Willingness to pay for health gains and QALYs

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Prior talks

- Wednesday 5.2.2020,13:00-16:00. Theory and principles of cost-effectiveness analysis, Prof. Karl Claxton
-
- Thursday 6.2.2020, 9:00-12:00. Measurement of health gains and Quality-adjusted Life Years (QALYs), Prof. Pekka Rissanen

- This talk ties in with prior talks in two ways:

  - Willingness-to-pay (WTP) as an alternative outcome measure to QALYs

  - CEA – decision rules? Can we use a WTP-for-a-QALY estimate to guide decision making based on CEA?

Aim of this presentation

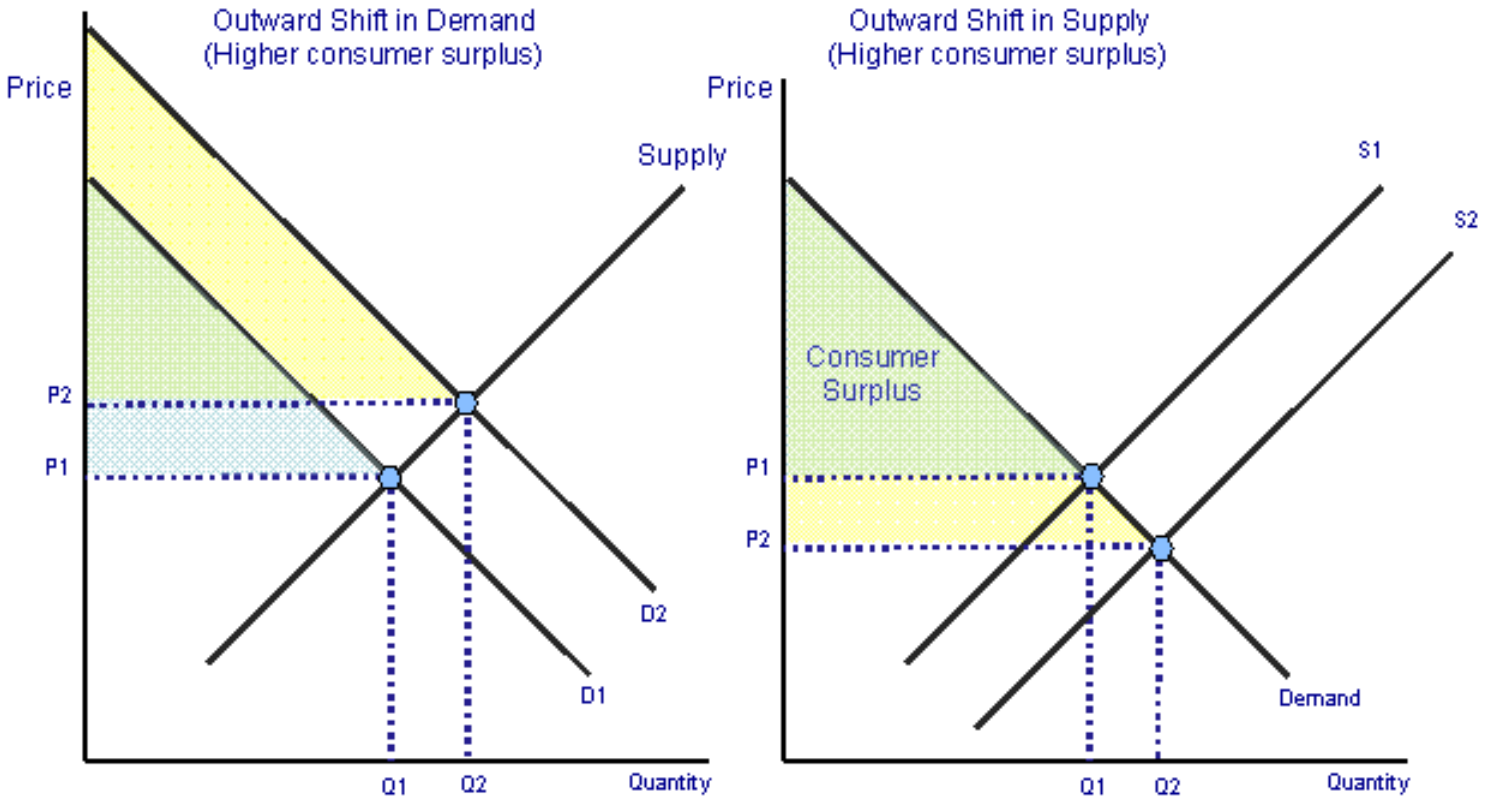
- An introduction to the concept of measuring WTP
- Not technical
- Strenghts and weaknesses
- Aim is to create a good intuitive understanding of the concept of WTP – and the challenges
- An invitation to be inquisitive and critical
- Should provide food for thought – inspiration to new research projects !

Structure of talk

- HOW TO: Introducing WTP methods (contingent valuation, DCE) HOW to measure
- WHY? The advantages of WTP (beyond QALY, beyond health outcomes)
- WHOSE preferences? The issues relating to interpretating data – rationality defintions (?)
- WHAT to measure? Design af WTP: which perspective – choice of payment vehicle
- WTP for a QALY

Willingness to pay (WTP) – an alternative measure of outcome

Willingness to pay – measuring consumer surplus



Measuring WTP for health gains

- Revealed preferences
- Stated preferences
  - Contingent valuation
  - Discrete choice experiments

Revealed preferences

Difficult to find competitive markets for health care, where price varies sufficiently to enable estimation of consumer surplus

Other markets:
House price= f(view, distance to public transport, size, number of bedrooms, size of plot, noise level)…Observing market prices may be used to isolate the value of noise from airports, motorways etc.

Looking at the jobmarket may reveal wage differences that appear to represent compensation for more risky jobs.

E.g. if the market functions perfectly and if all other differences in job characteristics are controlled for, one may establish the compensation required to make people accept a specific risk of death. This can lead to estimates of the value of a statistical life.

Revealed preference – an example

One work place (building site) entails a risk of death of 1/1000 per year in excess of the risk involved in working on another building site.

The building site with the higher risk pays their employees more: + 3000 Euro per year.

Let us assume that workers are indifferent between working in the two places, and that the jobs are otherwise identical.

Implication: 1/1000*value of statistical life (VOSL)= 3000 Euro $\Rightarrow$ VOSL=3,000,000 Euro

Revealed preferences – some remarks

Markets may be characterised by imperfect information (information asymmetry)

- Supplier induced demand
- Biased campaigns etc

Revealed preferences from the market does not necessarily reflect choice patterns that optimise consumer surplus – individuals may not actually be able to choose freely.

Stated preference studies should ideally attempt to overcome some of these issues.
Stated preferences – preferences elicited in a controlled (but hypothetical) environment.

The contingent valuation method

- a type of stated preference approach

A good/service is described and hypothetical questions regarding maximum willingness to pay are posed. A controlled experiment.

Focus is on maximum WTP – one is seeking to estimate consumer surplus: the difference between the consumers' maximum WTP and the price they actually need to pay (= marginal cost).

Different ways of posing the WTP question

Description of health care service X (e.g. could be psoriasis treatment described in terms of its effect on visual/non-visual appearance, how many times you have to apply it etc.)

Followed by OPEN ENDED WTP question:

- How much would you at maximum pay for this product? _____

Alternatively: use a payment scale as aid.
Alternatively: iterative bidding

Critique: this is not how we normally approach choices made in a supermarket…. Difficult for respondents

Repondents may anchor on to known prices

Dichotomous choice method

The most realistic….

Each respondent randomised to one, or only a few prices

Would you be willing to pay Euro 50?

Answering yes/no to a few questions is cognitively easy for respondents and resembles standard purchase situations (we seldom bargain, or find points of indifference in the supermarket)

The idea is that if we ask many respondents different WTP questions, we will be able to deduce the proportion of individuals who will enter the market at given prices – hence we can derive the demand curve and consumer surplus

Discrete choice experiments

Differ from contingent valuation in that focus is on *valuation of attributes* and not just the good as a package.

