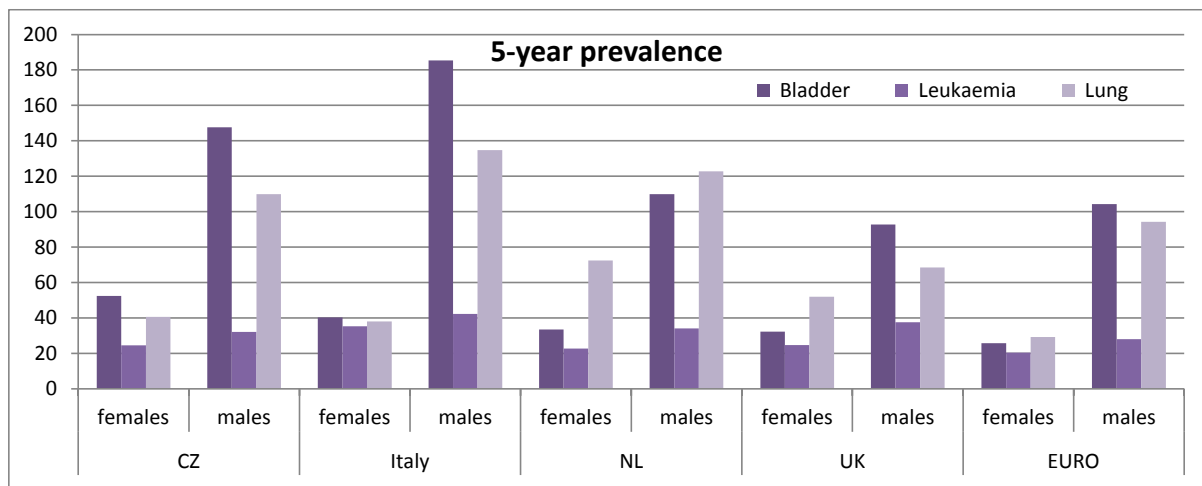
Source: Ferlay (2010)

Figure 3 - Standardized death rate for neoplasm of larynx, trachea, bronchus and lung (per 100 000 inhabitants)
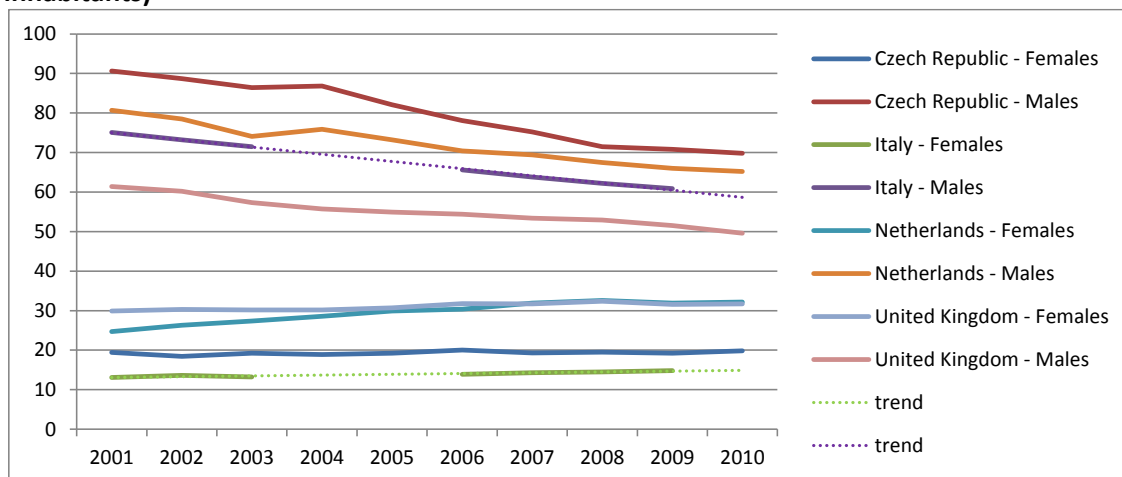
Source: Eurostat (2014)

Eurostat collects data on standardized death rate per 100 000 inhabitants by cause. The figure 4 shows trends in standardized death rates for neoplasm of larynx, lung, trachea and bronchus in the four EU countries.

EUROCARE 4 data (ISS, 2009) on cancer survival (newest available) for the Czech Republic (West Bohemia region), Italy, the Netherlands, the UK (England) and Europe covering period 1995-1999 are shown in the following graph (see Figure 4).

Figure 4 – Cancer 5-year relative survival rates (EUROCARE 4 study)
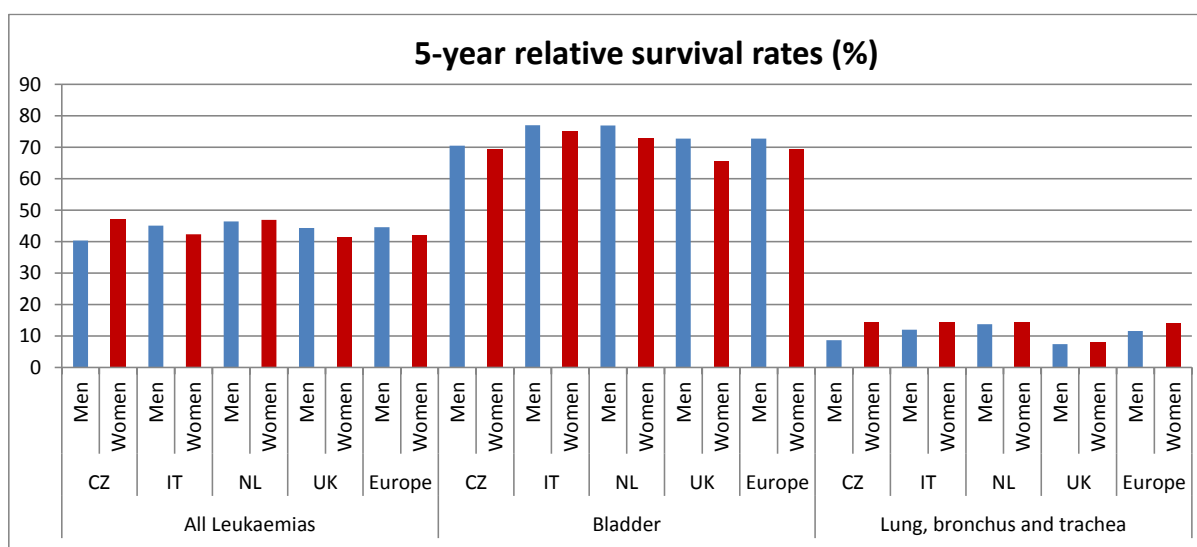
Source: ISS (2009)

1.2   Selecting the health outcomes

During the pre-survey we examined valuation of several organ-specific cancers, such as lung cancer, breast cancer, prostate cancer, liver cancer, and nonfatal skin cancer.

Considering consultations with medical doctors, epidemiologists and ECHA, we then decided to aim at four organ-specific and systemic cancers, including

Myelodysplastic syndrome (ICD-10: D46) that may be caused by environmental exposures (e.g. radiation or benzene) or as a secondary effect of cancer treatment toxicity;

Acute lymphocytic (lymphoblastic) leukaemia that may develop after exposure to alkylating agents or ionizing radiation for 5 to 10 years and generally follows the myelodysplastic syndrome;

Lung cancer (ICD-10: C34) that is the leading cause of death in the United States as in EU countries, including the Czech Republic (30 % of all male cancer deaths);

Bladder cancer (ICD-10: C67) that is a type of malignancy arising from epithelial lining of the urinary bladder

Description of symptoms, onset of illness, duration, treatment, and prognosis, impact of quality of life, prevalence and incidence was gathered for each of the four cancer types including general cancer in order to test this information among general public and practitioners during the pre-survey in 2013.

However, there is not one type of, as an example, bladder cancer, lung cancer, breast cancer, leukaemia or lymphoma. Each of them may differ with respect to severity of symptoms, onset of illness, prognosis, or impacts on quality of life.

More importantly, there are huge differences when it comes to prognosis. As a consequence, one cannot describe for example breast cancer as one disease; this is also true for leukaemia in adults where there is a tremendous number of subtypes (based on the consultations with ECHA experts). Overall, when one intends to value specific cancer risks realistic scenario can be described, but this scenario can't cover more than a fraction of the disease (same consultations).

Our team in agreement with ECHA project officers therefore decided to base valuation of health outcomes related to the carcinogens-health endpoint on anxiety and risk of general cancer without specific description of any organ affected.

In further stage of the pre-survey, we tested a description of general cancer that became a base of our final valuation scenario (see description of general cancer in Appendix 1).

1.3 The health outcomes in our Study

In our valuation scenario, we decided to work with two cancer-related probabilities and two effects conditional to getting cancer, that are as follows (for details see below).

Characteristics	*Description and possible values*
Chance of getting cancer	*Chance of getting cancer within the next 5 years.*
Chance of survival at 5 years (if you get cancer)	*Chance of being still alive after 5 years from the diagnosis, if you get cancer.*
Effects on everyday activities (if you get cancer)	*Fully active – No heavy physical work – Unable to work – Confined to bed half of the time*
Pain (if you get cancer)	*Pain during cancer treatment, recovery from treatment, or any other times*

Our valuation scenario offered

- **reducing respondent's chance of getting cancer** within the next five years, and/or

- **improving respondent's chance of surviving** if she/he does get cancer.

We point out that

- neither of these actions would remove cancer risks entirely. There would **always be some chance of getting cancer or dying from it**, even if these actions were implemented;

- these would be **individual actions** that the respondent would undertake himself/herself;

- the respondent would be **the only person** whose cancer risks and survival would be affected. These actions would not affect the cancer risks and survival of other members of the respondent's family.

Getting cancer

Our first outcome is based on the incidence, i.e. the probability of getting cancer.

We use data on the age-specific incidence rates for the EU for both sexes expressed as the number of cases per 100 000 persons a year (based on EUREG). Following information was provided:

According to European Union-wide health statistics, the incidence of cancer, which means the chance of getting it for the average person, is 24 in 1 000 over five years. This means that 24 out of 1 000 people will get cancer in next five years.

The figures above are averages based on the entire population, but in practice the chance of getting cancer depends on age. The older one is, the more likely he or she is to get cancer.

As shown in the graph below, for a 48-year-old the chance of getting any type of cancer in the next 5 years is 25 in 1 000. For a 62-year-old person, this chance is over twice times as large: It is 61 in 1 000.

Chance of getting cancer by age group

out of 1,000 over five years

Age group	Value
20-29	2
30-44	6
45-60	25
61-69	61
70-79	92
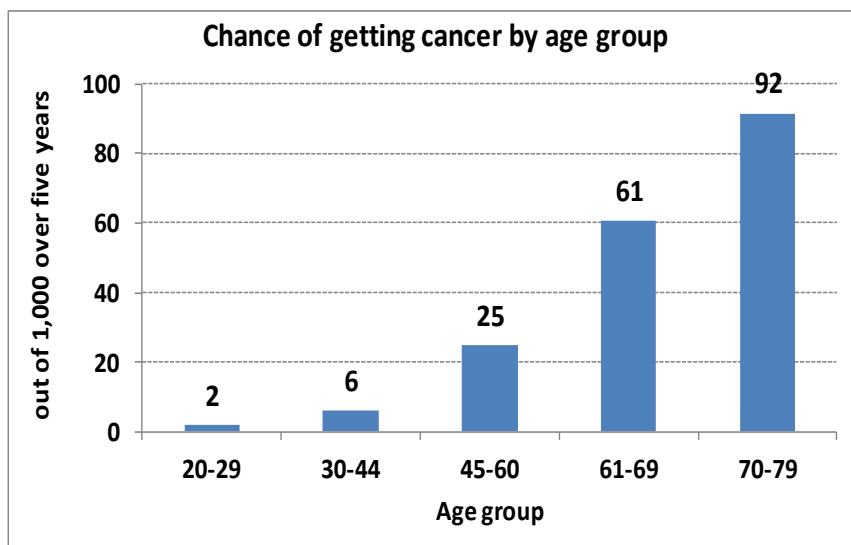
Surviving cancer

Next health outcome valued in this study is based on the survival and following text was provided.

Cancer is often a serious illness, but not everyone who gets cancer dies from it. Depending on how slow-growing or aggressive the cancer is, how early it is caught, and on the treatment(s) selected, in many cases cancer can be treated successfully.

Again, the chance of survival has been found to depend on age. As shown in the graph below, younger people (up to age 45) are more likely to survive cancer: 72 % survive for at least 5 years. The remaining 28 % will die within 5 years from the time of the diagnosis.

The odds are very different among older people. Among people 75 years old and older who were found to have cancer, only 24 % will survive after 5 years, and the remaining 76 % will die within 5 years.

Cancer survival rates at 5 years from diagnosis

Age group	Value
less than 45	72%
45-60	60%
61-74	44%
75 and more	24%

Now that we have explored cancer-related chances, please keep in mind that
- *only a relatively small share of all people get cancer next five years, and*
- *people who get cancer may survive cancer but still die from other causes.*

Pain and effects on everyday activities

When valuing the actions that would reduce one or the other probability or both, we asked a respondent to imagine all possible consequences of getting cancer. We specifically described several possible consequences of getting cancer for him/her and his/her quality of life, including…

- the effects on **everyday activities** and

- **pain**

By the effects on everyday activities we mean ability to continue **working, studying, doing housework, taking care of children or dependents,** doing **leisure activities or sports, taking care of yourself** (such as bathing, getting dressed, etc.), **walking as usual, going shopping or preparing your meals.**

We considered five possible degrees of impacts on everyday activities, similar to the quality-of-life measured by Karnofsky Performance Scale (as already used by Lang, 2010).

Fully active	*= you are fully active and more or less as you were before your illness*
No heavy physical work	*= you cannot carry out heavy physical work, but can do anything else*
Unable to work	*= you are up and about more than half the day and can look after yourself, but are not well enough to work*
Confined to bed half of the time	*= you are in bed or sitting in a chair for more than half the day and you need some help in looking after yourself*
Confined to bed all the time	*= you are in bed or a chair all the time and need a lot of looking after*

In the questionnaire we considered only two possible levels of pain:

- **mild** pain and

- **moderate** pain.

These impacts may be felt during cancer treatment, during recovery from treatment, for a long time, or even for as long as one lives—no one really knows ahead of time the duration of these effects.

Other consequences of getting cancer

We highlighted that "*no one can really predict what your level of anxiety or depression would be, or their effect on your personal or social relationships. For that reason, we will leave those unspecified in the scenarios that we will ask you to evaluate*".

However, before presenting our valuation exercise, we presented how cancer can affect quality of life.

In general, when people get cancer, they may have to undergo treatment and the quality of their life may be affected in many ways. Following information was presented. Afterwards we asked each respondent to rate how she/he is concerned about each of them (q. E1).

Based on medical research, cancer may have a number of effects and consequences on quality of life, including…

Aspect or consequences
Usual activities *– slight or severe problems may occur with usual activities, such as working, studying, doing housework, taking care of children, performing leisure activities, doing sports, preparing meals, shopping, and bathing and getting dressed ("self-care").*
Impossibility to practice self-care *– In extreme cases, one may be completely disabled and thus unable to do any of the usual activities – not even bathing and getting dressed, or walking for short distances. Some other people have reported virtually no disruption of usual activities. Others had to restrict daily activities only for a limited period of time, such as when they were undergoing treatment or recuperating from surgery*
*Inability **to take care of children, elderly parents or other dependents***
*In some cases, cancer can lead to **anxiety** and **depression**.*
*Some cancers can be very **painful**; others, less so. Treatment may be **painful** as well. Pain medication is usually given to help manage pain.*
*Treatment may be **uncomfortable**, cause nausea, dizziness and weakness.*
*Some people who have cancer feel that their illness makes them **socially isolated** (cancer can restrict social life, disrupt interactions with family and friends)*
*Cancer may force people to **miss work** because of treatment, recovery time and illness – to the point that one may no longer be able to keep his or her job.*
*Even if cancer was treated or removed, one may worry all the time about the possibility of it **coming back** after treatment.*

Not everyone experiences consequences this severe, however. Some people report that cancer did not cause any particular restrictions, and that they were able to continue working. Others have noted that they relied on family and friends for their support while undergoing treatment and recovering from the illness.

2   Review of the valuation literature (state-of-the-art)

Valuation of cancer risk and cancer treatment has attracted considerable attention over last 20 years as our review has identified around 50 valuation studies on cancer risks and conditions. These comprise both stated and revealed preference studies varying considerably in valued risk(s)/endpoint(s), context, attributes, sample size, elicitation techniques and other characteristics.

A number of issues were addressed in those studies, including the following that might be of relevance for the objective of our study:

- evidence for cancer differential according to dread, affected individual (self, child, other adult) and the type of cancer (i.e. affected organ) in valuation of mortality risk as expressed in value of statistical life (VSL) or marginal rate of (technical) substitution (risk-risk trade-off studies);
- treatment of morbidity (or non-fatal cancer), VSC/VSL ratio, and latency in cancer valuation;
- cancer profile description and generalizability of illness characteristics;
- WTP for treatment from health technology assessment (HTA) and (lower bound) WTP from hedonic price studies;
- scope of the temporal and spatial benefit transfer.

In total 53 WTP studies on cancers were identified, 45 of them employing stated preferences approach, 7 revealed preferences and one comparing both approaches. Most frequently studies originate from the US (23 studies), followed by Canada and the UK (5 studies each), Taiwan, Japan and Korea (4 studies each). In Europe, respondents from the UK, Italy, Denmark, Ireland, the Czech Republic, Portugal and Switzerland were surveyed.

Overall, 20 studies dealt with unspecific cancer, SP studies often in conjunction with other health outcome(s) (car accident death, respiratory and/or cardiovascular illness etc.). Among specific types of cancers, lung cancer was most frequent (12 studies), followed by skin cancer (7 studies), leukaemia (3 studies) and other (mainly organ) cancers (colon, bladder, uterus, colorectal, stomach, ovarian, lymph etc.).

2.1   Mortality risk differential for cancers

A common metrics of mortality risk reduction has traditionally been value of statistical life (VSL) but at least since the seminal work of Jones-Lee and colleagues (1985) it is hypothesised that people do "make significant distinction between different ways of dying and would be willing to pay substantial sums to avoid protracted period of pain prior to cancer death" (Jones-Lee, Hammerton, & Philips, 1985) what has been termed as **"cancer premium"**.

Cancer is associated with suffering and pain, and is highly dreaded (see Starr, 1969; Fischhoff et al., 1978; Slovic, 1987), which is often taken to imply that the VSL should be greater when the cause of death is cancer (Revesz, 1999; US EPA 2000). Some studies have found that people favour programs that reduce cancer mortality (e.g. Jones-Lee et al., 1985; Mendeloff & Kaplan, 1989; McDaniels et al., 1992; Savage, 1993; and Tolley et al., 1994), and others report no such cancer "premium."

In Magat et al. (1996), the median respondent was indifferent between reducing the risk of terminal lymph cancer and reducing the risk of automobile death, whereas terminal lymph cancer risk is about 1.33 worse than the risk of curable lymph cancer (and automobile death). Using a similar approach (risk-risk questions), Van Houtven et al. (2008) find that individuals have a strong preference for avoiding cancer risks, but that this preference wanes as the cancer latency period increases. Chilton et al. (2006) use a variant on the "risk-risk" approach to identify the separate effect of (contextless) baseline risk and dread effects for various risks, including the risk of dying in a pedestrian accident, automobile driver/passenger accident or murder. The respondents in their study reported substantial dread for certain types of death (especially for rail accident, fire in a public place and drowning), which in some cases was cancelled out by the low baseline risks.

None of the abovementioned studies estimated the VSL directly. The few studies that have attempted to value mortality risk reductions have found surprisingly little evidence that the cancer VSL is higher than the VSL for other causes of death. In a contingent valuation study in Taiwan, Hammitt and Liu (2004) find that the WTP to reduce the risk of cancer is about one-third larger than that to reduce the risk of a similar chronic, degenerative diseases. However, the coefficient on the cancer dummy is not significant at the conventional levels. Likewise, Hammitt and Haninger (2010) elicit the WTP to reduce fatal-disease risks in adults and children caused by consuming pesticide residue in foods. They find that the WTP for cancer and non-cancer diseases is similar to the WTP to reduce motor-vehicle crashes. One possible reason for these empirical findings is that low baseline risks may offset the effect of dread (or other perceptions) on the VSL (Chilton et al. 2006).

Tsuge et al. (2005) conducted conjoint choice experiments where the alternatives are defined by four attributes: cost, the size of the risk reduction, the type of risk (all causes of death, accident, cancer and heart disease) and latency. Tsuge et al. (ibid.) elicit the respondent's perceptions along many dimensions, including what they term "controllability" ("Government can reduce this risk"), "dread" ("Pain accompanies this risk" and "This risk is terrible."), a subjective assessment of exposure and subjective assessments of public and private knowledge. Tsuge et al. (ibid.) conclude that "it is almost unnecessary to adjust the VSL according to the difference in the type of risks if the VSL is adequately calculated."

US EPA (2010) in a recent draft White Paper suggested the term ***cancer differential*** as a more general reference to cancer premium. The differential is posited as "capturing elements of dread and fear of cancer, as well as pain and suffering from the period of illness preceding death. It might also include income and household productivity losses over this period of morbidity" (ibid.).

There is growing empirical and theoretical evidence suggesting that valuation of mortality risk reduction has not "one-size-fits-all" measure (Ackerman & Heinzerling, 2002; Sunstein, 2004) and that the risk reduction values are "individuated" (Scotton & Taylor, 2011). In CBA praxis such adjustment for cancers to default mortality risk reduction value (VSL) is sometimes applied, but no adjustment of VSL base values was recently recommended for OECD countries based on a throughout meta-analysis undertaken showing no clear evidence of a cancer premium in the VSL estimates (OECD, 2012, p. 70).[1] Also a recent US EPA's Scientific Advisory Board review of draft White Paper on Valuation of Mortality Risk Reduction for Environmental Policy (US EPA, 2011) is relatively cautious about proposed 50 % differential for cancer. US EPA's SAB instead suggests exploring 4 methods to estimate distribution of appropriate VSLs for relevant cases in developing: (1) independent estimates for relevant causes, (2) baseline distribution of estimates and set of adjustment factors for risk and individual characteristics, (3) meta-regression model of VSL as a function of risk and individual characteristics, and (4) estimating a structural preference function. Evaluation of different approaches should take account for fit with results from high-quality studies for given context and intuitive plausibility of the patterns of VSL distributions across context.

Since Jones-Lee et al. a number of stated preference studies have explored the cancer differential hypothesis but reached rather ambiguous conclusions:

- Savage (1993) finds significantly higher WTP for cancer (2-3 times);
- Magat, Viscusi and Huber (1996) in a risk-risk study found a median subject to be indifferent between death from lymph cancer and death from an automobile accident;
- Shackley and Donaldson (2002) find significant differences between mean WTP for the cancer programme and the other two programmes;
- Hammitt and Liu (2004) conclude that their results suggest cancer premium (approx. 30 % vs. non-cancer degenerative disease) but the result is not statistically significant at the conventional levels;
- Tsuge, Kishimoto and Takeuchi (2005) study finds about 20 % cancer premium but infers no necessity to adjust VSL according to the difference in the type of risks;

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[1] In fact, a cancer premium was found in meta-analysis of full unscreened dataset, but not in quality-screened models, cf. (OECD, 2012, p. 132).

- Van Houtven, Sullivan and Dockins (2008) in a risk-risk trade-off study find significant cancer premium (approx. three times over auto accident death at 5-year latency);

- Hammitt and Haninger (2010) study finds no statistically significant differences in WTP between cancer and other diseases, or with respect to the affected organ;

- Alberini and Ščasný (2011) study finds that VSL varies by cause of death with a premium for cancer up to 150%;

- Adamowicz, Dupont, Krupnick and Zhang (2011) find a modest cancer "discount" (about 15 %) in a trade-off between bladder cancer risk and microbial death risk reduction in drinking water;

- Chestnut, Rowe and Breffle (2012) study finds cause of death (cancer vs. heart attack) not significant;

- Cameron and DeShazo (2012) and Cameron, DeShazo and Johnson (2010) study is rather difficult to generalize but death risks from heart attacks and heart disease are valued similarly to some of cancer risks (breast or prostate cancer), but other cancers are valued differently (see below).

2.2 WTP for self vs. own child or other adult(s)

There is rather mixed evidence with respect to WTP for risk reduction for child or adult and respondent himself/herself or other member of his/her household. The OECD VSL meta-analysis recommends no adjustment due to limited evidence and unresolved issues (OECD, 2012). Usually, WTP for children is elicited in parental perspective (OECD, 2006), i.e. asking parents on their WTP for risk reduction for their child.

Dickie and Gerking (2003) found that parents are willing to pay 2.5 times more to reduce non-melanoma skin cancer risks to their children than to themselves and that parents form beliefs about their children's risk through their beliefs about risks to themselves. Dickie and Gerking (2007) on the other hand in an extension of the same study conclude that the marginal rate of substitution between child and adult health is one and also that parents reduce protective expenditures per family member when more children are present.

Hammitt and Haninger (2010) found a VSL about USD 6-10 million for the respondent or another adult in the household and about USD 12-15 million for a child in the household, but also insensitivity of WTP to the number of people protected in the whole household risk reduction question.

Alberini and Ščasný (2011) found no statistically significant difference in VSL for child vs. adult in Italy, but about 30% higher VSL for child than VSL for adult in the Czech Republic.

Li et al. (2012) in an ex-post setting find that patients treated for prostate cancer stated lower WTP for a hypothetical new drug than their family members.

2.3 Cancer risks attributes

Latency

A terminological distinction related to carcinogen exposure and cancer occurrence should be highlighted, i.e. latency and cessation-lag. Latency is the time between initial exposure and increased cancer incidence while cessation-lag refers to reduced cancer incidence after a period of time. The distinction between latency and cessation-lag can be illustrated by an example of cigarette smoking – the latency between initiation of exposure and an increase in lung cancer risk is approximately 20 years. However, after cessation of exposure, risk for lung cancer begins to decline rather quickly.

While some recent studies (Alberini & Ščasný, 2011; Hammitt & Haninger, 2010) find near-zero discount rate over latency period, the study of Hammitt and Liu (2004) finds WTP declining with the latency (discount about 1.5% per year), Tsuge et al. (2005) find discount rate for latency of effect of about 20% per year, and Van Houtven et al. (2008) find that cancer premium declines with the length of the cancer latency period reaching indifference at 30+ years of latency. Cameron and DeShazo (2012) and Cameron et al.(2010) also find WTP declining with latency (and at higher rate for older respondents).

