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The Value of Statistical Life for Adults and Children: Comparisons of the contingent valuation and chained approaches[1]

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Abstract

Estimates of the Value of Statistical Life (VSL) provide a vital input to a variety of policy decisions ranging from health provision to transportation planning. However, the bulk of VSL research has focussed on estimating average values rather than taking account of the potential variation in VSL across groups. Policymakers are particularly concerned that using estimates based on data concerning adults might provide poor proxies of the values associated with preventing child fatalities. We investigate this empirical problem while also addressing methodological critiques of standard contingent valuation (CV) approaches to VSL estimation which ask survey respondents to value an outcome described in terms of both the probability of occurrence and the health impact of an event.

A prior lab experiment confirms fundamental problems in subjects' abilities to provide internally consistent valuations of such compound goods. Given this, we compare CV approaches with the Z Z]v]vP u šZ}[}(. (1995) ZOC which splits the valuation task in two, assessing the ‰ŒE}]o]šÇ }(v À vš v šZ]•µš]o]šÇ }(šZ š À vš • ‰ Œ š together to obtain a VSL estimate. We provide a first application of this method to the estimation of the VSL for children and contrast this with values for adults. Results confirm prior expectations that VSL values for preventing child fatalities significantly exceed those for adults. Finally, we carry out the first replication of the chaining approach in a large and nationally representative sample of parents. We identify many advantages of chaining over CV approaches, however, through a novel variant of a validation test suggested by Carthy et al, we reveal anomalies in the estimates produced by the chaining method suggesting that a robust method for VSL calculation is yet to be refined.

Key words:

Value of statistical life; Contingent valuation; Chaining method; Non-market valuation; Health

Declarations of interest: none

Introduction

The standard procedure for assessing the economic case for or against public sector interventions is to undertake a cost-benefit analysis, weighing the different costs and benefits in monetary terms. When such interventions involve changes in the risks of death, illness or injury, it is then necessary to find some way of placing a monetary value on these changes. Two rather different approaches have been used. In policy relating to safety, where the focus has been upon accidents which may cause injury and/or premature death, a number of governments and their agencies have used the Value of ^šš]•š] o >](~s^>•š}ŒE‰ŒE•vššZ Preferences to pay (WTP) to avoid]v]À]µ small mortality risks that are then used to value the prevention of one expected (in the statistical

sense) fatality[1]. In policy relating to health care interventions, where the focus is upon preventing or treating illness that may lead to reductions in health status and/or premature death, an alternative approach has involved measuring the benefits in terms of the Quality Adjusted Life Years (QALYs) P]v • Œ •µoš }(v]vš ŒÀ vš]}vU v šŽ- V >z[ ]v P ÁÀ Z šŽ Œ šŽÁ some threshold which is regarded as good value for money[2]. Unlike the VSL approach, using QALYs does not assess welfare benefits, but rather how an intervention compares to some cost threshold.

In contrast to QALYs, in policy decision making the VSL is typically used as if it is unresponsive to age, and may therefore not be a true reflection of preferences (Shepard and Zeckhauser, 1984; Jones-Lee, 1989; Evans and Kerry Smith 2006; Hirth and Viscusi, 2008). Indeed, preventing the premature death of a child rather than an elderly person will register as a much larger benefit under a QALY-based system, yet this is not reflected in most official VSL measures where the same average value is applied to everyone. This is in part because we may be unable to predict the subset of people whose lives would be saved by accident preventing measures, while the treatment of a particular disease has a clear target population.

Nonetheless, the question of whether the benefit of reducing risk to the young is greater than that for other and in particular elderly groups has become more prominent in recent policy debates (see

[1] An alternative term for essentially the same concept is the Value of Preventing a Fatality (VPF). With either term, the important point to note is that this is not the value of preventing the otherwise certain death of an] vš](] o]v]À] µ oU µš šZ •µuuš]}v }(u vÇ ‰ }‰o [• tdW š} Œ µ amounts until the total reduction in probabilities adds up to 1. The UK Department for Transport (DfT) values šZ ‰ŒÀ vš]}v }((š o]šÇ }v Œ]š]v[• Œ} • š ¬íXôï u]oo]}v ~ (dU îì £1.55m per fatality prevented is listed in its most current guidance for undertaking cost-benefit analyses of road safety schemes (https://www.gov.uk/government/publications/webtag-tag-data-book-may-2018). The UK Health and Safety Executive have recently commissioned research into the feasibility and use of the CV based Value of a Life Year (VOLY; Desaigues et al., 2011) concept within UK decision making.

[2] In the UK, for example, the National Institute for Health and Clinical Excellence (NICE) has used per QALY thresholds of less than £20,000 as likely acceptable, and more than £30,000 as in need of good justification in first approximations when judging whether a new health care intervention represents sufficiently good value for money to be adopted by the UK National Health Service. https://www.nice.org.uk/process/pmg6/chapter/assessing-cost-effectiveness and further discussion in Donaldson et al. (2011).

reviews Ç K [Œ] ,vand Morgan, 2017). Some countries have contemplated using different VSLs for different age groups, notably: Canada (Hara Associates, 2000), the European Commission (EC, 2001), and, somewhat controversially,[3] the U.S. Environmental Protection Agency (Viscusi, 2009). Therefore, it is of both academic and policy interest to know whether people subscribe to a distinction between the VSLs of children and adults. Although the theoretical and empirical VSL literature is quite extensive (e.g. Alberini, 2005; Hammitt and Zhou 2006), and despite some evidence that age does appear to impact upon the value of preventing a fatality (Aldy and Viscusi, 2008), only a relatively small number of studies specifically address the issue of valuing mortality risks for children (Agee and Œ } l Œ íõõòV o Œ] v] v a • v É U îìííV o } t < µ] • š š and U îìííV Gerking 2003; Guerriero et al., 2017; Hammitt and Haninger, 2010; Jenkins et al. 2001; Mount et al 2003; Nastis and Crocker 2003).

There is no simple observable monetary value for the VSL (McDaid et al., 2015). Using wages as an estimate of a VSL wrongly equates prices and values (Rice, 2015). Revealed preference techniques using either wage premiums or expenditure on safety equipment (Bellavance et al., 2009) require strong assumptions regarding the information available on the risk associated with particular jobs or behaviours (Dolan et al., 2008), and values are very sensitive to the exact nature of risk estimation (Scotton, 2013).

These problems have meant that economists frequently apply stated preference (SP) methods such as discrete choice experiments (Andersson et al., 2016), or, most commonly, contingent valuation (CV) to estimate VSLs (e.g. Alolayan et al., 2017; Dickie and Gerking, 2003; Vassanadumrongdee and Matsuoka, 2005; Roldós et al., 2017). While CV methods have been used extensively worldwide to

[3] ^ U (} Œ Æ u ‰ o U š Z } v š Œ } À Œ • Ç • µ Œ Œ } µ weighted VSL played out in • µ • } (v Á • ‰ ‰ Œ Z o] v • • µ Z - • ^ W } • š E } ‰ µ •] P _ ~ E Á z } Œ l d] u • U D Ç ô U î ì ^ š } ‰ Z š Z] • } µ v š [š } s o µ E Á š Œ P š o : } š] Œ v • _ o U t D o Ç ô U î ì ï • U v ^ h v Œ } ‰ • š Z Z ^ v] } Œ š Z] • } µ v š [_ ~ t • Z] v P š } v W } • š U D Ç íï U î ì ï • X

estimate willingness to pay (WTP) and other measures for a wide variety of goods (Carson, 2011; Rakotonarivo et al., 2016), the large majority of these applications have been for risky options, i.e. goods which, in a contingent market, are certain to be supplied if sufficient funds are paid. As budget constraints, plausibility and ethical principles all mitigate against asking an individual to state their WTP to prevent the certainty of their death from a given cause, this approach is inappropriate for calculating a VSL. Therefore CV studies of health typically value risky options; goods which are provided as probabilities such as a change in a non-unity risk of death or the probability of being afflicted Ç] • • X d Z • Z } u ‰ } µ v (CV) survey respondents with a difficult challenge: having to evaluate (in monetary terms) their value for avoiding some (often unfamiliar) adverse health outcome; and simultaneously comprehend the (typically small) probability of that outcome occurring. Both are demanding and unfamiliar tasks and their joint estimation is arguably cognitively overwhelming. All CV studies assume that, when stating the value of reducing[4] her mortality risk by a specified amount, an informed individual has well-formed and theoretically consistent preferences (Carson and Groves, 2007). In cases where this assumption does not hold CV responses may be malleable and subject to bias. In particular commentators have long argued that in cases of cognitive overload, respondents may seek to infer information regarding appropriate responses from objectively irrelevant elements of the framing of a valuation question (Tversky and Kahneman, 1973, 1974; Slovic, 1995; Nielsen et al., 2012; Kjaer et al., 2018).

Indeed, the SP literature reports a number of persistent anomalies; results which suggest that respondents are unable to relate certain valuation questions to a set of standard economic preferences (Chilton et al., 2004; Desvousges et al., 1992; Dolan et al., 2008; Hausman, 2012; Jones-Lee et al., 1995; Jones-Lee and Loomes 2004; McFadden and Train, 2017). In the context of health outcomes, value estimates have often been found to be insensitive to scope (inadequately related to changes in the risk of a health state arising (Beattie et al., 1998; Vassanadumrongdee and Matsuoka,

[4] Following convention we adopt the female gender throughout to refer to a participant in our study

2005; Andersson et al., 2011), even when it cannot be plausibly argued that income is acting as a constraint on WTP (Søgaard et al., 2012; Gyrd-Hansen et al., 2014). Both Jones-Lee et al. (1995) and Dubourg et al. (1997) note inadequate responsiveness] v] v] À] µ o [• t d W Á Z v Œ] • l • Á Œ resulting in the inflation of corresponding VSL estimates. Clearly insufficient scope sensitivity renders such VSL estimates invalid for decision making purposes as reducing the risk probabilities presented to CV respondents will erroneously drive up the implied VSL. It has been argued that this phenomena is driven in part by the cognitive demands of valuing a compound good (Carthy et al. 1999; Gyrd-Hansen et al., 2012). Given this, we open the applied element of our analysis with a laboratory experiment designed to test how respondents cope with each element of the compound good: 1) valuing outcomes (using both familiar and unfamiliar goods to examine the effects of experience) and 2) assessing small risks of those outcomes occurring (with those risks being varied to examine scope sensitivity).

It was with the particular challenge of compound goods in mind that Carthy et al., (1999) proposed š Z Z Z] v] v P u š Z } [š } approach splits presentation of the compound good up into a two-step procedure. The first step asks subjects to trade-off a risk of a specified ill-health state against a risk of death (e.g. which is worse, an X% chance of a specified ill-health state or a Y% chance of death; respondents adjust Y until the two outcomes are equivalent). The second step asks the respondent to place a value on avoiding what would otherwise be a certain occurrence of that ill-Z o š Z • š š X } u] v] v P š Z • Œ • ‰ } v • • o o } Á • š Z health state up š } Z Z] to an inferred WTP to reduce the risk of death and hence the VSL. The VSL derived from the Carthy et al. (1999) study have since informed values used in cost-benefit analyses by a number of UK government departments (for example Department for Transport, Department for Local } u u µ v] š] • v ' } À Œ v u v š U ‰ Œ š u v š } (, o š Z U d Z ^ } š š] • Z ' } À Œ and Transport Department, Health and Safety Executive, Environment Agency, Health Protection

Agency, Food Standards Agency, as reviewed in Kelly 2010, Jones-Lee and Spackman, 2013) as well as internationally (European Maritime Safety Agency, 2014).

The chaining method has been the focus of some criticism given that it seems to be susceptible to certain anomalies (Thomas and Vaughan, 2013a&b), but it has been strongly defended by the original authors (Chilton et al., 2015; Jones-Lee and Loomes, 2015). Therefore, the present paper seeks to contribute to this debate and the wider literature through comparison of the chaining approach to the estimation of VSL with the more widely applied CV method. Furthermore, we use both methods to address the policy relevant question of whether VSLs for children and adults are different. While typically one would only ask someone about risks to their own life, we avoid the cognitive and moral challenges of asking children such demanding questions by investigating the values held by parents for both their own lives and those of their children. If a Z Z premium exists, it should be detectable within the subset of the population who are parents[5]. Any excess of the estimated child VSL over the parent VSL values should provide strong evidence of an age premium associated with young lives. Thus, while our formative lab experiment considers broader issues, our subsequent initial field study represents the first use of the chaining R u s Z } ‰ ‰ o] š } š Z À o µ } (the Z] o [• o] (CV and chaining methods have been trialled in the same sample to estimate the VSL; and the first replication of the chaining method in a much larger sample than before (300 vs 167).

We then extend our analysis to address a methodological challenge. In separating the compound good into its two constituent parts, Carthy et al., argue that the cognitive demand placed on a subject can be much reduced and certainly the results they obtain appear promising. We examine this claim by developing a novel variant of a test for internal consistency suggested by Carthy et al. This is achieved by splitting the first stage of the chaining approach into two tasks where respondents initially compare

[5] Note, we are not suggesting that any age premium we observe in this group should be used as a social value, but rather that if an age premium does exist in the wider population, then it will be most easily detectable in a sample of parents.

minor with major ill-health state, then compare the latter major-ill-health state with death. We term š Z] • Z } µ o [Z] v u š Z } v } u ‰ Œ š Z] • Á] š Z š Z } v À v š] } v pioneered by Carthy et al. (wherein WTP is applied to a single comparison between ill-health and death). Consistency should be evidenced by no significant difference arising in the VSL measures delivered by the single and double chaining variants. Conversely, if parents apply any Z Z] o ‰ Œ Ê u] µ u [at each stage of the chaining exercise, this will cause inconsistency in the VSL estimates obtained from the single and double chained approach with the latter inflating VSL in a potentially dramatic manner given the multiplicative nature of the chaining approach. In our second field study, we implement the first replication of the chaining method in a nationally representative sample, some six times larger than that used by Carthy et al., providing the first set of new data to bear on the robustness of the chaining approach since that initial study.

The rest of this paper is organized as follows. First, we discuss and present results from the laboratory experiment testing scope sensitivity of responses across different levels of risk and familiarity of goods. Next we present a first field survey of parents comparing the standard Carthy et al. (single chain) approach to the chaining method with a conventional CV analysis of VSL. Finally, we present our consistency test of the chaining method, contrasting the single and double chain variants across a very large (996 participants), nationwide, and nationally representative sample of parents.

Scope sensitivity, familiarity with the good and risk framing: an experiment

As discussed above, an initial objective was to test some of the key assumptions inherent in CV studies of VSL. Through the highly controlled of a lab experiment we sought to examine the sensitivity of stated WTP responses to: a) the familiarity of the goods being valued; b) the size of the risk reduction offered; and c) the framing of risk probability information. Concerns regarding responsiveness to scope in CV studies are not novel; indeed, instances of scope insensitivity are widespread within the

literature (Ojea and Loureiro, 2011). However, investigations into the causes of such problems remain an active area of research (Borzykowski et al., 2018). Despite this, and the crucial importance of scope sensitivity to CV based estimates of VSL, implausibly small sensitivity to scope often appears to be considered acceptable in the field literature (Amrian and Hagen, 2010; Whitehead, 2016), while very few studies conduct the controlled examinations afforded by experimental investigation (Hammitt and Graham, 1999; Andersson et al., 2016).

Such a controlled experiment was conducted with 99 students at the University of East Anglia. This used a self-administered, computerised questionnaire (coded in z-tree; Fischbacher, 2007), which randomised the presentation order of treatments and questions. As is best practice, each respondent was asked warm-up questions to help familiarise her with risk and probability and all questions involving risk used visual diagrams to illustrate probabilities, again as per best practice (e.g. Zhang et al., 2013; see Appendix 1 for the exact implementation of the study). The questionnaire took an average of 50 minutes to complete and participants were paid £5.50 to take part, with the chance of winning an additional £10 at the end of the survey if they chose to take an unrelated gamble.

The experimental subjects were presented with three goods offering different levels of familiarity: avoiding losses of money (£75); avoiding a temporary stomach complaint; and avoiding a condition causing temporary blindness. Each of these goods were offered at different levels of risk, with probabilities presented using different formats (either chances in 10, such as 1/10, or changes in 1,000, such as 100/1,000), the latter being a variant of the test for risk framing effects previously found to be significant (Pinto-Prades et al., 2006; Zhai and Suzuki, 2008). Respondents were asked to value each compound of good, risk and probability presentation in a manner similar to CV studies of the VSL

Question ordering was varied and analyses conducted so as to minimise the potential for initial responses to anchor subsequent responses (Jacowitz and Kahneman, 1995).[6]

Table 1 reports the mean, median and standard deviation values of stated WTP for the various compounds of outcome and risk reduction valued in this experiment. The pattern of values across compound goods appears plausible and panel (a) presents nonparametric tests of the scope sensitivity of WTP within each good., Œ š Z ‰ v µ o š] u š } o µ u v ‰ Œ • v š • Œ] • } (Z Á examining, for each outcome, whether WTP for a given risk reduction is significantly smaller than that for a substantially (five times) larger risk reduction. In all cases this weak sensitivity test is satisfied. However, as discussed previously, it should not be regarded as sufficient for the larger risk reduction to have just a larger WTP. Rather, it has long been understood that any income effects should be negligible (i.e. when the budget of the respondent cannot be reasonably argued to be binding) the implied value for the certainty of receiving a good should not be dependent on the risk level used to elicit that value (Jones-Lee, 1974; Weinstein et al., 1980; Hammitt and Graham, 1999). In line with previous studies (e.g. Beattie et al., 1998; Hammitt and Graham 1999; Vassanadumrongdee and Matsuoka, 2005; Andersson et al., 2016), value of the whole good (i.e. in this case the value of avoiding the certainty of either the money loss, temporary stomach complaint, or temporary blindness) can be calculated as WTP divided by the risk reduction. The final column of this table tests

[6] It is possible that a subject might use their response to an initial question to calculate their response to a subsequent question rather than referring to their preferences afresh. For example, if a respondent is first asked about her WTP to avoid a 1/10 chance of a stomach bug, she may then simply multiply her response by ( ] š š Œ u] v Z Œ t d W š } À }] ñ l í ì Z v } (• š } u Z µ P Y X d Z o] l o potentially be reduced where risks are expressed using different denominators (where the necessary calculation is far less obvious, e.g. where the second question concerns a 500/1000 risk), or between different outcomes. Therefore, to avoid these potential problems of anchoring, we focus our analyses on the first responses that an individual provides for a risk expressed using a particular denominator for each negative outcome. In the example above,] (Œ • ‰ } answer to the 1/10 risk was included in a scope sensitivity analyses, then their subsequent response regarding a 5/10 risk would be excluded on the grounds that simple v Z } Œ] v P Z µ Œ] • š] • u Ç Œ • ‰ } v •] À v • • Z Œ X subsequent response to a • u Œ risk expressed as 500/1000 would be included in our scope sensitivity analysis on the grounds that the anchoring heuristic may be weaker here. Question ordering was varied so that multiple risk representations (including all of the above) might be presented first in the list seen be an individual respondent, thereby avoiding any anchoring on that initial response.

whether the implied value of the whole good differs when calculated from responses to smaller as opposed to larger risk reduction. This test effectively examines whether the observed scope sensitivity is insignificantly affected by the level of risk used to elicit WTP; as one would require to avoid framing anomalies. In every case š Z] • Z • š Œ } v P [• fails] šWTP] šoÇ the whole good is inversely proportional to the size of the risk reduction used to estimate it. This confirms prior results that CV respondents over-estimate WTP for small probability risk reductions, a result which may be explained by cumulative prospect theory (Shogren, 1990; Tversky and Kahneman, 1992; Jones-Lee et al., 1995; Dubourg et al., 1997; Beattie et al., 1998; Chilton et al., 1999; u Œ v : } Z (• } v r ^ š).v u v U î ì ì ð

Panel (b) of Table 1 extends this analysis by testing whether the framing of a 0.1 risk as either 1/10 or 100/1,000 alters WTP. Test results clearly reject equality in all cases with WTP to reduce a 100/1,000 risk consistently and significantly greater than that to reduce a 1/10 risk. This is clear evidence of framing effects within such a deliberately straightforward experiment suggest that, when faced with compound, risky options, WTP responses to standard CV questions are likely to fail basic anomaly tests.

These simple tests question the assumptions underlying the CV approach to valuing compound risky options, as applied to the VSL (e.g. as used by Gerking et al., 1988; Krupnick et al., 2002; Alberini and a • v 2Ê1). As described subsequently, the chaining method avoids this challenge by splitting the risk assessment and valuation tasks. In the following section we provide a field study comparison of the standard CV approach to VSL estimation to the Carthy et al., chaining method.