Aim is to establish utility as a function of a health care services' attributes including price

Marginal rates of substitution between price and the other attributes provides estimates of willingness-to-pay for the attributes

Often values other aspects than just health outcomes. Fokus on trade-offs!

Example discrete choice experiment
Which treatment do you prefer?

	Treatment A	Treatment B
Number of treatments per day	Two	Two
Number of products used for each treatment	**Two products**	**One product**
Improvement – non-visual effect	Itch and irritation reduced	Itch and irritation reduced
Improvement –visual effect	**Small improvement**	**Large improvement**
Side effects	None	None
Price	**Euro 25**	**Euro 100**

Example discrete choice experiment
Which treatment do you prefer?

	Treatment A	Treatment B
Number of treatments per day	Two	Two
Number of products used for each treatment	One product	One product
Improvement – non-visual effect	**Itch and irritation reduced**	**Itch and irritation gone**
Improvement –visual effect	**Large improvement**	**Small improvement**
Side effects	None	None
Price	Euro 50	Euro 50

Example discrete choice experiment
Which treatment do you prefer?

	Treatment A	Treatment B
Number of treatments per day	**Two**	**One**
Number of products used for each treatment	Two products	Two products
Improvement – non-visual effect	Itch and irritation reduced	Itch and irritation reduced
Improvement –visual effect	Small improvement	Large improvement
Side effects	None	None
Price	**Euro 25**	**Euro 75**

Results discrete choice experiments

Assumption:

- Individuals act rationally:
  If treatment A is preferred to treatment B then U(A) > U(B)

Using logistic regression analysis where choice is the dependent variable, and treatment attributes are independent variables we establish the indirect utility function:

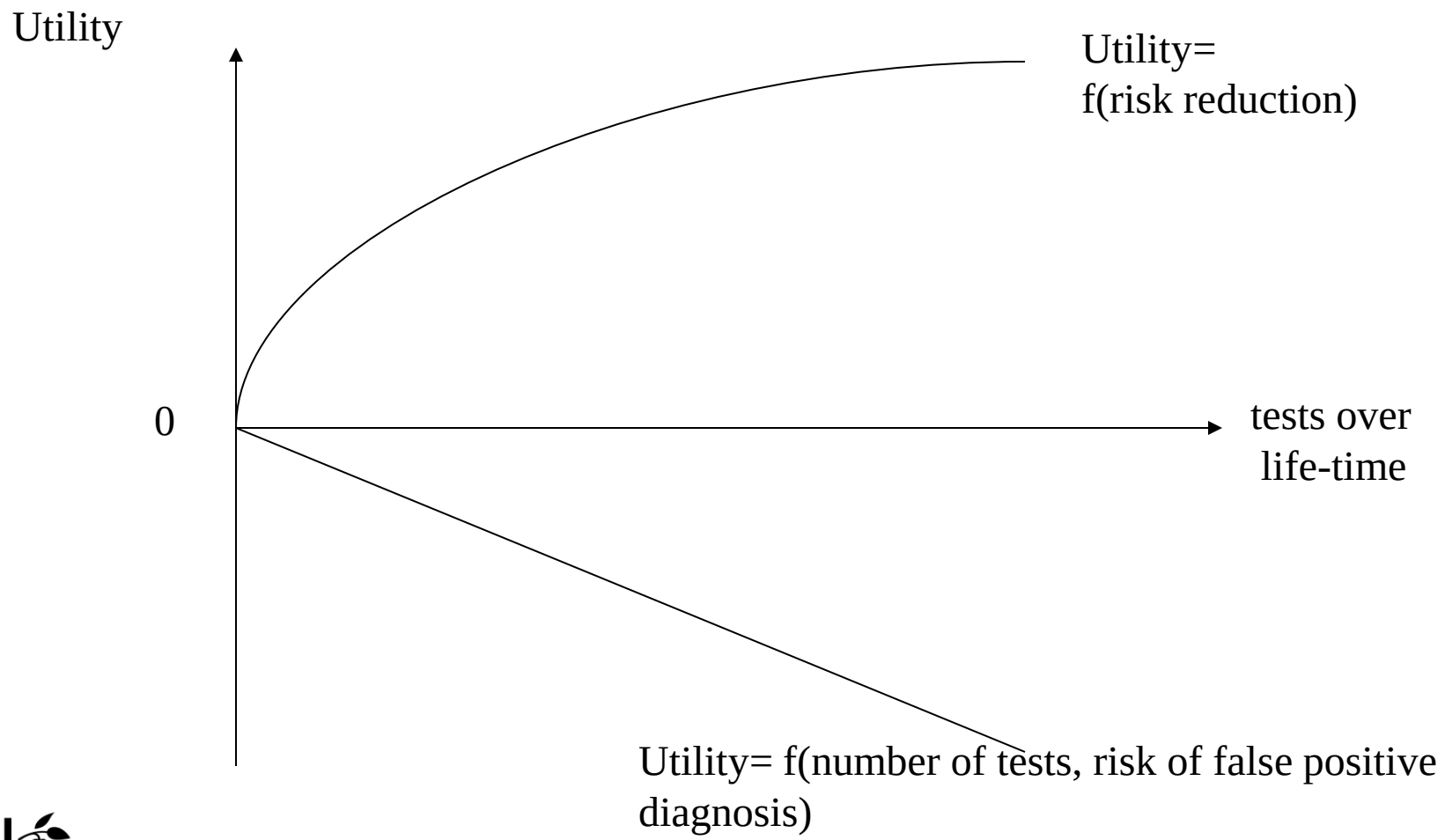
U= $b_1$number of treatments a day +
b_2 number of products +
b_3 improvement (non-visual) +
b_4 improvement(visual) +
b_5 side-effects +
b_6 price

Setting U=0 and we have an iso-utility curve and can calculate marginal rates of substitution

WTP for cancer screening programmes

- Measuring WTP for various screening programmes using discrete choice experiment. Relevant attributes:
  - Risk reduction
  - Number of tests over life-time
  - Risk of false positive diagnosis
  - Price
- Do you think that WTP
  - Will increase with screening intensity?
  - Will decrease with screening intensity?
  - Exhibit an inverted U-shape?

Expected utility functions….



The discrete choice

Table 1. An Example of a Card Presented to the Interviewee

	No participation	Program A	Program B	Program C
Number of mammographies performed over the next 25 years	0	17	17	25
Your risk of dying of breast cancer over the next 30 years	340 of 10,000 (3.40%)	220 of 10,000 (2.20%)	210 of 10,000 (2.10%)	210 of 10,000 (2.10%)
Your risk of being called in for an unnecessary clinical mammography	0	3,500 of 10,000 (35%)	3,500 of 10,000 (35%)	3,500 of 10,000 (35%)
Your out-of-pocket expense	—	DKK 0	DKK 2,000 per test In total: DKK 34,000 over 25 years	DKK 0