Private vs. public good

Itaoka, Krupnick, Saito, and Akai (2007) study finds only insignificant WTP premium for public-good context but substantially larger implicit rates of time preference in the private-good context. In contrast, Alberini and Ščasný (2011) find premium for public programmes of about 20% (if the programme is considered effective). The OECD VSL meta-analysis in this case recommends no adjustment of VSL due to limited evidence and unresolved issues (OECD, 2012)

2.4 Cancer type, illness description, cancer morbidity

Cancer type

Relatively few studies focused directly (in a single study) on effect of cancer type on valuation of mortality risks. Van Houtven et al. (2008) study finds higher WTP for cancers that are more familiar to respondents. This conforms in more general setting (cancer vs. non-cancer risks) to Savage's (1993) finding that the less people are informed about the risks of a particular hazard the less they are willing to spend.

Hammitt and Liu (2004) conclude that WTP depends on the affected organ (liver vs. lung cancer) and also on environmental pathway.

Cameron and DeShazo (2012 and Cameron et al. (2010) study provides different values for different cancers and concludes that "some cancers are of much greater concern than others", with WTP for reduction of colon cancer risk being somewhat lower than for breast or prostate cancer. Interestingly, they find that smokers have twice as high WTP (and the highest WTP overall) for lung cancer risk reduction vs. non-smokers. The study also suggests a striking decline of non-smokers' WTP for latent lung cancer (micro)risk reduction with age from USD 2.36 for the 30-year old to only USD 0.04 for the 60-year old.

Earlier study by Aimola (1998) finds a wide range of WTPs for different cancers (though using a small sample) as well, but also substantial insensitivity to the size of absolute risk reduction for respective cancers.

Cancer type, illness description

The literature review did not reveal any study that employed unspecified type of cancer with detailed description of symptoms, treatment and/or outlook. Two broad categories can be distinguished (not reflecting HTA studies) – (1) valuation studies with specific cancer types typically with several sentences to several paragraphs or overview table with description of symptoms, treatment and consequences, and (2) studies valuing "unspecified cancer" with no details on impacts (except for risk/mortality rates).

Specific cancers

Van Houtven et al. (2008) use relatively detailed separate descriptions of symptoms due to liver, brain and stomach cancer coupled with common description of treatment:

"Treatment with radiation, chemotherapy, or surgery can often help to slow the progress of the disease, but they can also cause side effects such as pain, nausea, vomiting, diarrhoea, and hair loss. They also weaken the immune system, which makes one more vulnerable to other illnesses like pneumonia. In cases of fatal [stomach/liver/brain] cancer, these treatments do not cure the disease. Even with treatment, most patients survive for only a few years after the first symptoms appear."

Magat et al. (1996) provide details about affected organ, symptoms, treatment and effects on quality of life in their description of lymph cancer. These were: chance of death in 5 years, hospitalization, surgery, constant pain, loss of mobility outside home, loss of strength and feeling, restricted recreational activity, occasional nausea and loss of energy.

Hammitt and Liu (2004) use only a brief description of lung and liver cancers with information on cause, acute or latent (20 years to onset of symptoms) development, and decline in life quality and death in 2-3 years.

Hammitt and Haninger (2010) study uses a description of valued risk using name and affected organ, latency, symptom description (if provided) and asks for rating of such health status by the respondent using EQ-5D and VAS. Half of the sample was provided with detailed symptom descriptions – paragraphs of approximately 150 to 200 words that included descriptions of pain, limitations in mobility, self-care and other activities and need for hospitalization. They found that the WTP is about 1.5 times higher when symptoms (irrespective whether cancer or other risk) were described than if they were not.

Cameron and DeShazo (2012) and Cameron et al. (2010) study constructs illness profiles as a time sequence of health states associated with a major illness described in terms of onset, recovery/life expectancy, two levels of pain and disability. The authors note that they seek to estimate demand for health risk reductions "conditional on people's ex ante information about all of these health risks".

Jeanrenaud and Priez (1999) use description of the consequences of lung cancer in their CVM study using the following characteristics – typical age, symptoms, treatment, drugs required, discomfort and undesirable effects, work-related impact, impact on life style, psychological impact, impact on close relatives, life expectancy.

Gyldmark and Morrison (2001) present illness descriptions using cards showing incidence, population at risk, symptoms, consequences of no treatment, treatment, and treatment outcome.

Adamowicz et al. (2011) study uses a screen describing symptoms of bladder cancer and baseline risk and showing trade-off between the (more immediate) beneficial aspects of reducing microbial contaminants and the potential adverse (and long-term) effects in terms of increased risks of contracting bladder cancer.

Subramanian and Cropper (2000) in a study on public choices between qualitative characteristics of live-saving programs and lives saved find that qualitative characteristics (voluntariness, controllability, seriousness, personal risk, efficacy, appropriateness, fairness, lag before program saves lives) do matter, but involuntariness and uncontrollability do not seem to matter much in explaining choices.

Unspecified cancer

Tonin, Alberini and Turvani (2009) asked respondents in a survey on valuation of risks from contaminated land about cancer perception and effectiveness of behaviour in reducing cancer risks but giving no other information on cancer.

Tsuge et al. (2005) elicit subjective perception of voluntariness, controllability, dread (pain), dread (fear), severity and exposure. No further details about cancer were provided, only latency was used as an attribute of the choice experiment.

Chestnut et al. (2012) study eliciting WTP for preventive programmes showed only information on annual mortality rates for adults in 10-year age groups (for all causes and for selected causes of death).

Alberini and Ščasný (2011) provided respondents with tutorial to probability, risk reduction options and basic information about three causes of death (cancer, respiratory illnesses, road-traffic accidents).

Cancer morbidity

Number of studies value the reduction of risk of contracting cancer without separating out the WTP to avoid the ill health associated with cancer from the risk of death. This not only makes difficult to compare results across different cancer types, but also complicates the identification of any cancer premium. The OECD VSL meta-analysis assumes separability of morbidity costs and recommends accounting for them separately.

Magat et al. (1996) report morbidity component of curable lymph cancer to be worth 0.58 times the value of an equivalent reduction in the risk of an automobile death. Adamowicz et al. (2011) find a value of statistical case of cancer illness of about 20-50 % of cancer VSL depending on the econometric model chosen.

Bosworth, Cameron and DeShazo (2009), while using estimated marginal rates of substitutions between avoided illness/deaths (micro-risk reductions, i.e. 1 in a million) and yearly cost of public programme, derive median WTP per illness avoided and WTP per death avoided at USD 0.49 and USD 2.94 respectively for unspecified cancer, USD 0.56 and USD 3.91 for leukaemia in children, USD 0.8 and USD 3.48 for colon/bladder cancer, USD 1.54 and USD 3.91 for leukaemia and USD 1.69 and USD 3.36 for lung cancer.

2.5 WTP and other metrics

SP/HTA studies on cancer treatment

A number of studies have estimated individuals' WTP for improved cancer treatment or health care programmes. However with regard to objective of our study, they provide only partial insights into individuals' ex-ante WTP for avoiding or reduce their risks of contracting cancers in the future.

Gyldmark and Morrison (2001) conclude that respondents affected by any of the diseases (mild hypertension, old persons' diabetes, broken wrist, uterus cancer) do not have significantly higher WTP compared to non-affected respondents.

Shackley and Donaldson (2002) study explores marginal approach to eliciting WTP (for cancer and two other programmes) but finds that marginal approach did not result in a reduction in the relative high number of preference reversals (i.e. inconsistency between the explicit ranking of the programmes and the implied ranking from WTP values).

Yasunaga, Ide, Imamura and Ohe (2007) in a CVM study on mammography screening report that provision of information about false positives (what authors term anxiety) significantly decreases the WTP, while Yasunaga, Ide, Imamura and Ohe (2006) in similar study on positron emission screening (PET) for cancer found no statistically significant difference between the WTP from two groups with only one told about false positive/negative results possibility.

Weston and Fitzgerald (2004) find sizeable WTP for methyl aminolevulinate photodynamic (MAL) vs. surgery treatment of basal cell carcinoma, primarily driven by improved cosmetic outcome (scars).

Lang (2010) in a CVM study on lung cancer patients in Taiwan found that the healthier the patients were the less they wanted to pay; also quality-of-life measured by Karnofsky Performance Scale (in contrast to EQ-5D) as well as family care, income and gender are significant factors in explaining WTP.

Health utility metrics and WTP

We have identified just two studies (one on WTP for cancer mortality risk reduction and one on WTP for hypothetical cancer treatment) that employed quality of life survey (both using EQ-5D) to derive health utility index to be used in regression analysis of WTP.

Hammitt and Haninger (2010) asked respondents to assess their current health and health conditional on having disease presented in the survey using EQ-5D and VAS, the composite HRQL index was estimated using the scoring rule developed for a large representative sample of the US population. A strong correlation between perceived health decrement and estimated WTP was found.

Lang (2010) used EQ-5D (along with WTP) elicited from respondents – lung cancer patients – and Karnofsky Performance Scale (KPS) determined by research nurses. While KPS was a significant predictor both for interval WTP estimates from dichotomous choice questions and for continuous data from subsequent open-ended WTP question, EQ-5D index value was not significant in any of the models presented in the paper.

3 Methods

3.1 Valuation methods

People do not trade health risks and especially mortality risks in market-places, therefore it is not possible to infer the value people place on improved safety from prices and quantities. Moreover, deriving the Value of Statistical Life or the willingness to pay associated with loss of welfare due to suffering, pain and other inconveniences is not a straightforward exercise and one needs to rely on non-market valuation techniques, which allow eliciting preferences of individuals. One approach is to observe the compensation required by workers to accept riskier jobs (Viscusi, 1993, Viscusi & Aldy, 2003). Many found several econometric difficulties and question the interpretation of the results from compensating wage studies (Black & Kniesner, 2003; Hintermann et al., 2010). Moreover, the health outcomes valued to date are quite specific and the technique does not lend itself to the valuation of other health risks specific for chemicals or for the environmental context (see Alberini et al., 2010).

Alternatively, it is possible to infer the values of preventive fatality by observing the expenditures incurred by people to reduce their risks of dying in an accident (e.g. Jenkins et al., 2001), the prices of vehicles with additional safety features (Andersson, 2005), the time spent engaging in protection (Blomquist, 1979), and other consumer behaviours (reviewed in Blomquist, 2003). Again, these health outcomes are quite specific and this valuation method does not seem to provide the means with which to derive WTP for the health end-points specified by our study.

There are several techniques based on the stated preference method to derive the benefit measures of health risk changes. Based on Carson and Louviere (2011), there are two main categories of the stated preference method that can be distinguished according to the elicitation methods that are utilized: in the first, *matching methods*, respondents are asked to provide a number that will make them indifferent in some sense. In the second, *the discrete choice experiments (DCE)*, the respondents are asked to pick their most preferred alternative from a set of options. The single-bounded or double-bounded dichotomous choice contingent valuation technique would then belong to the DCE methods, while contingent valuation using open-ended, payment ladder or bidding game as the elicitation format would classify as the matching method.

In our study we rely on **the discrete choice experiments method**. Specifically, we use a sequence of **binary discrete choice questions** (contingent valuation questions) with one of the options being the status quo.

The discrete choice experiments can simply be thought of as a decision-making situation among two or more alternatives described by different levels of their characteristic attributes of non-market goods valued (one of the attributes is typically a price). By repeating these hypothetical choices for each respondent with different values of attributes it can be assumed that the level of individual attributes determines the benefit of various alternatives and the respondent always chooses an alternative with the highest utility, as the attribute theory suggests (Lancaster, 1966). In this way the marginal rate of substitution between attributes may be inferred as well as monetary valuation of marginal changes in non-monetary attributes (Ryan et al., 2008).

In the discrete choice experiments, respondents are shown K ($K \geq 2$) alternative variants of a hypothetical good or policy described by a set of m attributes, and are asked to choose their most preferred alternative (Hanley et al., 2001; Bateman et al., 2002). The alternatives differ from one another in the levels taken by two or more of the m attributes. Price (or cost to the respondent) is usually one of the attributes, which allows the analyst to estimate the value people ascribe to the good or the monetized benefits of the policy.

The choice responses are assumed to be driven by an underlying random utility model.

3.2 Econometric model

We assume that respondents will select the risk-reducing alternative if their willingness to pay for the cancer risk reduction is greater than the cost of this alternative. We assume that the WTP in choice task j is:

(1)
$$WTP_{ij}^{*} = \alpha + \mathbf{QOL}_{ij}\boldsymbol{\beta} + PAIN_{ij}\gamma + DRISK_{ij}\delta + DSURV_{ij}\lambda + \varepsilon_{ij} \ ,$$

where i denotes the respondent, QOL is a vector of dummies capturing the quality-of-life impacts of cancer in scenario j, *PAIN* is a pain dummy, *DRISK* is the reduction in the chance of getting cancer stated to the respondent in scenario j, *DSURV* is the improvement in the chance of surviving cancer stated to the respondent in task j.

We do not observe *WTP**, but we posit that if the respondent chooses the risk-reducing alternative, then the willingness to pay for it, *WTP**, must be greater than the cost of that alternative. If we

assume that ε_{ij} is normally distributed around mean zero, the resulting statistical model for the response in choice task *j* is

(2) $\quad \Pr(Yes_{ij}) = \Pr(WTP_{ij}^* > COST_{ij}) =$

$$= \Phi(a + \mathbf{QOL}_{ij}\mathbf{b} + PAIN_{ij} \cdot g + DRISK_{ij} \cdot d + DSURV_{ij} \cdot l + COST_{ij} \cdot m)$$

where $\Phi(\ )$ denotes the cdf of the standard normal variate.

Respondents engaged in a total of seven choice tasks. Assuming that the error terms ε_{ij} are identically distributed and that the correlation between any two of them is ρ, the appropriate statistical model is a random effects probit. All results in this paper deploy random effects probit models.

Equations (1) and (2) can be used to derive the value of a statistical case of cancer (VSCC), namely the WTP for a unit change in the risk of developing cancer. For a given pain level and quality of life impacts, and holding the chance of survival the same, the VSCC is

(3) $\quad VSCC_j = \dfrac{-(a + QOL_j \cdot \mathbf{b} + PAIN \cdot g + 1 \cdot d)}{m} \cdot \dfrac{1000}{0.2}.$

In (3) we divide by 0.2 and multiply by 1 000 because the risk of getting cancer and the reduction in this risk is presented to the respondent as *X* in 1 000 over five years. The mean WTP for each subsequent reduction in the risk of getting cancer is $(-d/m) \cdot (1000/0.2)$.

We are also interested in the cancer Value of a Statistical Life. To estimate the cancer VSL, we first convert cancer risks and survival rate changes in the corresponding annual change in the unconditional risk of dying from cancer (*DUNCMORT*), and express the WTP for a risk-reducing alternative as:

(4) $\quad WTP_{ij}^* = \alpha + \mathbf{QOL}_{ij}\boldsymbol{\beta} + PAIN_{ij}\gamma + DUNCMORT \cdot \theta + \varepsilon_{ij}.$

The model of the responses is now a random effects probit with QOL, *PAIN*, *DUNCMORT* and *COST* as the right-hand-side variables.

(5) $\quad \Pr(Yes_{ij}) = \Pr(WTP_{ij}^* > COST_{ij}) =$

$$= \Phi(a + \mathbf{QOL}_{ij}\mathbf{b} + PAIN_{ij} \cdot g + DUNCMORT_{ij} \cdot t + COST_{ij} \cdot m)$$

The VSL is thus estimated as the coefficient on *DUNCMORT* from the random effects probit divided by minus the coefficient on *COST, multiplied by 1 000* because the change in unconditional

probability of dying (DUNCMORT) is computed in *X* in 1 000 over a year. The standard errors around the VSL (and the VSCC from equations (1) and (2)) are derived using the delta method.

(6)
$$VSL_j = -\frac{g}{m} \cdot 1000 \, .$$

Equations (1) and (4) allow for the WTP to depend on the pain and quality-of-life impacts of the cancer. But we further wish to see how individual characteristics of the respondents, familiarity with cancer, perceptions of the impacts of cancer and cancer risks affect the WTP. Equations (1) and (4) are easily amended to accommodate for additional regressors based on individual characteristics of the respondents or respondents' opinions and ratings. We estimate the basic models of the respondents separately for each country. We then pool the respondents and fit models with covariates and individual characteristics to the pooled data—but we include country dummies to allow for systematic differences in valuations across the four countries.

In the above models we assumed that the effect on quality of life and pain, if one gets a cancer, will directly influence respondent's indirect utility that is we considered QOL and PAIN as the labels in our econometric models. We further assume that respondent might get the utility from the effect on her quality of life and having pain only if one gets cancer. To capture the effect on the indirect utility we estimate the models augmented by the interactions of the changed risks (DRISK, DSURV, DUNCMORT) with QOL, or PAIN, variables respectively. The resulting statistical models (2) and (5) for the response in choice task *j* are as follows

(2a)
$$\Pr(Yes_{ij}) = \Pr(WTP_{ij}^* > COST_{ij}) = \Phi(a + \mathbf{b1} \cdot \mathbf{QOL}_{ij} \cdot DRISK_{ij} + g1 \cdot \mathrm{PAIN}_{ij} \cdot DRISK_{ij} + d \cdot DRISK_{ij} +$$
$$+ \mathbf{b2} \cdot \mathbf{QOL}_{ij} \cdot DSURV_{ij} + g2 \cdot \mathrm{PAIN}_{ij} \cdot DSURV_{ij} + l \cdot DSURV_{ij} + m \cdot COST_{ij})$$

(5a)
$$\Pr(Yes_{ij}) = \Pr(WTP_{ij}^* > COST_{ij}) =$$
$$= \Phi(a + \mathbf{b} \cdot \mathbf{QOL}_{ij} \cdot DUNCMORT_{ij} + g \cdot \mathrm{PAIN}_{ij} \cdot DUNCMORT_{ij} + \theta \cdot DUNCMORT_{ij} + m \cdot COST_{ij})$$

For a given pain level and quality of life impacts, and holding the chance of survival the same, the effect-specific VSCC value is derived as the derivative of the indirect utility as in (2a):

(3a)
$$VSCC_j = \frac{-(b \cdot QOL_j + g1 \cdot PAIN + d)}{m} \cdot \frac{1000}{0.2} \, .$$

4   The questionnaire and experimental design

4.1   The questionnaire structure

The questionnaire proper begins after we first gather information about the respondent's age and gender and the region he/she lives in (these variables are used to check quotas for the sampling). The survey questionnaire is divided into eight sections:

- A: Health status
- B: Probability tutorial
- C: Dread
- D: Cancer risks
- E: Effects of cancer
- F: Factors affecting cancer
- H: Valuation including de-briefing
- K: Socio-demographics

Section A collects information about the current and expected future health status of the respondent. It includes several questions adapted from the SF-36 battery and meant for assessing mobility, functionality and mental health.

Section B contains the probability tutorial, which relies on a well-tested graphical risk presentation device, a grid with 1 000 squares. Coloured squares represent the risks and are first scattered on the grid to convey randomness, then gathered to convey the size of the risks. In this section of the questionnaire, the adverse health event is an illness, such as the flu, cancer or diabetes. We test probability comprehension by asking respondents to indicate which one of two persons—person A, whose risk of getting an illness is 5 in 1 000, and person B, whose risk is 10 in 1 000—is more likely to get the illness over a specified period of time. We also discuss alternate ways to convey the size of risks using population equivalents and ask respondents to indicate which are the most meaningful to them.

Section C elicits the level of dread associated with a number of possible adverse events, such as dying in a road-traffic accident, a domestic accident, emergency surgery, cancer and others. Respondents are to indicate their level of dread on a scale from 1 to 5, where 1 means low or no dread and 5 means the strongest possible dread.

Section D focuses on cancer. We ask respondents to tell us whether they have ever had a benign tumour or/and cancer, and then we inquire about cancer among their closest family members and friends. We also ask them to tell us whether they feel that cancer runs in their family. After these initial questions, we move on to the quantitative aspects of cancer, which we break down into (i) the chance of developing cancer and (ii) the chance of surviving it, conditionally on getting it in the first place. We explain that the risk of getting cancer and the 5-year survival rate depend on the age of the individual, and we provide bar charts to illustrate risks and rates by age group. The age groups depicted in these bar charts are consistent with the sampling plan.

In section E, we discuss the effects of cancer on a person who gets cancer. We name possible limitations to usual activities, one's ability to continue to take care of himself/herself and others, mental health consequences, pain, the possible unpleasantness of cancer treatment, feelings of social isolation and the fact that cancer may force someone to miss work. We also inquire about people worrying that the cancer may come back after treatment. Respondents are asked to rate their concern about each of these possible consequences on a scale from 1 to 7, where 1 denotes little or no concern and 7 very high concern.

In section F, we ask people to tell us how important certain factors, such as genetics, lifestyle and diet, pollution, tobacco products and chemicals are in causing cancer and in affecting cancer survival. We also present examples of individual actions and government programs that affect the chance of getting cancer and cancer survival. Finally, we ask respondents to tell us how effective individual actions and government programs are, in their opinion, in reducing cancer risks.

Section H contains the valuation questions. As previously explained, these are a sequence of contingent valuation questions that are presented as the choice between the current situation and an improved situation. Improved situation means that the risk of cancer is reduced or cancer survival is improved or both—at a cost. The level of pain or quality of life impacts, should one get cancer, are kept the same as in the current situation. We ask respondents to engage in a total of seven such valuation questions. Debriefing questions are put at the end of the valuation section to ascertain the weight placed on each attribute, to allow for an opportunity to express disagreement with the valuation scenarios (i.e. protest votes), and to understand whether certain response patterns are legitimate or imply protest.

Section K elicits the usual socio-demographics and concludes the survey.

4.2   Discrete choice experiment

In our choice question we ask respondents to choose between one hypothetical action and the current situation. The current situation means that cancer risk and survival will be kept same as now. In order to disentangle the effect of gender and age, we computed the average baseline chances of getting cancer and of survival that were shown to all of our respondents. Due to the fact that these baseline probabilities vary across age, we restricted our sample to people between age of 45 to 60.

Before the choice question following information was provided to each respondent.

Let's now summarize the odds associated with cancer for your age group.
- *the chance of getting cancer is **25** in 1 000 over the next five years,*
- *the five-year chance of surviving is **60%**; this means that the probability of dying of cancer within five years from the diagnosis is **40%**.*

Here is an example:

	The Current Situation	*Option A (reduced risks)*
Chance of getting cancer over 5 years	*25 in 1 000*	*20 in 1 000*
Chance of 5-year survival (if you get cancer)	*60%*	*70%*
Effects on everyday activities (if you get cancer)	*No heavy physical work*	*No heavy physical work*
Pain (if you get cancer)	*Mild pain*	*Mild pain*
Annual cost for each of the next 5 years (total in parentheses)	*£ 0* *(in total £ 0)*	*£ 210* *(in total £ 1050)*

Then, seven choice questions followed, visualising the change in the probability of getting cancer at the grid with 1 000 squares and the change in survival on the graph, as shown below.

	The current situation	Option A (reduced risks)
Chance of getting cancer over 5 years	25 in 1 000	20 in 1 000
Chance of 5-year survival (if you get cancer)	60 %	70 %
Effects on everyday activities (if you get cancer)	Unable to work	Unable to work
Pain (if you get cancer)	Mild pain	Mild pain
Annual cost for each of the next 5 years (total in parentheses)	£ 0 (in total £ 0)	£ 210 (in total £ 1050)
Which would you choose?	The current situation	Option A (reduced risks)

- 1 in 1000 over 5 years chance of getting cancer
- reduced chance to get cancer

- 10% chance of 5-year survival
- increased chance to survive

In answering the choice questions, we asked the respondents to keep in their mind that...

- *all interventions are hypothetical, but we would like you to **answer as realistically and truthfully as you can**;*

- *please keep in mind that if you decided to pay for one of the proposed options, you would have **less money for other goods.** If the proposed options are important to you, but you judge them to be expensive, it might be possible for you to use your savings or borrow money to obtain them.*

- *If you choose to stay with **the current situation, you will pay no money** and get **no risk reduction**;*

- *the interventions would **reduce risks for you only**. No other household members or persons would experience the risk reductions coming with these interventions;*

- *as you move from the first choice exercise to the subsequent ones, please **do not regard the risk reductions and the payments as cumulative**. Please answer the choice questions as if each risk-reducing alternative was the only one you are making decisions about.*

Our discrete choice experiments consist of five characteristics, as described in the table below (Table 2).

Table 2 — Characteristics and their levels in the discrete choice experiment

Characteristics	Possible values
Chance of getting cancer within the next 5 years	Reduce the baseline by 0, 2, 3, 5 in 1 000 over 5 years
Chance of survival at 5 years from the diagnosis (if you get cancer)	Increase the baseline by 0%, 5%, 10%, 20%
Effects on everyday activities (if you get cancer)	Fully active No heavy physical work Unable to work Confined to bed half of the time
Pain (if you get cancer)	Mild pain Moderate pain
Cost per year for each of the next 5 years	ITA & NL UK CZ € 110 £ 100 CZK 2 000 € 225 £ 210 CZK 4 000 € 370 £ 340 CZK 6 600 € 540 £ 500 CZK 9 600

The costs in each of the four countries were expressed in national currencies, as shown above. The costs in British pounds and Czech crowns are based on the Euro values used in Italian and Dutch surveys by using purchasing power parity for individual consumption for 2012 (OECD.stat) and rounded.

Each respondent was asked to choose between one hypothetical action and the current situation *seven times*.

There is one *randomized experimental treatment* in the discrete choice experiments. In the first choice questions, a half of our respondents were asked to choose between a hypothetical option in that the chance of survival was increased, while the chance of getting cancer was always same as in the current situation (*QDsplit=2*). The chance of survival in the first three hypothetical situations was then same as in the current situation in the second half of our respondent (*QDsplit=1*). In the remaining four choice questions, the chance of both survival and getting cancer changed in all respondents.

We use *full factorial design to* create our choice sets for each of the two sub-samples separately. We posit the effects on everyday activities and pain are the same in the hypothetical and the current situation, but they may vary across the three choice cards. In total, it resulted in 112 variants of the choice sets that were blocked in 16 groups by 7.