(a) Tests for scope sensitivity	Mean WTP (£) Median (St. Dev.)		Weak test for scope sensitivity:* WTP smaller risk v WTP larger risk [Standard theory does predict a difference] p value (z statistic)	Strong test for scope sensitivity* Scaled WTP smaller risk v WTP larger risk [Standard theory does not predict a difference] p value (z statistic)
	Smaller risk reduction	Larger risk reduction		
Risk in 10	1/10 to 0/10	5/10 to 0/10		
Money stolen	6.21 5.00 (5.69)	19.55 15.00 (14.36)	<0.001 (-5.56)	0.044 (-1.71)
Stomach bug	8.57 5.20 (9.05)	23.96 15.00 (31.9)	<0.001 (-4.39)	0.004 (-2.66)
Temporary blindness	29.23 10.00 (75.89)	57.27 30.00 (104.22)	<0.001 (-3.41)	0.026 (-1.95)
Risk in 1,000	20/1,000 to 0/1,000	100/1,000 to 0/1,000		
Money stolen	5.17 4.50 (5.19)	14.49 7.95 (20.28)	<0.001 (-4.04)	0.011 (-2.30)
Stomach bug	7.61 5.00 (8.02)	14.81 8.10 (17.03)	0.009 (-2.35)	<0.001 (-3.58)
Temporary blindness	16.98 6.15 (29.17)	40.58 19.40 (67.00)	<0.001 (-3.11)	0.033 (-1.84)

(b) Tests for framing effects	Mean WTP (£) Median (St. Dev.)		Significance of difference between risk framed either as 1/10 or 100/1,000[7] [Standard theory does not predict a difference] p value (z statistic)
Risk framing	1/10 to 0/10	100/1,000 to 0/1,000	
Money stolen	6.21 5.00 (5.69)	14.49 7.95 (20.28)	<0.001 (-3.29)
Stomach bug	8.57 5.20 (9.05)	14.81 8.10 (17.03)	0.033 (-1.85)
Temporary blindness	29.23 10.00 (75.89)	40.58 19.40 (67.00)	0.041 (-1.74)

Table 1: WTP responses to avoid negative outcomes at different risk levels: Tests for (a) scope sensitivity and (b) framing effects

Note: Heavier weight grid cells denote data rather than test results

* Non-parametric one-tailed Mann-Whitney Wilcoxon test

[7] One tail test examines whether the 1/10 risk is perceived as smaller than the 100/1,000 risk.

Our experimental results raise considerable concerns regarding the ability of individuals to provide consistent valuations of compound risky health options. The chaining approach was specifically designed to address such challenges. However, how does it perform relative to the more commonly applied CV method when applied in a relevant field context, and how would both approaches address the policy relevant question of whether VSL varies between adults and children? Our first field study set out to answer these questions.

The chaining method

As summarised previously, the chaining method was first developed by Carthy et al (1999) with the intention of overcoming some of the difficulties faced by the CV method in assessing VSL based upon valuations of small changes in health risk. An illustrative example of a CV-style question, with the text in parentheses showing the changes employed when a respondent is asked about a child rather than themselves. The format, including payment time horizon, and risk level, are taken from Krupnick et al. (2002). Note that the respondent is being asked to simultaneously consider both the value of avoiding a negative outcome and the risk of that outcome.

> ^Consider a product that you could buy which reduces your (child's) chance of dying over the next ten years by 5/1000. The product has no other benefits or side effects except reducing the risk of death. Suppose that this product was not provided through public health services, nor would it be covered by private health insurance. Therefore the only way to obtain this product would be for you to pay for it.

tZ š]• šZ u Æ]uµu u}µvš Ç}µ Á}µo Á]oo]vP š} ‰ Ç (}Œ šZ

The chaining method avoids asking respondents to directly value a change in mortality risk, breaking the valuation and risk parts into two steps. The first step essentially uses the CV approach to ask respondents to value the avoidance or cure of what would otherwise be the certainty of a non-fatal ill-health incident. An illustrative example of this first stage in the chaining approach is given below (with the text in parentheses again referring to a respondent being asked about their child rather than themselves).

> Imagine that a test shows that you (your child) is going to suffer severe stomach pains, diarrhoea and vomiting for 2-3 days every 2 weeks for 12 months.
>
> I want you to suppose that a treatment is available which would avoid all of the effects of this to you (your child). Suppose that this treatment was not provided through public health services, nor would it be covered by private health insurance. Therefore the only way to obtain this alternative treatment would be for you to pay for it.
>
> What is the maximum amount you would be willing to pay for this treatment which would bring you (your child) back to full health within a few days after which you (your child) would be cured?

Adjustments to the payment elicitation format as well as the wording of other parts of the question can be made, but crucially this question involves certain, as opposed to risky, outcomes; the respondent does not have to simultaneously consider the probability of an outcome while also assessing their willingness to pay.

The assessment of risk preferences is considered in the second stage of the chaining method, where respondents undertake a risk trade-off. Œ š Z Ç š o X] v] Standard Gamble approach, a respondent is asked to trade-off between either (i) the certainty of a specified ill-health state or (ii) a

treatment which has some chance (e.g. 1/100) of delivering full health and some risk (e.g. 1/10) of death. Respondents vary the risk level until they are indifferent between (i) and (ii). This risk level can then be applied to the respondent's WTP to avoid the certainty of the specified ill-health state to obtain their imputed VSL.

While in principle the Standard Gamble approach should provide an unbiased estimate of VSL, as Carthy et al., (1999) [illegible] ill health states for anything but negligible mortality risks. At the extreme a complete unwillingness to accept any risk of death, even 1/1,000,000, would lead to an infinite VSL. To alleviate this concern and replicate the Carthy et al approach we employ a Modified Standard Gamble (MSG; Baker and Robinson 2004; Jones-Lee et al 1995). The MSG asks the respondent to imagine she has become unwell and is taken to hospital where doctors tell her that if she is not treated then she is certain to die. However, she also is told that there are two possible treatments available to her, both free of charge, for example as follows:

> Treatment A: If successful, the treatment will result in the respondent experiencing the consequences of a specified, non-fatal, ill-health state for a defined period [e.g. the severe stomach pain, diarrhoea and vomiting for 12 months case mentioned previously, or ill-health states X and Y referred to subsequently]. However, if the treatment is unsuccessful then the patient would fall unconscious and die shortly afterwards with probability of 1/1,000 [this risk is set by the analyst and can be varied].
>
> Treatment B: If successful, this treatment will result in return to normal health after a couple of days but if unsuccessful there is a risk that the treatment will result in immediate unconsciousness followed shortly by death [this risk, e.g. is varied until the

respondent states that they are indifferent between Treatment A and B

If successful then Treatment B has a better outcome than Treatment A, and therefore it is expected that the respondent will accept some additional mortality risk for the chance of this better outcome. Notice that in the MSG format, both treatments involve some risk of death, the intention being that this will counteract any certainty effect and still avoid the direct valuation of a risky compound good as in the CV approach.

The two steps of the chaining procedure thus provide: a) a link between money and certainty of a health state; and b) a link between that health state and a risk of death. These are then linked ~ Z Z] v [• š } P š Z Œ U } v v š] v P u } Œ Ÿ š] v] v (Z S L š] v] v . Ç • µ u U

Survey design and sampling

The survey comprised eight main sections: the first four asked the questions necessary to undertake the chaining method and the last four relate to the CV method. The chaining method preceded the direct CV method, as the text describing the chaining method introduced concepts within the survey v] v o µ • u - µ ^ % Á _ Œ « µ • š] } v • X Z v } u] •] v P š Z } Œ Œ } (š Z š Á } ‰ possible (as it would have required altering or adding to the survey text, hindering comparability of the results between treatments) nor considered desirable, including CV questions after the chaining method was deemed likely to improve the consistency of responses to the CV questions and therefore, if anything, was likely to favour the standard CV method. Eight different treatments of the survey were used to control for question ordering effects within each of the two methods (see Appendix 2). Respondents were all parents recruited from the Cambridgeshire area, approached either through

schools or at local attractions for young children.[8] The survey was conducted in person, with face-to-face interviews (as is best practice; Jones and Spackman, 2013) and took an average of a little more than 35 minutes to complete. The sample was not selected to be representative of parents nationally; rather, by randomly allocating each parent to each treatment, we sought to test how robust the CV and chaining methods were to anomalies. In total, 300 respondents took part in this survey, and the complete survey is given in Appendix 3 and the resources that were used in Appendix 4.

Treatments used to describe the non-fatal ill-health scenario were introduced in the warm-up section and parents were asked to consider the following ill-health states, X and Y, as follows:

- X: 3 weeks hospitalisation; 4 months severe pain; permanent pain in hip
- Y: 2 months hospitalisation; 4 months moderate pain; permanent pain in knee

After reading through the ill-health states the respondent ranked them in terms of perceived disutility, first if she was affected, and then if the ill-health states were suffered by her child.

In the chaining method section, each parent was asked to sort a series of randomly presented cards, each specifying a different payment amount, dependent on whether she would or would not be willing to pay that amount for the certainty of avoiding each of these ill-health states. Accounting for the highest amount that she was definitely willing to pay, and the lowest amount she was definitely not willing to pay, she was then asked to estimate the maximum she would pay, with the interviewer explaining that this need not be an amount on any of the cards. This is similar to the Carthy et al

[8] Participation rewards to respondents depended on where they were recruited: either £5 plus a £5 donation to the school; a £10 payment; or two passes for a local play centre (worth £7).

[9] Pre-š •š]vP o•} Æu]v šZ]Œ]oo Z oš Z •š š U •U • Œ] •W ^î Á l pain and bedridden; no permanent ill-Z oš ZX_ ,}Á À ŒU ‰]o}š]vP Œ À o šZ š Œ •‰}v health to trade the risk of ill-health and mortality risk for their children in the MSG with the ill-health state Z, and it was therefore decided to focus these questions on various combinations involving just X and Y.

procedure, with the one difference that ð Z Œ Ê • ‰ } estimate [while again being bounded above and below by the card sort, need not be a value displayed, and is therefore a continuous variable. The respondent then completes the MSG questions relating each of the ill-health states to risks of death. This was implemented with a similar card sorting exercise as to the WTP, but with risk levels rather than monetary amounts being shown on each card. Note, therefore, that we elicit two preference measures, one assessed in monetary terms, the other as additional risk of death to avoid a certain ill-health state. Each respondent was asked to answer on her own behalf and on behalf of a randomly selected child in her household.[10] Thus in the first step of the chaining method we obtained WTP values for both the adult and child to avoid the certainty of the ill-health states described above; and from the MSG we identified the risk of death in Treatment B at which the respondent was indifferent between Treatment A and Treatment B for herself and separately also for her child.

For the chaining method, and following the framework of Carthy et al. (1999), the VSL is calculated by multiplying the stated WTP to avoid a particular ill-health state by the risk trade-off between that ill-health state and death as per Equation (1):

$$8\,5.L\ 9\,6\,2\ H\ \eth \qquad (1)$$

where, to allow for potential framing effects, ð is defined as $\eth_{\acute{Y}} L \frac{5 ? G}{\eth ? G}$ where G is the mortality risk associated with Treatment A (e.g. G = 1/1,000 in prior discussions), and è$_{\acute{Y}}$ is the mortality risk level at which the respondent states she is indifferent between Treatment A and Treatment B. Assumptions regarding the utility function, and the consequent derivation of this equation are given in the Appendix to Carthy et al to which we refer the interested reader. We make one modification from their specification; we use only the monetary WTP value of avoiding the certain ill-health state, rather than a weighted[11] average of WTP and willingness to accept (WTA) values. This allows us to avoid the

[10] If the respondent had more than one child, she was asked to consider the child whose birthday was next.
[11] The exact weighting function depends on the specification of the utility function which is used in the calculations

well-recognised complications and cognitive load associated with eliciting WTA values[12] (Shogren et al., 2010)

The design of the CV element of the questionnaire was based on the approach employed in the highly cited Krupnick et al. (2002) study. After some questions intended to help the respondent think about her overall baseline mortality risk, she was asked to consider how much she would pay for a product that would reduce her risk of dying over the next ten years. Each respondent was asked about products which would reduce the risk of dying over 10 years by 5/1,000 and separately for a risk reduction of 1/1,000. Again, the value was elicited through a card sort exercise, and both questions were also asked with respect to her child. The ordering of the questions were varied depending upon the survey version implemented (see Appendix 2). Each respondent was asked about both levels of risk reduction in order that we could test for possible ordering effects within subject.

To estimate the VSL from CV responses, we follow the methods of previous studies (e.g. Gerking et al., 1988; Krupnick et al. 2002; Alberini and a • v2E11).[13] This estimates VSL as the WTP for a particular change in the probability of death, divided by this probability change (¿L) as shown in Equation (2):

$$VSL = \frac{WTP}{\Delta L} \qquad (2)$$

[12] Using a WTP format makes the survey cognitively more familiar than a WTA frame. The adoption of this approach should not be taken as implying that respondents are strictly risk neutral (or approximated to be, owing to a small income effect), but rather that a linear approximation of the utility function is acceptable for three reasons. First, for goods which have few (or no) substitutes, such as good health, the linear approximation should be theoretically consistent (Amiran and Hagen, 2010). Second, in practice, cost-benefit analyses do not typically account for diminishing marginal values, to the extent they do the cost-benefit analyses conducted by the many organisations listed in the main text, the underlying assumption is that the VSL multiplied by the number of prevented fatalities gives the total value of those prevented fatalities. Finally, if anything, reliance upon WTP rather than a weighted average of WTP and WTA is likely to yield a more conservative estimates of the VSL.

[13] A further approach is to use modelled rather than raw responses. However, this requires additional assumptions concerning the appropriate approach to modelling, assumptions which are somewhat contentious where the data is dominated by anomalous zero WTP responses, e.g. Krupnick et al. (2002) employ a spike model (Kriström, 1997). We prefer to avoid such assumptions and work with actual rather than modelled responses so as to adhere to the approach of Carthy et al. which is the main focus of our study.

Again, we refer the interested reader to Krupnick et al. (2002) for further details. In addition to the arguments given above regarding the] v] À] µ o [• µ š] o] š Ç (µ v š] } v U Á o • } v } š š Z with small baseline risks, the income effect is negligible and hence the linear approximation of the utility function is accepted as standard (Jones-Lee, 1974; Weinstein et al., 1980; Hammitt and Graham, 1999).

Results

WTP to avoid negative health outcome (£)	Mean (£) Median (St. Dev.)		Is the adult value lower than the corresponding child value?* p value (z statistic)
	Adult	Child	
Ill-health state X	29,083 5,000 (102,317)	97,849 15,000 (224,334)	<0.001 (-5.94)
Ill-health state Y	16,738 5,000 (81,824)	112,298 20,000 (242,255)	<0.001 (-7.11)

Table 2: First step (valuation) of the chaining method. Mean and median WTP values for avoiding the certainty of specified ill-health states.

Note: ill-health state X = 3 weeks hospitalisation; 4 months severe pain; permanent pain in hip
ill-health state Y = 2 months hospitalisation; 4 months moderate pain; permanent pain in knee
* Non-parametric one-tailed Mann-Whitney Wilcoxon test

Acceptable ‹ l í U ì ì ì	Mean Median (St. Dev.)		Is the adult value higher than the corresponding child value?* p value (z statistic)
	Adult	Child	
Ill-health state X	62.47 25.00 (95.66)	45.12 10.00 (82.67)	0.006 (-2.50)
Ill-health state Y	75.79 25.00 (119.99)	42.70 10.00 (81.30)	<0.001 (-3.17)

Table 3: Second step (MSG) of the chaining method. Levels of mortality risk (x) stated by respondent at which they are indifferent between Treatment B and particular ill-health state (X or Y) which itself has a mortality risk of 1/ 1,000

Note: Heavier weight grid cells denote data rather than test results
* Non-parametric one-tailed Mann-Whitney Wilcoxon test

Table 2 presents summary statistics of the results for the first step in the chaining method, valuing the certainty of avoiding a negative health outcome. Substantially different mean and median values for a given health outcome and large standard deviations highlight the positive skew of responses. Tests reveal that values for reducing risks to children are very substantially higher than those for adults; a finding which accords with general expectations and informs policy concerns.

Table 3 presents summary statistics for the second step in the chained approach, responses to the MSG question, and tests whether these values are significantly lower for children than for adults. Indeed, it is clear that respondents are prepared to accept substantially higher risk levels for themselves than for their children. Ceteris paribus, this implies a higher VSL for children than adults; a finding which accords with the policy concerns motivating this study.

Taken individually, the higher WTPs for children in Table 2 and the lower acceptable additional mortality risk for children in Table 3 both seem reasonable findings. However, the chaining approach combines these responses together in calculating VSLs and the child premium present in both value and risk assessments seems to suggest the potential for double counting if chained together. We investigate the potential for such biases in the final study of this paper. However, for the moment we press on to the CV results from the present study.

Table 4 presents the results from the CV questions regarding WTP to avoid either a 1/1,000 or 5/1,000 risk of death to either the respondent or their child. To avoid the potential problems of anchoring, ‰ V o ~ • } (d o ð } v o Ç e s p o n s e s t o t h e À r s t o f t h e s e four questions, the ordering of which was rotated across respondents as per Appendix 2. Results show clear differences in first response WTP for adult as opposed to child lives. Results from a weak scope sensitivity test (comparing WTP for a 1/1,000 risk to a 5/1,000 risk) show statistically significant scope in child values but not in

adult values which are dominated by zero WTP responses (medians for both risks being zero)[14]

W v o ~ • }(d o ð o µo š • šZ • u À oµ • P]v µš v}Á µ•]vP]v

life they value. Sc in an ordering which first asked a respondent to value a 1/1,000 risk reduction to

šZ]Œ }Á v o](U ‰ v o ~ • Œ ‰}Œš• À oµ • • }v šZ š Œ •‰}v v

Œ µ š]}v }(íIíUìì š} šZ e.] Œ ering Z] v [si o 6 (in Appendix 2). The potential for

anchoring is obvious and is reflected in findings. Now the adult valuations clearly pass a scope

sensitivity test. Comparison with the insignificant scope revealed in Table 3 suggests that the

responses underpinning Table 4 have been upwardly anchored by their previous (relatively high)

À oµ š]}v }(šZ]Œ Z]o [• o](X ^]u]o Œ o Ç Á µ š]}v• }(Z]o Œ]•l

prior (relatively lower) values for adults. For example, considering the 5/1,000 risk reduction values

for children, in panel (a) first responses provide a mean of £4,127 while in panel (b) anchoring on prior

(relatively lower) adult values gives a second response value of just £2,478 which is no longer

significantly different from the adult value in the first table. Consistency tests across first and second

responses are reported in panel (c) which shows clear evidence of anchoring effects in CV values at

the 5/1,000 risk level.

How do the chaining and CV methods compare? While almost none of the chaining respondents stated

that they would not be willing to pay anything to avoid a given ill health state[15], in the CV task the rate

of zero WTP response ranged from 13% for the 5/1000 risk reduction for the child to 6% for the

1/1000 reduction for the parent. High proportions of zero responses are a common and longstanding

feature of the CV literature observed both in VSL studies (see Krupnick et al, 2002)[16] and across a wide

range of contexts and countries (see for example, Rowe and Chestnut, 1982; Desvousges et al., 1987;

[14] Within-respondent tests reveal no significant impact of education upon these results; see details in Appendix 10

[15] In the chaining exercise just over 1% of respondents gave a zero WTP to avoid a certain ill health state for themselves and no zero bids were recorded in respect of ill health states for children.

[16] Krupnick et al 2002 report a 36% rate of zero responses, a rate which lies in the middle of our observed range.

Bostedt and Boman, 1996; Jorgensen et al., 1999; Strazzera et al., 2003; Cho et al., 2008; Chen and Hua, 2015; Ferreira and Marques, 2015; Lee, 2015; Lee and Heo, 2016; Vossler and Holladay, 2018; and the recent review of the issue of zero responses in CV studies by Chen and Qi, 2018). Recalling that, within our first field study, these are the same people who were happy to engage with the chaining exercise, the high rates of zero WTP and implied illogical zero VSL values, raise considerable concerns about the use of the CV method in this context, particularly where such problems are hidden by aggregate measures such as the mean.