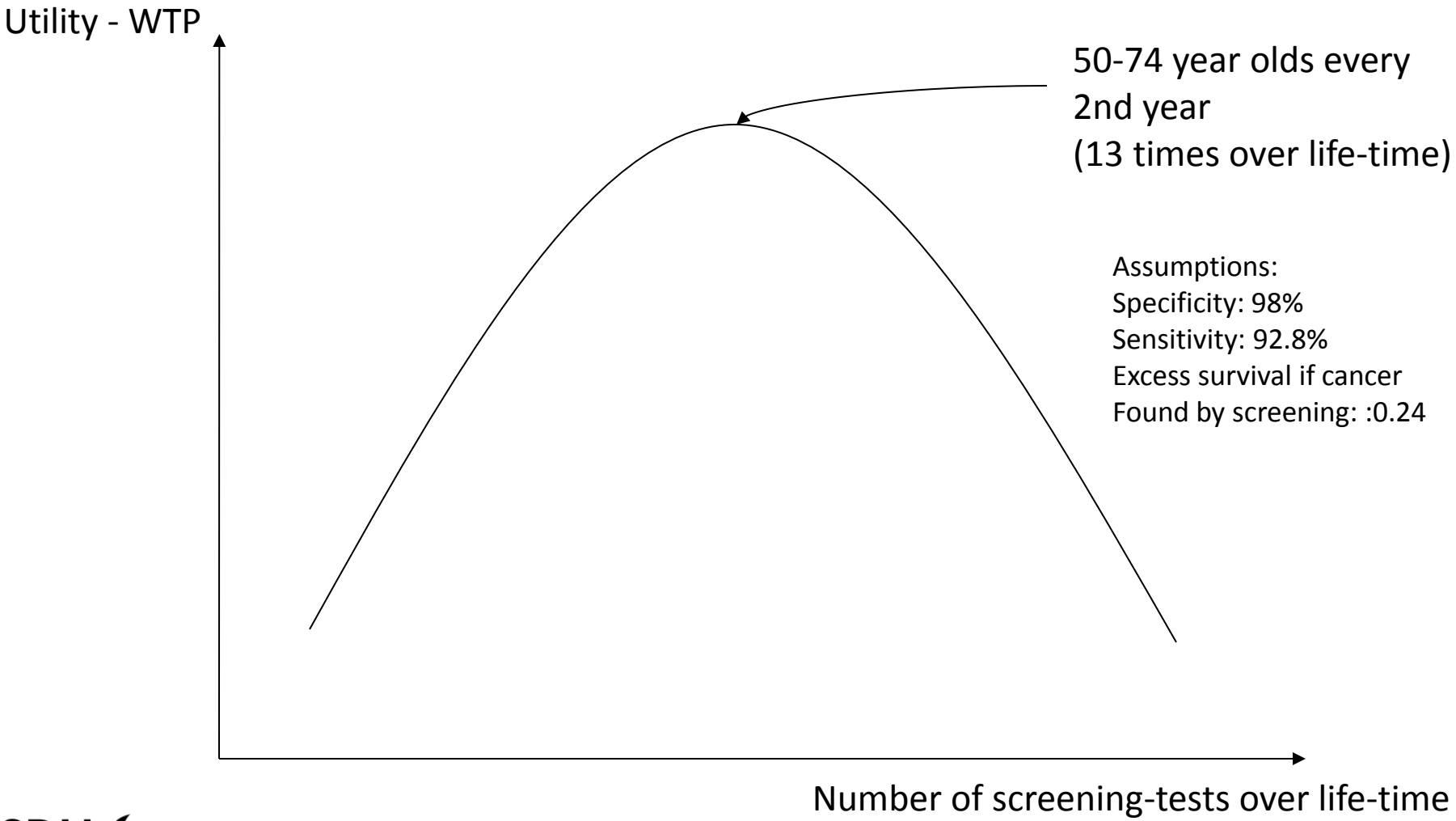
Results

Table 3. Calculated Utilities Derived from Participating in a Breast Cancer Screening Program

Program age group; screening interval	Number of tests performed over lifetime	Risk of false-positive diagnosis (out of 100)	Absolute risk reduction (out of 10,000)	Estimated utility (dU) (professional training/ no training)	Estimated participation rate (professional training/ no training)
50–64;3	5	9.6	56	0.892/1.279	0.709/0.782
50–64;2	7	13.2	62	0.966/1.394 *d*[a]	0.724/0.801
50–64;1½	10	18.3	72	1.083/1.570 *d*[a]	0.747/0.829
50–64;1	15	26.2	79	1.093/1.638 *d*[a]	0.749/0.837
450–69;3	7	13.2	79	1.245/1.790	0.777/0.857
50–69;2	10	18.3	91	1.395/2.022 *d*[a]	0.801/0.883
50–69;1½	14	24.6	100	1.462/2.152 *d*[a]	0.812/0.896
50–69;1	20	33.2	104	1.380/2.098 *d*[a]	0.799/0.891
50–74;3	9	16.6	93	1.445/2.087	0.809/0.890
50–74;2	13	23.1	112	1.681/2.453	0.843/0.921
50–74;1½	17	29.1	117	1.670/2.477 *d*[a]	0.842/0.922
50–74;1	25	39.7	125	1.584/2.447 *d*[a]	0.830/0.920

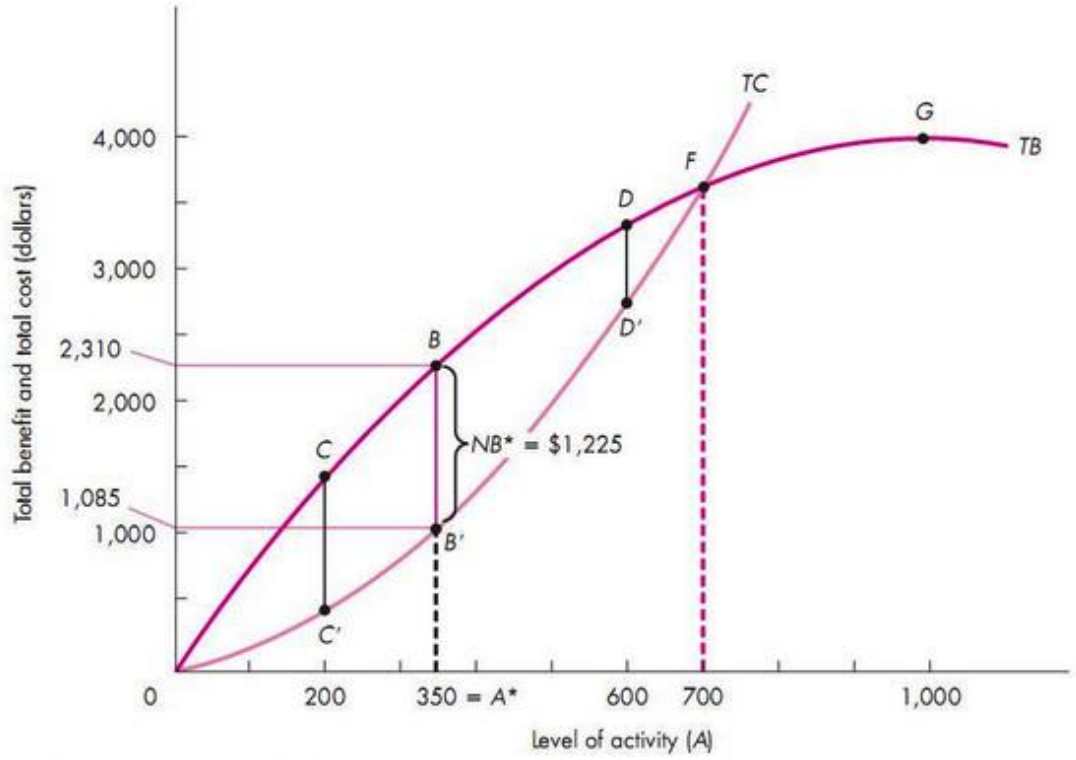
[a]*d* = dominated alternative.