5 The Survey

5.1 Pre-survey and pilot

The preparation of the questionnaire for ECHA III survey – Cancers – commenced in 2012 and the first draft was collated in autumn 2013. Meanwhile, several valuation scenarios based on organ-specific cancers were tested within 1-on-1 interviews with medical experts and team members. Since October 2013 to February 2014, 1-to-1 interviews with paper questionnaires were undertaken and based on the reports from the 1-to-1 interviews and comments of team members the questionnaire was modified. A fully electronic web version of the questionnaire was programmed in winter 2013 and testing and revisions continued.

The important part of the research was the pilot data collection to test and adjust functionality of the questionnaire. The pilot survey was carried out in two countries using CAWI data collection method. The pilot sample size was 106 respondents in the Czech Republic and 119 respondents in the United Kingdom.

The pilot survey was conducted between **February 25th and March 9th 2014**. Pilot was conducted on a sample of 276 respondents in the Czech Republic and in the United Kingdom, however, to speed up the implementation of the study, the analysis of data was performed on data collected by February 28th when majority of data were gathered (N=225). No significant problem was found in the instrument or in the experimental design.

5.2 Survey and sampling strategy

The survey was conducted in four EU countries, namely the Czech Republic, Italy, the Netherlands and the United Kingdom, using a computer-assisted-self-interviewing mode (CASI) and computer-assisted-web-interviewing approach (CAWI).

The respondents interviewed in the ECHA III survey on cancer risks were sampled from *general adult population between age of 45 and 60*.

To allow estimation of the EU-wide values for relevant health outcomes *the quotas* based on the country population characteristics were set.

Quotas were set in a collaboration of CUNI and IPSOS and include region, age, gender and household income (see Chapter 6). Within NUTS 2 / NUTS 3 interconnected quotas region and age and region

and education were applied. A problem with education categories was found in the United Kingdom. Only 3 educational categories were used because no national data (e.g. from National Statistical Office) are available; i.e. we relied on Eurostat data.

5.3   Programming the instrument

Due to the complexity of all the three instruments, we did not use any pre-programmed solution and decided to build our own instruments in-house. All three instruments were based on PHP framework Nette 1.9 and database system MySQL, both being widely used web technologies. The Nette framework is particularly useful in creation and validation of form elements as well as in setting up basic security layers.

The core of the application allows for translation of the instruments into multiple languages with a possibility to backtrack changes of the strings, it allows for a branched design of the questionnaire and for splitting the respondents into multiple samples and, furthermore, it allows the respondents to pause and continue later on, be it couple days later or from another computer. The system is also capable of real-time monitoring of pre-set socio-demographic quotas to ensure efficient data collection.

To allow for deeper analysis of the respondents' behaviour or for the identification of intentional speeders, every action of the respondents such as a page load and submitting of answers, including unsuccessful submitting of some answers (e.g. when not all required fields were filled in), is logged and can be revisited later.

The front end of the application had to fulfil the following criteria: width constrained to less than 1200px, usability on PCs as well as on tablets and cross-browser compatibility. As the instruments were designed to include interactive elements such as visual scales, the instruments use jQuery JavaScript library along with jqPlot plugin.

The data were automatically transferred to a central server and stored in a single database.

6   Data description

6.1   Data collection

The respondents were recruited from existing electronic panels maintained by IPSOS in the four countries and rewarded for completing the questionnaire. The electronic questionnaire was sent to respondents as a web link and was answered online. The main wave of the data collection took place between **March *20th and April 22nd 2014*.**

The final size of the cleaned dataset includes *3 888* respondents. Size of the samples in individual countries ranges between 824 (in Italy) and 1 293 (in the Czech Republic) respondents.

Table 3 — Sample sizes

	main wave	pilot	Total
Czech Republic	1 145	148	**1 293**
United Kingdom	733	128	**861**
Netherlands	910	-	**910**
Italy	824	-	**824**
Total	3 612	276	**3 888**

Overall, 8 556 members of the four country internet panels were contacted to participate in the survey. On average, the non-response rate was about 55 %, the highest in the Netherlands (66 %) and the lowest rate in the Czech Republic (22 %). Majority of the non-responses, about 46 % of contacted members of the four panels, was due to not allowing them to continue in the survey because of controlling the quotas. Less than 1 % closed the survey just after log in and 7 % finished the survey in some place during the interview. Almost nobody finished the survey during answering the choice questions (see Table **4**). In fact, excluding the contacted members of panels in order to have our samples country representative, the resulting non-response rate is 8 %, ranging from 5.4 % in Italy to 11.3 % in the Netherlands.

Table 4 — Number and percentages of non-responses

	CZ	UK	IT	NL	pooled

valid obs.		1 035	836	840	976	3 687
unfinished at the beginning		13	29	13	23	78
unfinished in the choice questions		1	0	2	3	6
unfinished at the filter		401	1 279	1 049	1 415	4 144
unfinished other		171	114	90	266	641
Total		**1 621**	**2 258**	**1 994**	**2 683**	**8 556**
Included in the dataset		1 293	861	824	910	3 888

	CZ	UK	IT	NL	pooled
non-response	**20 %**	**62 %**	**59 %**	**66 %**	**55 %**
not finished at the beginning	0.4 %	1.3 %	0.7 %	0.9 %	0.9 %
not finished at the filter (quota)	13.8 %	55.6 %	53.3 %	54.8 %	46.4 %
not finished in the choice questions	0.0 %	0.0 %	0.1 %	0.1 %	0.1 %
not finished other	5.9 %	5.0 %	4.6 %	10.3 %	7.2 %

The median time of survey completion was 22 minutes. If potential speeders are excluded, median time to complete the survey is 24 minutes (median time for Czechs is 28 min, 23 min for Italians and Dutch, and 22 min for Brits).

Table 5 — Time length of the interviews, in minutes

All interviews

	N	Mean	Median	Min	Max
pooled	3 888	293	22.3	4.6	38 952
cz	1 293	301	26.8	5.9	36 426
en	861	34	20.3	6.4	2 704
it	824	32	20.5	4.6	1 458
nl	910	763	20.7	5.9	38 952

it	672	25.9	22.3	13.1	89
nl	728	25.0	22.2	13.0	87

Speeders & interviews 90min+ excluded

	N	Mean	Median	Min	Max
pooled	3 201	26.8	23.4	13.0	90
cz	1 101	30.0	26.3	13.0	90
en	700	24.5	21.9	13.0	84

There are 180 interviews which took more than 2 hours. These were most likely interrupted since the average duration was 97 hours. As a consequence of these outliers, the average time was 4:53 hours. After excluding potential speeders (N=481) and the interviews that took longer than 90 minutes (N=180), the average time of the survey completion is 27 minutes and median is slightly more than 23 minutes. Czech respondents took the longest time to complete the survey, while Brits were the fastest to fill the questionnaires.

6.2   Data cleaning

Incomplete cases were deleted, 481 cases of respondents identified as potential speeders were labelled and removed from further analyses.

Table 6 — Share of potential speeders in answering the online questionnaire (for respondents in the main wave only) – fixed cut-off

	Valid cases	Valid cases with speeders excluded	Potential speeders (12:59)	Per cent (%)
Czech Republic	1 293	1 222	71	5.5
United Kingdom	861	721	140	16.3
Netherlands	910	685	131	16.9
Italy	824	779	139	14.4
Total	3 888	3 407	481	12.4

Those who completed the survey in less than 13 minutes were filtered out as ***speeders*** (see Table 6). The cut-off value is based on the values gathered in the pilot survey and on our experiment to behave as a speeder conducted by a few members of the project team and IPSOS employees. The cut-off point is the same for all four country subsamples.

All logical conjunctions in the questionnaires were verified and approved. There were some rare individual cases of filter errors in the web questionnaire, caused presumably by respondents clicking the back button. These cases were recoded as missing in concerned variables. There was no systematic inconsistency in the dataset or a case with substantial filter errors. The data were not weighted in any stage of the research.

Based on the recommendation of SSI (Survey Sampling International, 2013), a speeder is identified by completing the survey in 48 % of country specific median of total time, and as a consequence, the cut-off point is country specific. This strategy is followed in our alternative definition of the speeders.

Table 7 — Share of potential speeders in answering the online questionnaire (for respondents in the main wave only) – median based cut-off

	Valid cases	Potential speeders (48 % of median)	Per cent (%)
Czech Republic	1 293	68	5.3
United Kingdom	861	39	4.5
Netherlands	910	47	5.7
Italy	824	42	4.6
Total	3 888	196	5.0

6.3   Comparison of statistics with the quotas

The cleaned data without speeders were subsequently compared to original quota prescription for gender, age (2 categories), region (NUTS 3 in the Czech Republic and NUTS 2 in the remaining countries) and income country specific quotas (see Table 8 - Table 11 for gender and age just below). The achieved quotas varied less than 3 % from the original set up, with the exception of the Netherlands, where age quota differed by 3% and region quotas differed by more than 3% (2.3 – 9.8%). The quotas were tested by the goodness-of-fit chi-square test. The test did not reject the consistency of prescribed and achieved quotas for any quota variable.

Table 8 — Czech Republic

Gender	Set up quotas	Achieved quotas	Variance	Achieved number of respondents	Chi-square test (p-value)
Male	50.2 %	48.9 %	-1.3%	598	
Female	49.8 %	51.1 %	1.3%	624	
					0.38
Age	**Set up quotas**	**Achieved quotas**	**Variance**	**Achieved number of respondents**	**Chi-square test (p-value)**
45-54 y.o.	47.4 %	47.6 %	0.2%	582	
55-60 y.o.	52.6 %	52.4 %	-0.2%	640	
					0.87

Source: Czech statistical office 2011

Table 9 – United Kingdom

Gender	Set up quotas	Achieved quotas	Variance	Achieved number of respondents	Chi-square test (p-value)
Male	49.0 %	48.1 %	-0.9%	347	
Female	51.0 %	51.9 %	0.9%	374	
					0.64
Age	**Set up quotas**	**Achieved quotas**	**Variance**	**Achieved number of respondents**	**Chi-square test (p-value)**
45-54 y.o.	67.0 %	66.2 %	-0.8%	477	
55-60 y.o.	33.0 %	33.8 %	0.8%	244	
					0.63

Source: Eurostat 2011, Ipsos

Table 10 – Italy

Gender	Set up quotas	Achieved quotas	Variance	Achieved number of respondents	Chi-square test (p-value)
Male	49.0 %	48.9 %	-0.1%	335	
Female	51.0 %	51.1 %	0.1%	350	
					0.96
Age	**Set up quotas**	**Achieved quotas**	**Variance**	**Achieved number of respondents**	**Chi-square test (p-value)**
45-54 y.o.	67.0 %	67.6 %	0.6%	463	
55-60 y.o.	33.0 %	32.4 %	-0.6%	222	
					0.74

Source: Eurostat 2011, Ipsos

Table 11 – Netherlands

Gender	Set up quotas	Achieved quotas	Variance	Achieved number of respondents	Chi-square test (p-value)
Male	50.0 %	51.1 %	1.1%	398	
Female	50.0 %	48.9 %	-1.1%	381	
					0.54
Age	**Set up quotas**	**Achieved quotas**	**Variance**	**Achieved number of respondents**	**Chi-square test (p-value)**
45-54 y.o.	67.0 %	70.0 %	3.0%	545	
55-60 y.o.	33.0 %	30.0 %	-3.0%	234	
					0.79

Source: Eurostat 2011, Ipsos

6.4   Country sample descriptive statistics

6.4.1 Socio-demographics

Table 12 together with Table 16 present a set of descriptive statistics of the country samples. There are about even number of males and females. Mean age is 52 years. There are about 2.6 persons *(person)* from which there are 0.4 children under age 18 living in a household *(children),* with the highest share of children in the Italian sample. There are about 71 % of families in which no child under 18 is living (ranging from 60 % in Italy to 80 % in the UK). About 17 % are singles *(single)* and 34 % are couples without children *(couple)*.

Table 12 — Descriptive sample and population statistics

	Czech Republic		United Kingdom		Italy		Netherlands		pooled	
	N	mean	N	mean	N	mean	N	mean	N	mean
female	1 222	0.51	721	0.52	685	0.51	779	0.49	3 407	0.51
age	1 222	52.57	721	52.39	685	51.64	779	52.03	3 407	52.22
person	1 222	2.64	721	2.40	685	3.07	779	2.52	3 407	2.65
single	1 222	0.15	721	0.22	685	0.10	779	0.23	3 888	0.17
couple	1 222	0.36	721	0.40	685	0.24	779	0.35	3 888	0.34
childless	1 222	0.76	721	0.80	685	0.60	779	0.72	3 888	0.71
children	1 222	0.35	721	0.29	685	0.59	779	0.46	3 407	0.41
pincome	1 156	990	629	1 386	633	1 551	639	1 429	3 057	1 279
hincome, € PPP	1 123	1 581	603	2 096	624	2 095	624	1 953	2 974	1 871
hincome, curr.	1 123	26 968	603	1 982	624	2 144	624	2 173		n/a
pincmiss	1 222	0.05	721	0.13	685	0.08	779	0.18	3 407	0.10
hincmiss	1 005	0.09	545	0.18	595	0.10	575	0.23	2 720	0.14

Income data were asked as net monthly values, this should include all sources of income such as child support and other state support, interest, and other revenues. When asking information about income, we reminded the respondents that all answers will be treated confidentially. Respondents should choose one of 12 categories of personal income, or 10 categories of household income. Both

questions also included the option *"I would prefer not to answer"*, there was also the option *"I don't know"* when asking for household income. If a respondent preferred not providing this information, we showed him/her the following text: *"Please note that income is a key indicator for securing representativity of our sample. We assure you that all the information will be treated as completely confidential and anonymous."* and asked him/her for the second time to provide this information but with broader income categories (collapsing income categories into five, offering again the option not to provide this information).

Household income is distributed in ten income categories, with quite less filled lowest and highest categories. There are about 10 % of Czech and Italian respondents who did not know or would prefer not to answer, while this share is 19 % and 25 % among Brits and Dutch. The repeated asking resulted in income information from about 10 % of respondents who preferred not to answer on the previous question.

Table 13 — Household income, in %

Income category	Czech Republic	United Kingdom	Italy	Netherlands
1	3.1	6.8	6.1	4.0
2	6.8	8.3	9.8	8.2
3	7.3	7.9	7.7	6.6
4	8.3	5.3	10.6	9.9
5	11.5	8.6	9.2	9.2
6	13.1	8.4	11.4	11.0
7	12.7	8.6	7.7	9.2
8	10.5	11.0	9.8	10.1
9	12.3	9.0	10.6	5.2
10	4.6	6.8	6.2	1.7
Don't know	2.1	4.4	2.2	5.4
I would prefer not to answer	7.8	14.9	8.7	19.5

On average, monthly personal income is EUR 1 279 (PPP), Czechs have the smallest incomes (with a mean of EUR 990 PPP). Household income is almost EUR 1 871 (PPP), Czech have on average EUR 1 581 a month, while the mean in the remaining three country samples is about EUR 2 000 a month. About 10 % did not report their own net monthly income, and 14 % of those with more than one adult in family did not report their net monthly household income. Income expressed in PPS is recalculated from the amounts stated in the income categories in national currencies using

purchasing power standard for individual consumption for the year 2012 by Eurostat, that are CZK 17.0603, EUR 1.02356 in Italy, EUR 1.11216 in the Netherlands and GBP 0.945661. Incomes expressed in Euro by market exchange rate are based on the yearly average for 2013 as reported by Eurostat, CZK 25.98 and GBP 0.84926 per Euro.

With respect to respondents' marital status, major group of the respondents are married (ranging from 54 % in the UK to 65 % in Italy. Compared to other countries, Czech sample is characterised by the highest share of separate couples, there are also relatively more partners without a legal registration in the Italian sample and those living in registered partnership among Dutch.

Table 14 — Marital status (sample), in %

	Czech Republic	United Kingdom	Italy	Netherlands
Married	59.4	54.4	65.4	55.2
Registered partnership	0.8	1.3	0.6	4.6
Partner without a legal registration	0.9	3.9	5.7	1.0
Separated	19.1	12.5	5.4	12.5
Divorced	3.6	2.2	1.6	2.3
Widowed	3.5	14.6	12.4	12.6
Never married/ registered	10.7	9.9	8.5	9.9
Would prefer not to answer	2.0	1.4	0.4	1.9

The country samples differ significantly in the shares of individual employment categories. Most respondents declared gainful employment (summing up first three categories in the table above); the share of employed ranges between 72 % and 74 %, except Italy with about 67 % employed only. There is a higher share of employed in a part-time job in Italy (17 %) compared to Czechs (4 %). The share of self-employed is 7 % in Italy and between 10 % and 12 % in the remaining three countries. There are more housekeepers in the Netherlands and Italy (12-13 %), less in the UK (7 %) and only 1 % in the Czech Republic. Unemployed represent a share of 10 % to 14 %, but there are only 1 % unemployed respondents in Dutch sample.

Table 15 — Economic status

	Czech Republic	United Kingdom	Italy	Netherlands
Paid employment	56.3	34.3	38.7	31.5
30 hours a week or more	13.6	23.9	23.6	18.2
less than 30 hours a week	3.7	13.5	10.2	17.2
self employed	10.9	9.8	12.4	7.1
No paid employment	0.7	3.3	0.6	4.1
military service	0.2	0.3	0.6	0.0
retired	5.2	9.0	5.1	0.6
housewife	1.2	6.7	12.8	11.9
maternity leave	0.0	0.4	0.0	0.1
student	7.6	8.0	9.1	13.7
unemployed	14.9	10.3	1.0	13.1
disabled	1.1	2.8	1.8	3.2

Note: The columns do not sum to 100 % as multiple answers were allowed.

Larger share of Czech respondents live in small villages (up to 2 000 inhabitants). The share of respondents living in cities with more than 100 000 inhabitants ranges between 25 % and 30 %.

Table 16 — City size, in %

	Czech Republic	United Kingdom	Italy	Netherlands
up to 1 999 inhabitants	23.16	11.65	5.26	3.08
2 000 to 10 000	20.21	18.72	20.58	12.58
10 000 to 50 000	22.42	26.49	28.32	42.88
50 000 to 100 000	10.07	13.59	14.31	15.53
100 000 to 1 000 000	10.72	17.48	20.44	25.94
over 1 million	13.42	12.07	11.09	n/a

6.4.2 Respondents' health state self-assessment

In the initial part of the questionnaire, the respondents were asked about their health status. At first we asked to self-assessment of their health (using SF-36_1 question). Respondents from the UK felt to enjoy the most excellent or very good health (34 %). There are relatively more respondents who felt as in poor health in the Czech Republic and in the UK, about 10 % for both countries. Majority of the respondents (between 83 % and 92 %) however feel to enjoy very good to faint health.

Compared to one year ago, most of the respondents think that their health is now in general roughly same (about 60 %) or slightly worse (20 %). Only minor part of the respondents (2 % to 4 %) thinks that their health is now definitely worse than a year ago.

Table 17 — In general, would you say that your health is... (S36_1)

	Czech Republic	United Kingdom	Italy	Netherlands
Excellent	1.2	6.5	4.5	5.7
Very good	21.0	27.6	21.8	21.2
Good	41.6	35.1	43.4	43.9
Fair	25.7	20.9	27.3	23.9
Poor	10.6	9.9	3.1	5.4

Compared to respondents' present health, most of them think that their health status will be roughly the same in 5 years (40 % in CZ to 60 % in the UK) or slightly worse (20 % in the UK and 43 % in CZ). Only minor part of the respondents (3 % to 8 %) thinks that their health status will be definitely worse in 5 years. There are however 10 % of Czech respondents who think their health will be definitely worse.

Table 18 — Self-assessment of own health status now and in 5 years

	Compared to one year ago, how would your rate your health in general now?				Compared to your present health, your health status will be in 5 years?			
	cz	uk	it	nl	cz	uk	it	nl
Definitely better	3 %	5 %	4 %	7 %	2 %	6 %	5 %	4 %
Slightly better	8 %	12 %	10 %	14 %	6 %	11 %	10 %	13 %
Roughly the same	62 %	60 %	60 %	57 %	39 %	48 %	44 %	60 %
Slightly worse	23 %	21 %	24 %	18 %	43 %	27 %	37 %	20 %
Definitely worse	4 %	2 %	2 %	4 %	10 %	8 %	4 %	3 %

Same section of the questionnaire included also a subjective assessment of respondents' own overall health state using the visual analogue scale (VAS). VAS ranges between 0 and 100, where 100 indicates the best health the respondent can imagine. The following graph (

Figure 5) displays means and medians of the values stated by respondents.

Figure 5 — Mean assessment of health states (using VAS)
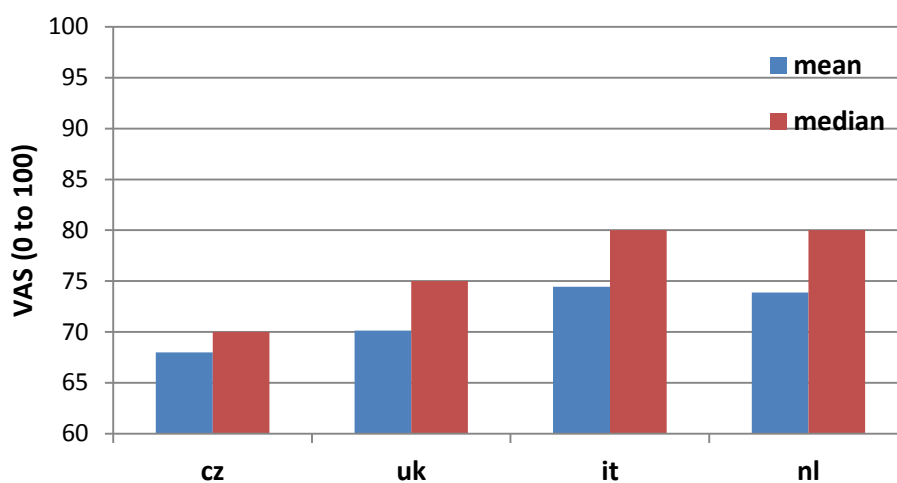
Note: 0 = worst health status you can imagine, 100 = best health status you can imagine

Using visual analogue scale to assess own health, we find that Czechs feel worst with respect to their own health (mean=68), followed by Brits (mean=70), while Dutch and Italians self-assessed their health with the highest scores (mean=74). These mean scores are a bit smaller than the scores we got in the ECHA-i study (74 in CZ and 78 in IT), but the VAS scores for respondents' health today stated initially in the ECHA-i study were allowed to be corrected after familiarization will all illnesses valued; the order of VAS means for the four countries are same in both studies, resulting in the lowest VAS scores in CZ and the highest in IT.

6.4.3 Experience with cancer

In the section focused on cancer, we start by asking on experience with cancer. This is apparently an important factor influencing preference for reducing cancer risks (Alberini and Ščasný, 2013). On average, about 17 % of the respondents have ever had benign tumour and 8 % have had malignant tumour or cancer. There is a slightly smaller share of those respondents in Italy (benign tumour) and quite a large share of Brits who have had malignant tumour (12.6 %).

Table 19 — Experience with cancer

	Czech Republic	United Kingdom	Italy	Netherlands
Have you ever had benign tumour	18.4 %	15.7 %	14.0 %	18.0 %
Have you ever had malignant tumour, or cancer	7.4 %	12.6 %	5.5 %	6.4 %
Have any of your closest family members (e.g., parents, siblings, spouse, or children) ever been diagnosed with cancer?	51.6 %	56.7 %	56.1 %	61.6 %
Do you believe that there is a predisposition to cancer in your family?	33.4 %	21.5 %	24.7 %	26.1 %
Have any of your friends ever been diagnosed with cancer?	68.2 %	65.3 %	71.7 %	61.9 %

About one fifth to one third of the respondents believes that there is a predisposition to cancer in their family. About 52 % to 62 % of the respondents have experienced cancer diagnosis among their closest family members (e.g. parents, siblings, spouse or children), with the largest share among Dutch and the lowest share among Czechs. There are even about two thirds of respondents with a friend who has been diagnosed with cancer (72 % in Italy, and 62 % in the Netherlands).

6.4.4 Probability tutorial

Section B aimed at tutorial on the notion of probabilities. In order to help to understand very small probabilities, we used a grid visual with 1 000 squares, same as we have done in our previous mortality risk valuation studies (cCASHh, VERHI). We placed a few blue squares on 1 000 white squared grid scattered at random and then next to one another to help respondents grasp just how large or small the chance is. To facilitate the understanding of such probabilities we used examples based on the city size. At the end we asked which of the above examples the respondent found the most helpful in understanding just how large or small the probability is. Next table (Table 20) reports the responses.

About one third of the respondents found the most helpful all our examples (29 % to 44 %). The grid with blue squares next to one another was preferred more than the one with scattered blue squares, especially among Brits. Only about 6 % (2 % in IT and 8 % in NL) found none of the examples helpful.

Table 20 — Example found most helpful in understanding small probabilities

	Czech Republic	United Kingdom	Italy	Netherlands	pooled
The grid with the blue squares scattered at random	17.3 %	16.4 %	20.3 %	15.7 %	17.3 %
The grid with the blue squares next to one another	26.4 %	39.5 %	27.6 %	21.3 %	28.2 %
The examples based on villages and cities	21.1 %	19.4 %	15.9 %	17.5 %	18.9 %
All of the examples	32.0 %	29.4 %	43.8 %	38.8 %	35.4 %
None of the examples	6.5 %	5.4 %	2.2 %	8.3 %	5.8 %
Another answer.	0.7 %	0.8 %	0.1 %	0.9 %	0.7 %

Note: The columns do not sum to 100 % as multiple answers were allowed (most of the respondents – at least 90 %, chosen one option only, however).

How the concept of probability in health was understood was quizzed by asking which one of the two people (Person A with the probability of getting illness of 5 in 1 000 or Person B with the probability equal to 10 in 1 000) has greater chance of getting the illness. The correct answer, Person B, was provided in the quiz by 70 % of Czechs and 82 % of Italians. If one considers the difference in probabilities to be very small, he/she can choose the option "The chance is the same"; this option was chosen by 9 % of Brits or 17 % of Czechs.

About 4 % of the respondents did not know which of the two persons has greater chance of getting the illness. However, there are another about 6.5 % of the respondents who chose the wrong answer – about 5 % among Italians and Dutch, but almost 9 % among Czechs. These respondents were defined as those who did not pass the quiz question and were dropped out from the analyses in some models.