(a) First response WTPs		Mean (£) Median (St. Dev.)		Weak scope sensitivity test* p value (z statistic)
		1/1000	5/1000	
Adult		441 0 (1210)	448 0 (1371)	0.267 (-0.62)
Child		1,047 50 (3484)	4,187 500 (18387)	<0.001 (-4.64)
Adult vs child values*	p value (z statistic)	0.021 (-2.03)	<0.001 (-6.08)	

(b) Second response WTPs		Mean (£) Median (St. Dev.)		Weak scope sensitivity test* p value (z statistic)
		1/1000	5/1000	
Adult		458 0 (1,728)	2341 100 (18,451)	0.001 (-2.98)
Child		880 25 (2,210)	2478 100 (7,359)	0.063 (-1.53)
Adult vs child values*	p value (z statistic)	0.0034 (-2.78)	0.1014 (-1.27)	

(c) Comparing first & second response WTP	Are first and second responses different?* p value (z statistic)	
	1/1000	5/1000
Adult	0.670 (0.44)	0.019 (-2.06)
Child	0.583 (0.21)	0.006 (-2.50)

Table 4: Summary statistics for WTP values from the CV responses for (a) for first responses, (b) for second responses, and (c) comparing these

Note: Heavier weight grid cells denote data rather than test results

* Non-parametric one-tailed Mann-Whitney Wilcoxon test

		Mean (£) [Mean excluding zero] <5% Trimmed mean> Median {Median excluding zero} (St. Dev.)				Framing tests: Significance of anomalies	
Method		CV		Chained		CV[1,**] p value (z statistic)	Chained[2,**] p value (z statistic)
Risk level (CV) or Treatment (Chaining)		1/1000	5/1000	X	Y		
Adult		441,000 [1,143,333] <164,607> 0 {500,000} (1206864)	99,633 [159,484] <28,985> 0 {30,000} (274214)	11,377,436 [11,628,409] <1,289,649> 268,188 {299879} (87221816)	9,144,810 [9,211,561] <1,016,644> 138,119 {151364} (85107745)	0.424[#] (-0.19)	0.218 (-0.78)
Child		1,046,959 [1,036,875] <321,071> 50,000 {500,000} (3484135)	837,321 [965,048] <291,351> 100,000 {200,000} (3677320)	38,420,686 [38420686] <12,003,187> 1,125,857 {1125857} (139644139)	98,399,253 [98399253] <8,802,169> 2,002,004 {2002004} (853117844)	0.973[#] (1.93)	0.324 (-0.05)
Adult vs Child values*	p value (z statistic)	0.021 (-2.03)	<0.001 (-6.01)	<0.001 (-4.75)	<0.001 (-7.17)		

Table 5: VSL estimates using the chaining and CV approach

Notes:
1. Significance of difference between CV VSL values based on WTP for 1/1,000 or 1/5,000 risk reductions
2. Significance of difference between Chained VSL values based on chaining from Health State X or Y

Heavier weight grid cells denote data rather than test results

* Non-parametric one-tailed Mann-Whitney Wilcoxon test, while standard theory expects no difference, the anomaly literature suggests that VSL calculated from a 1/1000 risk may exceed that calculated from a 5/1000 risk.

** Non-parametric two-tailed Mann-Whitney Wilcoxon test, standard theory expects no difference and there is no indication of a directional effect from the anomaly literature.

These results differ substantially when 0 responses for the WTP are removed. The estimate got from the 5/1000 WTP is significantly smaller: for parents (p = 0.001, z statistic = -3.04) and for children (p = 0.005, z statistic = -2.55)

The VSLs from both the CV and chaining approaches are summarised in Table 5. Table 5 for the CV section uses only the first responses as previously described in panel (a) of Table 4 so as to mitigate against the anchoring which is a clear feature of this data. The result is very clear given the means, medians, standard deviations and the fact responses are bound by zero, we observe highly positively skewed data.

Focussing upon the CV findings, here the skew is extreme with medians being zero for the adult values and relatively low for the child values. This results in mean values that are all below those given in the literature. In major part[17] this is likely to reflect the fact that we employ levels of risk similar to those observed in ordinary life (e.g. annual risks of car accidents, fatal cancers, etc. as per Viscusi, 1993) whereas the CV literature often uses much lower risk levels. The clear evidence of insensitivity to scope observed both in this paper, the wider literature and meta-analyses thereof (Lindhjem et al., 2011) strongly suggests that had we used conventional, small risk probabilities our CV derived VSL estimates would be significantly higher.

Untrimmed VSLs for the chaining method are particularly high for estimates of child values, suggesting that child premiums in both the valuation and MSG elements of the method may be causing a double counting bias; again we address this in our final study. Given that there are justifications for trimming extreme values (Chilton et al, 2015), the chained trimmed mean values fall more in line with the extant literature although again the child VSL values remain somewhat, but not implausibly high.

A further, clear message from Table 5 is that, within any method or starting point, VSL values for children are consistently higher than those for adults.

[17] See also our earlier footnote regarding our rejection of the Krupnick et al. decision to use modelled data from a spike model as opposed to raw WTP responses in calculating VSL. This is also likely to have avoided inflation of our CV VSL estimate.

[18] Z] o š } v š o X U v } š š Z š •] v P o Z] P Z À o µ Á } µ o Z À Œ • µ o š] v ^ v š] u • Z] P Z Œ š Z v (p. 297) in the Carthy et al., (1999) study had it not been removed from analysis.

Testing the internal consistency of the chaining method for estimating VSL: A second field study

Results from both our lab experiment and first field study point to significant issues for use of the CV method to estimate VSLs, most particularly in terms of anchoring and the insensitivity of WTP to changes in risk, especially where the absolute magnitude of the risks concerned are small, resulting in framing effects upon VSL estimates. In contrast, the robustness of the chaining method to such framing anomalies and very much lower rates of zero WTP responses (both problems inherent in our CV results), give some reason for cautious optimism regarding the usefulness of the approach. However, as outlined above, results from the first field study gave some cause for concern regarding the ability of the method to appropriately reflect any child premium possessed by parents. If parents use this premium to calculate both their WTP for (certainty) health improvements for their child, and also apply the same premium to their risk trade-offs on behalf of their child, then analysts' combination of these responses to generate VSL estimates may result in a double counting of this child premium. Moreover, the only previous application of the chaining method to the estimation of the VSL (Carthy et al., 1999), reported internal inconsistencies, which has since sparked debate regarding the method (Thomas and Vaughan 2015a&b; Chilton et al., 2015; Jones-Lee and Loomes, 2015).

The focus upon child versus parent VSL values allows us to propose a novel variant of the chaining consistency test devised by Carthy et al. Their chaining approach to estimating VSL links together a single WTP valuation of avoiding a specified ill health state with a corresponding single risk trade-off question, linking that ill-health state to a risk of a fatal outcome. In our final field study we contrast such a Z •] v P o Z] v [with a Z Œ }] µ o Z [variant of the chaining method. Here the risk trade-off is spilt into two parts; the first linking a minor (temporary) to a major (permanent) ill-health state, and the second linking that major ill-health state to mortality. If respondents are only] v } Œ ‰ } Œ š] v P š Z] Œ Z Z] o ‰ Œ u] µ u [ ] v š } š Z À o µ š] } v o u v š }

from the single to double chain variant should have no impact on resultant VSL. However, if the child premium is expressed at each stage of the chaining method then the double chain approach will produce higher values than the single chain variant. Comparison of the single and double chain variants also allows us to test if the chaining approach is internally consistent more generally, adult VSLs should not vary significantly across these variants.

A further insight is provided by switching from the MSG to a more conventional Standard Gamble (SG) format (as discussed previously). Comparison of the single chain VSL obtained in this final study with that given in the previous study allows us to inspect the magnitude of [illegible] derived VSL values.

Questionnaire design

The questionnaire employed a custom designed Computer Aided Personal Interviewing (CAPI) program to visually communicate the risk probabilities[19] and easily randomise the order of treatments. Straightforward descriptions of the ill-health states were adopted using an approach similar to that of Baker et al. (2008) and yielding the following ill-health states (copies of the description cards seen by respondents are given in Appendix 5, the complete questionnaire is in Appendix 6, and further supplementary materials are in Appendix 7):

- Temporary Illness Affecting Adult (TA): Severe stomach pains affecting the respondent with diarrhoea and vomiting for 2-3 days every 2 weeks for 12 months
- Temporary Illness Affecting Child (TC): [illegible] with diarrhoea and vomiting for 2-3 days every 2 weeks for 12 months

[19] The CAPI system conveyed risk probabilities both in terms of percentages and via a coloured grid similar to those used to convey risk in other stated preference studies (e.g. Zhang et al., 2013).

- Permanent Illness Affecting Adult (PA): Severe stomach pains affecting the respondent with diarrhoea and vomiting for 2-3 days every 2 weeks for the rest of life
- Permanent Illness Affecting Child (PC): Severe stomach pains affecting the respondent's child with diarrhoea and vomiting for 2-3 days every 2 weeks for the rest of life

An initial, multiple bounded discrete choice question was used to elicit WTP for these health states[20]. All respondents were then asked to state their willingness-to-pay to avoid the certainty of each of the above illnesses (the first stage of the chaining procedure). WTP responses were elicited using a set of cards[21] (given in Appendix 7) each detailing a separate payment amount which respondents sorted into three categories: Yes, No and Unsure. The respondent is then asked to give a final WTP as before, this results in an estimate of WTP which could take any value (i.e. it is a continuous variable) but does so in a way which capitalises on the cognitive ease of binary question formats. The order in which cards were presented to respondents was randomised (shuffled in front of the respondent) with the value on the first card being recorded to allow inspection of a potential starting point bias (Herriges and Shogren, 1996; Bateman et al., 2001).

Respondents were then presented with the risk trade-off questions variants using the SG format outlined previously. Respondents were asked to choose between the certainty of suffering one of the illness scenarios (Ta, Tc, Pa, Pc above) and an alternative risky treatment with some chance, 1- π, of complete recovery to full health and a π risk of a worse health outcome. This risky or worse health state[22] was either: (1) the permanent condition (Pa or Pc) when considering the certainty of a

[20] Following best-practice guidance (e.g. Bateman et al., 2002; Champ et al., 2017) more than half of the sample completed a budget constraint task. Subsequent testing revealed that this had no significant impact upon subsequently stated WTP values.

[21] Cards ranged in value from £60 to £6,000,000 expressed as both lump-sum payments and as per month equivalents if costs were spread over ten years.

[22] Note again that we use only the WTP estimate where Carthy et al. (1999) use the weighted average of WTP and WTA. We reiterate that doing so will only underestimate any bias.

temporary condition (Ta or Tc)[23] or (2) death when considering the certainty of a permanent condition (Pa or Pc). Starting from an initial level of $\gamma = 0.5$ the CAPI varied this value according to the responses given until the respondent considered the risk of the worse health outcome as just equivalent to the certainty of the alternative health outcome, the algorithm used for this updating is available in Appendix 8.

Combining the WTP and SG responses allows us derive VSL estimates. [illegible] estimated using Equation (3):

$$\frac{\text{[illegible]}}{\text{[illegible]}} \quad (3)$$

[illegible] approach estimates VSL using Equation (4):

$$\frac{\text{[illegible]}}{\text{[illegible]}} \quad (4)$$

[illegible] approach derives VSL by directly linking the willingness to pay to avoid the certainty of permanent illness (β_2) with that risk of death which the respondent feels is equivalent to the certainty of the permanent ill-health condition (γ_a) X [illegible] variant derives VSL by first dividing the willingness to pay to avoid the certainty of temporary illness (WTP$_t$) by that risk of permanent ill-health which the respondent feels is equivalent to the certainty of the temporary ill-health condition (γ_t). This sum is then divided by that risk of death which the respondent feels is equivalent to the certainty of the permanent ill-health condition (γ_p). Proponents of the chaining method (Carthy et al., 1999; Chilton et al., 2015; Jones-Lee and Loomes, 2015) have repeatedly

[23] The subject (adult or child) was kept constant at this stage. So if the adult was the subject of the permanent condition the adult would also be the subject of the temporary condition (and vice versa where the child was the subject).

emphasised that a respondent's WTP_1 should be equal to WTP_{1+}, hence the VSL values derived from the single and double chained variants should not differ significantly. Significant differences would suggest inconsistencies within the approach. Moreover, any inconsistency is particularly apparent for child values then this would suggest that even the single chain VSL may not be robust to double counting.

The questionnaire concluded with a variety of socio-economic and follow-up questions including the

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Sampling procedure

Sampling was undertaking by a professional surveying company in multiple locations across the UK[25] with respondents recruited using a recruitment questionnaire designed to ensure a representative quota sample of parents with children aged less than 18 years old. In total, 996 parents completed the survey, a far larger sample than the only previous study (Carthy et al., 1999) of the chaining method applied to the VSL. The survey was administered on a face-to-face basis by professional interviewers, with the respondents having access to laptops to visualise risks. Respondents were paid for taking part. Interviewers were trained so as to minimise bias as per best practice (Bateman et al., 2002). Interviews took place on both weekends and weekdays to avoid sampling bias. Tests confirmed no significant difference in sub-samples across the various versions of the questionnaire.

Results

[24] Analysis of these variables showed that they did not materially affect the central results of this study and so they are excluded from further discussion, see Appendix 11.

[25] Locations include: Bexleyheath, Cardiff, Chiswick, Colchester, Croydon, Glasgow, Hull, Leeds, Lewisham, London, Romford, Sheffield, Southend, and York.

(a) Ranking and WTP to avoid illness

As per previous studies (Baker et al. 2008), the warm-up exercises showed that respondents generally rank impacts upon child health as more important that those affecting adults, with permanent impacts outranking temporary symptoms (details in Appendix 9).

Turning to consider [illegible] few respondents were observed to state a zero WTP value in the temporary illness valuations (1% for adult and 0.3% for child), and for permanent conditions all WTP values were strictly positive non-zero. These represent much lower proportions of zero responses than those typical of CV studies (see previous discussions), a finding consistent with our first field study.

Resultant WTP values are presented in Table 6, which is solely calculated from responses to the first ill-health state valued so as to avoid any possibility of ordering effects. Results conform to prior expectations with the values given to avoid a permanent ill-health condition always being significantly higher than those for avoiding a temporary condition[26] and adult values being significantly lower than child values. As the temporary condition lasts for one year only, irrespective of the person affected, then results reflect a pure child premium. However, for the permanent condition this difference is likely to have been exacerbated by the higher life-remaining expectancy of the child relative to the parent. This is reflected in the greater excess of mean WTP for children as opposed to adults in the permanent (as opposed to temporary) condition.

[26] This result that stated WTP values are scope sensitive is highlighted in Appendix 11, which also shows that the socio-economic characteristics of the respondent do not affect her scope sensitivity

	Mean (£) Median (St. Dev.)		Are values to prevent permanent ill-health higher than those to prevent temporary ill-health?*
	Temporary ill-health	Permanent ill-health	p value (z statistic)
Adult	13,155 3600 (46958)	27,766 6000 (101906)	0.006 (2.50)
Child	18,354 5999 (39289)	64,424 9000 (427456)	0.001 (3.04)
Are child values higher than adult values?	p value (z statistic)	0.010 (2.32)	0.002 (2.83)

Table 6: WTP to avoid the certainty of negative health outcomes

Note: Heavier weight grid cells denote data rather than test results

* Non-parametric one-tailed Mann-Whitney Wilcoxon test

The encouraging findings of Table 6 are tempered by those of Table 7 which report results from a regression analysis to test for starting point bias. This examines the effect on stated maximum WTP of the value displayed on the randomly selected first card shown to respondents. After controlling for the four ill-health states (P_A, P_C, T_A, T_C) we see a clear, positive and statistically significant relationship between the amount shown on this first card and the final stated WTP. While such anchoring effects are common and long established in CV studies (Bateman et al., 1995; Green et al., 1998; Chien et al., 2005; Flachaire and Hollard, 2006) and indeed have been observed in incentivised, real payment experiments (Bateman et al., 2006), nevertheless the results of Table 7 suggest that the chaining method is not immune from such phenomena.

Table 7: results of a regression analysis testing for starting point bias

Predictor	Parameter (SE)	t value	p value
Intercept (Pa)	6.262 (0.209)	30.006	<0.001
Pc	0.369 (0.150)	2.470	0.011
Ta	-0.449 (0.175)	-2.564	0.014
Tc	-0.071 (0.175)	-0.404	0.686
Ln(starting bid)	0.301 (0.023)	13.137	<0.001

Notes: Dependent variable = natural logarithm of final stated (maximum) WTP
Adjusted R-squared (OLS estimator) = 0.175; N = 996.

(b) Standard Gamble results

Summary statistics of acceptable levels of risk (the permanent condition when faced with a certainty of the temporary condition, and of death when faced with a certainty of the permanent condition) are reported in Table 8.

	Mean risk Median (St. Dev.)	
	Temporary	Permanent
Adult	0.212 0.075 (0.266)	0.188 0.065 (0.253)
Child	0.182 0.075 (0.237)	0.132 0.006 (0.229)
Adult vs child values* p value (z statistic)	0.092 (-1.33)	0.003 (-2.79)

Table 8: Summary statistics for the risk values
Note: Heavier weight grid cells denote data rather than test results
* Non-parametric one-tailed Mann-Whitney Wilcoxon test

Table 8 reveals that parents are unwilling to allow their children to accept the same levels of risk that they would accept for themselves, with this difference in acceptable mortality risk being particularly significant for the more serious permanent ill-health state. Such results conform well to expectations and findings both in the health and other fields (Kahnemann and Tversky 1982, Jones-Lee, 1992, Gilovich and Medvec 1995, Connolly and Zeelenberg 2002, Sørgaard et al, 2012), however they suggest that respondents are applying a child premium in their risk responses, just as they did previously in the WTP questions. The implications for the chaining method of this double expression of a child premium are obvious and it is to these we now turn.

(c) VSLs for adult and child

As discussed earlier, the mean value for VSLs estimated through the chaining approach is highly susceptible to hyper-inflation by a few very extreme positive values. To combat this, one could calculate a double-mean [or Z }µ-o] value using the mean (median) of the sample WTP and acceptable risk level values to arrive at the mean (median) VSL. Indeed, simply calculating this from the statistics in Tables 6 and 8 is both easy and yields results which are plausible if low in the case of adults[27]. However, this imposes a set of assumptions on societal preferences which are difficult to defend and yield values which are challenging to interpret. Instead, we calculate VSL at an individual level, using only the single or double chain first responses given by that individual (to minimise any ordering effect as respondents pass through the four, randomly ordered, ill-health states: Pa, Pc, Ta, Tc) and trimming the resultant data to remove the top and bottom 5%[28] of values to combat extremes, these are reported in Table 9. As w] š Z v Ç ‰ }•] š] À o Ç •l Á]•šŒ] µš]}v }( ]v]À] further trimming of the data would result in an estimate of the VSL which is closer to the median value

[27] Single chain VSL for the parent and child respectively; mean: £147,691 and £1,488,061; median: £92,308 and £1,500,000

[28] Chilton et al., (2015) defend the trimming of data. In the present case trimming the top and bottom 5% reduces mean values by roughly one order of magnitude

which in turn is more similar to those reported elsewhere in the literature, but in the process this would gloss over the certainty bias and double counting anomalies observed.

		Mean VSL (£ million) Median (St. Dev.)		Is the single chain value lower than the corresponding double value? * p value (z statistic)
		Single chain	Double chain	
Adult		1,743 0.22 (4,991)	332,747,600 3.69 (1,578,980,000)	<0.001 (-22.17)
Child		4,436 2.53 (11,069)	1,549,329,000 519.48 (5,958,649,000)	<0.001 (-23.24)
Adult vs child values *	p value (z statistic)	<0.001 (-13.60)	<0.001 (-13.18)	

Table 9: Chained estimates of VSL for adults and children

Note: Calculated using Equations (3) and (4)
Heavier weight grid cells denote data rather than best results
* Non-parametric one-tailed Mann-Whitney Wilcoxon test

Ignoring the absolute values recorded in Table 9, at first glance these results appear promising. The VSL values for children are significantly larger than those for adults, conforming well to our expectations. However, comparing the mean single chain VSL with those estimated in the first field study, highlights š Z š Z Œ š (Indicated by our switch from the MSG to SG format for the second field study) hyper-inflates estimated VSL; respondents seem very unwilling to accept even small mortality risks when even a very adverse alternative ill-health state involves no risk of death. This inflation in resultant VSL is very substantially exacerbated when we move from the single to double chain format with the latter values being very significantly larger than the former.[29] This exacerbation applies to both the child and adult values suggesting that not only does the method

[29] Similarly to calculating the VSL with the single chain, using the double chain approach but with just population mean values does inflate the VSL, but this is much less than in the case the double chained VSL is calculated on the individual level and then averaged. We reiterate that such an approach would on u] • Œ ‰ Œ • v š ‰ } ‰ o [• ‰ Œ (Œ v • X

double count any child premium, it also double counts adults utility for their own health. An]vš Œ •š]vP Æš v•]}v š} šZ]• ‹µ •š]}v• }(may investigate whether this Z]o [• o premium is driven by being an individual who is cherished by the respondent, or by an age premium; •µ Z v]v•]PZš }µo P]v Ç •l]vP Œ •‰}v vš• }µš šZ]Œ ‰ C

Concluding remarks

We present a set of lab and field exercises to examine the robustness of the CV and Chaining methods for estimating VSL values for both adults and children. Findings across these studies reveal a number of consistent results. The CV approach of asking respondents to value compound goods consisting of both risk levels and outcomes reveals a number of anomalies. Despite a series of exercises to improve understanding of risk, respondents struggle to comprehend risk levels, giving inconsistent responses to the same probability levels expressed in different formats, and over-valuing small as opposed to larger reductions in risk. The CV method also seems prone to rejection in the form of high rates of zero WTP bids for health risk reductions which cannot reasonably be described as having no value.