WTP as a function of intensity



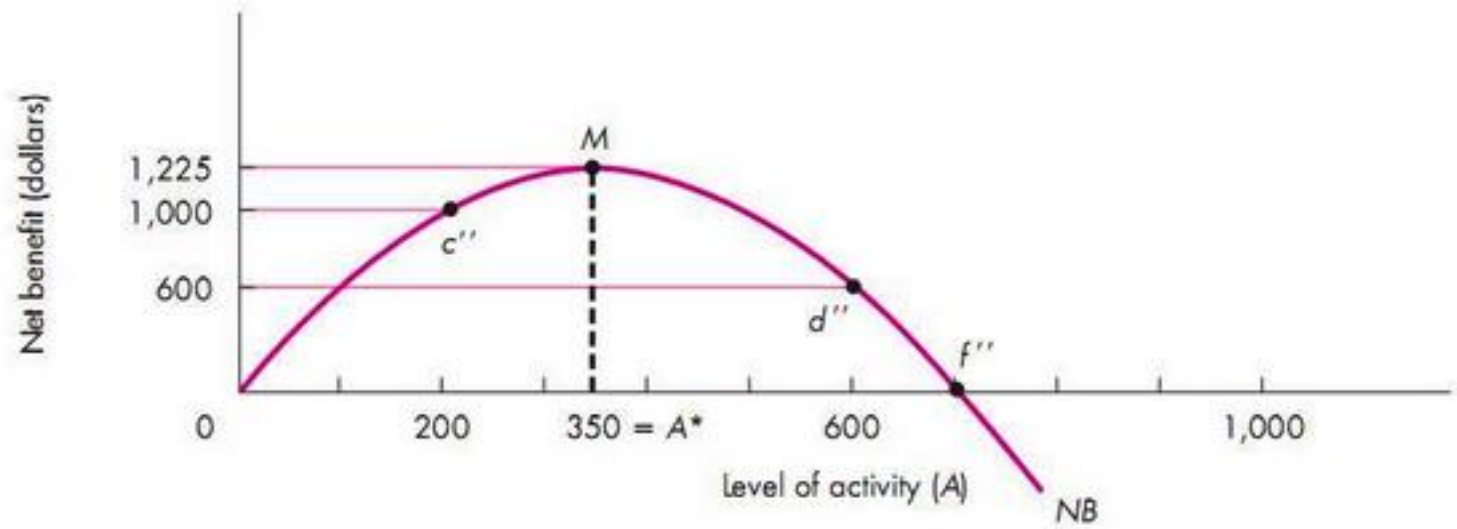
Gyrd-Hansen, International Journal of Health Technology Assessment in Health Care, 2000

Marginal benefit, marginal cost as a function of intensity, text book stuff



Panel A — Total benefit and total cost curves

Incremental net benefit



Panel B — Net benefit curve

QALY versus WTP

- If there is a high degree of proces (dis)utility amongst people who do not gain QALYs – it can be highly relevant to measure outcomes in WTP

- CUA: focus on the patients, and their gains. But generally not on the others…

- WTP – if there are other aspect than health gains:
  - Value of information
  - Sense of security
  - Reducing feelings of regret

  ULTIMATELY: it is a question of what the aim of the health care sector is:
  To maximise health (QALYs) or
  To maximise utility (WTP)

Willingness to pay (WTP) - issues to be aware of….

Moving from HOW to measure to WHAT do we want to measure.

The WHAT determines the HOW.

The issue of rationality

How to ”judge” preferences?

If individuals’ behaviours suggest preferences that appear irrational, unstable, or contrary to self-interest choosing a policy to satisfy those preferences may not improve social welfare.

BUT is the role of the analyst to describe or prescribe?

The latter is paternalistic. In the extreme case preferences might end up reflecting that of the analyst…☺

The analyst should largely avoid making judgments about whether values are rational or irrational

Behavior that appears irrational or unstable on the surface may in reflect an underlying rationality (that the analyst may not initially understand).

At the aggregate level, it most often does not matter if some individuals make mistakes, especially if the mistakes are unsystematic.

Example rationality/irrationality issue

Risks and outcomes may be the same – but the cause may be different

- This often leads to different valuation

Some contexts are more dreaded because they are characterised as being uncontrollable, catastrophic, involuntary….

E.g. shark attacks, tsunami, avian influenza pandemic (WTP for Tamiflu). Study from 2008. Value of statistical life = NOK 60 million (for Tamiflu)

Is this rational or irrational?

Psychological response to risk

We often apply risk information in stated preference studies

But risk information difficult to understand:

- Misinterpretation of probabilities
  - Overweighting of small probabilities
  - Insensitivity to small changes in probabilities
- Reliance on simple heuristics or decision rules
- Impact of base-line risk (focus on relative risk)
- WTP does generally not increase proportionally with risk reduction
  - Possible reason: WTP for reducing risk per se (independent of magnitude); the value of “doing something”
  - Complete insensitivity to scale : a problem

Question to you

You have the option of receiving preventative treatment for illness X OR illness Y.

X: your baseline risk is 20/10,000
risk reduction is 10/10,000

Y: your baseline risk is 80/10,000
risk reduction is 10/10,000

Which would you prefer?

Impact of base-line risk

Table 1 Individual Discrete Choice: Question A

	Frequency	Percentage
Treatment for illness X		
Baseline risk: 20/1000; risk reduction: 10/1000	174	42.3
Treatment for illness Y		
Baseline risk: 80/1000; risk reduction: 10/1000	121	29.4
Indifferent	68	16.5
Don't know	48	11.7
Total	411	100.0

Table 2 Social Discrete Choice: Question B

	Frequency	Percentage
Group 1		
Baseline risk: 20/1000; risk reduction: 10/1000	145	28.3
Group 2		
Baseline risk: 80/1000; risk reduction: 10/1000	225	43.9
Indifferent	105	20.5
Don't know	38	7.4
Total	513	100.0

Is it rational?

”Protest” bidding – what is a protest response?

- If a zero response is justified by principles/preferences not directly relating to the good that is being valued, such as “*on principle grounds I do not want to pay more in tax”* it is often categorized as a protest bid and excluded from analyses

- However: any type of payment vehicle will incur protest bids – but for different reasons

- No agreement exists about the procedures used to separate genuine zeros values from protest values

- No agreement exists about the treatment of protest responses in subsequent analyses

Arguments raised for being careful in treatment of zero bids

Meyerhoff and Liebe (2005):

- protest beliefs have a significant effect on WTP *and* on the amount of money stated by those who *are* WTP

Halsted, Luloff, Stevens (1992):

- the removal of protest bids can only be sustained if the characteristics of protest bidders do not differ from those of respondents whose bids are deemed legitimate (we should not discriminate against subgroups).

Lindsey (1994):

- protest bids should not be excluded if one is seeking to establish the true value of a policy option (inclusive of payment vehicle)

WTP for helicopter service

Table 1. Willingness-to-pay (WTP) for acute helicopter service per annum when the whole population is covered (public good) and when access is a matter of private choice (private good)

	Proportion WTP > 0 (%)	Proportion WTP > 0 exclusion protesters (%)	Mean WTP (n = 3434) (DKK)	Mean WTP exclusion protesters (n = 2768; 2615) (DKK)
Public good	56.6	70.2	438	543
Private good	42.1	55.3	301	395
Public good 'premium' (Mean dWTP)	+14.5	+14.9	+137[a]	+148

[a]The difference is statistically significantly different according to Wilcoxen matched pairs test ($p < 0.0001$).

TWO TYPES OF PAYMENT VEHICLE AT PLAY TAX vs PRIVATE INSURANCE – PROTESTERS IN BOTH SCENARIOS

Protest bidding and attitudes (helicopter case)

Protesting (WTP_{public}) strongly associated with:

- Weaker preferences for equity in access
- Higher level of *disagreement* with the statement that “Public health care services is of high quality”
- Higher level of *disagreement* with the statement “Closing local hospitals means that the distances to hospitals are too great”

Results imply that so-called protest bidders not only have strong views on access issues, but that they also differ with respect to other preferences

The choice of perspective

Which ultimately is closely linked to payment vehicle

Payment vehicle

- Out-of-pocket?
- Private health insurance premium?
- Increased income tax?

Health care services are often private goods (excludable)

The most realistic payment vehicle should be applied (depends on setting)

Increased income tax: altruism may be included in valuations, as respondents are paying towards a common pool and access will be ensured for all

Premiums as opposed to out-of-pocket: option value included.