Table 21 — Probability quiz

	Czech Republic	United Kingdom	Italy	Netherlands
Person A (5 in 1 000)	8.76	6.1	4.67	5.01
Person B (10 in 1 000)	69.64	80.86	81.61	76.77
The chance is the same	17.27	8.88	11.97	12.97
dk	4.34	4.16	1.75	5.26

We also wanted to make sure that we were clear when explaining the chance of getting cancer. After asking to examine the shown graph displaying the chances for various age groups carefully, we asked what the chance of getting cancer in the next 5 years for the respondent's age group is. The correct answer is 25 in 1 000 over the next 5 years.

Statistics of responses are displayed in the Table 22. Correct answer was provided by about 87 % respondents, except the Czech sample in which there are only 76 % of the respondents answering correctly. Due to the quite broad age categories we shown, respondents with age close to the age category boundaries might thought about adjusting their chance close to the value displayed in the graph for neighbouring age category. We therefore also displayed statistics for the chance between 20 to 24, 26 to 60, and just 61 (the chance for the age category 61 to 70 years old).

Table 22 — The chance of getting cancer in the next 5 years for respondent's age group

The chance in 1 000 over 5 years	Czech Republic	United Kingdom	Italy	Netherlands
0 to 19	5.24	1.66	2.34	3.47
20 to 24	1.89	0.7	1.02	0.78
just 25 (age 45-60)	**73.57**	**89.6**	**85.11**	**85.24**
26 to 60	5.62	2.64	3.22	3.87
just 61 (age 61-69)	9.33	3.47	5.11	4.75
62 and more (excl. 92)	3.6	1.67	2.64	1.56
just 92 (age 70-79)	0.74	0.28	0.58	0.39

6.4.5 Dreaded risk

Health problems or situations can be hazardous to one's health, or even fatal. We wanted to examine which of the situations listed in the table below (Table 23) are those that the respondents dread the most for the physical, psychological and social suffering they bring. We asked them to rate each of the health problem and situation on a scale from 1 to 5. We noted that by "dread" we do not mean how likely this situation is. Instead, we wanted the respondent to think of how much this situation scares him/her for the physical, psychological and social suffering it may bring.

First, we find that the respondents from the UK and from Italy are in general more scared, considering the mean value of all the rates, respondents from the Czech Republic follow. Dutch respondents ranked all health problems and situations by much lower scores than the respondents from the three remaining countries (on average by 1 point lower).

Table 23 — Dreaded risks

	Czech Republic	United Kingdom	Italy	Netherlands
Dying in a car or road traffic accident.	3.06	3.04	3.17	2.10
Dying in a domestic accident.	2.27	2.76	2.42	1.85
Surgery on an emergency basis.	2.92	3.01	3.21	2.20
Developing chronic respiratory illnesses (asthma, chronic bronchitis, emphysema).	2.73	3.31	2.99	2.26
Getting cancer.	**3.92**	4.05	**4.17**	**3.03**
Becoming paralyzed.	3.50	**4.18**	3.94	2.54
Having a heart attack.	3.57	3.71	3.64	2.70
Developing an illness that makes me completely dependent on being taken care of by someone else.	**4.04**	**4.43**	**4.27**	**3.24**

Note: The scale from 1 to 5, where 1 indicated low dread and 5 high dread. The two most dreaded risks are bolded.

The respondents considered *"developing an illness that makes me completely dependent on being taken care of by someone else"* the most dreaded risk in all four countries, while *"dying in a domestic accident"* is the least dreaded risk among the eight examined. *"Getting cancer"* is then the second most dreaded health situation (the third in the UK).

Respondents from Italy are highly dreaded due to getting cancer (75 % stated score 4 or 5), followed by respondents from the UK (73 %) and from the Czech Republic (65 %). Compared to other respondents, there are only 40 % of Dutch respondents who ranked cancer risk with 4 or 5 dread score. However, we highlight that Dutch respondents ranked all health problems and situations with lower scores than respondents from the three remaining countries.

Figure 6 — Dreaded cancer risks
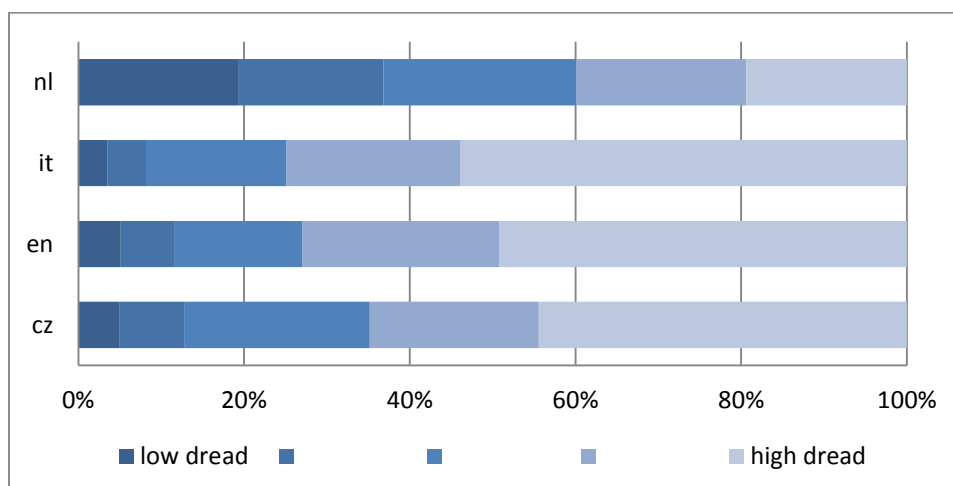
6.4.6 Perceived importance of factors and consequences of cancer

We investigated how important respondents believe certain factors are in causing cancer (or protecting from it) and in making cancer more or less "survivable" if one gets it. The responses are displayed in the Table 24.

The most important factor in <u>causing cancer</u> was considered not smoking (UK, IT, NL) and chemicals in consumer products (CZ). Next factors with respect to their importance are pollution (IT), preventive health care (CZ) and genetics (UK, NL).

Regarding the factors of <u>making cancer less or more survivable</u>, the most important one is cancer treatment (CZ, UK, NL) and not smoking (IT, UK), followed by preventive health care (CZ) and healthy and physically active lifestyle (IT, NL). Interestingly enough, pollution seems to be considered the least important factor in both making cancer survivable and getting cancer, except the opinion of the Italian respondents.

Table 24 — Importance of factors in causing cancer or making cancer 'survivable' (scored 4 or 5)

	how important this factor is in causing cancer				how important this factor is in making cancer more or less "survivable"			
	cz	uk	it	nl	cz	uk	it	nl
Genetics	78 %	**77 %**	79 %	**72 %**	63 %	63 %	70 %	58 %
Pollution	68 %	49 %	**89 %**	50 %	61 %	39 %	68 %	47 %
A healthy and physically active lifestyle	68 %	69 %	81 %	71 %	73 %	82 %	**89 %**	**81 %**
A healthy and fiber-rich diet	65 %	64 %	79 %	68 %	67 %	73 %	85 %	76 %
Not smoking	74 %	**86 %**	**89 %**	**82 %**	76 %	**88 %**	**89 %**	80 %
Avoiding environments where other people smoke	59 %	72 %	78 %	59 %	66 %	76 %	83 %	65 %
Preventive health care	**79 %**	67 %	65 %	54 %	**77 %**	75 %	75 %	65 %
Cancer treatment					**88 %**	**91 %**	84 %	**87 %**
Chemicals in consumer products	**80 %**	63 %	86 %	65 %	70 %	47 %	68 %	54 %

Note: The scale from 1 to 5, where 1 indicated "not important at all" and 5 "very important". Ratio of respondents who chosen score 4 or 5 at the five-point Lickert scale of importance, where 5 indicated the highest category, i.e. very important. The two most dreaded risks are bolded.

Among nine possible consequences of cancer (see Appendix 1 for exact verbatim), the respondents agreed all that ***impossibility to practise self-care*** is the most important consequence of cancer (the mean score between 4.4 in NL to 5.9 in CZ and UK on the 7-points Lickert scale). We note that Dutch respondents rated all consequences of cancer with systematically lower scores (about 1 score point) compared to the ratings given by respondents from the other three country samples.

They also agreed that the second most important consequence they are concerned about is that cancer is ***very painful*** (mean scores between 4.1 and 5.6), followed by ***possibility that cancer may come back*** (mean scores 4.2 to 5.4) which was rated as the third most important consequence. Fact that cancer treatment may be ***uncomfortable, causing nausea, dizziness and weakness*** (mean scores 4.1 to 5.3) is the next consequence they are greatly concerned about. Two consequences of cancer they are concerned about to lesser extent in all four country samples are that cancer may force them ***to miss work*** (3.7 to 5.0) and the least one, that illness may make them ***socially isolated*** (3.6 to 4.7).

Figure 7 — How possible consequences of cancer are concerned
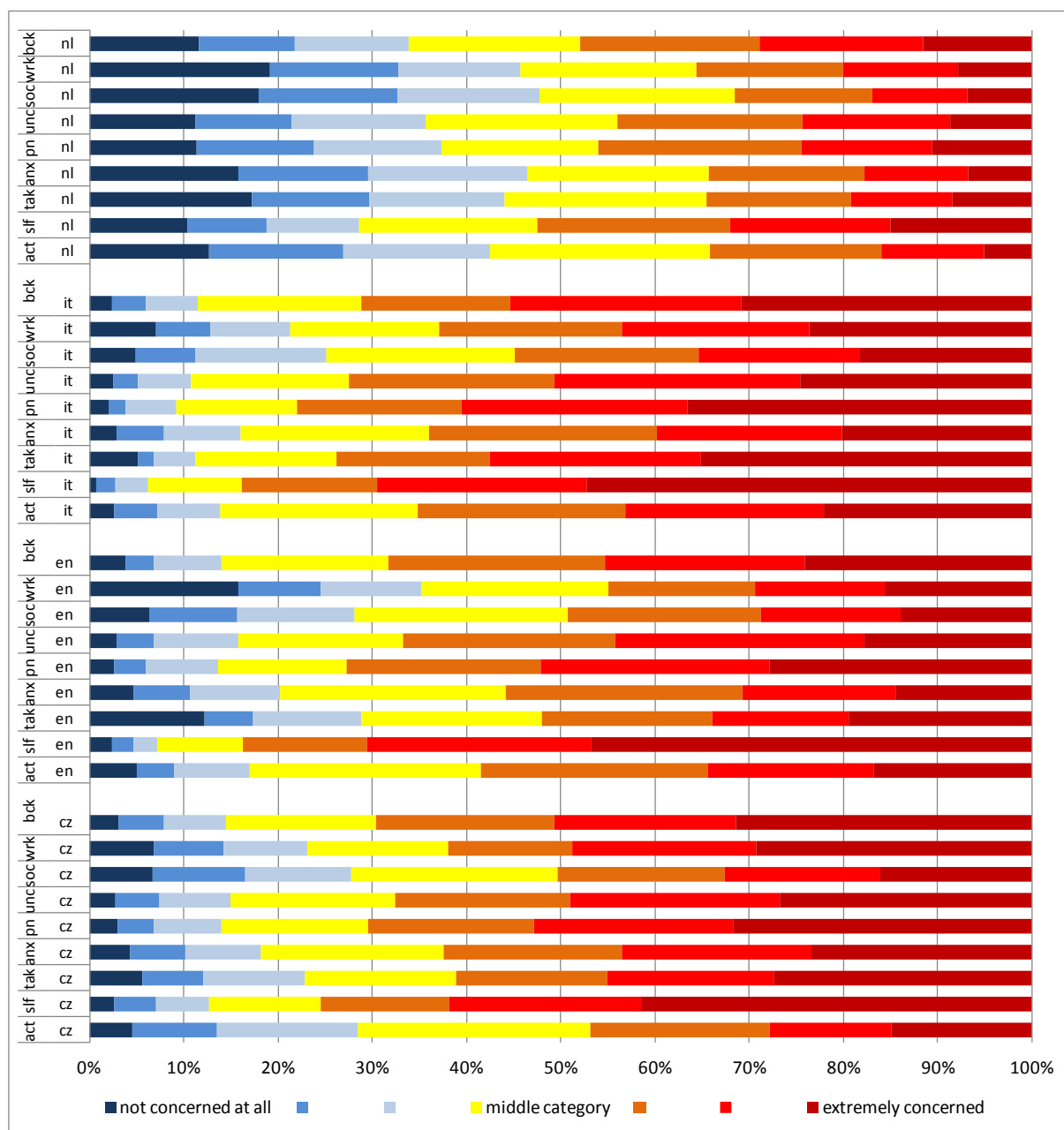
Notes:

Act- Usual activities

Slf - Impossibility to practice self-care

Tak - take care of children/dependents

Anx - anxiety and depression

Pn - very painful

Unc - uncomfortable (nausea, weakness)

Soc - socially isolated

Wrk - miss work

Bck - coming back

6.4.7 Effectiveness of actions to prevent or survive cancer

Majority of the respondents think that both governmental programs and individual actions are able to either increase the chance of surviving cancer or chance to prevent cancer (on average about 60 % agree with score 4 or 5 on the 5-point Lickert scale). Except the respondents from Italy, individual actions are considered either important or very important to improve both chances compared with governmental programs. The Italians rate both types of actions almost the same. The mean scores range between 62 % and 78 % in all four countries and for each of the four types of actions. However British and Czech respondents rate effectiveness of the governmental programs much lower, the mean scores ranging between 41 % and 45 % only.

Figure 8 — Perceived effectiveness of governmental programs and individual actions
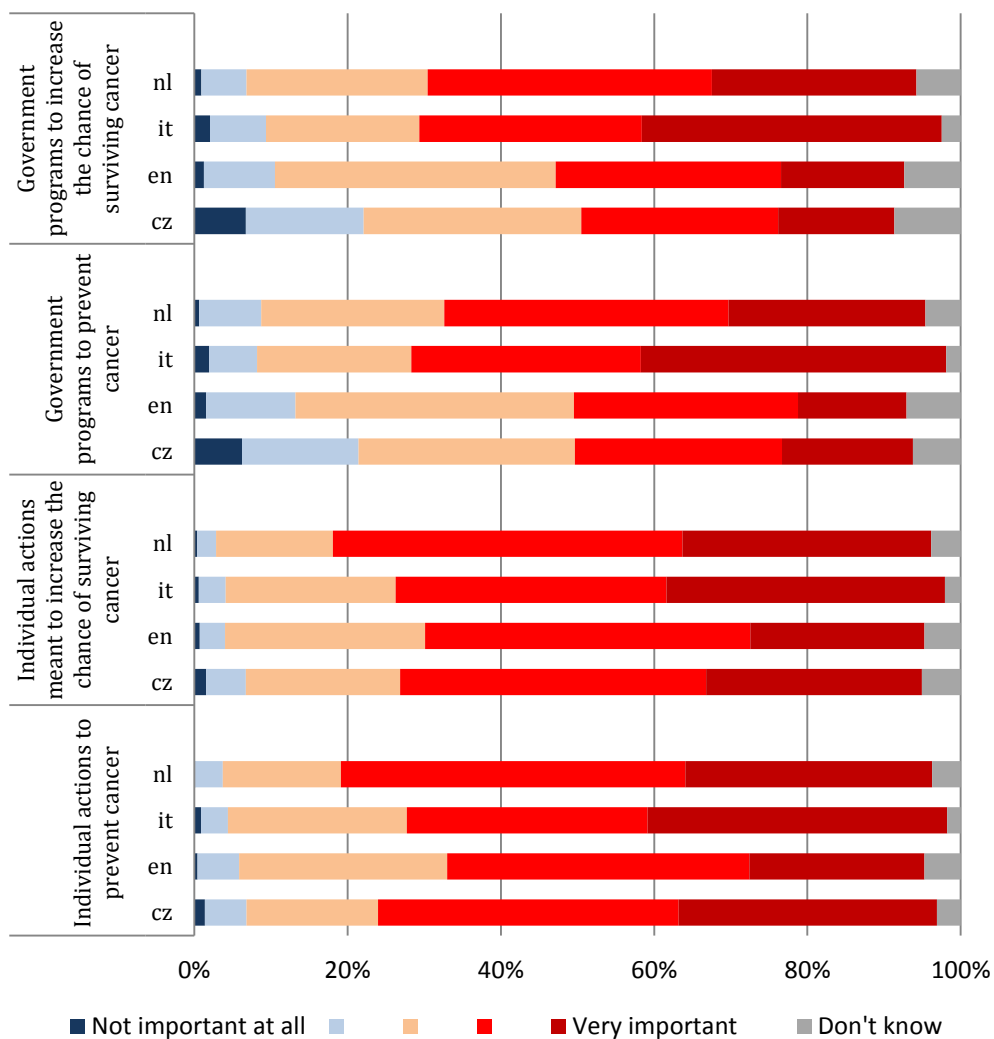
6.4.8 De-briefing after valuation tasks

We asked the respondents to rate each characteristic of the proposed options (change in chance of getting cancer, survival rate, effect on everyday activities, pain, and the costs) how important it was when he/she answered the valuation questions. We used the 5-point Lickert scale to measure their importance.

Table 25 — Importance of the attributes in the valuation questions, mean scores.

	Czech Republic	United Kingdom	Italy	Netherlands
Chance of getting cancer	3.97	4.08	4.08	3.54
Chance of surviving	4.25	4.42	4.28	3.97
Effects on everyday activities	3.95	3.90	4.03	3.64
Pain	3.96	3.87	4.05	3.65
Annual cost	3.85	3.53	3.63	3.48

Note: where 1=not important at all, and 5=very important.

The mean scores on the 5-point Lickert scale range from 3.5 (cost in the NL) to 4.4 (survival in the UK). The most important attribute is the increase in chance of surviving cancer. The share of respondents who rated the importance of the chance of surviving by two highest scores (4 or 5) is between 81 % and 88 % (IT and the UK respectively), while the two highest scores were used by 73 % respondents from the Netherlands. Cost attribute is considered the least important among the five presented on the choice cards, still the lowest score was chosen by less than 10 % respondents only (while the Czech respondents considered the cost attribute more important).

Figure 9 — Importance of the five characteristics in the valuation questions, %.
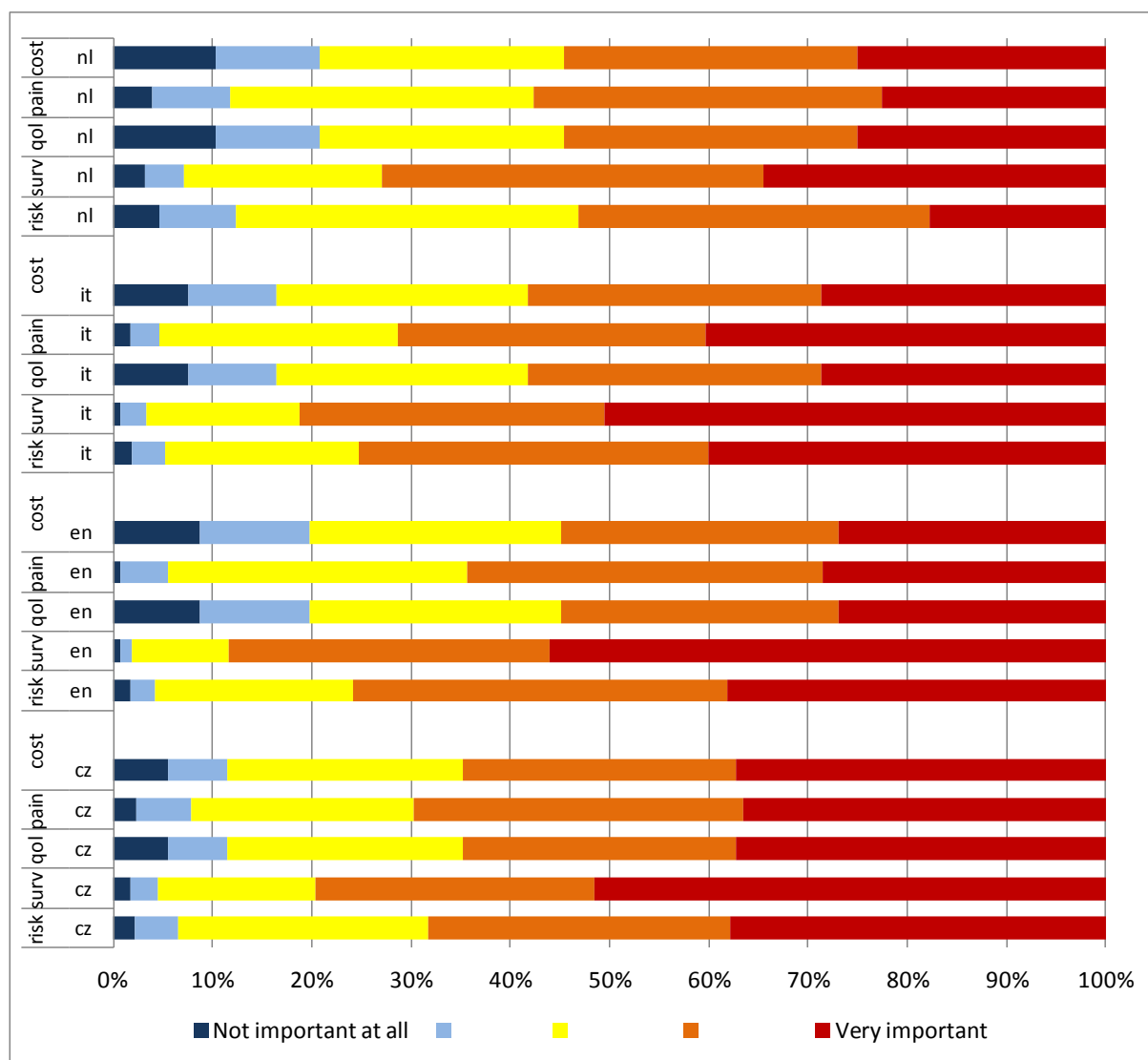
Note:
Risk - chance of getting cancer   *Surv - Chance of surviving*
Qol - Effects on everyday activities   *Pain - Pain*
Cost - Annual cost

The assessments of importance of other factors, i.e. consequences if one gets cancer, taken into account by the respondents when answering the valuation questions are presented in Figure 10. Using the 7-point Lickert scale, the highest mean score is reported for *inability to take care of yourself if one gets cancer* (5.5 to 6.2). Second important considered consequence of cancer is *inability to take care of children or dependents* (in CZ, UK, IT, with means between 4.6 and 5.7) or social life impacts among Dutch (4.9). The least important consequences of cancer were *social life impacts* (CZ and UK, 4.5-4.2) and *possible depression* (IT and NL, 5.14-4.3) respectively.

Table 26 — Importance of other consequences considered when answering the valuation questions, mean scores.

	Czech Republic	United Kingdom	Italy	Netherlands
Social life impacts if you get cancer	4.52	4.22	5.29	4.87
Anxiety associated with getting cancer	5.08	4.59	5.16	4.68
Possible **depression** if you get cancer	5.08	4.53	5.14	4.31
Inability to **take care** of children or dependents if you get cancer	5.31	4.61	5.74	4.73
Inability to **take care** of yourself if you get cancer	**5.92**	**5.64**	**6.23**	**5.52**

Note: where 1=not important at all, and 7=very important, NA excluded. The highest score bolded.

Figure 10 — Importance of other consequences considered in the valuation questions, %.
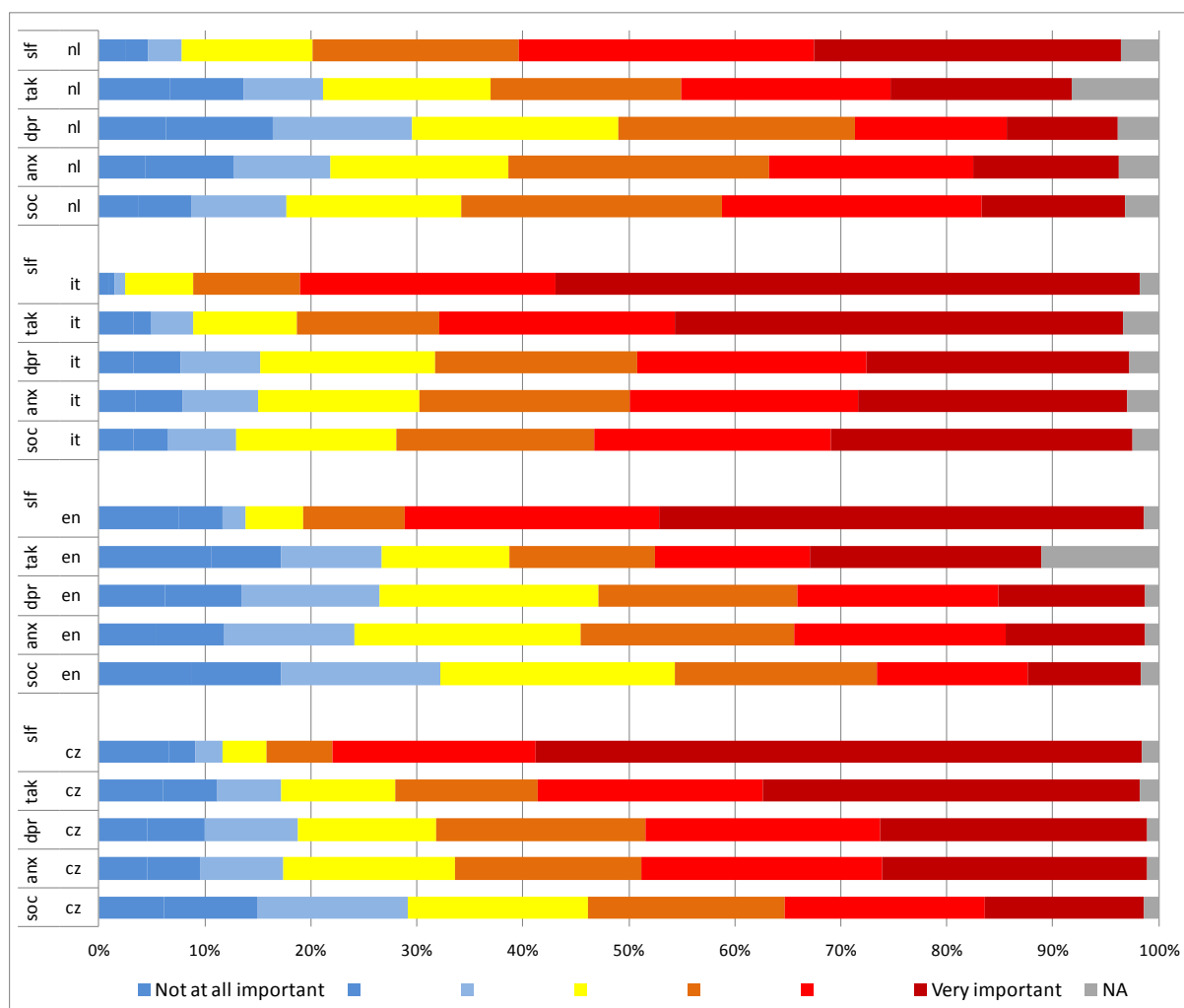
Note: Soc - Social life impacts if you get cancer; Anx - Anxiety associated with getting cancer; Dpr - Possible depression if you get cancer; Tak - Inability to take care of children or dependents if you get cancer; Slf - Inability to take care of yourself if you get cancer.