The chaining method therefore potentially offered a innovative response to the various problems exhibited by the CV approach, not least an unwillingness on the part of respondents to engage with such questions. The chaining method performs well in this respect with respondents appearing to understand and accept the constituent certainty valuation and risk trade-off elements of the method. However, the chaining approach appears just as vulnerable to starting point bias as the CV method. More uniquely the chaining approach seems vulnerable to an inflationary certainty effect when the risk trade-off is framed using conventional SG (as opposed to MSG) formats and is susceptible to small errors in stated risk levels when estimating the VSL. Furthermore, and of most concern, when exposed to the test for internal consistency, the chaining approach clearly fails, double counting any premium to yield infeasibly high VSL values.

In short our study reveals substantial challenges to the application of both the CV and chaining methods. Given the vital importance of deriving robust VSL estimates for practical project appraisal and benefit cost analysis there is clearly considerable work to be done before these problems can be solved. However, both of our field studies using either method do reveal a very clear message to the policy question which prompted this investigation, we find strong evidence that parents place a higher VSL on their child that they do for their own lives.

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Appendix 1: Screenshots of the survey respondents completed in the lab experiment

Appendix2: The eight treatments of thefirst field survey

Version 1	Version 2	Version 3	Version 4
Chaining Method	Chaining Method	Chaining Method	Chaining Method
1. WTP to prevent illhealth X to parent	1. WTP illhealth Y to parent	1. WTP illhealth X to child	1. WTP illhealth Y to child
2. MSG linking X to death for parent	2. MSG Y for parent	2. MSG X for child	2. MSG Y for child
3. WTP to prevent illhealth Y to child	3. WTP illhealth X to child	3. WTP illhealth Y to parent	3. WTP illhealth X to parent
4. MSG linking Y to death for child	4. MSG X for child	4. MSG gamble Y for parent	4. MSG X for parent
Direct WTP 10 year risk	Direct WTP 10 year risk	Direct WTP 10 year risk	Direct WTP 10 year risk
5. WTP to reduce mortality risk by 5/1000 for parent	5. WTP 5/1000 parent	5. WTP 5/1000 child	5. WTP 5/1000 child
6. WTP to reduce mortality risk by 1/1000 for parent	6. WTP 1/1000 parent	6. WTP 1/1000 child	6. WTP 1/1000 child
7. WTP to reduce mortality risk by 5/1000 for child	7. WTP 5/1000 child	7. WTP 5/1000 parent	7. WTP 5/1000 parent
8. WTP to reduce mortality risk by 1/1000 for child	8. WTP 1/1000 child	8. WTP 1/1000 parent	8. WTP 1/1000 parent
Version 5	Version 6	Version 7	Version 8
Chaining Method	Chaining Method	Chaining Method	Chaining Method
1. WTP illhealth X to parent	1. WTP illhealth Y to parent	1. WTP illhealth X to child	1. WTP illhealth Y to child
2. MSG X for parent	2. MSG Y for parent	2. MSG X for child	2. MSG Y for child
3. WTP illhealth Y to child	3. WTP illhealth X to child	3. WTP illhealth Y to parent	3. WTP illhealth X to parent
4. MSG Y for child	4. MSG X for child	4. MSG gamble Y for parent	4. MSG X for parent
Direct WTP 10 year risk	Direct WTP 10 year risk	Direct WTP 10 year risk	Direct WTP 10 year risk
5. WTP 1/1000 parent	5. WTP 1/1000 parent	5. WTP 1/1000 child	5. WTP 1/1000 child
6. WTP 5/1000 parent	6. WTP 5/1000 parent	6. WTP 5/1000 child	6. WTP 5/1000 child
7. WTP 1/1000 child	7. WTP 1/1000 child	7. WTP 1/1000 parent	7. WTP 1/1000 parent
8. WTP 5/1000 child	8. WTP 5/1000 child	8. WTP 5/1000 parent	8. WTP 5/1000 parent

Appendix 3: Complete questionnaire used in Field Study 1

INTERVIEWER INSTRUCT IONS

- Statements and questions appearing in bold are to be read out to the respondent.
- Instructions and comments for interviewers are given [CAPITALS].
- Ensure that any showcards not in use are set aside.
- Please write all comments in BLOCK CAPITALS.
- If the respondent wants to go back to change answers please cross through original and circle revised answer and mark REV.

0.1

INTERVIEWER ID	XXXXXX
DATE	XXXXXX
RESPONDENT ID	XXXXXX
TELEPHONE NUMBER	XXXXXX
START TIME	XXXXXX
FINISH TIME	XXXXXX

INTRODUCTION

%HIRUH ZH VWDUW ,¶G MXVW OLNH WR JLYH \RX VRPH J
WKH LQWHUYLHZ ZH¶UH DERXW WR GR 7KLV VWXG\ LV D
most of us would want to reduce our risks of illness or premature death by as much as possible, money spent on these things means there is less money to spend on RWKHU ³JRRG´ WKLQJV 6R WKHUH LV D QHHG WR VWUL of the public like ourselves want to see spent on safety and what we want to see VSHQW RQ RWKHU ³JRRG´ WKLQJV 7KLV VWXG\ DLPV WR WU\ DQG IL UHGXFWLRQV LQ LQMXULHV WR WKHPVHOYHV DQ UHODW

It is almost certain that different people will have different opinions about the LQMXULHV DQG WKHLU SUHYHQWLRQ ZRXOG EH DIIHFWHG LQ GLIIHUHQW ZD\V 7KHUHIRUH, WKHUH LV QR RQH ³FRUUHFW´ DQVZHU , P RQO\ LQWHU

The survey will take approximately 45 minutes to complete. I would like to reassure you that your answers will of course be treated in complete confidence and will be used solely as part of this research.

To start, can you tell me a little about the people who live in your household, including yourself?

[COMPLETE TABLE BELOW]
0.2

	Name/Identifier	Relationship (i.e. wife, son, etc.)	Occupation	Gender (M/F)	Age
1	XXX	The respondent	XXX	XXX	XXX
2	XXX	XXX	XXX	XXX	XXX
3	XXX	XXX	XXX	XXX	XXX
4	XXX	XXX	XXX	XXX	XXX
5	XXX	XXX	XXX	XXX	XXX
6	XXX	XXX	XXX	XXX	XXX

SECTION 1

1.1 ,Q WKH QH[W FRXSOH RI VHFWLRQV ZH¶UH LQWHUHVWHG W\SHV RI LQMXULHV)RU QRZ ,¶G OLNH \RX WR FRQFH from road accidents.

1.2 For the purpose of this exercise please imagine you had just had a road accident where you suffered an injury. Please assume that the road accident involved no RQH HOVH DQG LW ZDV QRERG\¶V IDXOW LW ZDV D SXU

,QMXULHV IURP URDG DFFLGHQWV FDQ YDU\ D JUHDW G three particular injuries described on these cards. Each card describes a particular injury that might result from such an accident. At the moment they are in no particular order.

[HAND RESPONDENT INJURY CARDS X, Y, Z]

:KDW ,¶G OLNH \RX WR GR LV UHDG WKURXJK WKH FDUGV DQG P RP HQW V sort them into order on the table in front of you with the one you would find most bearable at the top to the one you would least like to experience at the bottom. If you think any of these are equally as bad, you can place them along side each other.

:KHQ \RX¶UH FRQVLGHULQJ KRZ VHYHUH DQ LQMXU\ LV WKH LPSDFW DQ LQMXU\ PLJKW KDYH RQ \RXU LQFRPH an insurance scheme would cover any loss of income whilst on sick leave.

[RECORD RESPONDENTS RANKING RESULTS]

INJURY CARD	RANKING (1 TO 3) 1=least severe, 3=most sever
X	XXX
Y	XXX
Z	XXX

,Q WKH QH[W TXHVWLRQ ZH¶UH RQO\ LQWHUHVWHG LQ ,

SECTION 2

[REMOVE INJURY CARDS Y and Z]

2.1 So in this question I want you to consider how much it would be worth to you to avoid the hospitalization, restriction to activities, pain, and the permanent injury associated with injury X.

2.2 To give us an idea of the value to you of a quick recovery, I want you to suppose that an alternative treatment was possible which would return you to your normal health within 3-4 days. Please imagine that this treatment did not happen to be available on the NHS nor would it be covered by private health insurance Therefore the only way to obtain this alternative treatment would be to pay for it yourself. You may feel that a quick recovery is worth only a very little or even QRWKLQJ 7KHQ DJDLQ \RX PD\ IHHO LW LV ZRUWK TXLV guesV WKH ³FRVW´ RI WKH WUHDWPHQW , UHDOO\ ZDQW \ be worth to you in terms of your welfare.

2.3 Do you think your household would be willing to pay something, however large or small, to avoid you experiencing the consequences of Injury X?

[,) ³<(6´ &2175,28(7 ,) ³12´ 2 7

2.4 What is your main reason for not wanting to pay something?

[INSERT REASON]_____XXXXXXXXXX _____

[IF CONCERNED ABOUT NHS OR SIMILAR EXPLAIN THAT SURVEY IS NOT RELATED TO NHS IN ANYWAY. IF CONCERNED THAT WOULD BE TOO MUCH REASSURE THAT IT MAY ONLY BE A VERY SMALL AMOUNT. IF WTP = 0 GO TO SECTION 3]

2.5 Since you would consider paying something, I would like you to give me your best estimate of the largest amount of money that you think your household would be willing to pay for you to not have Injury X. By the largest amount of PRQH\ \RX¶G EH ZLOOLQJ WR SD\ , PHDQ WKH DPRXQW make you prefer to suffer injury X.

To help you work out yoX U DQVZHU WR WKLV TXHVWLRQ EHFDX people normally think about, I have here a set of cards with some money amounts on. There are a wide range of numbers (from £1 to £1,000,000) since we are not sure what people think.

2.6 So, to help \RX DQVZHU WKH TXHVWLRQ ,¶OO MXVW H[SO

[PLACE WTP TEMPLATE IN FRONT OF RESPONDENT; ONLY GIVE MONEY CARDS AFTER INSTRUCTIONS HAVE BEEN READ OUT]

In this top box you should place all the cards showing amounts of money you think it would definitely be worth to you to return to your normal health quickly rather than suffer the consequences of Injury X.

>32,17 72 ³'(),1,7(/< :28/' 3$<´ %2; 21 6+2:&$5'@

Place all the cards showing amounts of money that would definitely not be worth it to you to pay to return to your normal health quickly, preferring instead to put up with the consequences of the injury, in this box.

>32,17 72 ³'(),1,7(/< :28/' 127 3$<´ %2; 21 6+2:&$5'@

Any cards showing amounts that you are initially unsure about whether or not \RX ZRXOG SD\ FDQ EH SODFHG LQ WKL\ RU GGOH ³8QVX

>32,17 72 ³81685(´ %2; 21 6+2:&$5'@

[SHOW RESPONDENT ALL MONEY CARDS. SHUFFLE AND GIVE TO RESPONDENT.]

When answering the question, please bear in mind:

- You could pay for example out ofcurrent income/savings/investment or take out a loan.
- But whatever you pay or borrow to get better quickly will reduce the amount of money available to you to spend on other things, such as bills, holidays, and other things.

[RESPONDENT SORTS CARDS]

[RE&25' /2:(67$1'$5'6+(67$028817,1³81685(´%2;@

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXX	XXXXXX

27 So, the cards were just meant to help you think about your answer. Now \RX¶YH VRUWHG WKH FDUGV DQG NHHSLQJ \RXU LQFRP largest amount that you think the household would definitely pay? So, it might be an amount on one of the cards, or it might not.

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE THEIR +286(+2/'¶6 2:1 :73 &203/(7(7$%/(%(/2:@

RESPONDENTS BEST ESTIMATE O THE LARGEST WTP TO RETURN TO NORMAL HEALTH QUICKLY, RATHER THAN SUFFER INJURY X	£ XXXXXX

SECTION 3

[REMOVE INJURY CARD, MONEY CARDS, AND TEMPLATE]

3.1 In this next section, we are no longer interested in money. Instead we are interested in what you feel about risk; which in one way or another is part of all our day-to-day lives.

In th H I R O O R Z L Q J T X H V W L R Q V Z H ¶ O O E H D V N L Q J \ R X W R you might be willing to take on for hospital treatments that have certain benefits.

3.2 So, once again please suppose that you were injured in a road accident, involving only yourself, and were taken to hospital. The doctors tell you that, due to the nature of the injury you have sustained, if you were not treated you would certainly die However, they also tell you that you can choose between two treatments - this time both are available free of charge. Of course, as with any U H D V R Q D E O \ V H U L R X V K R V S L W D O W U H D W P H Q W E R W K F about this in a moment. From your point of view, you will not notice much difference between the treatments when you undergo them, so we are not asking you to choose between them on those grounds.

> 6 + 2 : 5 (6 3 2 1 ' (1 7 7 5 ($ 7 0 (1 7 & $ 5 ' µ $ ¶ $ 1 ' µ % ¶ @

3.3 The two treatments are shown on these cards : H ¶ Y H F D O O H G W K H 7 U H D W P H Q W $ D Q G 7 U H D W P H Q W % , ¶ O O V D \ V R P H W K L Q E H F D X V H L W ¶ V W K H V D P H L Q E R W K W U H D W P H Q W V , I W W K H Q \ R X ¶ O O K D Y H V R P H L Q I R U P D W L R Q D E R X W

3.4 However, each treatment has a different successful outcome.

If Treatment A were to be successful you would experience the consequences shown on Treatment card A.

[POINT TO SUCCESSFUL OUTCOME ON TREATMENT CARD A AND READ THROUGH]

In contrast, if Treatment B were to be successful you would return to your normal health in 3-4 days.

[POINT TO SUCCESSFUL OUTCOME ON TREATMENT CARD B AND READ THROUGH]

3.5 So, first of all, I want you to think about how you would choose between the treatments if the chance of the failed outcome were the same in both. Which treatment do you think you would choose if the chance of the failed outcome was exactly the same for both Treatment A and Treatment B?

[ALLOW RESPONDENT TO INDICATE CHOICE EITHER VERBALLY OR BY POINTING. IF THEY ARE UNWILLING TO CHOOSE EITHER OR INDIFFERENT BETWEEN THE TWO PROBE FURTHER AND REMIND IF NECESSARY THAT IF NOT TREATED THEY WILL CERTAINLY DIE/FAILED OUTCOME IS THE SAME IN BOTH TREATMENTS.]

[IF THE RESPONDENT CHOOSES TREATMENT A PROBE FURTHER TO TRY AND IDENTIFY WHERE EXTRA CLARIFICATION OF THE SCENARIO MAY BE NEEDED.]

[IF THE RESPONDENT CHOOSES TREATMENT B ALSO PROBE TO SATISFY RESPONDENT HAS UNDERSTOOD AND THEN CONTINUE BELOW]

3.6 OK, we have just considered the two treatments when the chances of a failed outcome were the same. Now I want you to think about how you would choose between the treatments if the chances were not the same.

Different treatments have different chances of failure. Some may be very high while others may be very low. Taking Treatment A first, I want you to assume in this question that it has a chance of failing of 1 in 1,000 as shown on this risk card. There are 1,000 squares. 999 are white and one is red. So out of every 1,000 Treatment As undertaken, 999 people would have the successful outcome and [POINT TO SUCCESSFUL OUTCOME ON TREATMENT A] and one would have the unsuccessful outcome [POINT TO SUCCESSFUL OUTCOME ON TREATMENT A].

[PLACE GRID WITH 1/1,000 RISK UNDER TREATMENT A]

1RZ OHW¶V WKLQN DERXW 7UHDWPHQW % DQG LPDJLQH of the failed outcome. What we want to try and find out is your best estimate of the highest chance of failure you would accept for Treatment B. To help you think DERXW WKLV ZH¶OO XVH VRPH FDUGV DJDLQ

[SHOW RESPONDENT RISK CARDS AND SHUFFLE THEM. TAKE TOP CARD FROM PILE. PLACE RISK SORTER TEMPLATE ON TABLE]

Each of the cards shows a different risk of failure for treatment B. For each one, please decide whether or not you would choose Treatment B over Treatment A, bearing in mind that the chance of failure for Treatment A remains at 1 in 1000. As usual, please sort the cards into three piles.

[GIVE RESPONDENT SORTING SHOWCARD]

[IF NECESSARY GO THROUGH SORTING PROCEDURE AGAIN AS FOLLOWS]

Place all the cards showing chances of failure of Treatment B where you would be prepared to take that risk under this heading at the top of the SHOWCARD. This meansyou would definitely choose Treatment B rather than Treatment A.

>32,17 72 ³:28/' '(),1,7(/< &+226(% 5$7+(5 7+$1 $ ´ +($',
ON TEMPLATE]

Then place all the cards where you would not be prepared to take that risk and would definitely not choose Treatment B under this heading at the bottom. This of course means you would choose Treatment A instead.

>32,17 72 ³:28/' '(),1,7(/< 127 &+226(% 5$7+(5 7+$1 $
HEADING ON TEMPLATE]

Any cards you are unsure about whether or not you would take that risk for Treatment B can be placed under this middle "Unsure" heading.

>32,17 72 ³81685(´ +($',1* 21 7(03/$7(@

[RESPONDENT COMPLETES SORTING TASK]

3.7 >5(&25' /2:(67 $1' +,*+(67 5,6. 1 81685(´ %2;@

LOWEST RISK	HIGHEST RISK
XXXXXXXX	XXXXXXXX

[IF THE RESPONDENT IS WILLING TO TAKE EXTRA CHANCES FOR TREATMENT B GO TO 3.9.]

[IF RESPONDENT IS UNWILLING TO TAKE EXTRA CHANCES GO TO 3.8.]

3.8 To find out if there is a chance of failure somewhere between 1 in 1,000 and 2 in 1,000 that you would accept for Treatment B, please consider the following.

[SHOW RESPONDENT SHOWCARD 3]

A 1 in 1,000 chance is the same as saying 10 in 10,000 and 2 in 1,000 is the same as 20 in 10,000. All the chances between 10 in 10,000 and 20 in 10,000 are shown in the list. Would you be willing to take any of these risks for Treatment B, bearing in mind the chance of failure is 10 in 10,000 for Treatment A? If so, can you tell me the highest chance of failure you would accept for Treatment B.

WOULD CHOOSE B 10 in 10,000 (1 in 1000)

(RATHER THAN A)

11 in 10,000
12 in 10,000
13 in 10,000
14 in 10,000
15 in 10,000
16 in 10,000
18 in 10,000
19 in 10,000

WOULD NOT CHOOSE B (CHOOSE A INSTEAD)

20 in 10,000 (2 in 1000)

[RECORD RESPONSE HERE IF NOT WILLING TO TAKE ON EXTRA RISK. RECORD 1/1,000 RESPONSE. JUMP TO SECTION 4.]

RESPONDENTS BEST ESTIMATE OF HIGHEST RISK OF FAILURE ACCCEPTED FOR TREATMENT B	XXXXXX

3.9 So looking at the cards you have placed in the different boxes, if the chance of failure is 1 in 1,000 for Treatment A, think for a moment and when you are ready, tell me your best estimate of the highest chance of failure you would accept for Treatment B. This may or may not be a risk shown on one of the cards.

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE THEIR OWN MAXIMUM RISK. COMPLETE TABLE BELOW]

RESPONDENTS BEST ESTIMATE OF HIGHEST RISK OF FAILURE ACCCEPTED FOR TREATMENT B	XXXXXXX

SECTION 4

[CLEAR AWAY RISK and TREATMENT CARDS AND TEMPLATE]

4.1 Now I want to go back to the ranking exercise you did at the beginning of the survey but now I want you to imagine that the injury is to another member of your IDPLO\ ZKR ,¶OO SLFN DW UDQGRP 7KH ,' QXPEHU RQ W focus on a childunder 16 in your family.

[IF RESPONDENT HAS ONE CHILD GO TO 4.2. IF HAS MORE THAN ONE CHILD GO TO 4.3].

4.2 As there is only one child in your family that means the following questions will focus on[INSERT NAME]. [GO TO 4.4]

>5(&25' 6$03/(&+,/'¶6 1$0([INSERT TABLE 1]

XXXXXXXX

4.3 To pick a child at random can you tell me which of your children has their birthday next?

>5(&25' 6$03/(&+,/'¶6 1$0($6 ,1 7$%/(@

XXXXXXXX

The following questions will focus on[INSERT NAME].

4.4 OK, so here are the injuries that you ranked earlier, only this time they are written to be applicable to a child.

[GIVE RESPONDENT INJURY CARDS, W, X, Y, Z.]

$V EHIRUH ,¶G OLNH \RX WR WDNH D IHZ PRPHQWV WR U this time think about how severe it would be for your child to suffer each of the injuries. Then sort them into order on the table from the one you regard as THE LEAST SEVERE for [INSERT NAME] at the TOP, to the one you regard as THE MOST SEVERE - that is the one you think would be worst for your child to suffer - at THE BOTTOM.