How to frame?

What are you willing to pay for good X?

What are you willing to pay in insurance premium for access to good X?

What are you willing to pay extra in public tax for access to good x?

Factors that play a role when anwering the above:

- Risk aversion
- Option value
- Altruism
- Pure altruism

WTP will differ across context and framing

- If citizens are *not risk averse*, and if citizens have *little consideration for others* – exclusion of option value and value associated with caring externalities (altruism) may be of little consequence

- Clearly, citizens' preferences will be different across countries

- However:
  - Health insurance is prevalent in most countries (indicating risk aversion)
  - In most countries the state intervenes to help the poor afford health care (e.g. Medicaid, Medicare…) – indicating altruism
  - So it seems that citizens are generally both risk averse and altruistic…

Option value and altruism

- Are probably most important to measure when *access* issues are highly present:
  - High technology health care
  - High cost health care
- These are also the type of health care interventions that are typically subject to scrutiny in the form of economic evaluations
- Yet: in most WTP studies only USE VALUE is measured
- (Note: this is the perspective of CUA, so yet another potential advantage of WTP is that altruism and option value can potentially be measured)

Different perspectives – different answers

Table 1. A framework of perspectives[a]

	A *Ex ante*		B *Ex post*	
1. Personal	$0<p_p<1$ $p_o = 0$	What value do you attach to treatment being available should you need it?	$p_p = 1$ $p_o = 0$	What value do you attach to your own treatment?
2. Social	$p_p = 0$ $0<p_o<1$	What value do you attach to treatment being available to others should they need it?	$p_p = 0$ $p_o = 1$	What value do you attach to the treatment of others?
3. Socially inclusive personal	$0<p_p<1$ $0<p_o<1$	What value do you attach to treatment being available to a group of people amongst whom you might find yourself?	$p_p = 1$ $p_o = 1$	What value do you attach to the treatment of yourself and others?

[a] p_p – the probability of one's own need for treatment. P_o – the probability that others in society will need treatment.
Note: The term treatment is used here in the widest possible sense to refer to any health-related intervention.

Dolan, Olsen, Menzel, Richardson, Health Economics 2003

Question to you:

- *Ex ante private insurance perspective versus*
- *Ex ante public insurance perspective*
- If people are altruistic, would you expect the responses to differ?
- And of so, in which way?
- There is somewhat mixed evidence.
- Pure altruism – consideration of others in all aspects….

The social perspective may suffer from different issues

Are respondents paternalistic or pure altruists, and what implications does this have?

Tax payments are more binding. Does compulsory/non-compulsory payment affect valuations? One can generally get out of private insurance. It is more difficult getting out of paying tax for a specific service. May also generate higher WTP for private set-up.

Do respondents associate payment vehicle with specific provider types? (as suggested in ambulance helicopter example).

Is the citizen perspective (payment vehicle: tax levy) associated with social desirability bias? (moral commitment) – warm glow.

Health state dependent utility (HSDU):

A specific issue related to ex post scenarios

Key question: is the value of money the same to you whether you are healthy or sick?

An ex post valuation normally involves placing citizens in an inferior health state, and asking them to indicate their WTP for health improvements.

Does the inferior health state impact on marginal utility of consumption?

If so, this is problematic if preferences are to guide policy making using tax payers money. Since the average tax payer is generally in OK health.

BEWARE of COSTS and BENEFITS being measured on different scales.

Evidence on HSDU

As summarised by Finkelstein *et al* (2009) there are different empirical approaches to establishing how health state affects utility of consumption

Finkelstein *et al* report 6 studies that have estimate the magnitude of state dependence (Edwards, 2008; Lillard and Weiss, 1998; Sloan *et al*, 1988; Viscusi and Evans, 1990; Evans and Viscusi, 1991; Finkelstein, Luttmer and Notowidigdo, 2008;2012).

Two other studies (Levy and Nir, 2012; Tengstam, 2014, Gyrd-Hansen, 2018) have subsequently been conducted on the subject.

Of these nine studies, three demonstrate negative state dependence (i.e. poorer health decreases marginal utility of consumption), whereas five studies show positive state dependence and one study shows no state dependence.

An example of a study (Gyrd-Hansen, 2018)

"Imagine that you are on a waiting list for an operation, which you will have one year from now. The operation is a preventative measure and you currently have no health problems. However, after the operation it is advised that you do not work for a year, in order to prevent complications in the year after the operation."

"Your health state in the year following the operation will be as follows:"
(*respondents were randomized to one of six health states which were described using the EQ-5D descriptive system: H1:21111, H2: 21121, H3: 22221, H4: 22222 (shown), H5:23322 or H6: 33322*

- You have some problems in walking about
- You have some problems washing or dressing yourself
- You have some problems with performing your usual activities
- You have moderate pain or discomfort
- You are moderately anxious or depressed

Methods – the question

- “You will have no out-of-pocket expenses in connection with the operation, or the year that follows. After a year your health will return to normal, and you will be able to go back to work.”

- “Imagine that you have no savings, or that you do not have access to your savings. You are insured such that you will keep what is close to your normal salary whilst you are unable to work. Your income after tax will, however, be reduced by DKK 1000 per month.”

- “Since you know that you will be undergoing the operation a year from now, you have the possibility of putting some of your current income aside in order to ensure you have more income in the period after the operation. In other words, you have the possibility of distributing your monthly loss of DKK 1000 per month over the two-year period (the year before the operation and the year after the operation).

Which distribution do you prefer?

Methods – response options

(if respondent gave outlier response there would be follow-up question that allowed for even more extreme distributions; this was followed up by open-ended option)

The year before the operation when you are HEALTHY **Put aside every month:**	The year after the operation when you are NOT HEALTHY **Use less every month**	I prefer: (put one "X")
0 DKK	-1000 DKK	
-100 DKK	-900 DKK	
-200 DKK	-800 DKK	
-300 DKK	-700 DKK	
-400 DKK	-600 DKK	
-500 DKK	-500 DKK	
-600 DKK	-400 DKK	
-700 DKK	-300 DKK	
-800 DKK	-200 DKK	
-900 DKK	-100 DKK	
-1000 DKK	0 DKK	

Results

preferred C1/C2 distributions and mean diffINC

Table 2. Results. Income allocation choices across health states.

	Preferred income distributions (%) n=2000						
Distribution (DKK) $C_1;C_2$	H0	H1 (21111)	H2 (21121)	H3 (22221)	H4 (22222)	H5 (23322)	H6 (33322)
0; -1000*	17.6 (14.1)	16.5 (13.7)	17.9 (15.1)	15.7 (13.3)	15.0 (11.8)	21.0 (18.2)	15.3 (12.5)
-100; -900	1.8	1.4	2.1	0.7	3.5	0.7	1.7
-200;-800	3.5	0.7	2.8	1.7	3.5	2.1	5.2
-300;-700	2.5	6.0	3.9	3.5	3.1	1.7	3.5
-400;-600	3.2	2.5	3.9	2.4	3.1	6.3	4.2
-500;-500	44.4	46.0	44.2	42.7	37.6	40.6	41.1
-600;-400	2.8	2.8	2.5	2.1	3.8	2.4	3.1
-700;-300	2.1	2.8	2.5	1.0	2.1	0.7	4.5
-800;-200	2.1	1.8	0.7	2.1	2.4	1.7	1.7
-900;-100	0.4	0.4	0.4	0.7	1.5	0.3	0.0
-1000;0*	19.7 (12.3)	19.3 (10.9)	19.3 (12.3)	27.3 (17.5)	24.4 (13.9)	22.4 (12.2)	19.5 (13.6)
Total N	284	285	285	286	287	286	287
$C_1>C_2$	28.5	27.0	30.5	24.1	28.2	31.8	30.0
$C_1=C_2$	44.4	46.0	44.2	42.7	37.6	40.6	41.1
$C_1<C_2$	27.1	27.0	25.3	33.2	34.2	27.6	28.9
Mean diffINC (DKK)	43.67	80.70	24.37	167.83	154.70	67.13	40.42

*Including more extreme distributions (max diffINC: +3000; min diffINC: -3000).