7 WTP estimates

7.1 Risk-reducing alternatives choice

All of the analyses described in this section of the report are based on samples that exclude those respondents whom we classified as "speeders," i.e., those who completed the questionnaire in less than 13 minutes. There are 3 407 respondents in the cleaned sample, so this gives us 23 849 binary WTP responses – seven from each respondent. Willingness to pay is expressed in EUR by purchasing power standard, and hence VSCC and VSL values are expressed in EUR PPS.

Table 27 displays the percentage of the respondents who chose the risk-reducing alternative over the status quo by country and by design (QDsplit). These shares suggest that the experiment design was balanced and reasonable. The percentage choosing the risk-reducing alternative increases with the magnitude of the reduction in the chance of getting cancer and with the improvement in conditional survival (surv).

Table 27 — Percentage of choosing the risk-reducing alternative over the status quo, by country, by treatment, and by the changed risks

	yes, %	N obs
all	52.39	23 849
QDsplit=1	48.61	11 774
QDsplit=2	56.07	12 075
Country		
Czech Republic	52.63	8 554
United Kingdom	53.56	5 047
Italy	54.66	4 795
Netherlands	48.93	5 453
change in risk of getting cancer		
2	47.37	6 363
3	52.89	6 591
5	56.84	5 686
change in survival		
0%	40.86	5 046
5%	47.28	6 057
10%	55.54	5 805
20%	62.70	6 907

The percentage of choosing the risk-reducing alternative is smaller in the first three choice questions, in which only one chance was improved, compared to the next four choice questions, in which both chances are improved (see Table 28).

Table 28 — Percentage of choosing the risk-reducing alternative over the status quo, by pairs

	QD_split=1	QD_split=2
pair1	41.80	54.96
pair2	42.03	52.58
pair3	38.76	51.83
pair4	57.85	59.59
pair5	54.40	56.64
pair6	50.18	57.62
pair7	55.23	59.3

Each respondent was choosing between the risk reducing program and the status quo seven times. However, only one risk attribute – either the risk of getting cancer or the survival rate – was changed relative to the status quo in the first three pairs, while both risks might be improved in the remaining four choice sets. We used a split sample strategy: split sample 1 valued programs with changes in the risk of getting cancer, while the split sample 2 received programs with the changes in the survival rate. This clean strategy allows us to analyse individual preferences for the changes in the two risks separately. Moreover, one can easily compute the corresponding effect on unconditional mortality and hence VSL. The results from models using the responses from the first three choice questions are used for deriving values for the benefit transfer. These results are presented in Section 7.4.

Variables used in our econometric models are described in following table.

Variable name	Type	Description of the variable
Attributes of experiments		
QoL1	dummy	=1 if effect on everyday activities (quality of life impacts) equals to *'No heavy physical work'*
QoL2	dummy	=1 if effect on everyday activities equals to *'Unable to work'*
QoL3	dummy	=1 if effect on everyday activities equals to *'Confined to bed half of the time'*
		reference category QoL0 = *'Fully active'*
painmode	dummy	=1 if moderate pain
		reference category = mild pain
DRISK	continuous	Change in chance of getting cancer, per x in 1,000 over a year
DSURV	continuous	Change in chance of 5-year survival, if one gets cancer, in %
UNCMORT	continuous	Change in chance of 5-year unconditional probability of dying (derived from the chance of getting cancer and chance of conditional survival), in %
COST	continuous	Willingness to pay for a risk improvement, annual cost for each of the next 5 years expressed in Euro by purchasing power standard
Country dummies		
cz	dummy	=1 if respondent is from the Czech sample
it	dummy	=1 if respondent is from Italian sample
nl	dummy	=1 if respondent is from the Dutch sample
		reference category = uk (British sample)
Risk characteristics, risk perception and attitudes interacted with cancer-related risks		
cancer_dread	dummy	=1 persons with high or very high cancer dread (4 or 5 on a scale from 1 to 5)
pain_experience	dummy	=1 if experienced cancer
has_cancer	dummy	=1 if a respondent has or has had cancer
family_cancer	dummy	=1 if having close family members with cancer
predisposition	dummy	=1 if person believes that cancer runs in his family
selfcare	dummy	=1 if concerned that cancer will impair one's ability to take care of himself or herself
dependents	dummy	=1 if concerned that cancer will impair one's ability to take care of others
Individual	dummy	=1 if person thinks that individual actions are effective at reducing the risk of getting cancer
individual	dummy	=1 if person thinks that individual actions are effective at increasing the chance of survival if one gets cancer
riskcomeback	dummy	=1 if person thinks that cancer will come back
treat-uncomfort	dummy	=1 if concerned about the treatment being uncomfortable
treat-painful	dummy	=1 if concerned about the treatment being painful
geneticsR	dummy	=1 if beliefs about genetics to get cancer
geneticsS	dummy	=1 if beliefs about genetics to survive cancer
pollution	dummy	=1 if beliefs about pollution exposures to get cancer
pollutionS	dummy	=1 if beliefs about pollution exposures to survive cancer
prevention	continuous	importance of preventive health care in reducing cancer risks
preventionS	continuous	importance of preventive health care in improving survival prospects
chemicalsR	continuous	respondent's assessment that chemicals in products affect cancer risks
chemicalsS	continuous	respondent's assessment that chemicals in products affect cancer survival
importanceR	dummy	=1 if considering the cancer risk reduction an important attribute of the scenario
importanceS	dummy	=1 if considering the survival chance an important attribute of the scenario

7.2   Estimation results: models with one –way interactions

Results from the random effects probit version of the model (2) are displayed in tables below. In these tables, column **one** uses the full sample (without speeders), column **two** drops observations from respondents who failed the probability quiz, and column **three** uses the clean sample and suppressed the intercept. We first run the models separately for each country.

The results show that in each country, the respondents are willing to pay more for larger reductions of the chance of getting cancer and for larger improvements in the chance of surviving it. The coefficients on these regressors are positive and significant at the conventional levels as expected. The coefficient on cost is negative and statistically significant: in other words, the likelihood of accepting a risk-reducing alternative decreases, all else the same, with the price of that alternative.

By contrast, the coefficients on the quality of life dummies are not always monotonic or statistically significant, and likewise for the moderate pain dummy, which in one case—the Czech Republic—has a negative coefficient. We remind the reader that the omitted category is mild pain. These mixed results are surprising, but they disappear when we pool the data and fit a single model that controls for the country of origin of the responses (see

Table **33**). The attributes of the illness and of the risk-reducing alternatives are important.

Table 29 — Estimation result for the model with DRISK and DSURV, country samples

CZ	one	two	three
QoL1	0.1258	0.0654	0.1626
	(2.114)	(0.912)	(2.374)
QoL2	0.1093	0.0756	0.1964
	(1.883)	(1.084)	(3.028)
QoL3	0.1008	0.0132	0.1206
	(1.744)	(0.19)	(1.846)
painmod	-0.0638	-0.1014	-0.0206
	(-1.47)	(-1.944)	(-0.419)
DRISK	0.0364	0.0351	0.0672
	(2.722)	(2.174)	(4.585)
DSURV	0.0421	0.0451	0.0485
	(14.257)	(12.772)	(14.045)
cost	-0.0023	-0.0026	-0.0023
	(-17.51)	(-15.957)	(-15.339)
intercept	0.3314	0.5503	
	(3.413)	(4.733)	
lnsig2	1.3021	1.3065	1.3114
	(17.506)	(14.586)	(14.528)
sigma_u	1.9176	1.9217	1.9265
Rho	0.7862	0.7869	0.7878
N	8 551	5 956	5 956

IT	one	two	three
QoL1	0.3028	0.3029	0.2817
	(3.811)	(3.28)	(3.18)
QoL2	0.1673	0.1888	0.1623
	(2.147)	(2.102)	(1.939)
QoL3	0.1269	0.1131	0.0898
	(1.675)	(1.294)	(1.087)
painmod	0.1015	0.1603	0.1440
	(1.773)	(2.435)	(2.296)
DRISK	0.1203	0.1382	0.1315
	(6.656)	(6.618)	(6.859)
DSURV	0.0530	0.0610	0.0601
	(13.296)	(13.045)	(13.227)
cost	-0.0016	-0.0021	-0.0021
	(-9.139)	(-10.036)	(-11.18)
intercept	-0.2124	-0.1227	
	(-1.667)	(-0.818)	
lnsig2	1.2493	1.4447	1.4498
	(12.665)	(12.855)	(12.876)
sigma_u	1.8676	2.0593	2.0645
rho	0.7772	0.8092	0.8100
N	4 784	3 904	3 904

UK	one	two	three
QoL1	0.2333	0.2801	0.2461
	(2.899)	(3.088)	(2.835)
QoL2	0.0349	0.0717	0.0261
	(0.434)	(0.794)	(0.313)
QoL3	0.1316	0.1663	0.1274
	(1.699)	(1.91)	(1.559)
painmod	0.0049	0.0840	0.0562
	(0.083)	(1.287)	(0.912)
DRISK	0.1312	0.1435	0.1330
	(7.323)	(7.175)	(7.277)
DSURV	0.0710	0.0778	0.0767
	(16.898)	(16.124)	(16.153)
Cost	-0.0027	-0.0027	-0.0028
	(-14.591)	(-13.251)	(-15.009)
intercept	-0.0428	-0.1911	
	(-0.327)	(-1.302)	
lnsig2	1.3776	1.4094	1.4178
	(14.188)	(13.019)	(13.075)
sigma_u	1.9913	2.0233	2.0317
rho	0.7986	0.8037	0.8050
N	5 039	4 075	4 075

NL	one	two	three
QoL1	0.0826	0.1193	0.0402
	(1.107)	(1.389)	(0.491)
QoL2	0.1875	0.1734	0.0745
	(2.58)	(2.076)	(0.965)
QoL3	0.1061	0.1424	0.0582
	(1.463)	(1.721)	(0.746)
painmod	0.0490	0.0445	-0.0111
	(0.907)	(0.72)	(-0.187)
DRISK	0.1052	0.1161	0.0931
	(6.417)	(6.166)	(5.39)
DSURV	0.0617	0.0700	0.0673
	(16.313)	(15.733)	(15.44)
cost	-0.0020	-0.0022	-0.0025
	(-12.128)	(-11.39)	(-13.77)
intercept	-0.3979	-0.4219	
	(-3.321)	(-3.083)	
lnsig2	1.2734	1.2882	1.2995
	(13.764)	(12.168)	(12.188)
sigma_u	1.8902	1.9043	1.9150
rho	0.7813	0.7838	0.7857
N	5 441	4 177	4 177

We compute the VSCCs for cancers with moderate pain and quality of life impact equal to one, and report them in Table 30. The values are EUR 583 000 – 772 000 for the UK, EUR 460 000 – 1 070 000 for the Czech Republic, EUR 984 000 – 1 389 000 for Italy, and can be calculated only in one case for the Netherlands (EUR 248 000). Each marginal VSCC (holding the characteristics of the cancer the same) is worth EUR 236 000 – 264 000 in the UK, EUR 68 000 – 138 000 for the Czech Republic, EUR 311 000 – 349 000 for Italy and EUR 189 000 – 262 000 in the Netherlands.

Table 30 — Value of a Statistical Case for cancer (VSCC), in thousand € (PPP)

model	Other effects	UK	CZ	IT	NL
one	QoL=0, mild pain	**247**	**78**	**379**	**258**
		(39)	(29)	(71)	(47)
	QoL=1, moderate pain	**616**	**922**	**984**	**n/a**
		(220)	(181)	(353)	
two	QoL=0, mild pain	**264**	**68**	**337**	**262**
		(43)	(32)	(61)	(49)
	QoL=1, moderate pain	**583**	**1 070**	**1 167**	**n/a**
		(245)	(197)	(319)	
three	QoL=0, mild pain	**236**	**148**	**311**	**189**
		(34)	(32)	(49)	(36)
	QoL=1, moderate pain	**772**	**460**	**1 389**	**248**
		(184)	(183)	(252)	(202)

Turning to the random effects probit model corresponding to equation (4), the results are similar: the coefficients on the unconditional cancer mortality risk reductions are positive and significant and those on the cost are negative and significant. The other coefficients are mixed and similar to their counterparts in the model with separate DRISK and DSURV. In tables 31-32, column one uses the full sample (without speeders), column two drops observations from respondents who failed the probability quiz, and column three and four uses this clean sample to estimate the model with unconditional probability of dying (UNCMORT), cost, with or without suppressing the intercept (alternative specific constant) respectively.

Table 31 — Estimation result for the model with UNCMORT (unconditional risk of dying)

United Kingdom

	one	two	three	four
QoL1	0.2513	0.2990		
	(3.12)	(3.29)		
QoL2	0.0412	0.0769		
	(0.514)	(0.853)		
QoL3	0.1232	0.1569		
	(1.594)	(1.805)		
painmod	-0.0185	0.0600		
	(-0.323)	(0.927)		
UNCMORT	8.3514	9.1888	9.2106	9.0993
	(18.832)	(18.006)	(18.274)	(19.536)
cost	-0.0027	-0.0028	-0.0027	-0.0028
	(-14.93)	(-13.565)	(-13.458)	(-15.345)
intercept	-0.0612	-0.2164	-0.0714	
	(-0.49)	(-1.534)	(-0.583)	
lnsig2u_cons	1.3828	1.4182	1.4113	1.4150
	(14.232)	(13.085)	(13.026)	(13.066)
sigma_u	1.9965	2.0321	2.0252	2.0289
rho	0.7994	0.8051	0.8040	0.8046
N	5 039	4 075	4 075	4 075

Czech Republic

	one	two	three	four
QoL1	0.1296	0.0679		
	(2.178)	(0.947)		
QoL2	0.1305	0.1008		
	(2.255)	(1.45)		
QoL3	0.1091	0.0242		
	(1.893)	(0.35)		
painmod	-0.0585	-0.0943		
	(-1.363)	(-1.827)		
UNCMORT	4.6268	4.9155	4.8404	5.5153
	(14.996)	(13.315)	(13.274)	(16.682)
cost	-0.0023	-0.0026	-0.0025	-0.0022
	(-17.486)	(-15.909)	(-15.899)	(-15.6)
intercept	0.2243	0.4299	0.4298	
	(2.414)	(3.864)	(4.395)	
lnsig2u_cons	1.3074	1.3135	1.3094	1.3168
	(17.572)	(14.661)	(14.623)	(14.586)
sigma_u	1.9226	1.9285	1.9245	1.9317
rho	0.7871	0.7881	0.7874	0.7887
N	8 551	5 956	5 956	5 956

Italy

	one	two	three	four
QoL1	0.3220	0.3276		
	(4.053)	(3.549)		
QoL2	0.1691	0.1925		
	(2.175)	(2.147)		
QoL3	0.1126	0.0958		
	(1.492)	(1.1)		
painmod	0.0732	0.1277		
	(1.3)	(1.974)		
UNCMORT	6.3384	7.2614	7.0635	7.2541
	(14.887)	(14.573)	(14.508)	(16.225)
cost	-0.0016	-0.0021	-0.0020	-0.0019
	(-9.361)	(-10.277)	(-10.053)	(-10.811)
intercept	-0.1798	-0.0847	0.1255	
	(-1.478)	(-0.589)	(1.001)	
lnsig2u_cons	1.2393	1.4288	1.4086	1.4028
	(12.584)	(12.743)	(12.597)	(12.582)
sigma_u	1.8582	2.0430	2.0225	2.0166
rho	0.7754	0.8067	0.8036	0.8026
N	4 784	3 904	3 904	3 904

Netherlands

	one	two	three	four
QoL1	0.0963	0.1349		
	(1.29)	(1.569)		
QoL2	0.1957	0.1868		
	(2.706)	(2.242)		
QoL3	0.1000	0.1357		
	(1.382)	(1.642)		
painmod	0.0318	0.0271		
	(0.594)	(0.444)		
UNCMORT	7.1782	8.1123	8.0000	7.4777
	(18.144)	(17.377)	(17.325)	(17.564)
cost	-0.0021	-0.0023	-0.0022	-0.0025
	(-12.341)	(-11.591)	(-11.586)	(-14.431)
intercept	-0.4368	-0.4742	-0.3360	
	(-3.793)	(-3.6)	(-2.915)	
lnsig2u_cons	1.2721	1.2875	1.2874	1.3067
	(13.762)	(12.176)	(12.178)	(12.297)
sigma_u	1.8890	1.9036	1.9035	1.9220
rho	0.7811	0.7837	0.7837	0.7870
N	5 441	4 177	4 177	4 177

The cancer VSLs are very similar—whether or not we calculate them for specified quality of life impacts and pain, or from the coefficients on UNCMORT and COST alone. They are displayed in Table 32. The cancer VSL is around EUR 3 million in the UK, about EUR 2 million in the Czech Republic, between EUR 3.5 million and EUR 4 million in Italy, and between EUR 3 million and EUR 3.6 million in the Netherlands.

Table 32 — Value of a Statistical Life for cancer, in thousands € (PPP)

	Other effects	UK	CZ	IT	NL
one	QoL=0, mild pain	**3 090**	**1 996**	**3 910**	**3 477**
		(242)	(167)	(470)	(317)
	QoL=1, moderate pain	**3 154**	**2 123**	**4 042**	**3 326**
		(220)	(151)	(440)	(278)
two	QoL=0, mild pain	**3 313**	**1 924**	**3 470**	**3 606**
		(276)	(178)	(384)	(342)
	QoL=1, moderate pain	**3 364**	**2 082**	**3 648**	**3 467**
		(253)	(161)	(361)	(301)
three	*No other effects controlled*	**3 369**	**1 902**	**3 494**	**3 567**
		(282)	(177)	(395)	(338)
four	*No other effects controlled*	**3 266**	**2 481**	**3 759**	**2 996**
		(205)	(173)	(334)	(203)

We also wish to see whether risk perceptions, attitudes and experience with cancer influence the WTP to reduce cancer-related risks.

Table **33** to Table 35 present the results of random effects probit models where we 1) pool the samples from the four countries, 2) include country dummies to allow for systematic differences in WTP across them and 3) include various terms and interactions based on the survey responses.

The results show that persons with high or very high cancer dread (4 or 5 on a scale from 1 to 5) – *cancer_dread=1* – are willing to pay more to reduce cancer-related risks. Those with pain experience (*pain_experience*), however, are willing to pay less, and those who have or have had cancer (*has_cancer*) are not especially affected in any way. Perhaps this latter result is due to the relatively small share of respondents who indicate that they currently have or have had cancer in the past.

We were somewhat surprised that having close family members with cancer (*family_cancer*), and the belief that cancer runs in the family (*predisposition*), have little effect on the WTP. Likewise, concern that cancer will impair one's ability to take care of himself or herself (*selfare*) or others (*dependents*) doesn't affect the WTP significantly.

As expected, we find that those persons who think that individual actions are effective at reducing the risk of getting cancer are willing to pay more to reduce cancer-related risks, which in our scenarios rely on individual initiatives (as opposed to government programs); see the interactions (individual x DRISK) and (individual x DSURV).

We also find that cancer risk reductions are valued less if someone is concerned about the treatment being uncomfortable (*treat-uncomfort*) or painful *(treat-painful)*, whereas beliefs about genetics *(geneticsR, geneticsS)* and pollution exposures *(pollutionR, p*ollutionS*)* affecting the onset of cancer or cancer survival have little effect.

The respondent-rated importance of preventive health care in reducing cancer risks *(preventionR)* has a negative effect on the WTP, whereas the perceived importance of preventive health care in improving survival prospects *(preventionS)* is positively associated with the WTP. We checked whether the respondent's assessment that chemicals in products affect cancer risks *(chemicalsR)* or cancer survival *(chemicalsS)* influences the WTP, but the former has no effect, and the latter is significant only at the 10% level.

In general, the survey participants seemed consistent and deliberate in their choices, because the WTP is more sensitive to the size of the cancer risk reductions for those who stated that the cancer risk reduction attribute of the scenarios was important to them *(importanceR)*. Surprisingly, considering the survival chance *(importanceS)* an important attribute of the scenarios does not translate into a stronger sensitivity of the WTP to the survival probability.

Table 33 — Estimation results – DRISK and DSURV models with risk perceptions, attitudes and experience with cancer

	one	two	three	four	five	six	seven	eight	nine
cz	-0.0806	-0.0567	-0.0438	-0.0407	-0.0391	-0.0407	-0.0307	-0.0428	-0.0851
	(-0.817)	(-0.575)	(-0.444)	(-0.411)	(-0.395)	(-0.408)	(-0.308)	(-0.425)	(-0.844)
it	0.0800	0.0738	0.0646	0.0689	0.0692	0.0687	0.0715	0.0522	0.0231
	(0.714)	(0.66)	(0.578)	(0.614)	(0.617)	(0.612)	(0.637)	(0.458)	(0.203)
nl	-0.2835	-0.1816	-0.1796	-0.1764	-0.1793	-0.1799	-0.1394	-0.1437	-0.2124
	(-2.613)	(-1.635)	(-1.618)	(-1.586)	(-1.609)	(-1.613)	(-1.226)	(-1.263)	(-1.854)
painmod	0.0124	0.0121	0.0124	0.0124	0.0124	0.0124	0.0124	0.0124	0.0119
	(0.479)	(0.468)	(0.478)	(0.478)	(0.478)	(0.478)	(0.478)	(0.477)	(0.46)
QoL1	0.1805	0.1812	0.1809	0.1808	0.1809	0.1809	0.1805	0.1804	0.1803
	(5.053)	(5.072)	(5.064)	(5.063)	(5.064)	(5.064)	(5.054)	(5.05)	(5.048)
QoL2	0.1292	0.1297	0.1299	0.1299	0.1299	0.1298	0.1296	0.1295	0.1294
	(3.684)	(3.697)	(3.704)	(3.703)	(3.703)	(3.702)	(3.697)	(3.694)	(3.689)
QoL3	0.1169	0.1174	0.1176	0.1175	0.1175	0.1175	0.1172	0.1172	0.1173
	(3.386)	(3.399)	(3.406)	(3.404)	(3.403)	(3.403)	(3.395)	(3.394)	(3.397)
DRISK	0.0898	0.0899	0.0900	0.0900	0.0900	0.0900	0.0901	0.0900	0.0900
	(11.253)	(11.265)	(11.276)	(11.276)	(11.272)	(11.271)	(11.283)	(11.281)	(11.275)
DSURV	0.0543	0.0543	0.0543	0.0543	0.0543	0.0543	0.0543	0.0543	0.0543
	(30.174)	(30.17)	(30.174)	(30.174)	(30.176)	(30.176)	(30.168)	(30.168)	(30.169)
Cost	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022
	(-27.066)	(-27.063)	(-27.059)	(-27.058)	(-27.058)	(-27.057)	(-27.05)	(-27.053)	(-27.047)
cancer_dread		0.3092	0.3257	0.3240	0.3208	0.3198	0.2706	0.2607	0.2415
		(3.993)	(4.194)	(4.168)	(4.112)	(4.082)	(3.263)	(3.12)	(2.895)
pain_experience			-0.1943	-0.1959	-0.1972	-0.1982	-0.2078	-0.2114	-0.2024
			(-2.594)	(-2.613)	(-2.629)	(-2.628)	(-2.75)	(-2.795)	(-2.682)
has_cancer				0.0596	0.0587	0.0575	0.0659	0.0685	0.0655
				(0.441)	(0.435)	(0.425)	(0.487)	(0.506)	(0.485)
family_cancer					0.0347	0.0309	0.0281	0.0284	0.0249
					(0.477)	(0.394)	(0.358)	(0.362)	(0.318)
predisposition						0.0114	0.0061	0.0048	0.0034
						(0.128)	(0.069)	(0.054)	(0.039)
selfcare							0.1467	0.1123	0.0861
							(1.802)	(1.256)	(0.964)
dependents								0.0812	0.0793
								(0.929)	(0.91)
individual x DRISK									0.3468
									(4.326)
Individual x DSURV									(omitted)
intercept	0.0434	-0.1837	-0.1262	-0.1319	-0.1487	-0.1478	-0.2100	-0.2048	-0.3878
	(0.481)	(-1.726)	(-1.162)	(-1.206)	(-1.294)	(-1.285)	(-1.749)	(-1.704)	(-3.05)
lnsig2u_cons	1.2850	1.2786	1.2766	1.2763	1.2763	1.2763	1.2750	1.2747	1.2682
	28.9560	28.8010	28.7550	28.7490	28.7480	28.7480	28.7150	28.7080	28.5530
sigma_u	1.9012	1.8951	1.8932	1.8930	1.8930	1.8930	1.8917	1.8914	1.8853
rho	0.7833	0.7822	0.7819	0.7818	0.7818	0.7818	0.7816	0.7815	0.7804
N	23 815	23 815	23 815	23 815	23 815	23 815	23 815	23 815	23 815