[ENCOURAGE RESPONDENT TO SAY SOMETHING ABOUT THEIR RANKING. RECORD RESPONDENTS CHOICES IN TABLE BELOW]

INJURY CARD	RANKING (1 TO 3) 1=least severe 3=most severe
X	XXXXXX
Y	XXXXXX
Z	XXXXXX

[REMOVE INJURY CARDS EXCEPT INJURY Y]

4.5 Now suppose that [INSERT NAME] has been involved in a road accident that affected only [HIMSELF/HERSELF] and has resulted in Injury Y

[POINT TO INJURY CARD Y ON TABLE AND READ]

In this question we would like to find out how much your household would value the opportunity for [INSERT NAME] to get better very quickly to avoid Injury Y. Imagine that there was an alternative treatment which would return [INSERT NAME] to [HIS/HER] normal health within 3-4 days and would avoid the permanent injury.

4.6 Do you think your household would be willing to pay something, however large or small, to avoid the consequences of [INSERT NAME] having Injury Y?

[,) ³ < (6 ´ & 2 1 7 , 1 8 (7 ,) ³ 1 2 ´ O 4.7] 7

4.7 What is your main reason for that?

[RECORD REASON] ___ XXXXXX _____

[GO TO SECTION 5]

4.8 6 H H L Q J D V \ R X U K R X V H K R O G Z R X O G E H Z L O O L Q J W W K L Q N D E R X W W K H P D [illegible] P X P \ R X U K R X V H K R O G Z R X O G E W K H V D P H F D U G V D V E H I R U H « 6 R E H D U L Q J L Q P L Q G Z K and that money spent on this could then not be spent on other things, could you V R U W W K H F D U G V D V E H I R U H L Q W R S L O H V R I D P R X Q W V S D \ G H I L Q L W H O \ Z R X O G Q ¶ W D Q G W K R V H W K D W \ R X ¶ U H

[SHUFFLE MONEY CARDS AND GIVE TO RESPONDENT ALONG WITH WTP SORTER TEMPLATE]

[RESPONDENT COMPLETES SORTING TASK]

> 5 (& 2 5 ' 2 : (6 7 $ 1 ' + , * + (6 7 $ 0 2 8 1 7 , 1 ³ 8 1 6 5 (´ % 2 ; @

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXXX	XXXXXX

4.9 As before the cards are only meant to help you think about your answer. 1 R Z \ R X ¶ Y H V R U W H G W K H P F R X O G \ R X W H O O P H W K H P your household would definitely pay for [INSERT NAME] to return to normal health quickly, rather than suffer Injury Y. So, the largest amount that you would put in this pile. [POINT TO WOULD DEFINITELY PAY BOX]. This might be an amount on one of the cards, or may not be.

RESPONDENTS BEST ESTIMATE O THE LARGEST AMOUNT THEY WOULD PAY	£ XXXXXX

SECTION 5

[CLEAR AWAY INJURY CARD, MONEY CARDS AND TEMPLATE]

5.1 6R LQ WKLV QH[W TXHVWLRQ ZH¶UH QR ORQJHU LQ feel about risk. For the purpose of this question I want you to assume that [INSERT NAME] has been injured in a road accident, involving only [HIMSELF OR HERSELF], and has been taken to hospital. The doctors tell you that, due to the nature of the injury [INSERT NAME] has sustained, if [HE/SHE] is not treated [HE/SHE] will certainly die. However, they also tell you that you can choose between two treatments ± both free ² however, as with any reasonably serious hospital treatment both of these treatments carry a risk of failure.

[SHOW RESPONDENT TREATMENT CARD E AND F]

5.2 7KH WZR WUHDWPHQWV DUH VKRZQ RQ WKHVH F Treatment E and F. As before the failed outcome is the same in both. So, if either treatment failed then your child would fall unconscious and die shortly afterwards.

However, each treatment has a different successful outcome.

If Treatment E were to be successful your child [INSERT SAMPLE CHILD NAME] would experience these consequences.

[POINT TO SUCCESSFUL OUTCOME ON TREATMENT CARD E AND READ ALOUD.]

In contrast, if Treatment F were to be successful your child [INSERT SAMPLE CHILD NAME] would return to [HIS/HER] normal health in 3-4 days.

[POINT TO SUCCESSFUL OUTCOME ON TREATMENT CARD F AND READ ALOUD.]

5.3 I want you to assume that the chance of the failed outcome for Treatment E is 1 in 1,000, shown on this risk card. What I want you to think about is the highest risk you would accept for Treatment F.

These cards, which I want you to sort in a moment, show chances of failure for Treatment F.

[SHUFFLE THE TREATMENT RISK CARDS]

[TAKE TOP RISK CARD FROM PILE]

5.4 [DESCRIBE CARD AND PROCEDURE IF NECESSARY]

5.5 For each one, please decide whether or not you would choose for your child to have Treatment F over Treatment E. Remember that the chance of failure for Treatment E remains in all cases as 1 in 1,000.

[PLACE RISK SORTING TEMPLATE ONTO TABLE]

As before, please sort the cards into the three piles.

[RESPONDENT COMPLETES SORTING TASK]

>5(&25'/2:(67 $1'+,*+(67 5,6.,1 ³81685(´ %2;@

LOWEST RISK	HIGHEST RISK
XXXXXX	XXXXXX

[IF RESPONDENT IS WILLING TO TAKE EXTRA CHANCES FOR TREATMENT F JUMP TO 5.7]

[IF RESPONDENT IS UNWILLING TO TAKE EXTRA CHANCES FOR TREATMENT F GO TO 5.6.]

5.6 To find out if there is a chance of failure somewhere between 1 in 1,000 and 2 in 1,000 that you would accept for Treatment F, please consider the following.

[GIVE RESPONDENT SHOWCARD 4]

A 1 in 1,000 chance is the same as saying 10 in 10,000 and 2 in 1,000 is the same as 20 in 10,000. All the chances between 10 in 10,000 and 20 in 10,000 are shown in the list below. Would you be willing to take any of these risks for Treatment F bearing in mind the chance of failure is 10 in 10,000 for Treatment E? If so, can you tell me the highest chance of failure you would accept for Treatment F.

WOULD CHOOSE F (RATHER THAN E)	10 in 10,000 (1 in 1,000)
	11 in 10,000
	12 in 10,000
	13 in 10,000
	14 in 10,000
	15 in 10,000
	16 in 10,000
	18 in 10,000
	19 in 10,000
WOULD NOT CHOOSE F (CHOOSE E INSTEAD)	20 in 10,000 (2 in 1,000)

[RECORD RESPONSE BELOW AND JUMP TO SECTION 6. IF RESPONDENT UNWILLING TO TAKE 11 IN 10,000 RECORD A 1/1,000 RESPONSE]

RESPONDENTS BEST ESTIMATE O HIGHEST RISK OF FAILURE ACCCEPTED FOR TREATMENT F	XXXXXX

5.7 So, as before the cards are only to help you think about your answer. Now \ R X ¶ Y H V R U W H G W K H F D U G V F D Q \ R X W H O O P H \ R X U E H \ R X ¶ G D F F H S W I R U 7 U H D W P H Q W) 6 R W K L V P L J K W E H D could be anotherrisk.

RESPONDENTS BEST ESTIMATE O HIGHEST RISK OF FAILURE ACCCEPTED FOR TREATMENT F	XXXXXX

SECTION 6

[CLEAR AWAY RISK CARDS, TEMPLATE, and TREATMENT CARDS]

6.1 In this section, I want you to go back to thinking about risks to yourself. This time, however, not only risks from traffic accidents, but all risks. Of course at all ages we face health risks including risks that can kill us. Usually we aim to reduce these risks as much as possible but it is not always possible to eliminate them completely.

6.2 >6((7$%/(%(/2:)25$33523,$7(5,6.&$5'6)25(6321'(17 AGE GROUP. PASS CARD TO RESPONDENT]

Risk Charts for different ages

Age	Risk
0-5	16
6-10	18
11-16	22
17-25	31
26-35	41
36-45	57
46-55	78
56-65	158
65 +	250

[HAND RESPONDENT SHOWCARD 5.]

This card shows the average risk of dying from all causes in the next 10 years for a someone in your age group. This is the risk of you dying from now or any time in the next 10 years. So, the risk means you could die today, in 1 year, 3 years, 5 or 7 years for example.

The card shows a[N in 1,000] chance of dying. This means that out of every 1,000 people your age [1000-N] would still be alive 10 years from now and [N] people out of the 1,000 would die.

[HAND RESPONDENT SPECIFIC RISK CARD]

Some of the leading causes of death in your age group for the average person are shown on this card. So, for example out of 1,000 people in your age group on average [N] would die in the next 10 years from cancer. So, the average risk is shown on this card as [N in 1,000]. The leading types of cancer are shown here [POINT TO TEXT UNDER TABLE].

Going back to the risk of dying from everything, this card shows the risk for the average person [POINT TO RISK CARD]. <RX PD\ WKLQN WKDW \RX¶UH U same, higher or lower than the average.

Do you think your risk is the same, higher, or lower than the average?

[RECORD ANSWER]

6.3 In this next question I want you to imagine that there was a product, like a magic wand type thing, that you could buy which would reduce your risk of dying by 5/1,000. For the average person, this risk reduction is shown on this card. [SHOW AND POINT TO RISK CARD 6] The product has no other benefit or side effects except reducing your risk of dying. The product is not available on the NHS nor is it covered by health insurance.

[IF RESPONDENT THINKS THEIR RISK IS DIFFERENT THEN READ THE FOLLOWING] Even if you think that your risk is different from the average it ZRXOG UHGXFH HYHU\RQH¶V ULVN EV VR LW ZLOO by 5/1,000.

6.4 Do you think your household would be willing to pay something every year for 10 years, however large or small, for this product which would reduce your risk of dying in the next 10 years by 5/1,000?

[,) ³<(6´ &2175,28(7 ,) ³12´2 6.5]7

[GO TO SECTION 7]

6.5 What is your main reason for not being to willing to pay something?

[INSERT REASON]___XXXXXXXX_____

[GO TO SECTION 8]

6.6 I want you to imagine that to work, the product would have to be bought and used once a year every year for the next 10 years. I want you to think about the maximum amount your household would be willing to pay for this produce once D \HDU HYHU\ \HDU IRU WKH QH[W WHQ \HDUV :H¶OO arrive at your best estimate of the largest amount that your household would pay to reduce your overall risk of dying by 5/1,000 over the next 10 years. Once again, please sort these cards into piles of amounts that you feel your household would definitely be willing to pay and definitely not be willing to pay and those which \RX DUH XQVXUH DERXW 3OHDVH UHPHPEHU WKDW LW¶V for 10 years.

[GIVE RESPONDENT MONEY CARDS AND WTP SORTING TEMPLATE. RESPONDENT COMPLETES SORTING TASK]

>5(&25'/2:(67 $1' +,*+(67 $02817 ,1 ³81685(´ %2;@

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXXXXX	XXXXXXXX

6.7 Again, looking at the cards you have placed in the different boxes, could you tell me your best estimate of the largest amount that your household would be willing to pay once a year for the next 10 years to reduce your risk of dying in the next 10 years by 5/1,000?

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE TO THEIR OWN WTP. COMPLETE TABLE BELOW]

RESPONDENTS BEST ESTIMATE O THE LARGEST AMOUNT WOULD PAY TO REDUCE RISK BY 5/1,000	£ XXXXXXXX

SECTION 7

7.1 Now I want you to imagine, that product P is not actually available. However, another product is available, Product Q. If bought, product Q would reduce your risk of dying by 1/1,000. This is shown on this card.

[SHOW RESPONDENT CARD 7.]

It reduces ever\ RQH¶V ULVN E\ VR LW ZLOO DOVR UHGX 1/1,000 even if your baseline risk is different from the average.

7.2 Once again the product has to be bought and used once a year for the next 10 years to be effective. Do you think you would be willing to pay something every year, however large or small, for this product which would reduce your risk of dying in the next 10 years by 1/1,000?

[,) ³<(6´ &217,18(7 ,) ³12´ O 7.3] 7

7.3 What is your main reason for not wanting to pay something?

[INSERT REASON]_____XXXXXXXX _____

[GO TO SECTION 8]

7.4 :H¶OO XVH WKLV VHW RI PRQH\ FDUGV WR DUULYH largest amount that your household would pay to reduce your overall risk of dying by 1/1,000 over the next 10 years. Once again, please sort these cards into piles of amounts that you feel your household would definitely be willing to pay and definitely not be willing to pay and those which you are unsure about.

[SHUFFLE AND GIVE RESPONDENT MONEY CARDS AND WTP SORTING TEMPLATE. RESPONDENT COMPLETES SORTING TASK]

>5(&25'/267 $1' +,*+(67 $02817 ,1 ³81685(´ %2;@

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXXXX	XXXXXXX

7.5 Again, looking at the cards you have placed in the different boxes, could you tell me your best estimate of the largest amount that your household would be willing to pay to reduce your risk of dying in the next 10 years by 1/1,000?

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE TO THEIR OWN WTP. COMPLETE TABLE BELOW]

RESPONDENTS BEST ESTIMATE O THE LARGEST WTP	£ XXXXXXXX

SECTION 8

8.1 In this section, I now want you to think about all risks that your child, [INSERT NAME] faces.

8.2 >6((7$%/(%(/2:)25$335235,$7(5,6.&$5')25&+,/'¶
AGE GROUP. PASS CARD TO RESPONDENT]

Risk Charts for different ages

Age	Risk
0-5	16
6-10	18
11-16	22
17-25	31
26-35	41
36-45	57
46-55	78
56-65	158
65 +	250

Unfortunately children also face risks of illnesses and accidents. This card shows the overall risk of dying in the next 10 years for a child in [INSERT NAME] ¶V DJH group. This is the risk of your child dying from now or any time in the next 10 years.

The card shows a [N in 1,000] chance of dying. This means that out of every 1,000 children [INSERT NAME] ¶V D100-N] would still be alive 10 years from now and [N] children out of the 1,000 would die.

This card shows the leading causes of mortality for children in [INSERT NAME] ¶V age group. [SHOW CARD WITH SPECIFIC RISKS] So, you can see that the average risk of dying from cancer for example is [N in 1,000]. So, that means that out of every 1,000 children in [INSERT NAME] ¶V DJH [N] would die from cancer in the next 10 years. Leading types of cancer are shown here [POINT TO TEXT]. The other leading causes are shown on the other grids.

Looking back at the overall risk, this is the average risk, so you might think that [INSERT NAME] ¶V RYHUDOO ULVN LV WKH VDPH KLJKHU RU

Do you think [INSERT NAME] ¶V ULVN LV WKH VDPH KLJKHU RU OR

[RECORD ANSWER]

8.3 Imagine that there was a product, Product K, that your household could buy which would reduce [INSERT NAME] ¶V ULVN RI G\LQJ LQ WKH QH[W 5/1,000. As with the products we talked about before for you, it would have to be

bought and used once a year for the next 10 years to be effective. So, for the average child this is shown on this card. [SHOW AND POINT TO CARD 13] Even L I \R X U F K L O G ¶ V U L V N L V G L I I H U H Q W / H U R Z K H D Y H U D J 5/1,000. The product has no other benefit except reducing [INSERT NAME] ¶ V U L V N of dying.

The product is not available on the NHS nor is it covered by health insurance.

8.4 Do you think your household would be willing to pay something once a year for the next 10 years, however large or small, for this product which would reduce [INSERT NAME] ¶ V U L V N R I G \ L Q J L Q W K H Q H [W 10 YEARS BY

[,) ³ < (6 ´ & 2 1 7 , 1 8 (7 ,) ; GO TO 8.5]

8.5 What is your main reason for not wanting to pay something?

[INSERT REASON]_____XXXXXXX _____

[GO TO SECTION 9]

8.6 : H ¶ O O X V H W K L V V H W R I R F O H \ F D U G V W R D U U L Y H largest amount that your household would pay to reduce [INSERT NAME] ¶ V overall risk of dying by 5/1,000 over the next 10 years. Once again, please sort these cards into piles of amounts that you feel your household would definitely be willing to pay and definitely not be willing to pay and those which you are unsure about.

[GIVE RESPONDENT MONEY CARDS AND SORTING TEMPLATE. RESPONDENT COMPLETES SORTING TASK]

[RECORD LOWEST AND HIGHEST $ 0 2 8 1 7 , 1 ³ 8 1 6 8 5 (´ % 2 ; @

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXXXX	XXXXXXX

8.7 Again looking at the cards you have placed in the different boxes, could you tell me your best estimate of the largest amount that your household would be willing to pay to reduce [INSERT NAME] ¶ V U L V N R I G \ L Q J L Q W K H Q H [W 5/1,000? It might be a number on a card, or it might not be.

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE TO THEIR OWN WTP. COMPLETE TABLE BELOW]

RESPONDENTS BEST ESTIMATE O THE LARGEST AMOUNT WOULD 3 $ < 7 2 5 (' 8 & (& + , / ' ¶ 6 5 5/1,000	£ XXXXX

SECTION 9

9.1 Now I want you to imagine, that instead of product K another product is D Y D L O D E O H : H ¶ O O F D O O L W 3 U R G X F W & [INSERT NAME] ¶ V U L V N R I G \ L Q J R Y H U W K H Q H [W \ H D U V E \ L V V K R Z Q R Q W K L V F D U G 2 Q F H D J D L Q H Y H Q L I \ R X U F K as the average, the product will reduce [HIS/HER] risk by 1/1,000.

[SHOW RESPONDENT RISK CARD 9.]

9.2 Once again to be effective the product would have to be bought and used once a year. Do you think you would be willing to pay something once a year for the next 10 years, however large or small, for this product which would reduce [INSERT NAME] ¶ V risk of dying in the next 10 years by 1/1,000?

[,) ³ < (6 ´ & 2 1 7 , 1 8 (7 ,) ³ 1 2 ´ O 9.3] 7

9.3 What is your main reason for not wanting to pay something?

[INSERT REASON]_____XXXXXXXX _____

[GO TO SECTION 10]

9.4 : H ¶ O O X V H W K L V set of money cards to arrive at your best estimate of the largest amount that your household would pay to reduce [INSERT NAME] ¶ V overall risk of dying in the next 10 years by 1/1,000. Once again, please sort these cards into piles of amounts that you feel your household would definitely be willing to pay and definitely not be willing to pay and those which you are unsure about.

[GIVE RESPONDENT MONEY CARDS AND SORTING TEMPLATE. RESPONDENT COMPLETES SORTING TASK]

[RECORD LOWEST AND HIGHEST AMOUNT, 1 ³ 8 1 6 8 5 (´ % 2 ; @

LOWEST AMOUNT £	HIGHEST AMOUNT £
XXXXXXX	XXXXXXX

9.5 Again, looking at the cards you have placed in the different boxes, could you tell me your best estimate of the largest amount that your household would be willing to pay to reduce [INSERT NAME] ¶ V U L V N R I G \ L Q J L Q W K H Q H [W 1/1,000?

[ENCOURAGE RESPONDENT TO VERBALISE/INDICATE TO THEIR + 2 8 6 (+ 2 / ' ¶ 6 : 7 3 & 2 0 3 / (7 (7 $ % / (% (/ 2 : @

RESPONDENTS BEST ESTIMATE O THE LARGEST AMOUNT WTP	£ XXXXXX

SECTION 10

10.1 Now I just want to ask you some follow up questions about the interview. This is so I can understand more about your answers and whether there are additional issues W K D W , K D Y H Q ¶ W W K R X J K W D E R X W R U L Q F O X G H G

10.2 In this questionnaire, we used the concept of probability. How well do you feel you understand this concept on a scale of 1 to 5?

1 2 3 4 5

I do not understand it — I understand it very well

10.3a Did you find the grids helpful when considering your answers?

1 2 3 4 5

Not at all helpful — Crucial to my understanding

10.3b When answering the questions did you mostly rely on the grids or the numeric S U R E D E L O L W \ " $ J D L Q D V F D O H R I W R Z K H U H L probabilities and 5 is completely relied on the grids. 3 is relied on both equally.

1 2 3 4 5

completely relied on numeric probabilities — completely relied on the grids

10.4a When we showed the probability of dying over the next 10 years for a person like you, did you feel that this was...

- More or less what you had expected
- higher than you expected
- lower than you expected
- you had no idea what to expect

10.4b When we showed the probability of your child dying over the next 10 years, did you feel that this was...