A seventh arm involved no health implications H0). Captures any reason for differing MU across the time periods other than change in health.

Results

When looking at the sample as a whole (H1 to H6), we find no evidence of positive or negative HSDU since $DiffINC_{H1..H6} - DiffINC_{H0}$ is not statistically significantly different from zero.

For health states H3 and H4 we found positive HSDU, suggesting that only intermediate health states generate non-neutral HSDU.

Results suggest that positive health state dependency may be prevalent for intermediate health states – i.e. intermediate health increases marginal utility of consumption/income.

Frequency of payment

Does frequency of payments affect WTP?

There are indications that this may indeed by the case:

Suncorp insurance company advertisement:
"Our monthly insurance payment option will ease the burden that a yearly annual premium can bring. You can spread your annual insurance bill across twelve easy to manage monthly payment….A fee of 15% of the premium applies if you choose to pay by the month"

WTP per month or per year?

Stated preference studies ask respondents to state their WTP per year: e.g. Krupnick *et al* 2002; Olsen and Donaldson 1998, Alberini 2006

And per month: e.g. Zethraus *et al* 1997; O'Brien *et al* 1995; Johannesson *et al* 1997; Blumenschein *et al* 1998

There is no consensus!

What if this "detail" has significant effect on valuations?

There are practically NO studies that have looked at the impact of frequency of payment on valuations

Little, but worrying evidence

- Johannesson et al (1993): monthly payments increased the annual maximum WTP by 50%
- Gyrd-Hansen, Jensen and Kjær (2014): monthly payments increased the annual maximum WTP by >100%

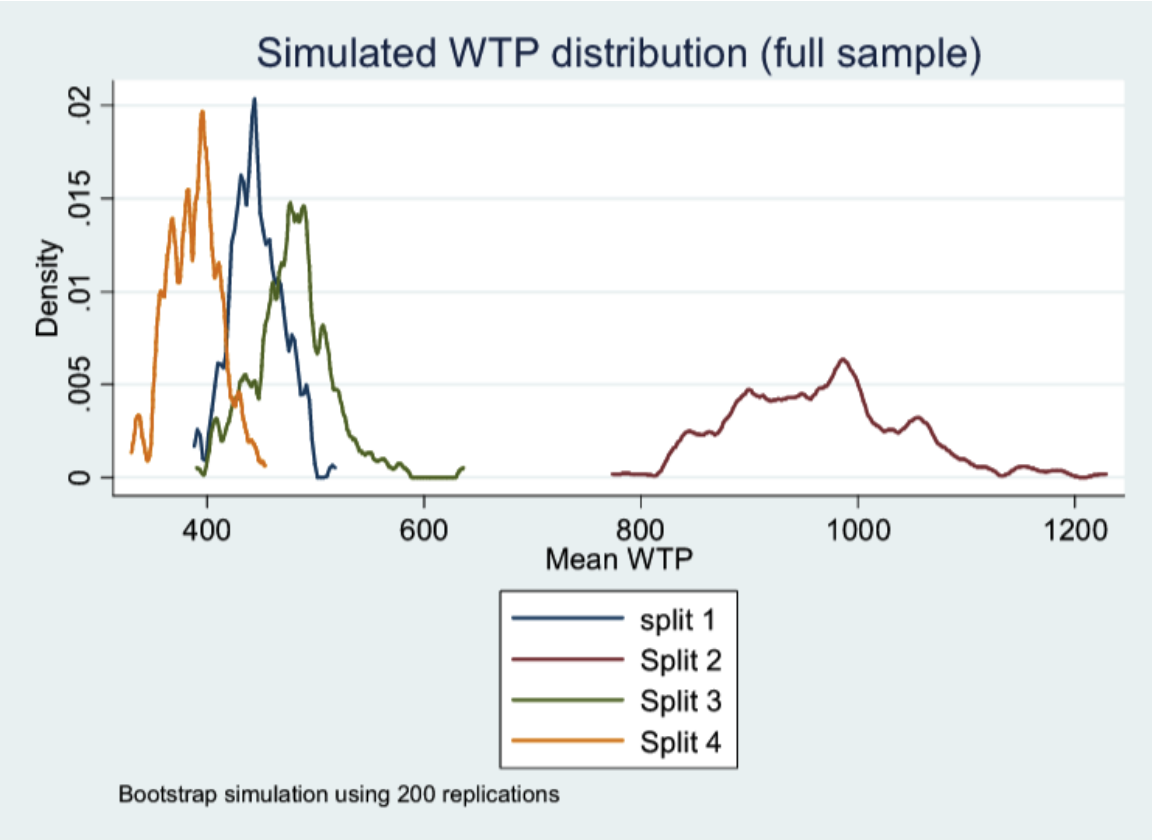
- There is no consensus!

Gyrd-Hansen, Jensen, Kjær, 2014

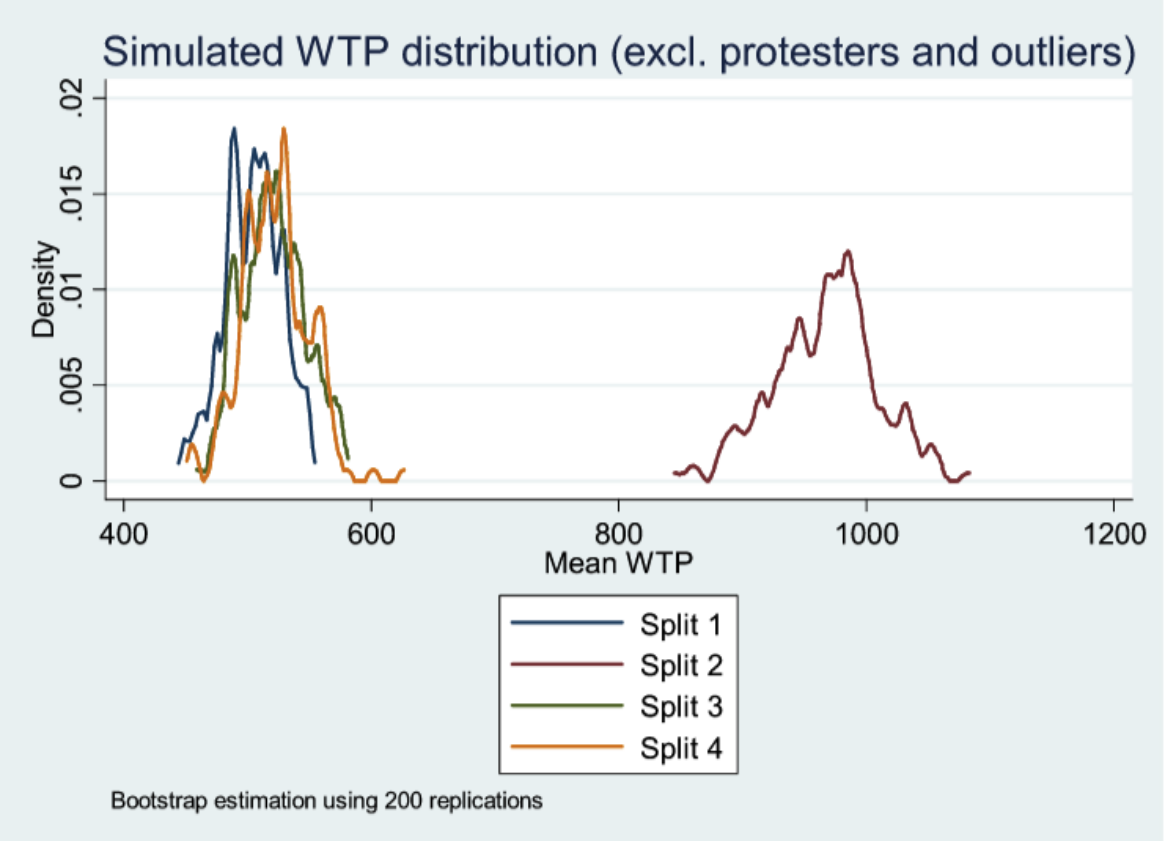
Table I. Data description. WTP distributions for splits 1 to 4