Table 34 — Estimation results – UNCMORT models with risk perceptions, attitudes and experience with cancer

	one	two	three	four	five	six	seven	eight	nine
cz	-0.0818	-0.0580	-0.0451	-0.0421	-0.0404	-0.0420	-0.0320	-0.0441	-0.0865
	(-0.829)	(-0.588)	(-0.457)	(-0.425)	(-0.409)	(-0.42)	(-0.32)	(-0.438)	(-0.857)
it	0.0783	0.0721	0.0628	0.0670	0.0673	0.0668	0.0696	0.0503	0.0211
	(0.698)	(0.644)	(0.562)	(0.597)	(0.6)	(0.595)	(0.621)	(0.441)	(0.185)
nl	-0.2852	-0.1834	-0.1814	-0.1784	-0.1813	-0.1819	-0.1416	-0.1458	-0.2148
	(-2.627)	(-1.65)	(-1.633)	(-1.602)	(-1.626)	(-1.63)	(-1.244)	(-1.281)	(-1.874)
painmod	-0.0005	-0.0008	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0010
	(-0.019)	(-0.031)	(-0.022)	(-0.022)	(-0.022)	(-0.022)	(-0.023)	(-0.024)	(-0.04)
QoL1	0.1923	0.1930	0.1927	0.1927	0.1927	0.1927	0.1924	0.1922	0.1921
	(5.38)	(5.399)	(5.392)	(5.39)	(5.391)	(5.391)	(5.382)	(5.378)	(5.375)
QoL2	0.1394	0.1399	0.1401	0.1400	0.1400	0.1400	0.1398	0.1397	0.1395
	(3.987)	(3.999)	(4.005)	(4.004)	(4.004)	(4.004)	(3.997)	(3.994)	(3.99)
QoL3	0.1135	0.1139	0.1141	0.1140	0.1140	0.1140	0.1137	0.1137	0.1138
	(3.293)	(3.305)	(3.311)	(3.309)	(3.309)	(3.309)	(3.299)	(3.299)	(3.303)
UNCMORT	6.2979	6.2973	6.2987	6.2986	6.2990	6.2990	6.2983	6.2981	6.2973
	(33.255)	(33.253)	(33.26)	(33.26)	(33.261)	(33.261)	(33.258)	(33.257)	(33.254)
cost	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022
	(-27.427)	(-27.424)	(-27.421)	(-27.42)	(-27.419)	(-27.418)	(-27.412)	(-27.415)	(-27.408)
cancer_dread		0.3090	0.3255	0.3239	0.3206	0.3197	0.2706	0.2607	0.2415
		(3.988)	(4.189)	(4.164)	(4.106)	(4.077)	(3.262)	(3.118)	(2.892)
pain_experience			-0.1940	-0.1955	-0.1969	-0.1978	-0.2073	-0.2110	-0.2019
			(-2.589)	(-2.606)	(-2.623)	(-2.622)	(-2.743)	(-2.788)	(-2.674)
has_cancer				0.0573	0.0565	0.0554	0.0637	0.0663	0.0632
				(0.424)	(0.418)	(0.409)	(0.47)	(0.489)	(0.468)
family_cancer					0.0358	0.0323	0.0295	0.0298	0.0262
					(0.491)	(0.411)	(0.375)	(0.38)	(0.335)
predisposition						0.0104	0.0052	0.0039	0.0025
						(0.118)	(0.059)	(0.043)	(0.028)
selfcare							0.1461	0.1115	0.0852
							(1.793)	(1.246)	(0.953)
dependents								0.0816	0.0797
								(0.933)	(0.914)
individual x DRISK									0.3478
									(4.336)
Individual xDSURV									(omitted)
intercept	0.0037	-0.2231	-0.1656	-0.1710	-0.1884	-0.1876	-0.2493	-0.2441	-0.4278
	(0.041)	(-2.123)	(-1.542)	(-1.582)	(-1.656)	(-1.647)	(-2.096)	(-2.05)	(-3.392)
lnsig2u_cons	1.2865	1.2800	1.2780	1.2778	1.2778	1.2778	1.2765	1.2762	1.2696
	28.9930	28.8380	28.7910	28.7850	28.7840	28.7840	28.7520	28.7440	28.5880
sigma_u	1.9026	1.8965	1.8946	1.8944	1.8944	1.8944	1.8932	1.8928	1.8867
rho	0.7836	0.7825	0.7821	0.7821	0.7821	0.7821	0.7819	0.7818	0.7807
N	23815	23815	23815	23815	23815	23815	23815	23815	23815

Table 35 — Estimation results – models with other risk factors

	ten (DRISK,DSURV)		ten (UNCMORT)	
	estimate		estimate	
cz	-0.0003	(-0.003)	-0.0006	(-0.006)
it	0.1482	(1.357)	0.1449	(1.313)
nl	-0.1983	(-1.888)	-0.2193	(-2.067)
painmod	-0.0014	(-0.04)	-0.0006	(-0.016)
QoL1	0.1797	(5.035)	0.1849	(5.171)
QoL2	0.1326	(3.79)	0.1497	(4.265)
QoL3	0.1187	(3.445)	0.1225	(3.547)
DRISK	-0.0709	(-2.859)		
DSURV	0.0475	(12.207)		
UNCMORT			4.8269	(11.797)
cost	-0.0021	(-26.939)	-0.0021	(-26.846)
riskcomeback	0.0315	(0.665)	0.0324	(0.684)
treat-uncomfort	-0.0143	(-0.896)	-0.0150	(-0.937)
treat-painful	-0.0399	(-2.478)	-0.0395	(-2.444)
geneticsR	-0.0101	(-0.604)	-0.0341	(-2.108)
geneticsS	0.0025	(0.709)	0.0040	(1.151)
pollution	0.0065	(0.412)	-0.0024	(-0.153)
pollutionS	-0.0069	(-2.001)	-0.0060	(-1.743)
prevention	-0.0375	(-2.39)	-0.0491	(-3.143)
preventionS	0.0091	(2.37)	0.0115	(3.017)
chemicalsR	0.0055	(0.309)	-0.0105	(-0.594)
chemicalsS	0.0410	(1.921)	-0.0142	(-0.753)
importanceR	0.2141	(11.791)	0.1842	(10.581)
importanceS	0.0032	(0.926)	0.0045	(1.304)
intercept	-0.0193	(-0.219)	-0.1018	(-1.143)
lnsig2u_cons	1.1947		1.2190	
	26.5890		27.1730	
sigma_u	1.8173		1.8395	
rho	0.7676		0.7719	
N	23 815		23 815	

7.3   Estimation results – models with the two-way interactions

Following our alternative specification for the random effects probit models, described in eq. (2a) and (5a), we enter QoL and pain interacted with the risk reduction and improvement in survival. As shown in Table 37, we suppress the intercept and the country dummies.

First, we found that *DRISK*, *DSURV* and COST are all significant and have the expected signs. The coefficient for DRISK and DSURV are used to derive the willingness to pay for reducing the probability of getting cancer, or for increasing the chance of survival, respectively, if one stays fully active (QOL=0) and was mild pain only, should he get cancer. The coefficients on the interaction of quality of life dummies and DSURV, and moderate pain and DSURV are positive, as expected, but not significant at any conventional level. We turn to model BT1 in that we allow including the interactions of QOL and PAIN with DRISK only. Similarly, as the result presented in Table 36, quality of life effects would add between EUR 60 000 (if confined to bed half of the time) and EUR 140 000 (if no heavy physical work can be performed) to the value of VSCC for the mildest severity of a cancer (i.e. fully active, mild pain). The VSCC for the mildest severity cancer is about EUR 160 000 (see

Table **33**).

The Value of a Statistical Life for the mildest severity of a cancer is EUR 2.7 million. (The Quality of life effect –if one gets cancer– increases the value of VSL by between EUR 285 000 (confined to bed) and EUR 535 000 (no heavy physical work), resulting in a total VSL between EUR 3.0 million and EUR 3.2 million. Moderate pain does not have an effect on VSL. VSCC and VSL for the four countries are displayed in tables 38 and 39.

Table 36 — VSCC and VSL for base case (fully active, mild pain), and effects of QoL and pain on VSCC and VSL (based on pooled samples).

	VSCC	VSL
Fully active, mild pain *(base category)*	€ 156 774	**€ 2 700 158**
No heavy physical work	+ € 136 154	**+ € 535 787**
Unable to work	+ € 86 021	**+ € 381 080**
Confined to bed half of the time	+ € 62 049	**+ € 285 408**
Moderate pain	*	*

*Note: * The coefficients for moderate pain are not significant at the conventional level.*

Table 37 — Estimation results –models with the two-way interactions between cancer risks, pain and quality of life, pooled data

	Coef.	z stat	p	Coef.	z stat	p
DRISK	0.0661648	6.07	***	0.075576	6.01	***
DRISK × QoL1	0.0574624	5.12	***	0.057713	3.9	***
DRISK × QoL 2	0.0363045	3	***	0.02693	1.71	*
DRISK × QoL 3	0.0261872	2.3	**	0.014603	1.07	
DRISK × painmod	-0.0027117	-0.32		-0.00767	-0.73	
DSURV	0.0541823	31.11	***	0.050957	17.25	***
DUSURV × QoL1				0.000235	0.06	
DUSURV × QoL 2				0.003751	0.96	
DUSURV × QoL 3				0.005212	1.57	
DUSURV × painmod				0.00203	0.74	
Cost	-0.0021102	-30.01	***	-0.00213	-29.5	***
/lnsig2u	1.288991			1.289972		
sigma_u	1.905026			1.90596		
Rho	0.7839764			0.784142		
No. of obs	23815			23815		
No. of groups	3407			3407		

*Note: This model includes risk variables **DRISK** (reducing risk of getting cancer) and **DSURV** (improving the chance of survival, if one gets cancer) that are interacted with quality of life impacts and pain. For instance, the variable **riskqol1** is the interaction between the continuous variable on risk reduction in getting cancer and the dummy equal to one if the quality of life impacts had level 1, i.e., no heavy physical work. The term **riskmod** is the interaction between risk reduction in getting cancer and moderate pain cancer. Reference category (DRISK, and DSURV) describes QoL=0 (i.e. fully active) and mild pain.*

	Coef.	z stat	p	Coef.	z stat	p
UNCMORT	5.747016	23.99	***	6.259635	36.89	***
UNCMORT × QoL1	1.14037	4.71	***			
UNCMORT × QoL2	0.8110909	3.24	***			
UNCMORT × QoL3	0.6074625	2.59	**			
UNCMORT × painmod	-0.0856289	-0.47				
cost	-0.0021284	-30.35	***	-0.00213	-30.38	***
/lnsig2u	1.287945			1.284918		
sigma_u	1.90403			1.90115		
rho	0.7837992			0.783286		
No. of obs	23815			23815		
No. of groups	3407			3407		

*Note: **DUNCMORT** describes change in the <u>unconditional</u> risk of dying from cancer. This continuous variable is again interacted with QoL and moderate pain, having QoL=0 and mild pain in the reference category, as in the above model.*

Table 38 — Estimation results –models with the two-way interactions between cancer risks (DRISK, DSURV), pain and quality of life, the country samples

	UK			CZ			IT			NL		
	Coef.	z stat	p value	Coef.	z stat	p value	Coef.	z stat	p value	Coef.	z stat	p value
DRISK	0.090377	3.21	***	0.0658127	3.12	***	0.0802519	2.96	***	0.0792414	2.94	***
DRISK × QoL1	0.0919364	2.88	***	0.034415	1.39		0.076483	2.31	**	0.0321672	1	
DRISK × QoL 2	0.0535261	1.49		0.0265378	1.02		0.0136039	0.39		0.0098219	0.29	
DRISK × QoL 3	0.0787463	2.58	**	0.0076714	0.34		0.0256248	0.87		-0.0517106	-1.75	*
DRISK × painmod	-0.0073617	-0.31		-0.0397207	-2.25	**	0.0161675	0.71		0.0185792	0.82	
DSURV	0.069751	10.17	***	0.0401196	8.07	***	0.0498792	7.83	***	0.0540041	8.84	***
DUSURV × QoL1	-0.0020064	-0.23		0.0020041	0.31		-0.0003158	-0.04		0.0012575	0.16	
DUSURV × QoL 2	-0.0088971	-0.98		0.0037948	0.59		0.009127	1.04		0.0096769	1.23	
DUSURV × QoL 3	-0.0063654	-0.83		0.0036232	0.64		-0.0010578	-0.15		0.0236006	3.43	***
DUSURV × painmod	0.008669	1.39		0.0042503	0.93		0.0011692	0.19		-0.0067504	-1.2	
cost	-0.0026391	-16.09	***	-0.0020922	-17.26	***	-0.0015855	-10.05	***	-0.0022732	-15	***
lnsig2u	1.377738			1.320611			1.244575			1.285852		
sigma_u	1.991462			1.935384			1.863185			1.902038		
rho	0.7986275			0.7892834			0.7763593			0.7834442		
No. of obs	5 039			8 551			4 784			5 441		
No. of groups	721			1222			685			779		
VSCC	**€ 171 227**			**€ 157 281**			**€ 253 081**			**€ 174 295**		
VSCC(qol1)	**€ 174 181**			*€ 82 246**			**€ 241 195**			*€ 70 753**		
VSCC(qol2)	*€ 101 410**			*€ 63 421**			*€ 42 901**			*€ 21 604**		
VSCC(qol3)	**€ 149 192**			*€ 18 333**			*€ 80 810**			**- € 113 740**		
VSCC(mod pain)	*- € 13 947**			**- € 94 926**			*€ 50 985**			*€ 40 866**		

*Note: * Not significant coefficients.*

Table 39 — Estimation results –models with the two-way interactions between cancer risks (CUNCMORT), pain and quality of life, the country samples

	UK			CZ			IT			NL		
	Coef.	z stat	p value	Coef.	z stat	p value	Coef.	z stat	p value	Coef.	z stat	p value
DUNCMORT	7.688098	13.57	***	4.699021	11.94	***	5.598894	10.74	***	6.026467	12.02	***
UNCMORT × QoL1	1.600135	2.91	***	0.8174203	2.03	**	1.52311	2.8	***	0.7855214	1.58	
UNCMORT × QoL2	0.1349964	0.23		0.8737172	2.12	**	0.9481222	1.68	*	1.083252	2.14	**
UNCMORT × QoL3	0.6626586	1.24		0.5192864	1.31		0.1259949	0.25		1.051502	2.17	**
UNCMORT × painmod	0.1971459	0.48		-0.3591641	-1.18		0.1297224	0.32		-0.1597206	-0.43	
Cost	-0.0026583	-16.55	***	-0.0020823	-17.71	***	-0.0015625	-10.37	***	-0.002299	-15.46	***
lnsig2u	1.377228			1.311377			1.232182			1.287905		
sigma_u	1.990954			1.926469			1.851676			1.903992		
rho	0.7985454			0.7877435			0.7742002			0.7837924		
No. of obs	5 039			8 551			4 784			5 441		
No. of groups	721			1 222			685			779		
VSL	€ 2 892 111			€ 2 256 649			€ 3 583 292			€ 2 621 343		
VSL(qol1)	€ 601 939			€ 392 556			€ 974 790			*€ 341 680**		
VSL(qol2)	*€ 50 783**			€ 419 592			€ 606 798			€ 471 184		
VSL(qol3)	*€ 249 279**			*€ 249 381**			*€ 80 637**			€ 457 374		
VSL(modpain)	*€ 74 162**			*€ 172 484**			*€ 83 022**			*- € 69 474**		

*Note: * Not significant coefficients. The variable **DUNCMORT** describes change in the <u>unconditional</u> risk of dying from cancer. The variables **mortqol** describes the interactions between the changes in the unconditional risk of dying from cancer and quality of life impacts, whereas **mortmod** is the interaction of unconditional mortality and moderate pain. The reference category described QoL=0 and mild pain cancer.*

7.4   Estimation results – models for the benefit transfer

In this section we analyse are analysing the responses from the first three valuation questions only. While respondents included in split sample 1 choose between a program that reduces the risk of getting cancer and the status-quo, respondents from split sample 2 made a choice between a program that increases the chance of survival, if one gets cancer, and the status-quo. Respondents in both split samples made three such choices. The benefit transfer to derive VSL and VSCC for cancer for each EU Member State is based on the results from the model with two-way interactions between the risk variable and covariates on quality of life and pain impacts.

Table 40 — One-way interaction for the first three choices, for each split sample

	Split sample 1		Split sample 2	
	coeff.	t stat	coeff.	t stat
DRISK	0.28953	8.009		
DSURV			0.07833	10.065
cancer-risk ×				
… × QoL1	-0.15055	-1.199	0.14684	1.148
… × QoL 2	0.04301	0.3	0.20239	1.277
… × QoL 3	-0.16153	-1.09	0.13612	0.829
… × painmod	0.12501	1.314	0.08318	0.937
COST	-0.00262	-9.12	-0.00326	-7.941
intercept	-0.82754	-3.764	0.27594	1.834
lnsig2u	16.407	1.9455	1.77301	16.155
sigma_u	2.64521		2.42663	
rho	0.87496		0.85483	
N obs.	3483		3759	
N of groups	1161		1253	

Note: The term 'risk' describes DRISK in split sample 1, whereas it is DSURV in split sample 2.

We exclude speeders, and person who failed the probability quiz. This cleaning procedure yields 3,483 and 3,759 responses, which were provided by 1,161 respondents from the split sample 1, or by 1,253 respondents from the split sample 2, respectively. The results for the model with one-way interactions

are displayed in Table 40. Both coefficients on DRISK and DSURV are positive and significant. However, the coefficients on quality of life and pain effect are not significant. The coefficient on cost is always negative and significant.

Table 41 displays the results for the models with two-way interactions, when the risk attributes are interacted with the effect on quality of life or on pain. Again, the coefficients on the risk attributes are positive and significant. When interacting the quality of life and pain effect with the survival rate, these coefficients become not significant.

Table 41 — Two-way interactions for the first third choices, the split-samples

	Split sample 1		Split sample 2	
	coeff.	t stat	coeff.	t stat
DRISK	0.21147	5.32		
DRISK × QoL1	-0.09102	-2.409		
DRISK × QoL 2	-0.03455	-0.831		
DRISK × QoL 3	-0.07415	-1.946		
DRISK × painmod	0.02835	1.081		
DSURV			0.10161	7.59
DUSURV × QoL1			-0.01467	-1.248
DUSURV × QoL 2			-0.01792	-1.44
DUSURV × QoL 3			-0.02101	-1.637
DUSURV × painmod			0.00242	0.322
COST	-0.00316	-12.286	-0.00238	-8.372
lnsig2u	1.88938	16.147	1.77203	16.196
sigma_u	2.57202		2.42544	
rho	0.86869		0.85471	
N	3483		3759	
VSCC	334 604 €			
VSL	4 182 555 €		4 269 328 €	

The results in the panel for split sample 1 imply **a VSCC of EUR 335,000** and **a VSL of EUR 4,182,555**. The VSL is computed from the change in unconditional mortality attributable to the change in the chance of getting cancer.

The results in the panel for split sample 2 imply a VSL of **EUR 4,269,328** (all values are expressed in 2014 EUR Purchasing Power Standard 2012). Here the change in the unconditional risk of dying is coming from the improvement in the chance of surviving cancer. The two alternate VSLs are quite close to each other.

For our benefit transfer, we use the estimate of VSCC reported in the split sample 1 panel in Table 41, and the estimate of VSL is based on VSL derived from the split sample 2 in Table 41.

8 Benefit transfer

The ultimate goal of this study is the development of the average EU-wide WTP value for each health outcome being valued in this study.

In many benefit transfer applications the study and policy sites are not fully compatible with respect to time, currency, and population's income. Therefore, welfare estimates need to be properly adjusted for these discrepancies. Differences in price levels are usually corrected for using consumer price index, while different currencies are converted using market (nominal) exchange rate. However, similar market goods may cost different amounts of money in different countries – the relationship formally illustrated by Ready et al. (2004). To account for these differences a purchasing power parity (PPP) corrected exchange rate is preferable. Additional differences in values may come from divergence in income between two sites. This issue may become critical in benefit transfer between countries heavily differentiated in income (Ready and Navrud 2006; Wilson and Hoehn 2006). The possible effect of income differences might be controlled for by using income the elasticity of WTP approach, following the formula:

$$WTP_{PS=}WTP_{SS} \cdot \left(\frac{INC_{PS}}{INC_{SS}}\right)^{\varepsilon}$$

where WTP is the willingness to pay, the two subscripts PS and SS denotes the policy site and the study site, respectively, INC is income and ε represents income elasticity of WTP between the income levels observed at the two sites.

Even though some evidence indicates that non-market goods, such as environmental or health related, might be luxury goods, implying income elasticity of demand to be higher than one (Ghalwash 2008), Flores and Carson (1997) show that the relation between income elasticity of demand and income elasticity of WTP is not straightforward, and in case of rationed (public) goods knowledge of the one

does not allow to draw conclusions on the other (Czajkowski and Ščasný, 2010). A considerable number of studies provide evidence that income elasticity of WTP for non-market goods may be less than one; see Czajkowski and Ščasný (2010) for the review. They also estimated the income elasticity of WTP as a function of monthly income; considering the range of median household income in the EU (which ranges between about EUR 1 000 to EUR 3 000 PPS a month), the income elasticity can lie between 0.3 and 1.2, with the elasticity of 0.7 for the EU average household monthly income. In the first our study on skin sensitisation and dose toxicity, the income elasticity of WTP was estimated between 0.21 (for less severe endpoints) and 0.31 (more severe endpoints).

The EU-wide WTP values are computed through benefit transfer technique using the following inputs:

- mean WTP value for respective health end-point derived from the aggregate pooled data (PPP-adjusted);
- income elasticity of WTP of 0.70, and with the elasticity of 0.31 and 1.0 that represent the lower and upper bound of their range;
- mean of household income for EU28 countries for 2012 retrieved from Eurostat.[2] Household incomes reported by survey respondents were equalized according to the OECD-modified scale and are expressed in PPS Euro.[3]

Table 42 – Equalized household income and household size, speeders excluded

	N obs.	equalized household income (PPS)				equalized household size
		Mean	**Median**	**Min**	**Max**	**mean**
pooled data	3404	€ 13 342	€ 11 724	€ 1 151	€ 57 108	1.74
cz	1220	€ 11 063	€ 10 550	€ 1 380	€ 35 172	1.75
en	721	€ 15 901	€ 14 680	€ 1 151	€ 57 108	1.64
it	684	€ 13 652	€ 12 459	€ 2 091	€ 49 236	1.92
nl	779	€ 14 660	€ 13 848	€ 1 485	€ 48 552	1.67

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[2] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di04&lang=en
[3] cf. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Equivalised_income

Applying the income elasticity of WTP, country-specific mean WTP values were derived for each EU Member State for each valued health outcome. Next, for each health outcome, a EU28-wide WTP value is derived by calculating the population-weighted mean WTP from the 28 individual country-specific values. Table 43 reports the EU28-wide WTP values for each respective health outcome. Four different values of VSCC and VSL are provided that differ according to the level of quality of life effect. Except the lowest level of QOL, the additional WTP value for the remaining three levels do not differ much, and therefore we report VSCC and VSL for the average of QOL effect, except for the fully active level.

Table 43 – Mean EU28-wide WTP values (in EUR PPS, population weighted mean)

	Estimate from pooled data	income elasticity = .31	income elasticity = .7	income elasticity = 1.0
VSCC	335 000	357 518	**395 656**	432 771
VSL	4 269 000	4 555 950	**5 041 951**	5 514 922

For sensitivity analysis purposes we also calculated the mean WTP from the 28 individual country-specific values, without population weighting. The differences between population-weighted and non-weighted WTP estimates are relatively small, the difference is between 4 % (income elasticity of WTP = 0.31) and 12 % (income elasticity of WTP = 1.0). The non-weighted estimates are reported in Table 44.

Table 44 – Mean EU28-wide WTP values for sensitivity analysis (in EUR PPS, without population weighting)

	Estimate from pooled data	income elasticity = .31	income elasticity = .7	income elasticity = 1.0
VSCC	335 000	343 053	**363 597**	387 500
VSL	4 269 000	4 371 627	**4 633 422**	4 938 028

9 Conclusions

The primary objective of this stated-preference study was to estimate willingness to pay to avoid selected adverse human health outcomes due to exposure to chemicals in the European Union, and to derive representative EU-wide benefit estimates reference values that ECHA and other bodies can use when carrying out economic analyses (cost-benefit analysis) or health impact assessment in connection to REACH Regulation. This report has focused on **carcinogens, specifically cancers**, which were dealt with in the third survey conducted in the study.

Our study did not aim at valuing organ-specific cancers. A novel valuation scenario is developed that is based on valuation of quality of life and pain impacts of cancer. Moreover, we break the chance of dying from cancer into the probability of getting cancer times the chance of dying from it, conditional on getting it. Specifically, the following health outcomes and cancer attributes were selected for valuation:

i.   the chance of getting cancer within the next 5 years

ii.   the chance of survival at 5 years from the diagnosis

iii. effects on everyday activities

iv.   pain

when the last three attributes are conditional to occurrence of cancer. Willingness to pay for reducing the chance of getting cancer can be translated into a *Value of a Statistical Case of Cancer (VSCC)*. Using information about changes in two probabilities, we computed the unconditional probability of dying that allows us deriving a *Value of a Statistical Life (VSL)*.

The respective willingness-to-pay values were elicited from a sample of adult population of age 45 to 60 in four EU Member States: the Czech Republic, the United Kingdom, the Netherlands and Italy using a series of discrete choice questions. In total 3 888 respondents were interview, and after cleaning the speeders, our dataset consists of 3 407 valid observations.

The mean values of WTP for the pooled sample of four countries are estimated from a random effects probit model and are expressed in 2014 Euro PPS. Our recommended set of the EU-wide WTP values is based on the population-weighted WTP values that we computed for each EU Member State based on the purchasing power adjusted unit value benefit transfer of the WTP values as estimated in this study, and assuming an income elasticity of WTP of 0.7. The EU-wide values of cancer-specific VSL and VSC are as follows:

Table 45 – Recommended mean WTP values for cancer-related health outcomes, EUR PPS

	WTP
Value of a statistical case of a cancer (VSCC)	396 000
Value of a Statistical Life for cancer	5 000 000

Surprisingly, we found that the impact on quality of life, if one gets cancer, does not change either the VSL or the VSCC. Even in the few model specifications where the coefficients for quality of life impacts are significant, the effect on VSLs or VSSC is practically very small. We found that VSL and VSCC values are smaller when it was anticipated surviving in poor rather than relatively good health. This seems to be counterintuitive, but still theoretically possible due to possible effect of anticipated poor health condition on utility of wealth (Hammitt, 2005). Pain, if one gets cancer, do not have effect on probability of choosing the risk-reducing program either.

Among the four EU countries, the respondents from Italy have the largest and the Czech respondents have the lowest willingness to pay for reducing risk of getting a cancer, implying the highest and the lowest values of VSCCs and VSLs.

Other main findings from this study, where we tested the validity of the WTP values above, include:

- The results show that in each country, respondents are willing to pay more for larger reductions in the chance of getting cancer and for larger improvements in the chance of surviving it. The coefficients on these regressors are positive and significant. The likelihood of accepting a risk-reducing alternative decreases, all else the same, with the price of that alternative.