- More or less what you had expected
- higher than you expected
- lower than you expected
- you had no idea what to expect

10.5 When you answered the question about your willingness to pay for the product WKDW UHGXFHV \RXU ULVN RI G\LQJ ,¶P LQWHUHVWHG LQIOXHQFHG E\ DQ\ GRXEWV \RX KDG DERXW WKH HIIHFWL

1. yes
2. no
3. I did not think about it

10.6 When you were thinking of the product did anything specific come to mind or did the product remain abstract?

1. ˆ yes
2. ˆ No, it remained abstract

10.6b (if yes)What exactly?
1. ˆ a medical exam
2. ˆ a medication
3. ˆ surgery (a surgical operation)
4. ˆ a dietary supplement
5. ˆ a change in my lifestyle and eating habits
6. ˆ other, please explain

10.7 So now thinking about all the willingness to pay questions, so the injury ones as well as the product ones,

« 'LG \RX WKLQN DERXW ZKHWKHU RU QRW WKH KRXVHKR

1. yes
2. No

10.8 When you answered the questions about your willingness to pay « « GLG \RX FRQVLGHU \RXU VDYLQJV RU ORDQV LQ DGGLWL

1. yes, I considered my savings or loans as well as my income
2. no, I just considered my income.

10.9 When we asked you about your willingness to pay to reduce your probability of dying over the next 10 years, did you understand that the payment would have to be made every year for the next 10 years?

1. yes
2. no

FINISH TIME:

Appendix 4: Resources used to assist with Field Study 1

Adult injury cards X and Y

Injury X

- In hospital for 3 weeks
- Severe restrictions to activities for first 4 months. For exam cannot do household chores easily. After 4 months can res gentle activities although with some discomfort.
- Severe pain for 4 months then improving over time
- Perma ent slight to moderate pain in hip. Unable to underta high impact exercise

Injury Y

- In hospital for 2 months
- Severe restrictions to activities for first 4 months. For exam cannot do household chores easily. After 4 months can resume gentle activities although with some discomfort.
- Moderate pain for 4 months then improving over time
- Permanent slight to moderate pain in knee Unable to undertak high impact exercise

Child injury cards X and Y

Injury X

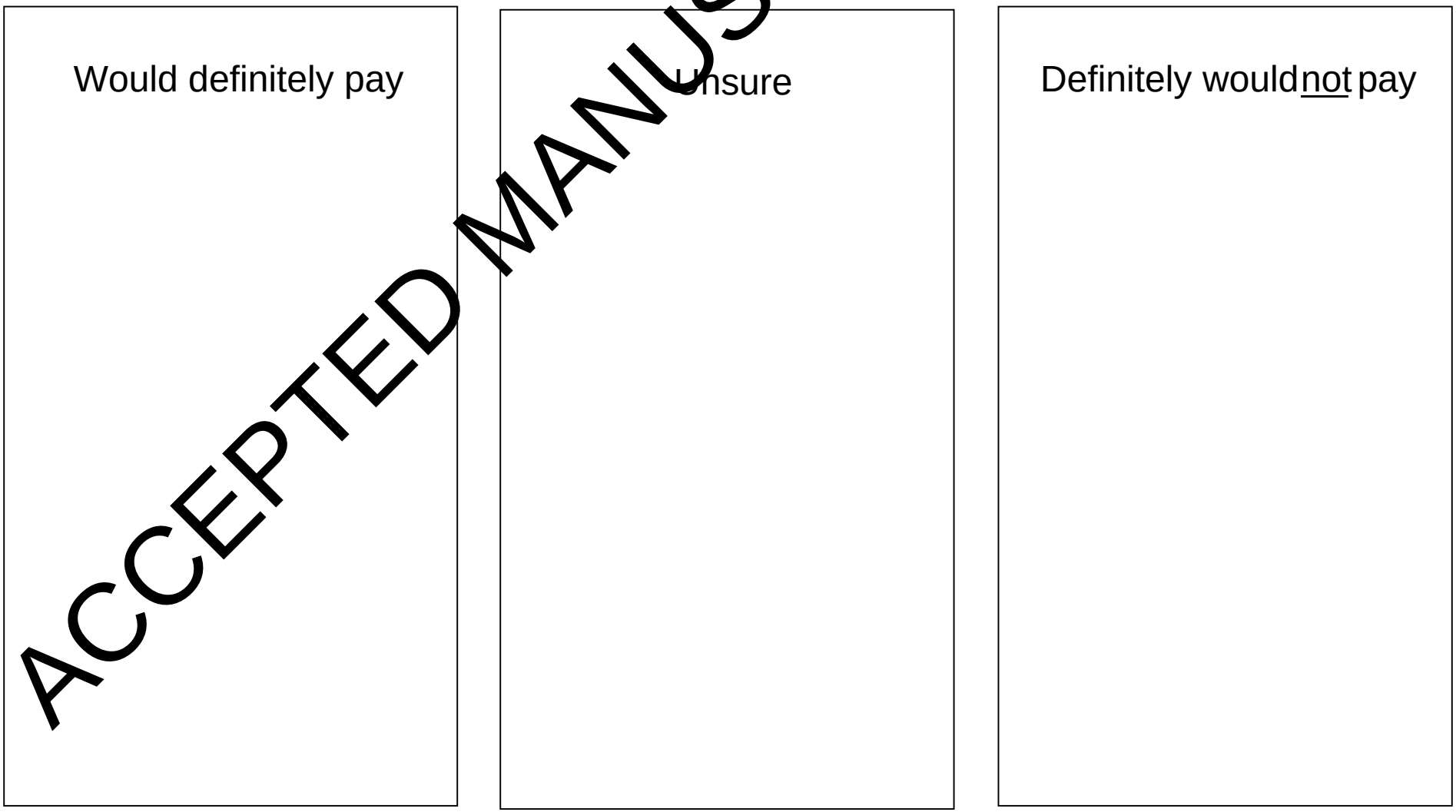
- In hospital for 3 weeks
- Severe restrictions to activities for first 4 months. For exam cannot attend school. After 4 months can resume school although cannot play boisterous games. Improves over time
- Severe pain for 4 months then improving over time
- Permanent slight to moderate pain in hip. Unable to undert high impact exercise

Injury Y

- In hospital for 2 months
- Severe restrictions to activities for first 4 months. For exam cannot attend school. After 4 months can resume school although cannot play boisterous games. Improves over time
- Moderate pain for 4 months then improving over time
- Permanent slight to moderate pain in knee Unable to undertak high impact exercise

Money cards

£5	£10	£20	£50
£100	£250	£500	£1,500
£5,000	£10,000	£25,000	£50,000
£150,000	£500,000	£1,000,000	£1



Treatment A

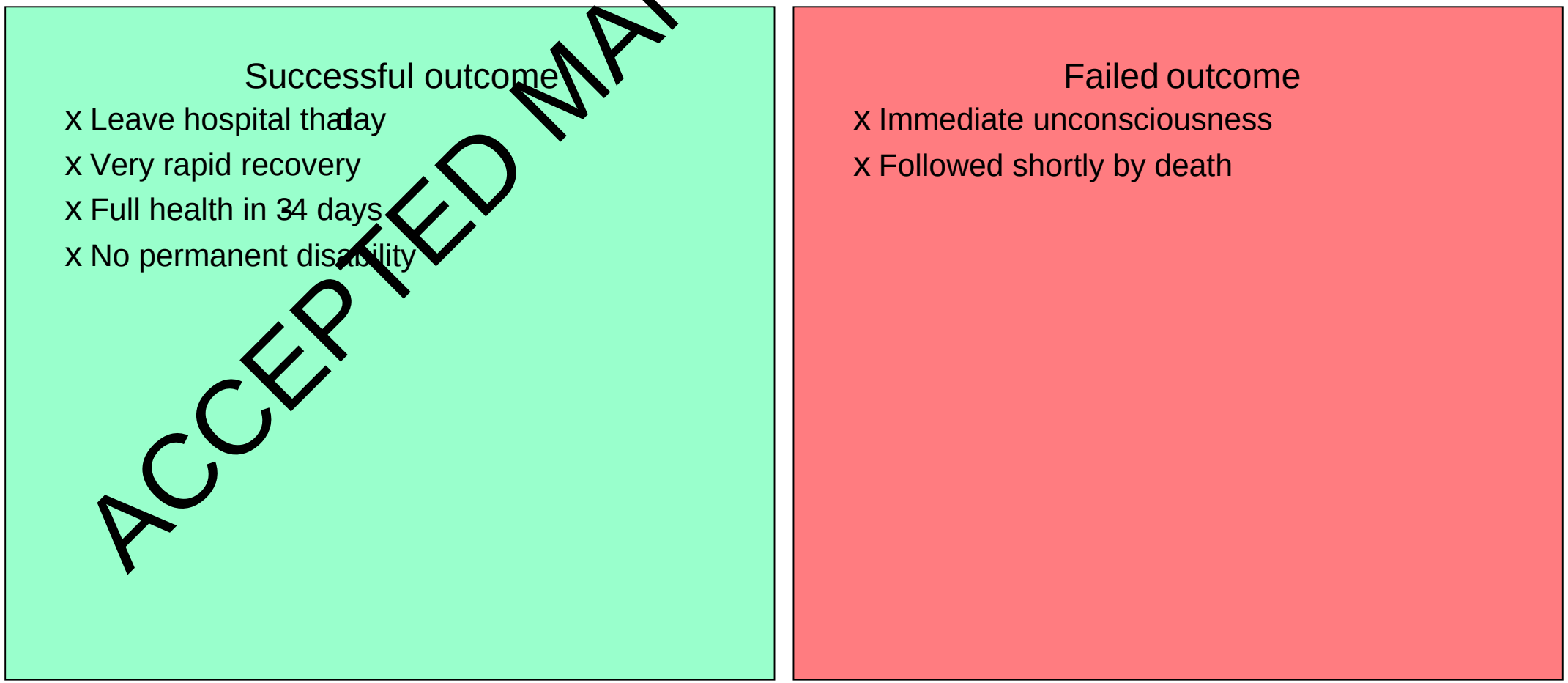
Successful outcome

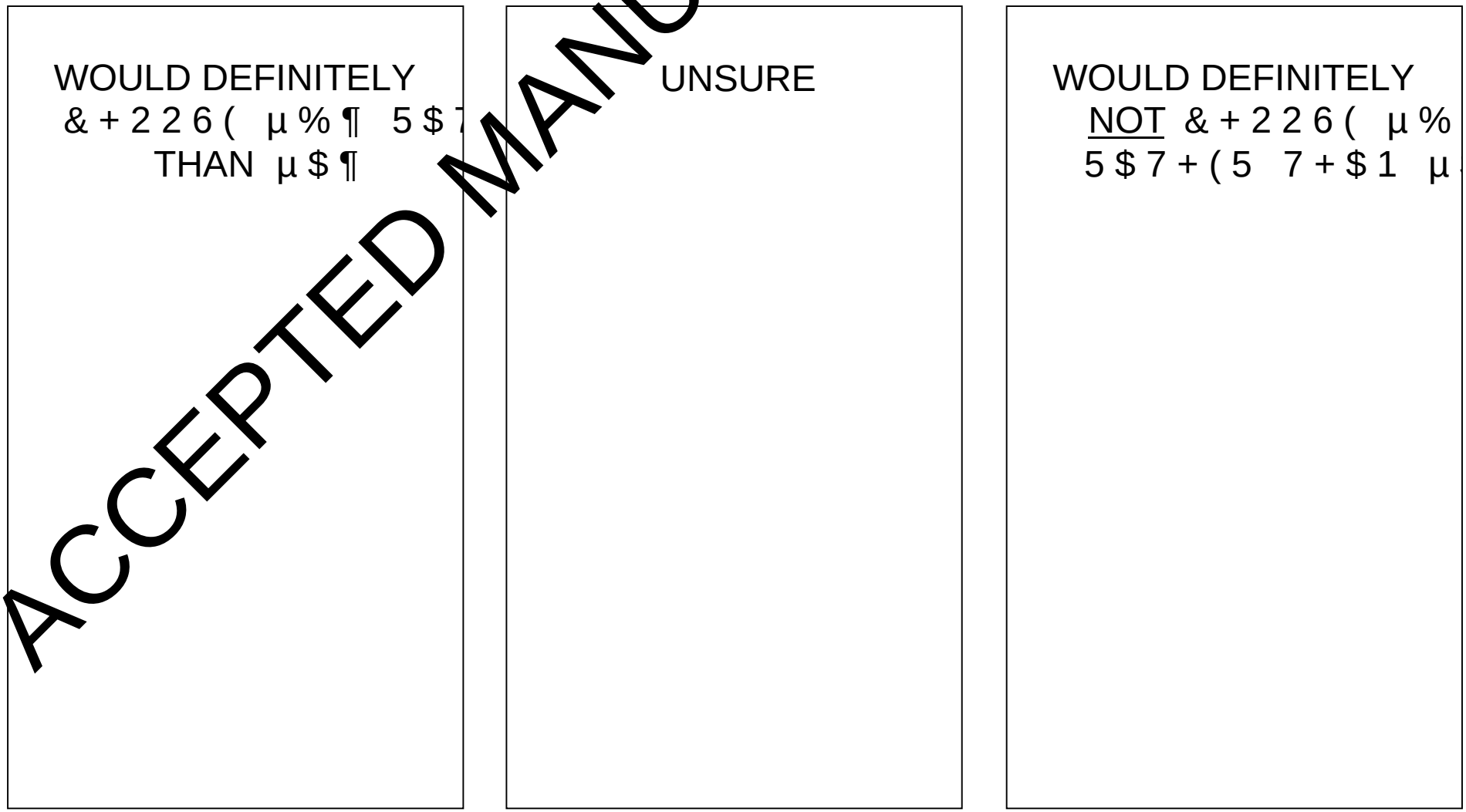
- x In hospital for 3 weeks
- x Severe restriction to activities for first 4 months.
- x Severe pain for 4 months then improving over time
- x Permanent slight to moderate pain in hip. Unable undertake high impact exercise.

Failed outcome

- x Immediate unconsciousness
- x Followed shortly by death

Treatment B





Treatment E

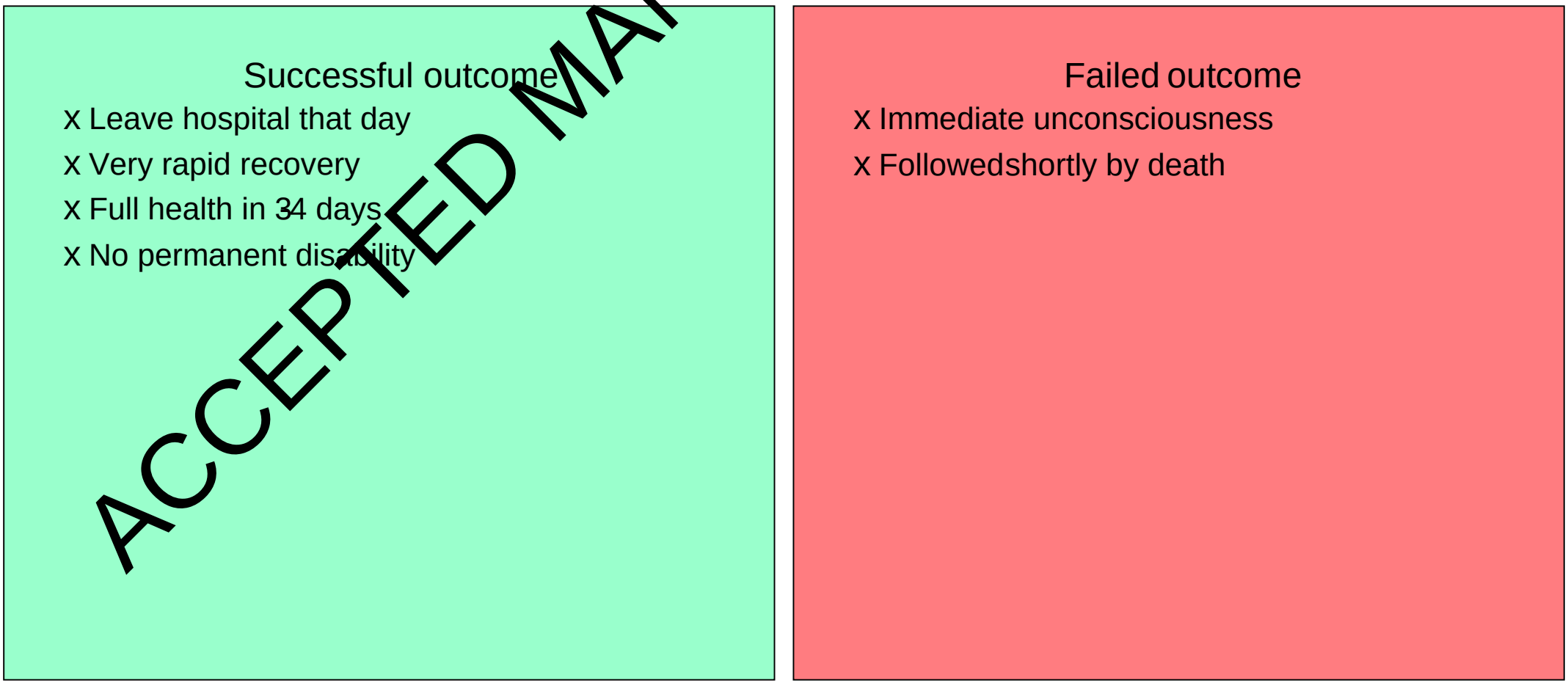
Successful outcome

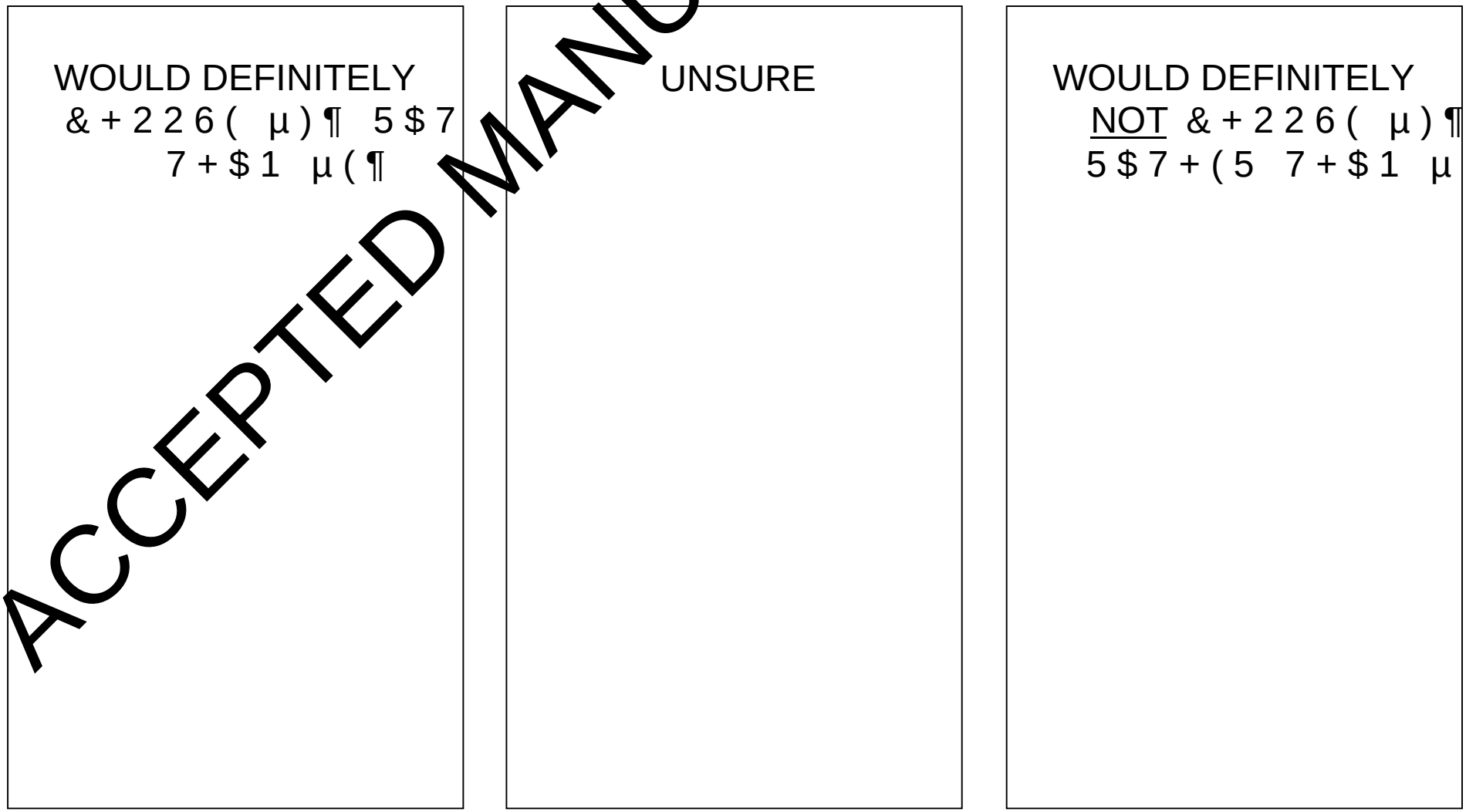
- x In hospital for 2 months
- x Severe restriction to activities for first 4 months.
- x Severe pain for 4 months then improving over tim
- x Permanent slight to moderate pain in knee. Unabl undertake high impact exercise.