Data set	*N*	Mean	25th percentile	50th percentile	75th percentile
Split 1: payment card (PC-year)					
All responses	1280	447	0	200	500
Excl. protesters	1134	505	50	200	500
Excl. protesters and outliers	1134	505	50	200	500
WTP > 0	923	620	100	500	1000
Zero WTP	357			27.9% of all responses	
'Protest' zero WTP	146			11.4% of all responses	
'Non-protest' zero WTP	211			18.6% of all non-protest responses	
Split 2: payment card (PC-month) with monthly payments. Annual payments calculated and reported to ease comparison					
All responses	1221	972	0	420	1200
Excl. protesters	1019	1164	60	600	1200
Excl. protesters and outliers	1011	972	60	600	1200
WTP > 0	816	1454	420	600	1200
Zero WTP	410			33.6% of all responses	
'Protest' zero WTP	207			16.9% of all responses	
'Non-protest' zero WTP	203			19.9% of non-protest responses	

Results I


Simulated WTP distribution (full sample)
Density
0
.005
.01
.015
.02
400
600
800
1000
1200
Mean WTP
split 1
Split 2
Split 3
Split 4
Bootstrap simulation using 200 replications

Results II



P.S – yes/ no filters also produce different results –se eg Ahlert et al, SSM, 2016

Can we establish one unique WTP per QALY estimate?

Many studies – why?

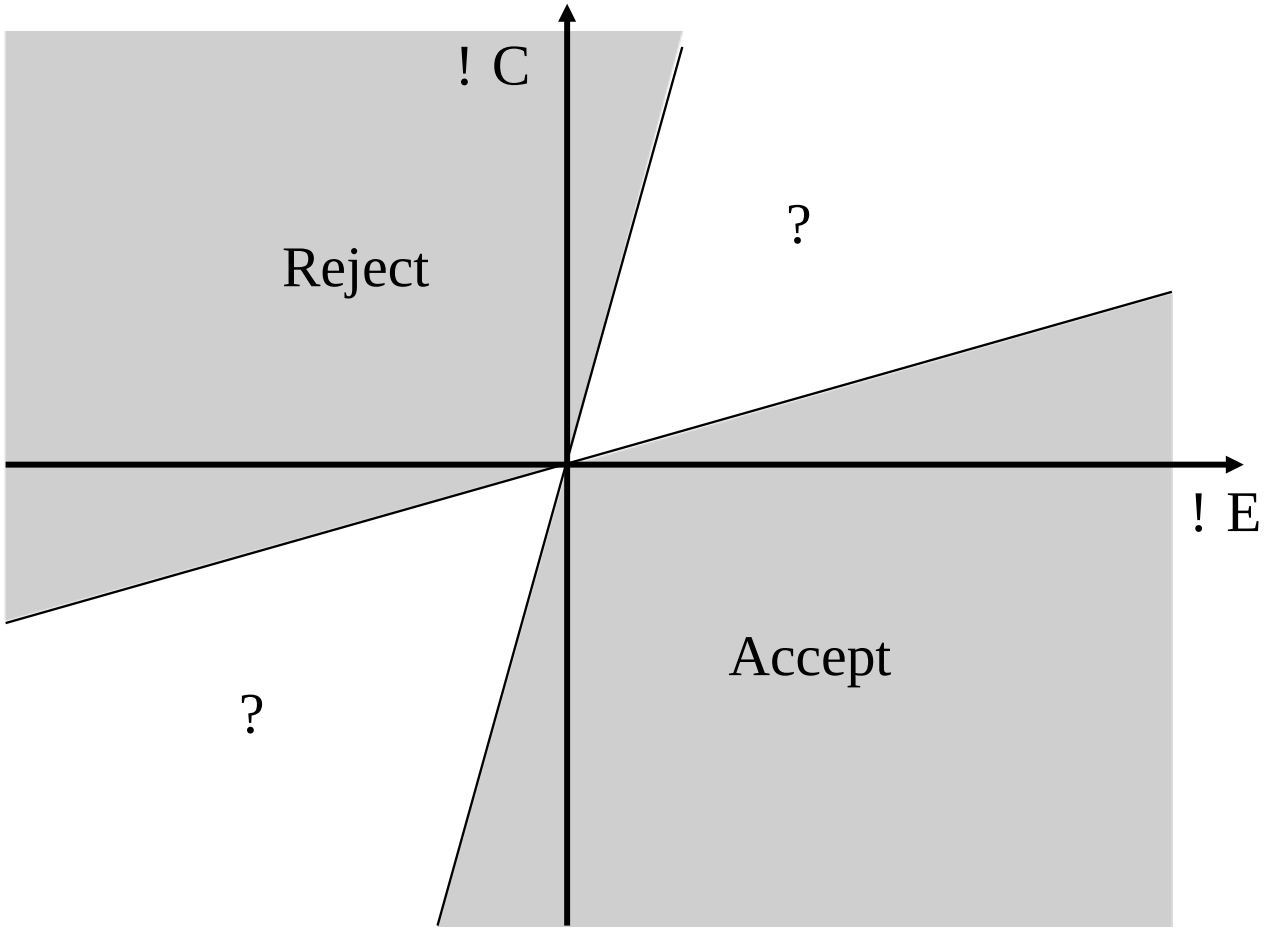
- Because a WTP-per-QALY estimate would offer a decision rule for CUA!
- Note however that we then ignore all the other dimensions of value that may be captured in WTP (information value, process disutility option value, altruism etc)

- We are down to use value, and a pure focus on patients' gains.

- Is it feasible to estimate one unique WTP-per-QALY?

- Note that one distinguishes between a sociale value of a QALY and a

WTP for a QALY?



Key assumptions

- Key – restrictive assumptions:
  - Follows the a QALY is a QALY is a QALY doctrine
  - *severity independence severity :* for equally sized QALY gains, the elicited WTP-Q must be independent of the health states presented to the respondent
  - *Proportionality in scope:* WTP and QALY must increase proportional in size.
  - Or is linearity sufficient?
  - Generally these assumptions are not fulfilled

Methods - WTP for a QALY

Respondents react differently to TTO and WTP question

Table II. Relationship between zero bid responses in the WTP and TTO setting

	QALY gain		
	>0	=0	Total
WTP			
>0	1069	376	1445
=0	36	26	62
Total	1105	402	1507

How to analyse?

Means of ratios or ratios of means?

Ratios of means:

$$\text{Open ended WTP}: \ \text{WTP/QALY}_{\text{aggregate}} = \frac{(1/n)\sum_i \max \text{WTP}_i}{(1/n)\sum_i \text{QALY gain}_i}, \qquad i = 1, \ldots, n$$

Means of ratios:

$$\text{Open-ended WTP}: \ \text{WTP/QALY}_{\text{disaggregate}} = \frac{1}{n}\sum_i \frac{\max \text{WTP}_i}{\text{QALY gain}_i}, \quad i = 1, \ldots, n$$

In the latter case QALY=0 reponses will be excluded. WTP per QALY estimates higher

The two approaches are used interchangably….