- By contrast, the coefficients on the quality of life dummies are not always monotonic or statistically significant, and likewise for the moderate pain dummy. These mixed results are surprising, but they disappear when we pool the data and fit a single model that controls for the country of origin of the responses. The attributes of the illness and of the risk-reducing alternatives are important.

- We excluded the speeders, defined as those who completed the questionnaire in less than 13 minutes, and in some models also those who failed the probability quiz. We however did not excluded potential protesters from analysis, and as a result, our results provide a conservative, lower bound of WTPs, and hence of VSCC and VSL values.

- There are considerable differences in WTP between countries. Willingness to pay is consistently higher in Italy than the remaining countries across all illnesses and in the most of models.

- The coefficients of interaction term in the joint estimation of WTP for reducing chance of getting cancer and quality of life effects are positive in pooled data suggesting that WTP for more severe effects is increasing. This is however not a case for the chance of survival and in neither case also for moderate pain effect.

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Appendix 1: Description of cancers selected for the presurvey

Myelodysplastic syndrome

Myelodysplasia may origin from close contact to benzene and toluene or other similar chemical substances. The symptoms of loss of blood cells lead to MDS diagnosis. In about one third of patients MDS transforms into acute myeloid leukaemia within months or a few years. (To discuss: Valuation of acute myeloid leukaemia within valuation of MDS via introducing specific attribute on transformation of MDS into AML).

Myelodysplastic syndrome (ICD-10: D46) is caused by environmental exposures (e.g. radiation or benzene) or as a secondary effect of cancer treatment toxicity. In laboratory tests typical chromosomal aberrations are found (impaired differentiation of blood precursors), but subjective symptoms are usually unspecific.

Tentative outcome description

Symptoms	fatigue, limited performance, repeated infections, easy bleeding, bruising, and bruises, diseases of the mouth, large liver and spleen
Onset of illness	onset is subtle and the MDS diagnosis is often determined based on symptoms such as bleeding, recurrent infections and changes in blood cells count
Duration	illness is not curable and can develop into acute leukaemia
Treatment	if bone marrow donor is not found supportive treatment is only cure available. According to the development of the incidence of blood cells aggressive chemotherapy or low-dose chemotherapy might be used
Prognosis	treatment is often unsatisfactory and transformation to acute leukaemia may occur
Quality of life	physical limitations, fatigue. Need for repeated visits to a doctor. In case of marrow transplantation complications may arise. Palliative treatment is usually not successful. Rapid transition to acute leukaemia is possible

Acute lymphocytic/ myelgenous leukaemia

Acute lymphocytic (lymphoblastic) leukaemia may developafter exposure to alkylating agents or ionizing radiation for 5 to 10 years and generally follows the myelodysplastic syndrome. Overall leukaemia incidence was 13.3/100 000 in men, and 9.5/100 000 in women. Acute lymphocytic (lymphoblastic) leukaemia (ICD-10: C91), acute myelogenousleukemia (C92).

Tentative outcome description

Symptoms	malaise, weakness, fatigue, pallor of skin and major mucous membranes. Repeated heavy and exhausting infections especially in upper airways. Severe disease of the mucous membranes of the mouth, angina without response to antibiotics. Easy bleeding, bruising, epistaxis, bleeding from gums, skin changes and swellings, bleeding into the brain with symptoms
Onset of illness	Usually illness develops rapidly – it takes a few weeks from first subtle symptoms to severe ones.

Duration	duration may differ according to the patient's condition, cell type, different genetic changes. The clotting disorders and, consequently, a fatal brain haemorrhage may occur at some types of leukaemia in the course of diagnosis. Illness may last only a few weeks.
Treatment	Stem cell transplantation preceded with hematopoiesis attenuation at marrow in younger patients (under 55 years), aggressive therapies (often repeatedly) for the elderly patients. The consequences of therapy can be fatal.
Prognosis	Without any treatment, the disease lasts from the first symptoms till death 2 to 3 months. After treatment with chemotherapeutic agents occurs in 35 % survival for three years. With the transplantation survival rate more than 50 % in three years.
Quality of life	Physical constraints: hospitalization, the need for a long stay in isolation in a sterile environment in the intensive care unit, parenteral food intake, at the best mushy or liquid food must be sterile. Physical limitations inherent in the role: sick leave. Social roles: Limited communication with colleagues and friends, with family, because they can be hosts of infection that may be lethal for the patient. Outlook for the rest of your life: After the transplantation more than 50 % of patients survive more than three years. Aggressive treatment (chemotherapy) may result in death. Infections or bleeding can cause death. For patients over 50 years, the prognosis is worse, transplantation is often not an option, co-morbidity may lead to death. Limitation of leisure: treatment with a stay in hospital, including supportive care, with remission and subject to regular inspections and monitoring return to work possible.

Lung cancer

Lung cancer (ICD-10: C34) is the leading cause of death in the United States as in the Czech Republic (30 % of all male cancer deaths). There is a trend of increasing number of lung tumours in women. The incidence of lung cancer was 87.7/100 000 in men and 35.9/100 000 in women in the CR in 2009. Mortality (in CZ) was 77/100 000 in men and 30.1/100 000 in women in 2009. Five-year survival for both sexes is around 10 %.

Tentative outcome description

Symptoms	Initially, the disease is asymptomatic. The patient has a variety of nonspecific problems. Shortness of breath, pneumonia, weight loss, fatigue, cough, expectoration, pain, fever, chest pain, blurring of voice, vocal cord palsy, thoracic nerves palsy, pain that spreads to the hands. May also be affected by other organs.
Onset of illness	Symptoms can be detected by a chance when a sudden shortness of breath, chest X-ray examination during ultrasound. The disease may be found even in the presence of distant metastases in the brain, bones, liver, bone marrow and affects by pain, by oppression of neighbouring tissue and function decreasing. Pains at the finger bones could be a first symptom.
Duration	At the time of treatment 70 % of all patients is inoperable. Generally 80 % of patients die within one year after the establishment of diagnosis. Five years survival in total all cases reaches 8 to 15%.
Treatment	Surgery is the promising method only, yet 70% of patients is operated on late and inoperable condition. Radiotherapy and chemotherapy have a relative chance in sensitive small cell carcinoma. Chemotherapy is initially inductive (aggressive), then repeated to maintain remission.
Prognosis	Generally 80 % of patients die one year of diagnosis in the CR.Five-years survival in total in

	all cases reaches 8 % to 15 %.
Quality of life	Physical constraints: pain, needs for hospitalization, surgery, post-operation pains, rehabilitation, prevention of scar retraction, postoperative sensory irritation, neuralgia, later adverse effects of chemotherapy l - cancer of the urinary bladder Physical limitations inherent in the role: incapacity, disability Social roles: Restrictions on communications with colleagues and friends, with family at the time of hospitalization, rehabilitation, dependency on nursing care after surgery, home care, palliative care Outlook for the rest of his life: At the time of treatment 70% of all patients inoperable. Generally 80% of patients die within one year after the establishment diagnosis. Five years survival in all cases reaches 8 % to 15%. After treatment by chemotherapy infectious complications are possible, hepatopathy, scar retraction after surgery, secondary cancer. Reduce spending free time: surgery, chemotherapy and then a repeated hospitalization

Bladder cancer

Bladder cancer (ICD-10: C67) is a type of malignancy arising from ephithelial lining of the urinary bladder.

The incidence of bladder cancer is not high - about 4%. Some 4 to 8 patients in 100 000 inhabitants die from a tumour of bladder each year. Development of neoplasm is facilitated by exposure to some industrial pollutants, especially aromatic amines.

Incidence: 2796 diseases with bladder cancer and renal pelvis occurs annually, of which 2033 are men (39.5/100 000) and 763 are women (14/100 000); Czech data.

Mortality: In total, from the disease dies 889 inhabitants, of whom 539 are men (10.5 / 100 000) and 350 are women (6.6 / 100 000); Czech data.

Tentative outcome description

Symptoms	resemble cystitis with urge to urinate and blood in urine; there may be a closure of the ureter, hydronephrosis and renal pelvic inflammation. It may be completely asymptomatic.
Onset of illness	might be unnoticed, resembling bladder inflammation
Duration	Once the diagnosis is established, patient has to be treated to prevent transition to the incurable stage. After treatment long-term regular follow-up is needed every three months for at least two years.
Treatment	Endoskopic surgery to withdrawal of the bladder (cystectomy), lymph nodes, female organs, ureters connection to the colon. Chemotherapy by instillation or total.
Prognosis	depends on the initial stage and response to treatment of the bladder cancer patient, the outlook for stage 0 or I cancers is fairly good; most bladder cancers that return can be surgically removed and cured
Quality of life	At the beginning a trivial problems like inflammation, unpleasant investigations, biopsy, cystoscopy, endoscopic surgery to remove the contents of total male pelvis. Incapacity, restriction of social contacts. Mostly good survival, but after a great need for operative intervention to prevent infection, incontinency, inflammatory kidney disease.

Generic cancer	incidence rates: 483,9; death rates: 211,4 per 100 000 (2005)
Cancer	Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer. Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths (around 13% of all deaths) in 2008. Lung, stomach, liver, colon and breast cancer cause the most cancer deaths each year.
Risk factors for cancers	Cancer arises from one single cell. The transformation from a normal cell into a tumour cell is a multistage process, typically a progression from a pre-cancerous lesion to malignant tumours. These changes are the result of the interaction between a person's genetic factors and three categories of external agents, including: physical carcinogens, such as ultraviolet and ionizing radiation; chemical carcinogens, such as asbestos, components of tobacco smoke, aflatoxin (a food contaminant) and arsenic (a drinking water contaminant); and biological carcinogens, such as infections from certain viruses, bacteria or parasites.
Early detection	Cancer mortality can be reduced if cases are detected and treated early.
Treatment	Cancer treatment requires a careful selection of one or more intervention, such as surgery, radiotherapy, and chemotherapy. The goal is to cure the disease or considerably prolong life while improving the patient's quality of life. Cancer diagnosis and treatment is complemented by psychological support. Invasive to palliative – surgery, chemo-/radio-therapy, hormonal, immune or gene therapy, pain relief management
Symptoms	Loss of appetite, weight loss, fatigue, weakness, indigestion, pain, fever of unknown origin, hepatitis, enlarged liver and spleen, bleeding, enlarged lymph nodes, local oedema, change in appearance.
Onset of illness	According to location, type of tumour cells and disease state of the patient has a different beginning. The disease may be found only in the presence of distant metastases in the brain, such as visual disturbances, neurological symptoms, in the bones, liver, bone marrow, which results in pain, oppression of other tissues, limiting its function. Pain in the bones of fingers can be the first symptom.
Duration	Weeks to (many) years; even after successful treatment lifelong follow-up required
Prognosis	No generalization possible
Quality of life	Physical constraints: pain, hospitalization, surgery, postoperative pain, rehabilitation, prevention of scar retraction, postoperative sensory irritation, neuralgia, adverse effects of chemotherapy – secondary cancer Physical limitations inherent in the role: incapacity, disability Social roles: Restrictions on communications with colleagues and friends, with family at the time of hospitalization, rehabilitation, dependency on nursing care after surgery, home care, palliative care Outlook for the rest of life: a permanent doctor follow-up and examination Leisure time restriction: repeated hospitalization for surgery and chemotherapy

Appendix 2: The questionnaire: the figures illustrating the probabilities

Survey Questionnaire: HEALTH ISSUES

Thank you for participating in this survey about health issues. Completing the questionnaire should take no more than 30 minutes.

We are interested in your opinions, and there are no right or wrong answers to the questions in this questionnaire.

All of the information you provide through this questionnaire will be treated confidentially and anonymously, in compliance with the legislation on the protection of privacy. All information will be used solely **for research, and not for commercial, purposes. This research is not funded by, and has no connection to, any health insurance or pharmaceutical company.**

The survey is conducted in four Member States of the European Union, namely Italy, the Netherlands, the United Kingdom, and the Czech Republic. Your opinion is very important to us, and we thank you in advance for your time.

Please click the "**continue**" button below to begin the survey.

To complete the questions, please click where appropriate or write your answer in the box.

Please don't use the Back button.

We thank you in advance for your time.

S1. What is your gender?
Male	1
Female	2

S2. May we just ask—how old are you? Please enter your age in the box below.
……………. years old

Programmer: Terminate survey if no answer to either S1 or S2, or if the age is not comprised between 45 and 60.

S3 In which region do you live?
North East	1
North West	2
Yorkshire and the Humber	3
East Midlands	4
West Midlands	5
East of England	6
London	7
South East	8
South West	9
Wales	10
Scotland	11
Northern Ireland	12

SECTION A: Health status

A1. How good is your health today?

The scale below is numbered from 0 to 100, where 0 means the <u>worst</u> possible health and 100 means the <u>best</u> health you can imagine.

Please click on the scale (or write the appropriate number in the box) to indicate how your health is today.

SF_36_1. A2. In general, would you say that your health is...?
Please choose one answer.

Excellent	1
Very good	2
Good	3
Fair	4
Poor	5

SF_36_2. A3. Compared to one year ago, how would your rate your health in general now?
Please choose one answer.

Much better now than one year ago	1
Somewhat better now than one year ago	2
About the same	3
Somewhat worse now than one year ago	4
Much worse now than one year ago	5

A_3. A4. Compared to your present health, what do you think your health status will be in 5 years?
Please choose one answer.

Definitely better	1
Slightly better	2
Roughly the same	3
Slightly worse	4
Definitely worse	5

SF_36_3. A5. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?
Choose one answer on each Line

	Yes, Limited a Lot	Yes, Limited a Little	No, Not limited at All
Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	[1]	[2]	[3]
Lifting or **carrying groceries**	[1]	[2]	[3]
Climbing **several** flights of stairs	[1]	[2]	[3]
Climbing **one** flight of stairs	[1]	[2]	[3]
Bending, kneeling, or **stooping**	[1]	[2]	[3]
Walking **more than a mile**	[1]	[2]	[3]

Walking **half a mile**	[1]	[2]	[3]
Walking approximately **50 meters**	[1]	[2]	[3]
Bathing or dressing yourself	[1]	[2]	[3]

SF_36_13. A6. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?
Choose one answer on each Line.

	Yes	No
Cut down the amount of **time** you spent on work or other activities	1	2
Accomplished less than you would like	1	2
Were limited in the **kind** of work or other activities	1	2
Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

SF_36_17. A7. During the past 4 weeks**,** have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?
Choose one answer on each Line.

	Yes	No
Cut down the **amount of time** you spent on work or other activities	1	2
Accomplished less than you would like	1	2
Didn't do work or other activities as **carefully** as usual	1	2

SF_36_20. A8. During the past 4 weeks**,** to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups you belong to?
Please choose one answer.

Not at all	1
Slightly	3
Quite a bit	4
Extremely	5

SF_36_21. A9. How much *bodily* pain have you had during the past 4 weeks?
Please choose one answer.

None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very severe	6

SF_36_22. A10. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
Please choose one answer.

Not at all	1
A little bit	2
Moderately	3
Quite a bit	4
Extremely	5

SF_36_32. A11. During the past 4 weeks**,** how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

Please choose one answer.

All of the time	1
Most of the time	2
Some of the time	3
A little of the time	4
None of the time	5

A_5. A12. Do you currently smoke?

Please choose one answer.

Yes	1
No, but I am a former smoker.	2
No, and I never smoked	3

FILTR: IF A12=yes

A12a. About how many cigarettes do you smoke a day?

Please choose one answer.

Smoke 1-5 cigarettes per day	1
Smoke 6-10 cigarettes per day	2
Smoke 11-20 cigarettes per day	3
Smoke 21-40 cigarettes per day	4
Smoke more than 40 cigarettes per day	5
Can't choose	6

SECTION B: Understanding probabilities

In this section of the questionnaire we introduce the concept of **probability** or **chance**.

If we roll dice, the **chance** of getting any one of the six numbers is 1 in 6 (that is about 17%), because the dice have 6 sides.
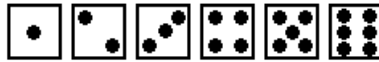
We can illustrate the concept of probability even when the number of possible cases is larger. Imagine that there is a lottery, that a total of 1000 lottery tickets have been sold, and that there is only one winner for this particular lottery. The chance of buying the winning ticket is thus 1 in 1000.

This situation can be visually depicted as shown in this figure. There are 1000 squares in this grid, and the blue one represents the winning ticket. Each ticket has a chance of 1 in 1000 of being drawn.
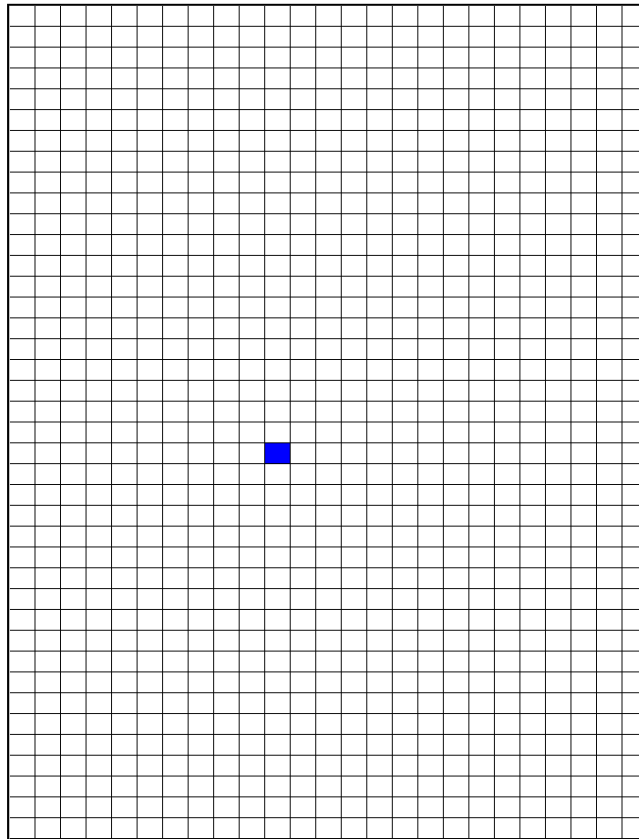
The same figure can also be used to describe probabilities in completely different situations, such as the health status of a population.

For example, suppose that we want to compute the chance of getting an illness (such as the flu, cancer or diabetes). We compute this chance as the number of cases of the illness in a sample of 1000 people from the population in a specified period of time.

In what follows, BLUE squares denote people who get the illness, and GREY squares indicate people who do not get the illness.

■ = ILL

☐ = HEALTHY

Suppose that 5 people in 1000 get the illness over the specified period of time. This means that 995 people do not get the illness and remain healthy. Of course, no one knows for sure who will die and who will remain alive.

This rectangle has 1 000 squares.
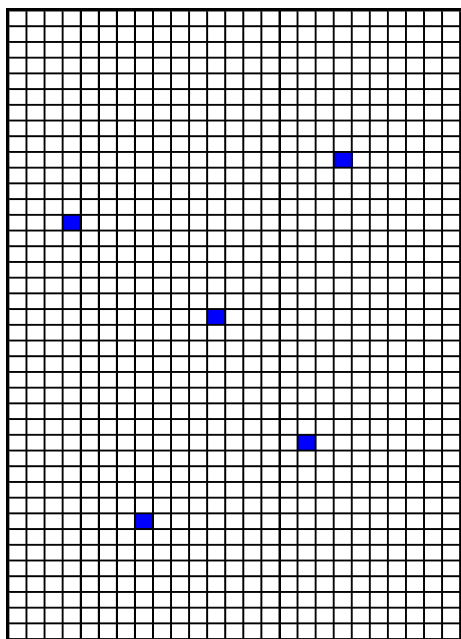
Another way of saying the same thing is that a person has a chance of getting the illness equal to 5 in 1000 over the given period of time, and of not getting it equal to 995 in 1000.

Now we will explore the concept of probability in this health context.

Suppose there are two people.

Person A:
Probability
of getting
the illness
=
5 in 1 000
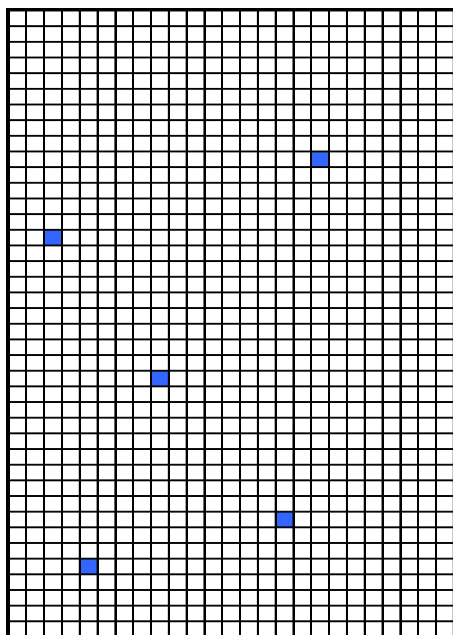
Person B:
Probability
of getting
the illness
=
10 in 1 000
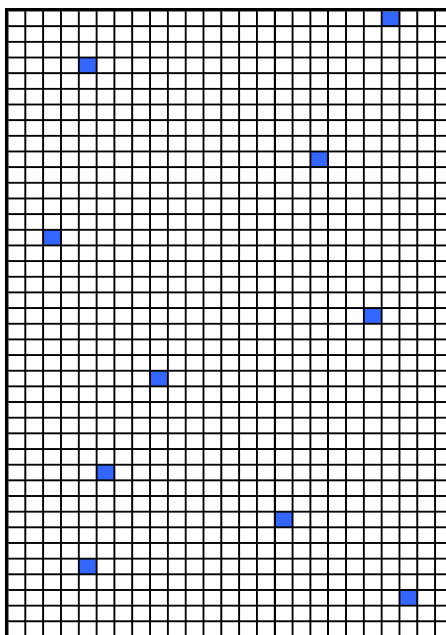
B1. Which of these two people has a greater chance of getting the illness?
Please choose one answer.

Person A	1
Person B	2
The chance is the same for person A and person B	3
I don't know	4

Now let's look again at person A on the earlier screen. This person has a chance of getting the disease over a specified period of time equal to 5 in 1000.

We can display this chance in two possible ways.

As before, the 5 blue squares can be scattered on the grid as on <u>the left</u>.

In the grid on <u>the right</u>, we have moved the five blue squared so that they are next to one another; We will be using this way of visualizing the risk later.
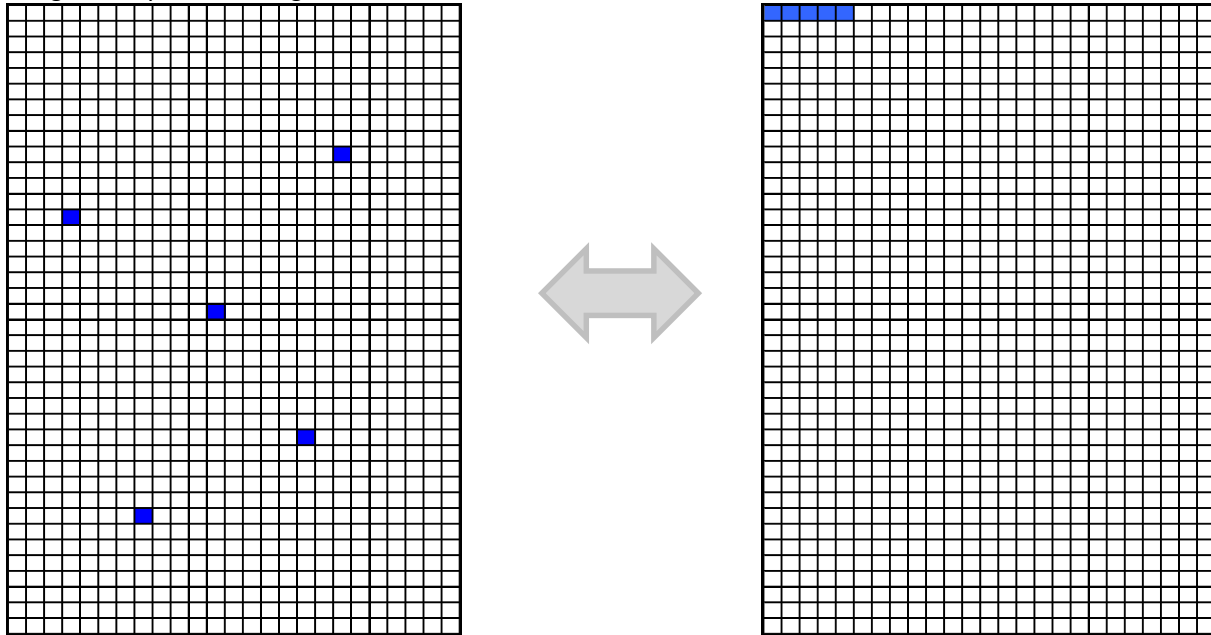
Some people have told us that placing the blue squares next to one another helped them grasp just how large or small the chance is. For other people it did not make a difference. Yet other people found the following comparisons helpful:
5 in 1 000 is the same as…

…5 persons out of a village with 1 000 people, or

…5 people out of a large theatre or opera house

…50 people out of a small town with 10 000 people

…5 000 people out of a large city with 1 000 000 people

B2. Which of the above examples did you find most helpful in understanding just how large or small the probability is?
Please select all that apply.

The grid with the blue squares scattered at random	1
The grid with the blue squares next to one another	2
The examples based on villages and cities	3
All of the examples	4
None of the examples	5
Another answer.	6
Please explain: ………………………………………………………	

SECTION C: Dread

C1. In the table below we list illnesses, health problems or situations that can be hazardous to one's health or even fatal.
Which of these situations are those that you dread the most for the physical, psychological and social suffering they bring? Try to rate each of them on a scale from 1 to 5, where 1=low dread and 5=high dread.

Please keep in mind that for "dread" we do not mean how likely this situation is. Instead, we want you to think of how much this situation scares you for the physical, psychological and social suffering it may bring.

Programmer: Keep the order, but rotate the start at random, for ex. 1 to 8, then 2..8 followed by 1, etc.

Aspect or consequences	Low dread				High dread
Dying in a car or road traffic accident.	1	2	3	4	5
Dying in a domestic accident.	1	2	3	4	5
Surgery on an emergency basis.	1	2	3	4	5
Developing chronic respiratory illnesses (asthma, chronic bronchitis, emphysema).	1	2	3	4	5
Getting cancer.	1	2	3	4	5
Becoming paralyzed.	1	2	3	4	5
Having a heart attack.	1	2	3	4	5
Developing an illness that makes me completely dependent on being taken care of by someone else.	1	2	3	4	5

SECTION D: Cancer

In this section of the questionnaire we wish to focus on cancer. Most of us have heard about this illness, or even have first-hand experience with it.