Failed outcome

- x Immediate unconsciousness
- x Followed shortly by death

Treatment F





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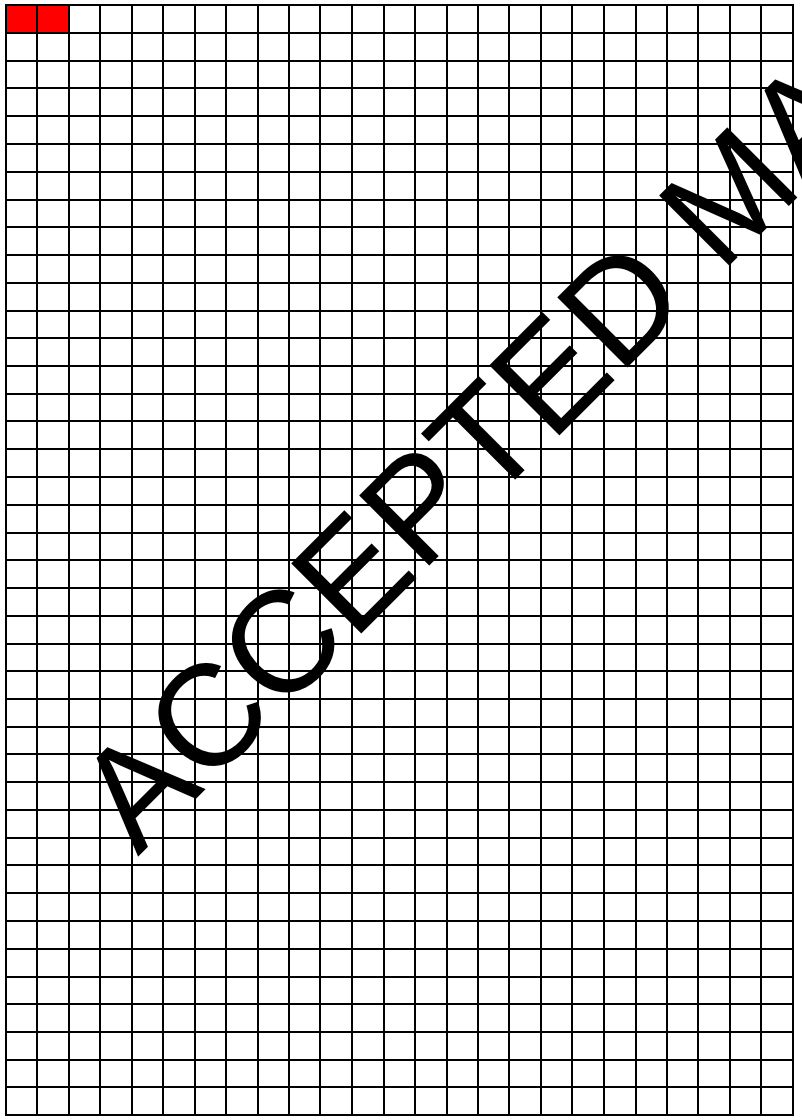

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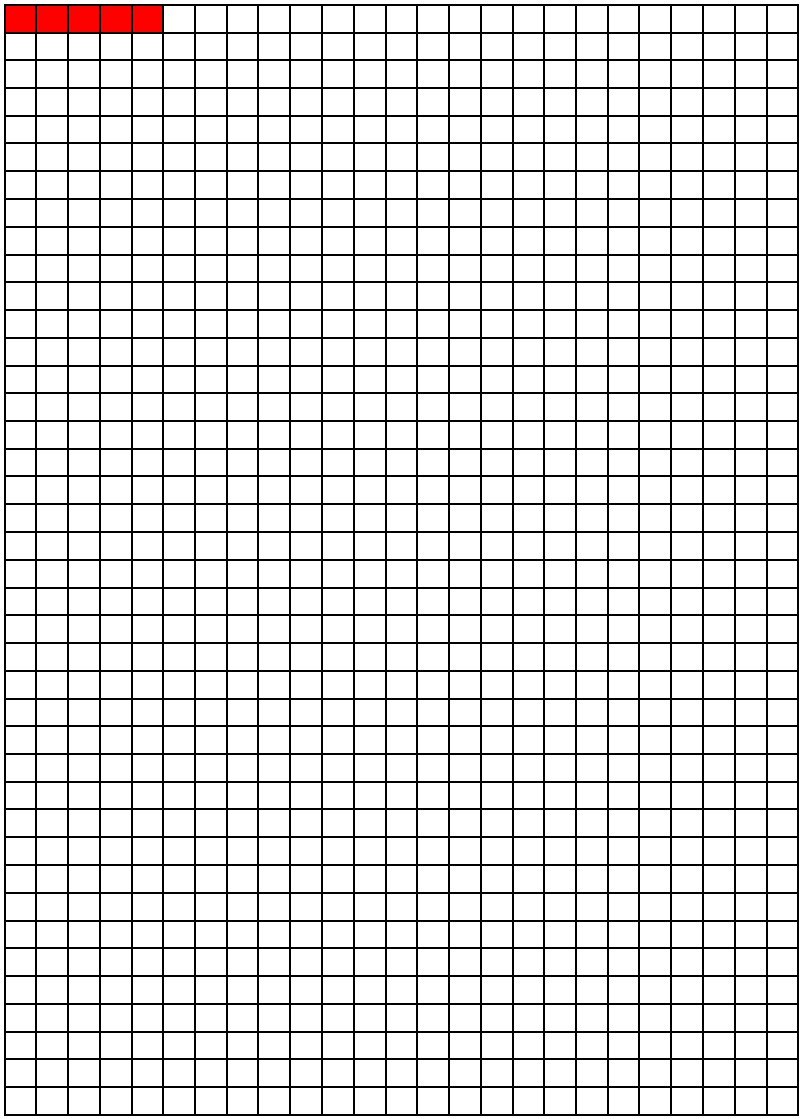

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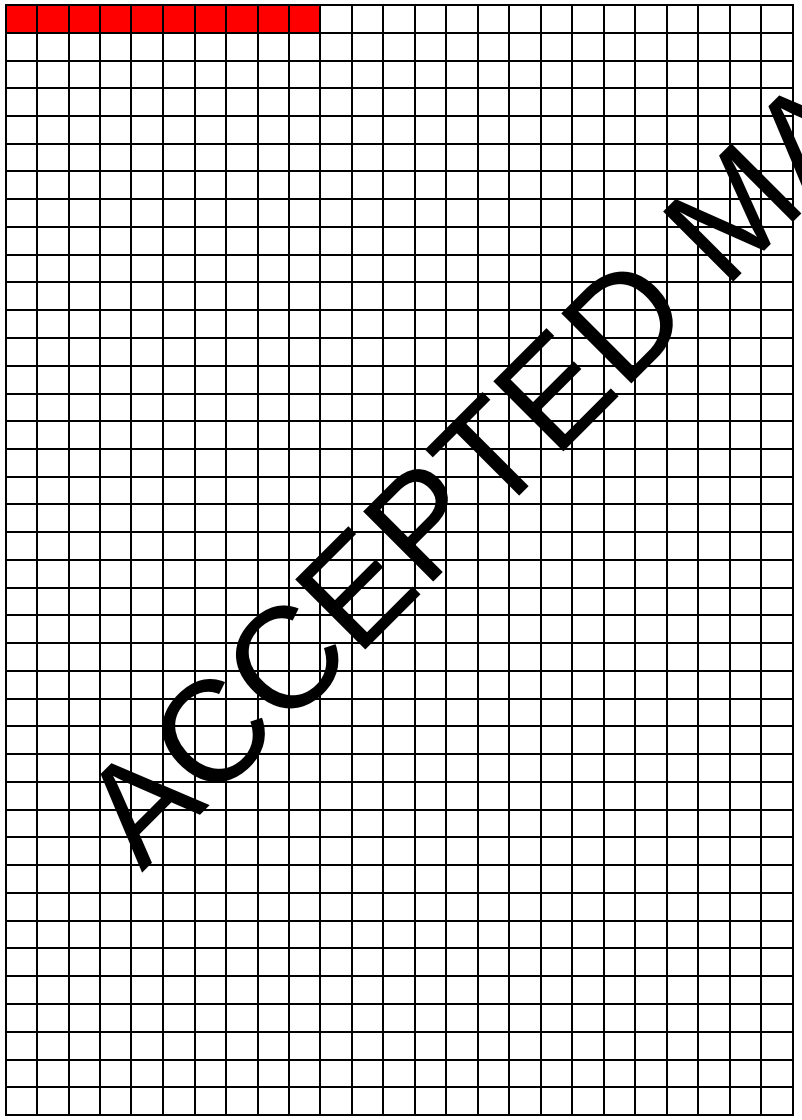

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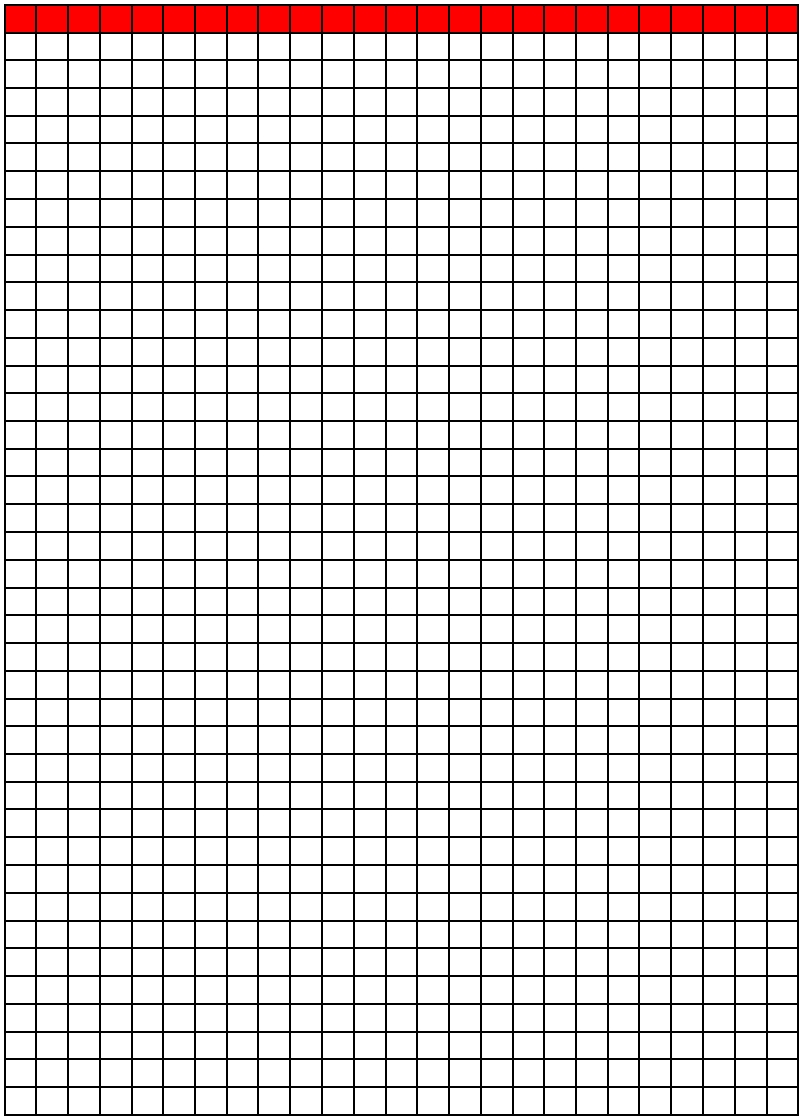

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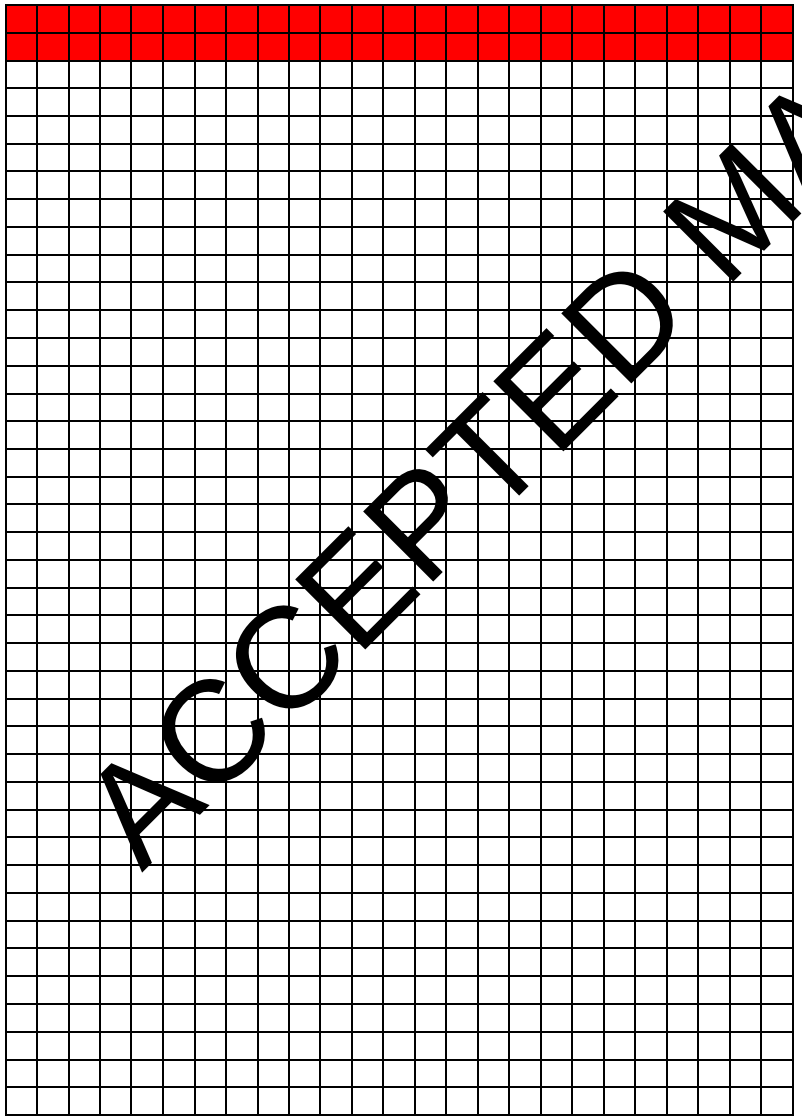

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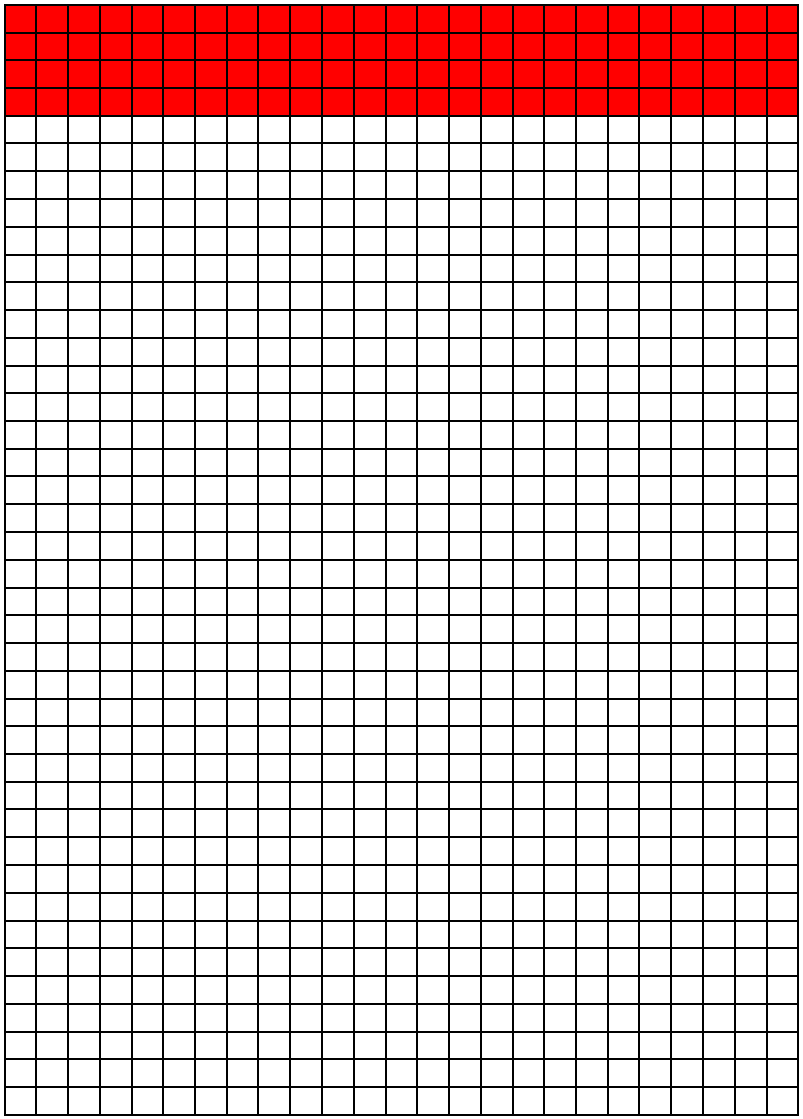

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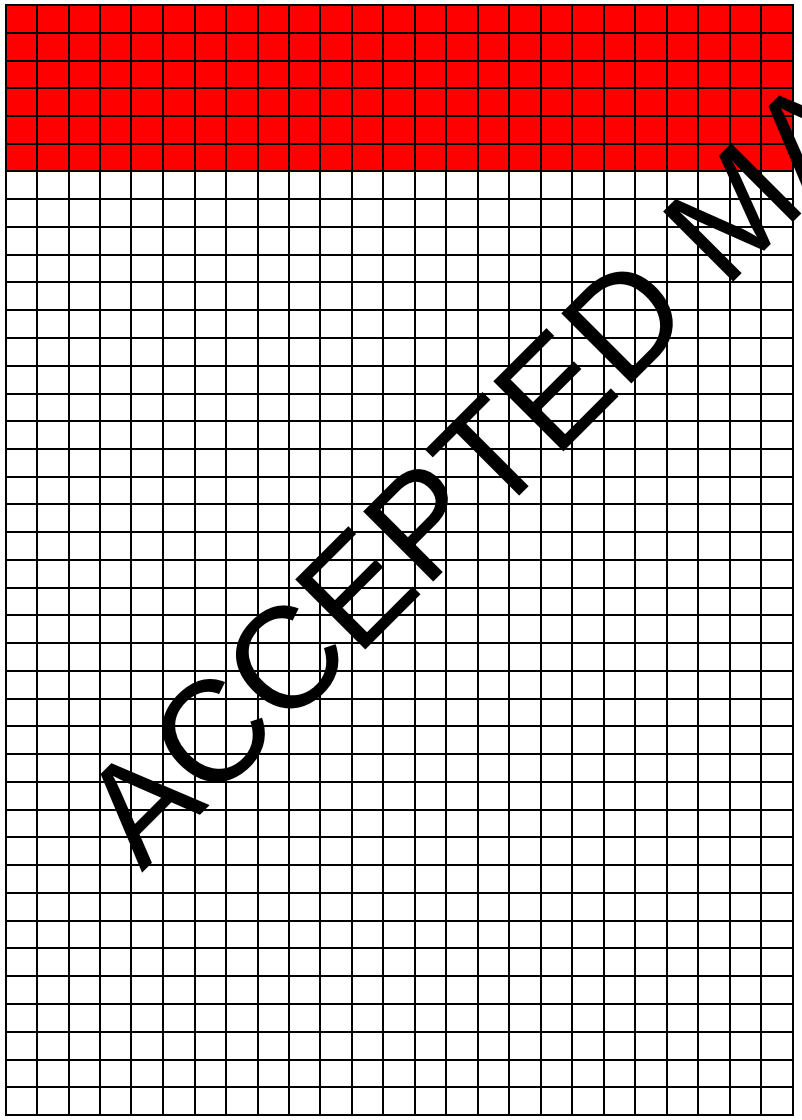