Table I. Overview of previous empirical studies analysing WTP for a QALY

Authors	WTP approach	Analytical WTP/QALY approach
Donaldson *et al.* (2008)	Card sorting	Disaggregated (mean of ratios)
Byrne *et al.* (2005)	Open ended	Disaggregated (mean of ratios)
King *et al.* (2005)	Bidding game	Disaggregated (mean of ratios)
Pinto-Prades *et al.* (2009)	Payment card	Aggregated (ratio of means)
Gyrd-Hansen (2003)	Dichotomous choice	Aggregated (ratio of means)
Cunningham and Hunt (2000)	Payment card	Aggregated (ratio of means)
Zethraeus (1998)	Dichotomous choice	Aggregated (ratio of means)

WTP per QALY - design

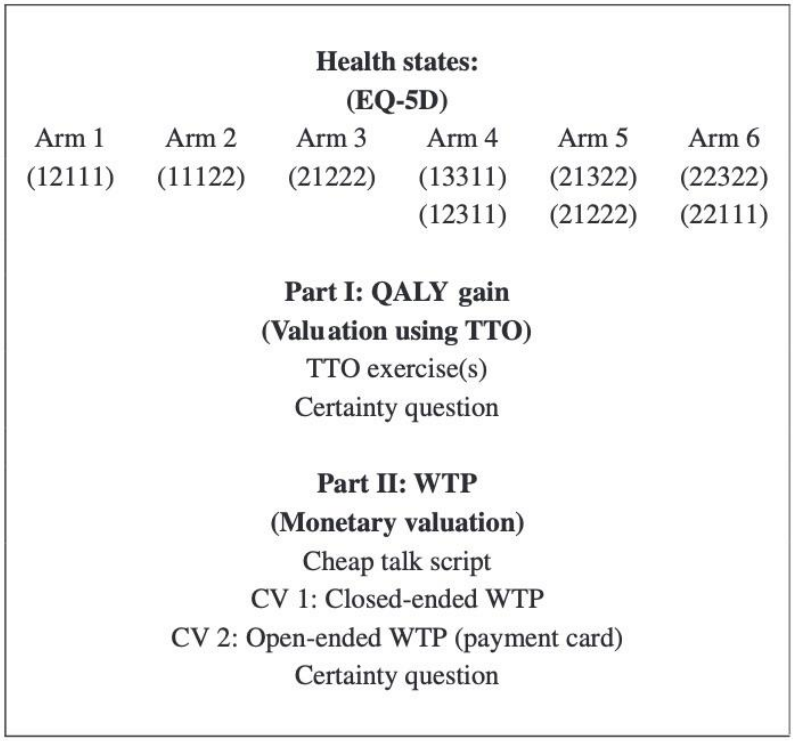


Figure 1. Questionnaire structure

Gyrd-Hansen D, Kjær T, 2012

Association QALY gain and WTP
- general problem: insensitivity to scope

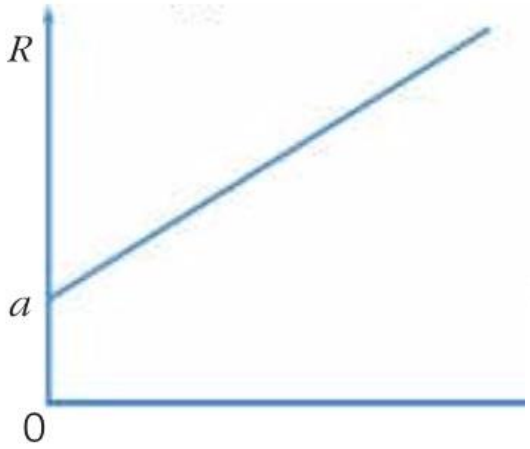
Table III. Mean (median) maximum WTP per month in DKK for different levels of QALY gain

QALY gain	WTP all	*N*	WTP arms 1–3	*N*	WTP arms 4–6	*N*
QALY = 0	2467 (1000)	402	2294 (1000)	176	2602 (1000)	226
0 < QALY ≤ 0.25	2527 (1000)	423	2795 (1000)	225	2222 (1000)	198
0.25 < QALY ≤ 0.50	3194 (1250)	248	3591 (1250)	140	2680 (1000)	108
0.50 < QALY ≤ 0.75	4061 (1000)	169	4702 (1000)	104	3035 (1000)	65
0.75 < QALY ≤ 1	2288 (1000)	85	2125 (1000)	63	2755 (1000)	22
QALY > 1	3350 (1000)	180	4500 (1000)	98	1976 (1000)	82

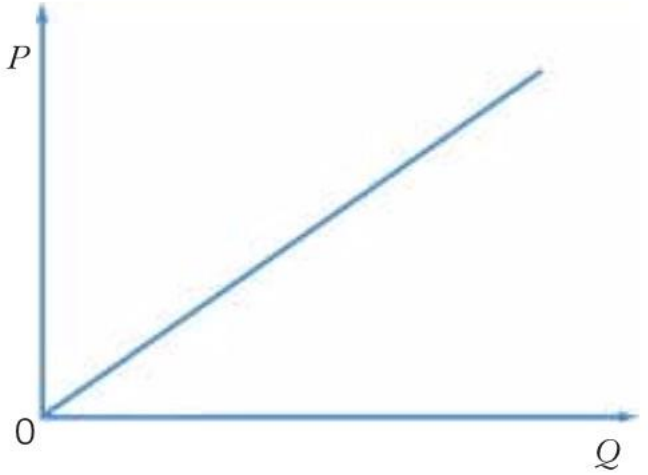
Gyrd-Hansen, Kjær, 2012

Linearity or proportionality in scope?

Linearity can be represented by the graph below.



Direct proportionality can be represented by the graph below.



Results

Table V. Summary of WTP/QALY results from different analytical approaches

	Excluding overhead	Including overhead
Aggregated approach – ratio of means (full sample included)		
Open ended (maximum WTP)	n.a.	148 900 DKK
DC-standard logit	20 404 DKK	61 828 DKK
Disaggregated approach – mean of ratios (excludes those with zero QALY gains)		
Open ended (maximum WTP)	n.a.	203 485 DKK
DC-standard logit	241 963 DKK	331 829 DKK
DC-MMNL Log normal	169 813 DKK	722 743 DKK
DC-MMNL Triangular	161 097 DKK	302 333 DKK
DC-MMNL Uniform	214 903 DKK	535 156 DKK
DC-MMNL Rayleigh	96 516 DKK	438 767 DKK

Note: The MMNL are estimated using Nlogit 4.0 (Greene 2007).

Review – WTP per QALY

Ryan og Svennson, 2015

- This paper conducts a review of the literature on the WTP for a QALY. In total, 24 studies containing 383 unique estimates of the WTP for a QALY were identified.

- Trimmed mean and median estimates amount to 74,159 Euro and 24,226 Euros (2010 price level), respectively.

- In regression analyses, the results indicate that the WTP for a QALY is significantly higher if the QALY gain comes from life extension rather than quality of life improvements. The results also show that the WTP for a QALY is dependent on the size of the QALY gain

Social value of a QALY

- QALYs are often used with an assumption that QALYs are valued equally
- However, this assumption has been questioned from the outset.
- Important empirical literature (e.g. Baker et al., 2010; Dolan and Tsuchiya, 2005; Lancsar et al., 2011; Nord and Johansen, 2014; Shah, 2009; van de Wetering et al., 2015; Wagstaff, 1991; Williams, 1997) has focused on how contextual factors impact on the societal value of a QALY.
- A recent review of that literature Gu et al (2015) found that the relative social value of a QALY potentially differs according to key characteristics of the individual such as age, severity, culpability, and socio-economic status.

Concluding remarks

- I have tried to give an overview – covering:

- HOW to measure WTP (in brief)
- Illustrating WHY WTP may be a good measure of outcomes in some circumstances
- But also that is is important to be aware of exactly WHAT you want to measure (choice of perspective).
- Importantly: I have presented problem areas: be critical! There is scope for future research
- Much work is being done to estimate WTP for a QALY, and the social value of a QALY. But it is not without difficulties…..

Thank you for your attention!

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