Programmer: Allow continuing without filling any option.
D1. May we just ask—have you ever had…
    …benign tumor   yes   no
    …malignant tumor, or cancer yes   no

D2. Have any of your closest family members (e.g., parents, siblings, spouse, or children) ever been diagnosed with cancer?
    Yes   1
    No   2
    Don't know   3

D3. Do you believe that there is a predisposition to cancer in your family?
    Yes   1
    No   2
    Don't know   3

D4. Have any of your friends ever been diagnosed with cancer?
    Yes   1
    No   2
    Don't know   3

In this section of the questionnaire we would like to discuss the chance of getting cancer, and the chance of surviving it.

Getting cancer

According to European Union-wide health statistics, the incidence of cancer, which means the chance of getting it for the average person, is 24 in 1 000 over five years. This means that 24 out of 1 000 people will get cancer in next five years.

The figures above are averages based on the entire population, but in practice the chance of getting cancer depends on age. The older one is, the more likely he or she is to get cancer.

As shown in the graph below, for a 48-year-old the chance of getting any type of cancer in the next 5 years is 25 in 1 000. For a 62-year-old person, this chance is over twice times as large: It is 61 in 1 000.

Chance of getting cancer by age group

Age group	out of 1,000 over five years
20-29	2
30-44	6
45-60	25
61-69	61
70-79	92
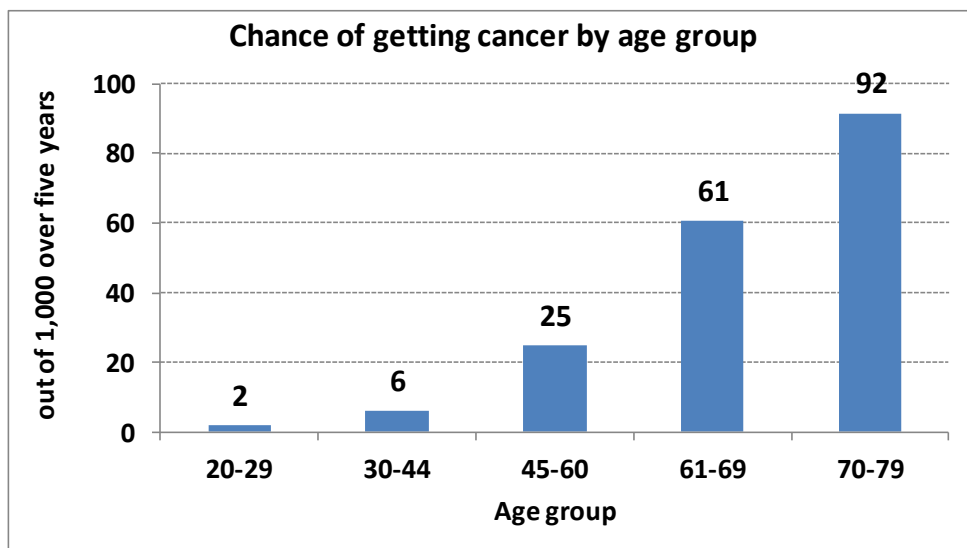
D5. We would like to make sure that we were clear when we explained the concepts shown on the earlier screens. Please examine the graph carefully. In the graph, what is the probability of getting cancer in the next 5 years for your age group?
............................in 1 000 over 5 years

Surviving cancer

Cancer is often a serious illness, but not everyone who gets cancer dies from it. Depending on how slow-growing or aggressive the cancer is, how early it is caught, and on the treatment(s) selected, in many cases cancer can be treated successfully.

Again, the chance of survival has been found to depend on age. As shown in the graph below, younger people (up to age 45) are more likely to survive cancer: **72%** survive for at least 5 years. The remaining **28%** will die within 5 years from the time of the diagnosis.

The odds are very different among older people. Among people 75 years old and older who were found to have cancer, only **24%** will survive after 5 years, and the remaining **76%** will die within 5 years.

Cancer survival rates at 5 years from diagnosis

Age group	Survival rate
less than 45	72%
45-60	60%
61-74	44%
75 and more	24%

Now that we have explored cancer-related chances, please keep in mind that
- only a relatively small share of all people get cancer next five years, and
- people who get cancer may survive cancer but still die from other causes.

SECTION E: Effects of cancer

Now we would like to discuss how cancer can affect quality of life.
In general, when people get cancer, they may have to undergo treatment and the quality of their life may be affected in many ways.

Based on medical research, cancer may have a number of effects and consequences on quality of life, including… …

Aspect or consequences
Usual activities --- slight or severe problems may occur with usual activities, such as working, studying, doing housework, taking care of children, performing leisure activities, doing sports, preparing meals, shopping, and bathing and getting dressed ("self-care").
Impossibility to practice self-care -- In extreme cases, one may be completely disabled and thus unable to do any of the usual activities—not even bathing and getting dressed, or walking for short distances. Some other people have reported virtually no disruption of usual activities. Others had to restrict daily activities only for a limited period of time, such as when they were undergoing treatment or recuperating from surgery
Inability **to take care of children, elderly parents or other dependents**
In some cases, cancer can lead to **anxiety** and **depression**.
Some cancers can be very **painful**; others, less so. Treatment may be **painful** as well. Pain medication is usually given to help manage pain.
Treatment may be **uncomfortable**, cause nausea, dizziness and weakness.
Some people who have cancer feel that their illness makes them **socially isolated** (cancer can restrict social life, disrupt interactions with family and friends)
Cancer may force people to **miss work** because of treatment, recovery time and illness - to the point that one may no longer be able to keep his or her job.
Even if cancer was treated or removed, one may worry all the time about the possibility of it **coming back** after treatment.

Not everyone experiences consequences this severe, however. Some people report that cancer did not cause any particular restrictions, and that they were able to continue working. Others have noted that they relied on family and friends for their support while undergoing treatment and recovering from the illness.

SECTION E: Effects of cancer

Based on medical research, cancer might have a number of effects and consequences on quality of life, including…

E1. How concerned are you about these possible consequences of cancer?
When entering your rating score, please think about yourself, and not about other people such as a relative or friend, as a potential cancer patient.

Please rate them on a scale from 1 to 7, where 1=not concerned at all and 7=extremely concerned.

Aspect or consequences	Not concerned at all						Extremely concerned
	1	2	3	4	5	6	7
Usual activities --- slight or severe problems may occur with usual activities, such as working, studying, doing housework, taking care of the children, performing leisure activities, doing sports, preparing meals, shopping, and bathing and getting dressed ("self-care").	1	2	3	4	5	6	7
Impossibility to practice self-care -- In extreme cases, one may be completely disabled and thus unable to do any of the usual activities—not even bathing and getting dressed, or walking for short distances. Some other people have reported virtually no disruption of usual activities. Others had to restrict daily activities only for a limited period of time, such as when they were undergoing treatment or recuperating from surgery	1	2	3	4	5	6	7
Inability **to take care of children, elderly parents or other dependents**	1	2	3	4	5	6	7
In some cases, cancer can lead to **anxiety** and **depression**.	1	2	3	4	5	6	7
Some cancers can be very **painful**; others, less so. Treatment may be **painful** as well. Pain medication is usually given to help manage pain.	1	2	3	4	5	6	7
Treatment may be **uncomfortable**, cause nausea, dizziness and weakness.	1	2	3	4	5	6	7
Some people who have cancer feel that their illness makes them **socially isolated** (cancer can restrict social life, disrupt interactions with family and friends)	1	2	3	4	5	6	7
Cancer may force people to **miss work** because of treatment, recovery time and illness - to the point that one may no longer be able to keep his or her job.	1	2	3	4	5	6	7
Even if cancer is treated or removed, one may worry all the time about the possibility of it **coming back** after treatment.	1	2	3	4	5	6	7

SECTION F: Factors affecting cancer

F1. Many medical studies have investigated, or are currently investigating, possible links between certain factors and cancer. We list some of them below. For each of them, could you please tell us how important you believe this factor is in <u>causing</u> cancer (or protecting from it)?

Please rate each of them on a scale from 1 to 5, where 1=not important at all and 5=very important.

	Not important at all				Very important	Don't know
	1	**2**	**3**	**4**	**5**	**888**
Genetics	1	2	3	4	5	888
Pollution	1	2	3	4	5	888
A healthy and physically active lifestyle	1	2	3	4	5	888
A healthy and fiber-rich diet	1	2	3	4	5	888
Not smoking	1	2	3	4	5	888
Avoiding environments where other people smoke	1	2	3	4	5	888
Preventive health care	1	2	3	4	5	888
Chemicals in consumer products	1	2	3	4	5	888

F2. For each of the following factors, could you please tell us how important you believe this factor is in making cancer more or less "<u>survivable</u>" if one gets it?

	Not important at all				Very important	Don't know
	1	**2**	**3**	**4**	**5**	**888**
Genetics	1	2	3	4	5	888
Pollution	1	2	3	4	5	888
A healthy and physically active lifestyle	1	2	3	4	5	888
A healthy and fiber-rich diet	1	2	3	4	5	888
Not smoking	1	2	3	4	5	888
Avoiding environments where other people smoke	1	2	3	4	5	888
Preventive health care	1	2	3	4	5	888
Cancer treatment	1	2	3	4	5	888
Chemicals in consumer products	1	2	3	4	5	888

It is possible to reduce the chance of getting cancer or improve the chance of surviving cancer, by means of individual actions or public programs.

In general, the risk of getting cancer and/or dying from it can be affected through ….

Actions or initiatives	Type of cancer	What does this action do?
Pap smear (smear test)	Cervical cancer in women	Detects cancer, possibly at early stages, and improves the chance of surviving it
Environmental programs that protect drinking water quality, soil and surface water quality	Various types of cancer	Prevents cancer
Healthy and physically active lifestyle	Various types of cancer	Prevents cancer and can improve the chance of surviving it
Mammogram Breast self-examination	Breast cancer in women	Detects cancer, possibly at early stages, and improves the chance of surviving it
Government program to reduce air pollution (e.g., emissions by factories or cars)	Lung cancer Various types of cancer	Prevents cancer
Colonoscopy and rectal exam	Colon cancer	Detects cancer, possibly at early stages, and improves the chance of surviving it
Avoiding buying products containing health adverse chemicals	Various types of cancer	Prevents cancer

F_4. F3. Thinking of cancer, how effective do you believe the actions listed below are in reducing the chance of getting cancer or improving one's chances of survival, if he or she gets cancer?
Please rate each of them on a scale from 1 to 5, where 1=not effective at all and 5=very effective.

	Not effective at all	Little effective	Somewhat effective	Effective	Very effective	Don't know
Individual actions meant to <u>prevent</u> cancer	1	2	3	4	5	888
Individual actions meant to increase <u>the chance of surviving</u> cancer	1	2	3	4	5	888
Government programs meant to <u>prevent</u> cancer	1	2	3	4	5	888
Government programs meant to increase <u>the chance of surviving</u> cancer	1	2	3	4	5	888

SECTION H: Valuation

In this section we would like you to consider hypothetical actions that would

a) reduce <u>your</u> chance of getting cancer within the next five years, and/or
b) improve <u>your</u> chance of surviving if you do get cancer.

However, neither of these actions would remove cancer risks entirely. There would always be some chance of getting cancer or dying from it, even if these actions were implemented.

These would be **individual actions** that you would undertake yourself.

You would be **the only person** whose cancer risks and survival would be affected. These actions would not affect the cancer risks and survival of other members of your family.

When valuing these actions, we ask you imagine all possible consequences of getting cancer. We specifically describe several possible consequences of getting cancer on your quality of life, including…

- the effects on **everyday activities**, and
- **pain**

By the effects on everyday activities we mean ability to continue **working, studying, doing housework, taking care of children or dependents,** doing **leisure activities or sports, taking care of yourself** (such as bathing, getting dressed, etc.), **walking as usual, going shopping or preparing your meals.**

We will consider five possible degrees of impacts:

Fully active	= you are fully active and more or less as you were before your illness
No heavy physical work	= you cannot carry out heavy physical work, but can do anything else
Unable to work	= you are up and about more than half the day and can look after yourself, but are not well enough to work
Confined to bed half of the time	= you are in bed or sitting in a chair for more than half the day and you need some help in looking after yourself
Confined to bed all the time	= you are in bed or a chair all the time and need a lot of looking after

In the rest of questionnaire we will consider only two possible levels of pain:
- **mild** pain, and
- **moderate** pain.

These impacts may be felt during cancer treatment, during recovery from treatment, for a long time, or even for as long as one lives—no one really knows ahead of time the duration of these effects.

No one can really predict what your level of anxiety or depression would be, or their effect on your personal or social relationships. For that reason, we will leave those unspecified in the scenarios that we will ask you to evaluate.

We will ask you to consider alternative scenarios described by the following five attributes:

Characteristics	Description and possible values
Chance of getting cancer	Chance of getting cancer <u>within the next 5 years</u>.
Chance of survival at 5 years (if you get cancer)	Chance of being still alive after <u>5 years from the diagnosis</u>, if you get cancer.
Effects on everyday activities (if you get cancer)	Fully active – No heavy physical work – Unable to work – Confined to bed half of the time
Pain (if you get cancer)	Pain during cancer treatment, recovery from treatment, or any other times
Cost per year for the next 5 years	The total annual cost of the actions that reduce cancer risks, for each of the next 5 years.

Most of these actions cost money.

For example, medical tests for early detection of cancer imply some costs, even maybe just in terms of the time and effort required to go and have the test.

Replacing certain chemicals in products may likewise increase the cost and hence the price of some of the goods you buy.

We would like to ask you to choose between one hypothetical action and the current situation. The current situation means that cancer risk and survival will be kept same as now.

Let's now summarize the odds associated with cancer for your age group.
- the chance of getting cancer is **25** in 1 000 over the next five years,
- the five-year chance of surviving is **60%**; this means that the probability of dying of cancer within five years from the diagnosis is **40%**.

Here is an example:

	The Current Situation	Option A (reduced risks)
Chance of getting cancer over 5 years	**25 in 1 000**	**20 in 1 000**
Chance of 5-year survival (if you get cancer)	**60%**	**70%**
Effects on everyday activities (if you get cancer)	No heavy physical work	No heavy physical work
Pain (if you get cancer)	Mild pain	Mild pain
Annual cost for each of the next 5 years (total in parentheses)	**£ 0** (in total £ 0)	**£ 210** (in total £ 1050)

H0. Which would you choose?

The current situation	1
Option A (reduced risks)	2

	The current situation	Option A (reduced risks)
Chance of getting cancer over 5 years	25 in 1 000	20 in 1 000
Chance of 5-year survival (if you get cancer)	60 %	70 %
Effects on everyday activities (if you get cancer)	Unable to work	Unable to work
Pain (if you get cancer)	Mild pain	Mild pain
Annual cost for each of the next 5 years (total in parentheses)	£ 0 (in total £ 0)	£ 210 (in total £ 1050)
Which would you choose?	The current situation	Option A (reduced risks)

- 1 in 1000 over 5 years chance of getting cancer
- reduced chance to get cancer

0%   60%   70%   100%

- 10% chance of 5-year survival
- increased chance to survive

Programmer: Make sure that respondents can answer this question.

We hope that it is clear from this presentation that option A reduces the risk of getting cancer with the consequences shown in the table above, and increases the chance of surviving, if you get it.

In answering the following questions, please keep in mind that...

- all interventions are hypothetical, but we would like you to **answer as realistically and truthfully as you can**;
- please keep in mind that if you decided to pay for one of the proposed options, you would have **less money for other goods.** If the proposed options are important to you, but you judge them to be expensive, it might be possible for you to use your savings or borrow money to obtain them.
- If you choose to stay with **the current situation**, **you will pay no money** and get **no risk reduction**;
- the interventions would **reduce risks for you only**. No other household members or persons would experience the risk reductions coming with these interventions;
- as you move from the first choice exercise to the subsequent ones, please **do not regard the risk reductions and the payments as cumulative**. Please answer the choice questions as if each risk-reducing alternative was the only one you are making decisions about;

There are no right or wrong answers to the choice questions: We are simply interested in your opinions.

Programmer:
Set random variable SAMPLESURV={0,1}

IF SAMPLESURV=1 then use 3 choice cards in that the chance of survival is changed only (chance of getting cancer is always same and equal to 25 in 1000)

In the next <u>three</u> choices,
- **the chance of survival is increased** in the hypothetical situation,
- while **the chance of getting cancer is same** as in the current situation,
- **the effects on everyday activities** and **pain** are same in the hypothetical and current situation, but they may vary **across the three choice cards**.

	The current situation	Option A (reduced risks)
Chance of getting cancer over 5 years	25 in 1 000	25 in 1 000
Chance of 5-year survival (if you get cancer)	60 %	80 %
Effects on everyday activities (if you get cancer)	Unable to work	Unable to work
Pain (if you get cancer)	Moderate pain	Moderate pain
Annual cost for each of the next 5 years (total in parentheses)	£ 0 (in total £ 0)	£ 340 (in total £ 1700)

■ - 1 in 1000 over 5 years chance of getting cancer

0%   60%   80%   100%

- 10% chance of 5-year survival
- increased chance to survive

Which would you choose?	The current situation	Option A (reduced risks)

On the next <u>three</u> choices,

- **the chance of getting cancer is reduced** in the hypothetical option,
- while **the chance of survival is same** as in the current situation,
- **the effects on everyday activities** and **pain** are same in the hypothetical and current situation, but they may vary **across the three choice cards**.

FIRST CHOICE	SECOND CHOICE	THIRD CHOICE
Programmer: Use "Option A"	Programmer: Use "Option B"	Programmer: Use "Option C"
H1. Which would you choose?	**H2. Which would you choose?**	**H3. Which would you choose?**
The current situation 1	The current situation 1	The current situation 1
Option A (reduced risks) 2	Option B (reduced risks) 2	Option C (reduced risks) 2

|	The current situation	Option G (reduced risks)
Chance of getting cancer over 5 years	25 in 1 000	23 in 1 000
Chance of 5-year survival (if you get cancer)	60 %	65 %
Effects on everyday activities (if you get cancer)	Unable to work	Unable to work
Pain (if you get cancer)	Mild pain	Mild pain
Annual cost for each of the next 5 years (total in parentheses)	£ 0 (in total £ 0)	£ 100 (in total £ 500)
Which would you choose?	The current situation	Option G (reduced risks)

■ - 1 in 1000 over 5 years chance of getting cancer
■ - reduced chance to get cancer

0%   60%65%   100%

■ - 10% chance of 5-year survival
■ - increased chance to survive

In the next <u>four</u> choices

- both **the chance of survival** and **the chance of getting cancer are improved** in the hypothetical option,
- **the effects on everyday activities** and **pain** are same in the hypothetical and current situation, but they again may vary **across the four choice cards**,

FOURTH CHOICE		SIXTH CHOICE	
Programmer: Use "Option D"		Programmer: Use "Option F"	
H4. Which would you choose?		**H6. Which would you choose?**	
The current situation	1	The current situation	1
Option D (reduced risks)	2	Option F (reduced risks)	2

FIFTH CHOICE		SEVENTH CHOICE	
Programmer: Use "Option E"		Programmer: Use "Option G"	
H5. Which would you choose?		**H7. Which would you choose?**	
The current situation	1	The current situation	1
Option E (reduced risks)	2	Option G (reduced risks)	2

SECTION I: Debriefing questions

I1. How important was each of these characteristics of the proposed options when you answered the questions?
Please rate each characteristic on a scale from 1 to 5, where 1=not important at all and 5=very important.

	Not important at all				Very important
	1	**2**	**3**	**4**	**5**
Chance of getting cancer	1	2	3	4	5
Chance of surviving if one gets cancer (if you get cancer)	1	2	3	4	5
Effects on everyday activities (if you get cancer)	1	2	3	4	5
Pain (if you get cancer)	1	2	3	4	5
Annual cost for each of the next 5 years	1	2	3	4	5

** new page **

I2. How did you think you would pay for the proposed action?
Please select all that apply.

Using my personal income	1
Using my household income	7
Using savings	2
Borrowing money	3
Did not really think about how I would pay for the measures	4
I did not think that there would be any payments	5
Other	6
please explain...	

** new page **
FILTR: if "current situation" was preferred at least 4 times
Programmer: Randomise the order of the 15 options, but please store the order shown.

I_4. I3. You indicated a few times that the option you like best is the one that does not reduce risks. Which of the following best describe the reason(s) for this?
Please select up to 3 the most important.

I can't afford to pay for the proposed options	1
I did not believe in the situations described in the choice questions	2
The choice questions were unrealistic	3
I consider it unethical to pay for health interventions	4
I do not wish to impose the costs on my family members	5
The proposed risk reductions were not significant enough to justify the costs	6
I am not sure I understood the options, so I decided to stay with the current situation	7
Health care is covered by the public health care system and so I don't see why I should pay extra	8
I did not receive adequate or enough information.	9
I don't trust the information I have been given.	10
The choices were too hypothetical	11
I prefer to stay at the current level of cancer risks, because I think it is the best state.	12
The choice was too difficult.	13
The alternatives were too similar to the current situation.	14
I couldn't decide	15

XX. I4. How important were the following factors when you were answering the questions?

	Not at all			Very important				Not applicable
	1	**2**	**3**	**4**	**5**	**6**	**7**	
Social life impacts if you get cancer	1	2	3	4	5	6	7	777
Anxiety associated with getting cancer	1	2	3	4	5	6	7	777
Possible **depression** if you get cancer	1	2	3	4	5	6	7	777
Inability to **take care** of children or dependents if you get cancer	1	2	3	4	5	6	7	777
Inability to **take care** of yourself if you get cancer	1	2	3	4	5	6	7	777

Now we will ask you a few questions about yourself to better understand the answers you gave us. Please rest assured that the information will be treated as confidential and will be used only for research purposes.

K1. Including yourself, how many people live in your household at present?
By "household" we mean a person living alone or a group of people who live together in the same private dwelling and share expenditures, including the joint provision of the essentials of living.

1	1
2	2
3	3
4	4
5	5
6	6
7 or more	7

K2. How many (if any) children under the age of 18 live with you in your household?

0	0
1	1
2	2
3	3
4	4
5 or more	5

** new page **

K3. What is the size of the municipality you live in?

up to 199 inhabitants	1	10 000 to 19 999 inhabitants	7
200 to 499 inhabitants	2	20 000 to 49 999 inhabitants	8
500 to 999 inhabitants	3	50 000 to 99 999 inhabitants	9
1 000 to 1 999 inhabitants	4	100 000 to 999 999 inhabitants	10
2 000 to 4 999 inhabitants	5	1 million or more inhabitants	11
5 000 to 9 999 inhabitants	6		

K4. What is your current marital status?

Married	1
Civil (registered) partnership	2
Having a partner without a legal registration	7
Separated from spouse/ civil partner (still legally married)	3
Divorced from spouse/ legally separated from civil partner	4
Widowed/ civil partner died	5
Never married/ never in a civil partnership	6
I would prefer not to answer	*999*

K5. **What is your highest achieved level of education?**

Incomplete primary	1
Primary completed	2
Lower vocational, no GCSE	3
General secondary, no GCSE	4
Vocational with GCSE	5
Technical secondary with GCSE	
(e.g., secondary technical schools, secondary economic schools)	6
Academic secondary with GCSE	7
Post-secondary (post-secondary courses,	
tertiary professional schools, grades 5 and 6 at a conservatory, etc.)	8
Tertiary, bachelor's degree	9
Tertiary, master's degree	10
Post-graduate education (Ph.D., CSc., Doc., etc.)	11
I would prefer not to answer	999

K6. **Which of the following best describes your employment situation?**
Please select from the list the employment status that applies to you (tick all applicable).

Paid employment	1
30 hours per week or more	2
less than 30 hours per week	3
self employed	4
No paid employment	5
military service	6
retired/pensioned	7
stay-at-home mother/father not otherwise employed	8
on maternity/paternity or parental leave	13
student	9
unemployed	10
disabled	11
other	12

K7. **Do you receive any social benefits?**

Yes.	1
No.	2
I would prefer not to answer	999

K8. What is <u>your</u> monthly net personal income after tax? Please include income from all sources.

We would like to remind you that all answers will be treated confidentially.

(Please include all sources of income such as child support and other state support, interest, and other revenues …)

Less than £400	1	Between £2001 and £2300	8
Between £400 and £800	2	Between £2301 and £2750	9
Between £801 and £1000	3	Between £2751 and £3500	10
Between £1001 and £1200	4	Between £3500 and £4500	11
Between £1201 and £1400	5	More than £4500	12
Between £1401 and £1600	6	I would prefer not to answer.	999
Between £1601 and £2000	7		

Please note that income is a key indicator for securing representativity of our sample. We assure you that all the information will be treated as completely confidential and anonymous.

K8_1 What is <u>your</u> monthly net personal income after tax? Please include income from all sources.

We would like to remind you that all answers will be treated confidentially. (Please include all sources of income such as child support and other state support, interest, and other revenues …)

Less than £800	1	Between £1601 and £2750	4
Between £800 and £1200	2	More than £2750	5
Between £1201 and £1600	3	I would prefer not to answer	999

K9. What is <u>your</u> <u>household's total</u> net monthly personal income after tax ? Please include all sources. *(Please include all sources of income such as child support and other state support, interest, and other revenues …)*

Less than £800	1	Between £2301 and £2750	7
Between £800 and £1050	2	Between £2751 and £3500	8
Between £1051 and £1300	3	Between £3501 and £4500	9
Between £1301 and £1600	4	More than £4500	10
Between £1601 and £2000	5	I don't know.	888
Between £2001 and £2300	6	I would prefer not to answer	999

Please note that income is a key indicator for securing representativity of our sample. We assure you that all the information will be treated as completely confidential and anonymous.

K9_1 What is your household's total net monthly personal income after tax? Please include all sources.

(Please include all sources of income such as child support and other state support, interest, and other revenues …)

Less than £1050	1	Between £2301 and £3500	4
Between £1050 and £1600	2	More than £3500	5
Between £1601 and £2300	3	I don't know.	888
		I would prefer not to answer	999

This is the end of the survey.
This is the end of the questionnaire. Thank you very much for your time and cooperation.