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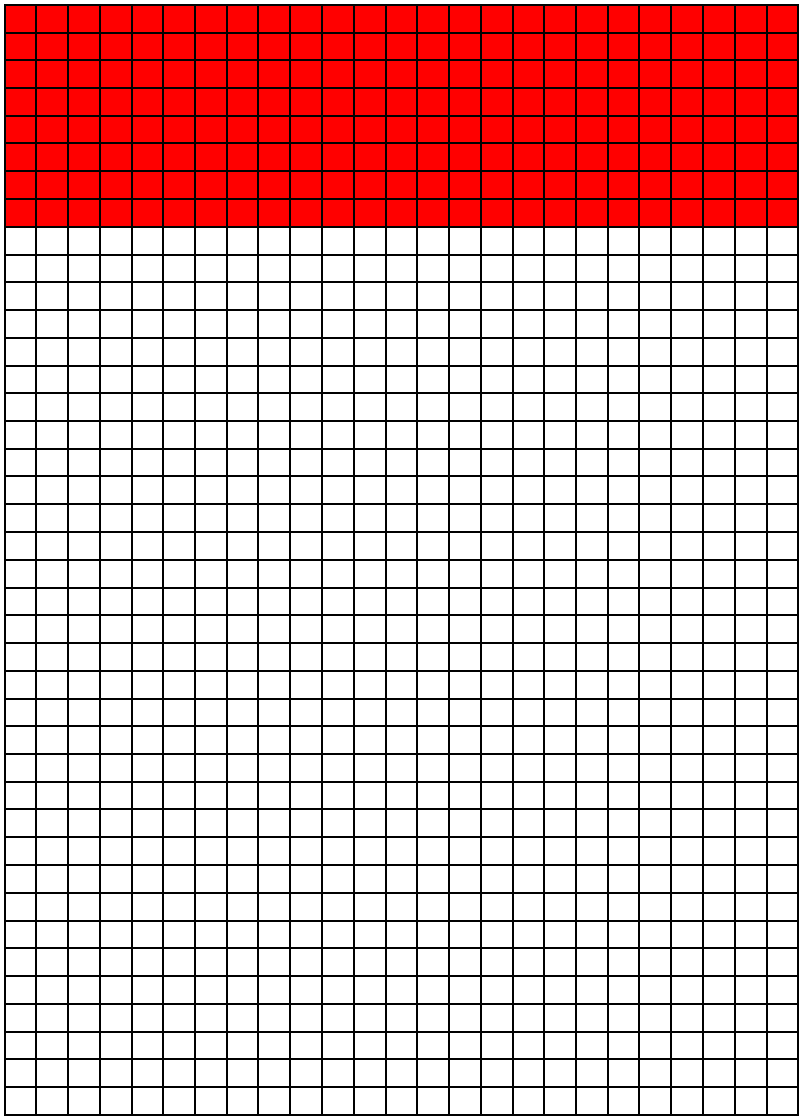

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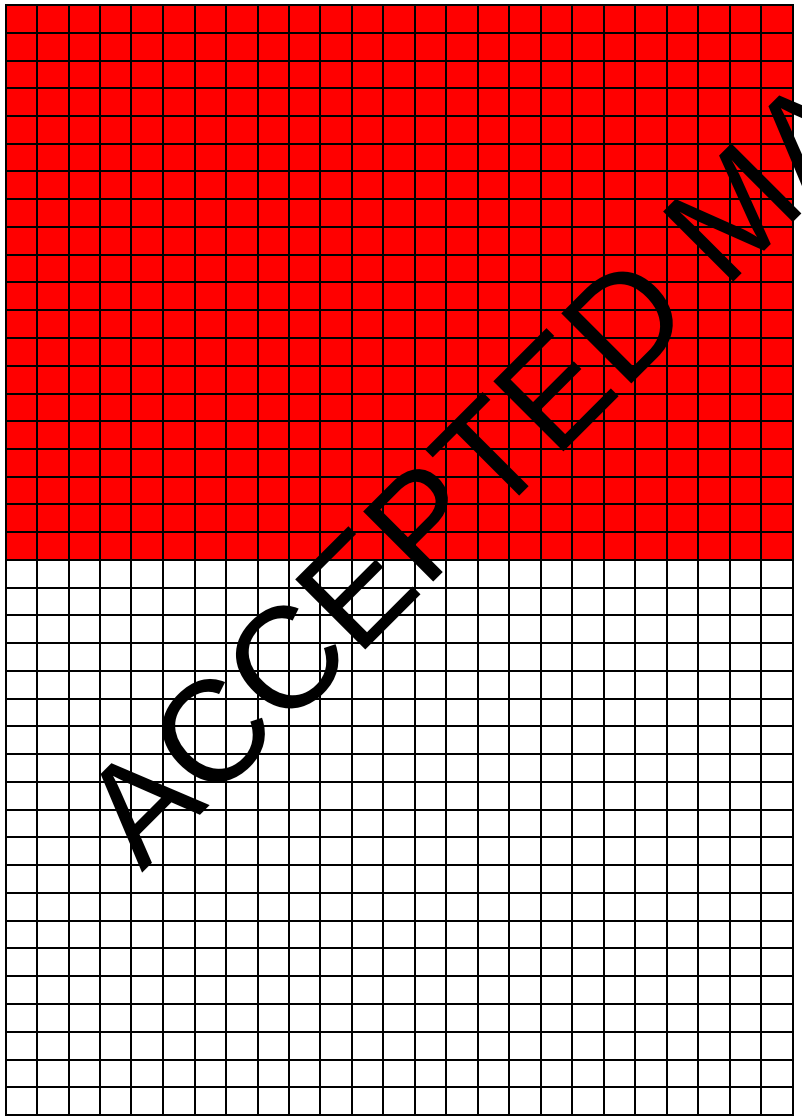

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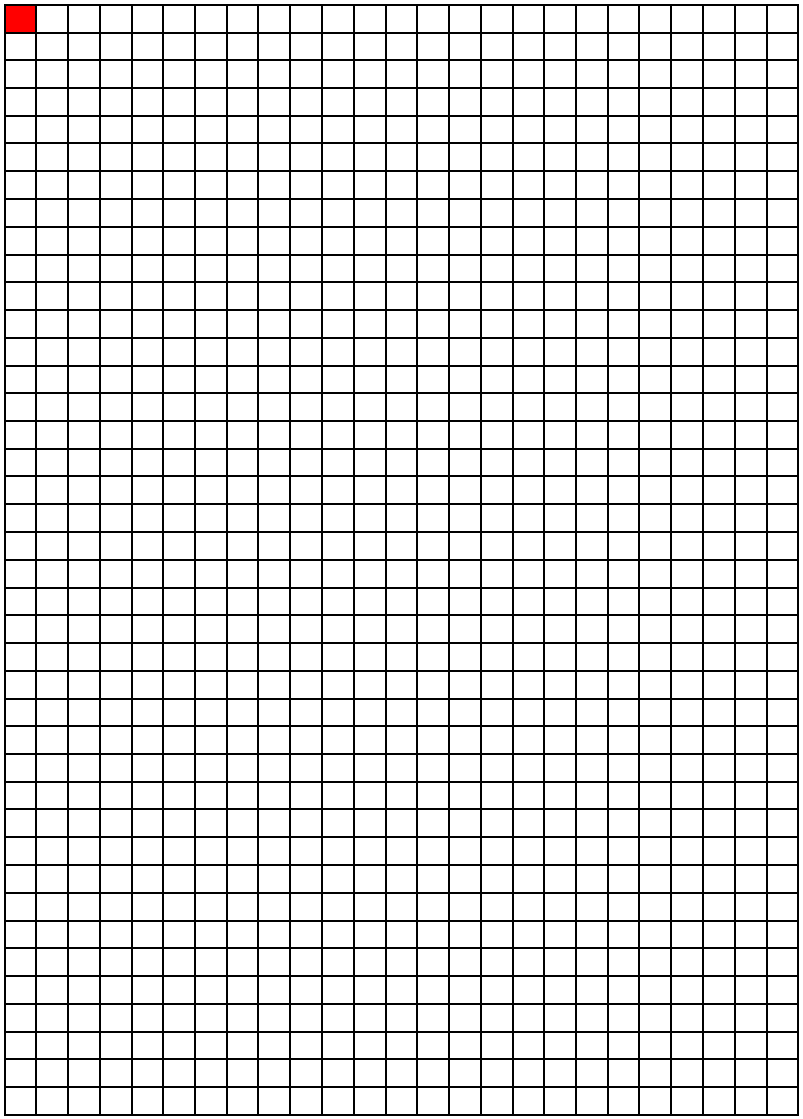

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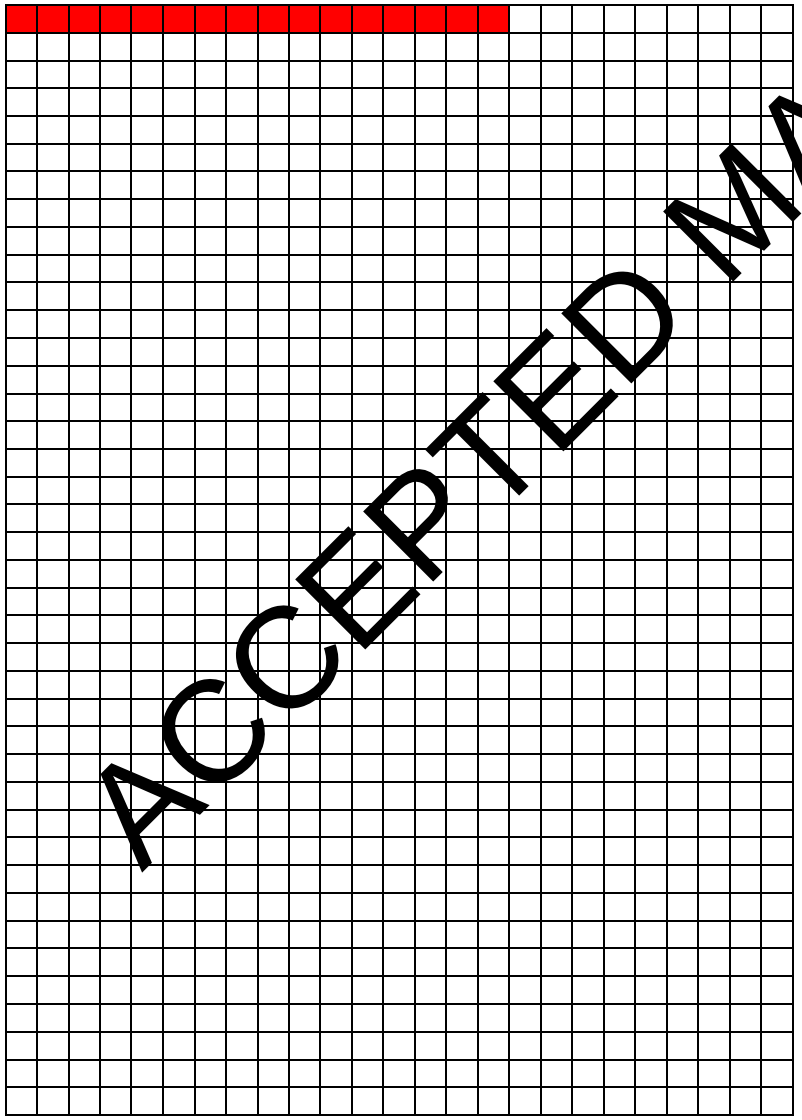

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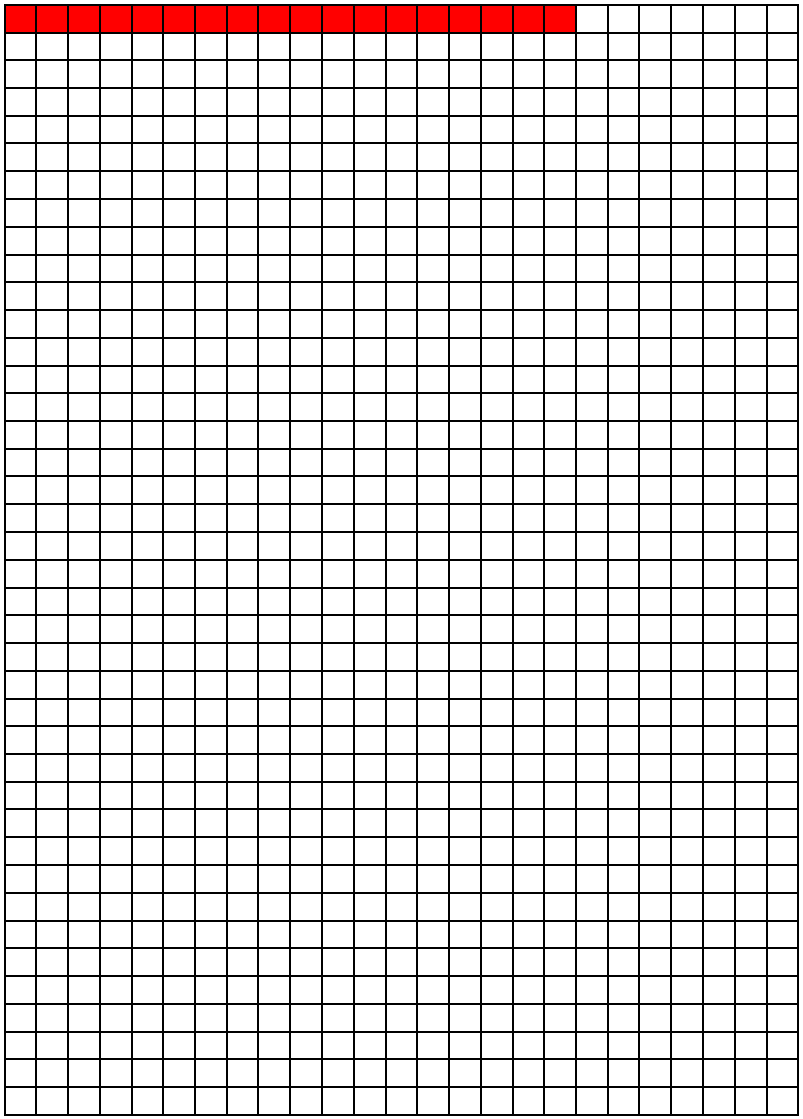

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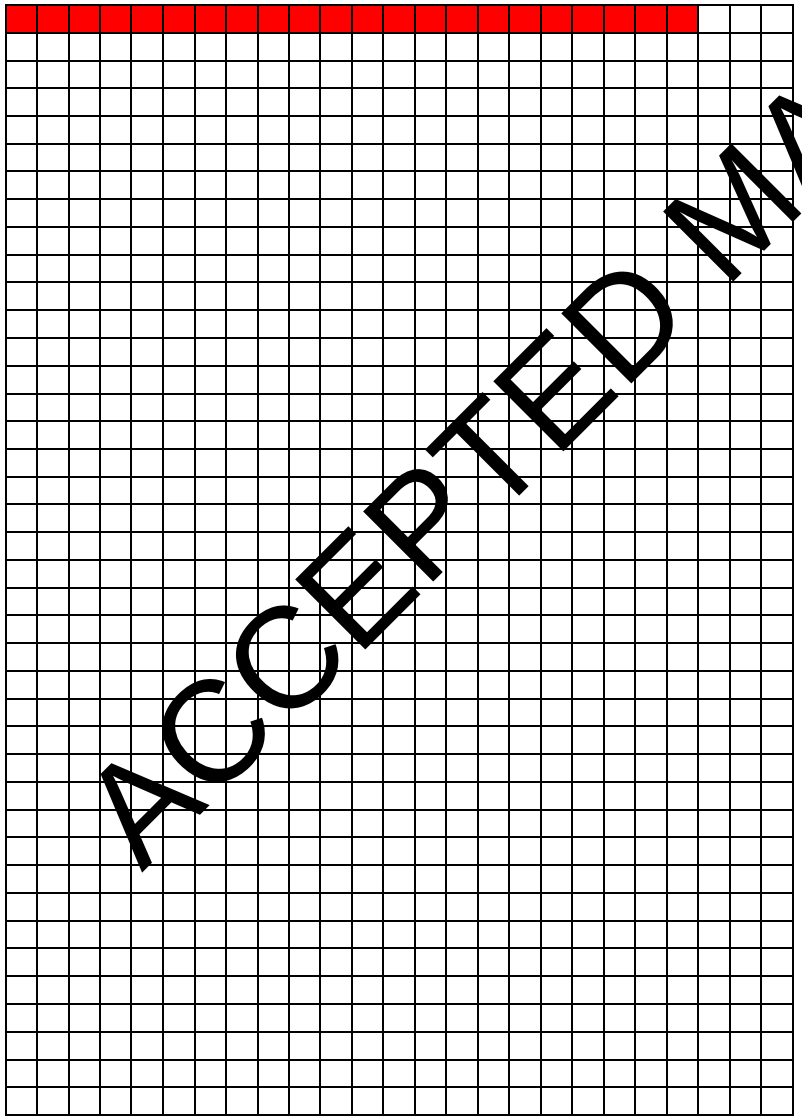

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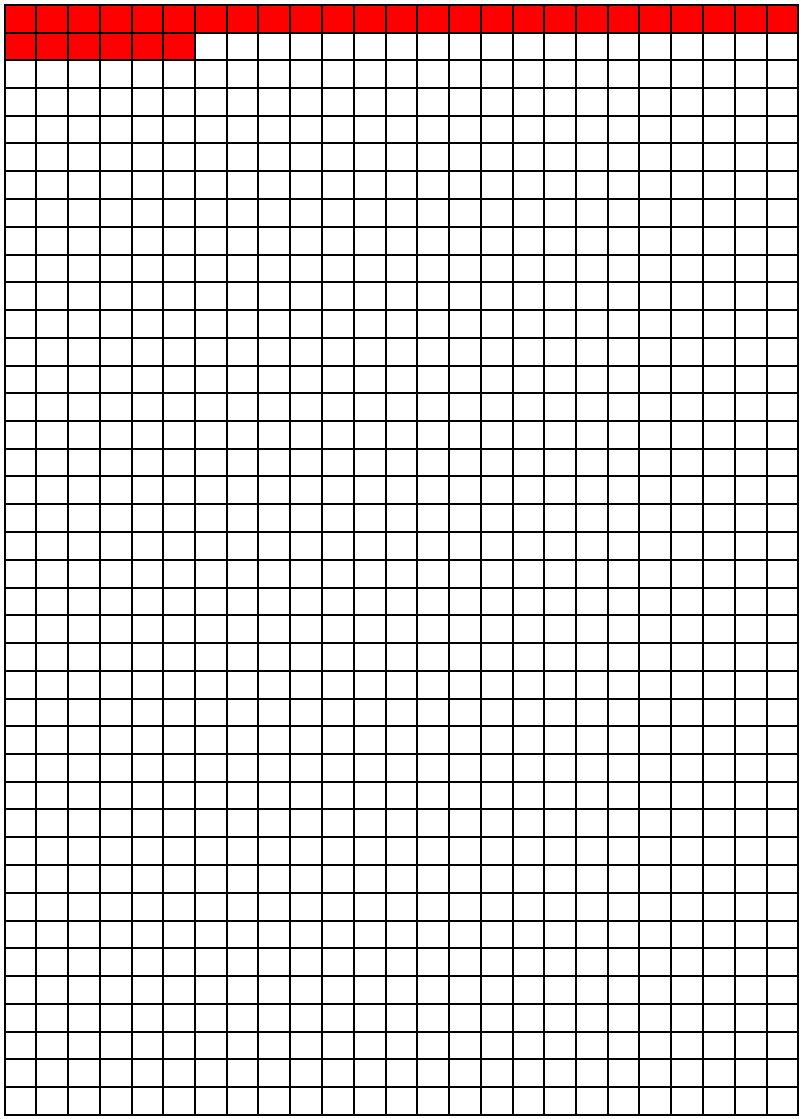

SECTION 0: INTRODUCTION AND PERSON SELECTION

0.1 Good morning/afternoon/evening. My name is ..... and I am from Accent. As I/my colleague exp
we are an independent market research company carrying out research for the University of East Anglia
Thank you very much for agreeing to take part in this research. This study is about health and the
value we place on reducing health risks both to ourselves and to others.

IF MORE THAN ONE CHILD THEN SKIP QUESTION Q0.2 AND ASK QUESTION Q0.3

0.2 IF ONLY ONE CHILD AT 0 , Q W U R 5 ($ ' 2 8 7 5 D W K H U W K D Q V K L Q N
that you do not know, we want to select someone from your family who you are responsible for. I
will at some points in this questionnaire refer to your child. Can I just make a note of \ R X U F
name? (1 7 (5 & + , / ' ¶ 6 1 $ 0 (% (/ 2 :

+ R Z R O G L V > (1 7 (5 & + , / ' ¶ 6 1 $ 0 (@ " B B B B B B B B B
Is that a boy or a girl?
Boy
Girl

$ Q G Z K D W L V W K D W F K L O G ¶ V U H O D W L R Q V K L S W R \ R X "
Son
Daughter
Stepchild
Grandchild
Foster child
Other (please specify)

GO TOSECTION 1

0.3 IF MORE THAN ONE CHILD AT 0 Intro THEN READ OUT Rather than think about some abst
³ R W K H U S H U V R Q ´ W K D W \ R X G R Q R W N Q R Z Z H Z D Q W
responsible for. We need to select one person at random that you are responsible for so can you
me which of your children has their birthday next?
(1 7 (5 & + , / ' ¶ 6 1 $ 0 (% (/ 2 :
Is that a boy or a girl?
Boy
Girl

$ Q G Z K D W L V W K D W F K L O G ¶ V U H O D W L R Q V K L S W R \ R X "
Son
Daughter
Stepchild
Grandchild
Foster child
Other (please specify)

GO TO SECTION 1