



Environment Center
Charles University
in Prague

THE ECHA STUDY ON FERTILITY, BIRTH DEFECTS, AND DEVELOPMENTAL TOXICITY: HOW MUCH ARE IMPROVING FERTILITY AND REDUCING RISK OF BIRTH DEFECTS WORTH?

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Motivation of the study

- Exposure to chemicals increases the risk of **lower / compromised fertility** due to several reproductive dysfunctions, including lower sperm count, lower motility of sperm, changes in the oestrous cycle, changes in hormone levels, changes in sexual behaviour, spontaneous abortion (Kumar 2008).
- Maternal exposure to pesticides, PCBs, PCDBs, Pb, Hg, and other endocrine disruptors may lead to various **birth defects** (Wigle et al. 2008; Prüss-Ustün 2011).
- Environmental contaminants (e.g. Pb, methyl-Hg, PCBs, Cd, As, Mg) can damage a child's developing brain and nervous system and cause **neurodevelopmental effects** (US EPA 2013).

Study Challenges

- Valuation of **benefits** due to a change **health outcome** linked to **fertility and developmental toxicity**
 - underexplored area → with no previous SP studies; some studies exist on valuation of certain technologies, studies on COI or QoL impacts (QALYs)
- **Context and scenario** matters
 - private vs. public good scenario
- **Target population**
 - no way to elicit preferences from (unborn) babies
 - preferences for a private good can be elicited only from a person who would like to have a/another baby
- Ethics
 - very **sensitive issue** and questions

FERTILITY



State-of-the-art on Fertility Valuation

assisted reproduction technologies (IVF)

- 9 studies
- *ex ante* (WTP for insurance) out-of-pocket **WTP for IVF** in case the couple **had experience with infertility** (Granberg et al., Ryan 1996, 1997)
- *ex post* (**WTP for treatment** in the event respondent need it)
- VSC: **\$40,640 to over a million \$** (WTP is larger for *ex ante* and for very small chance of success)
- issues: perception of the probability of using fertility treatment; setting the probabilities related to insurance;

reducing risk of experiencing infertility

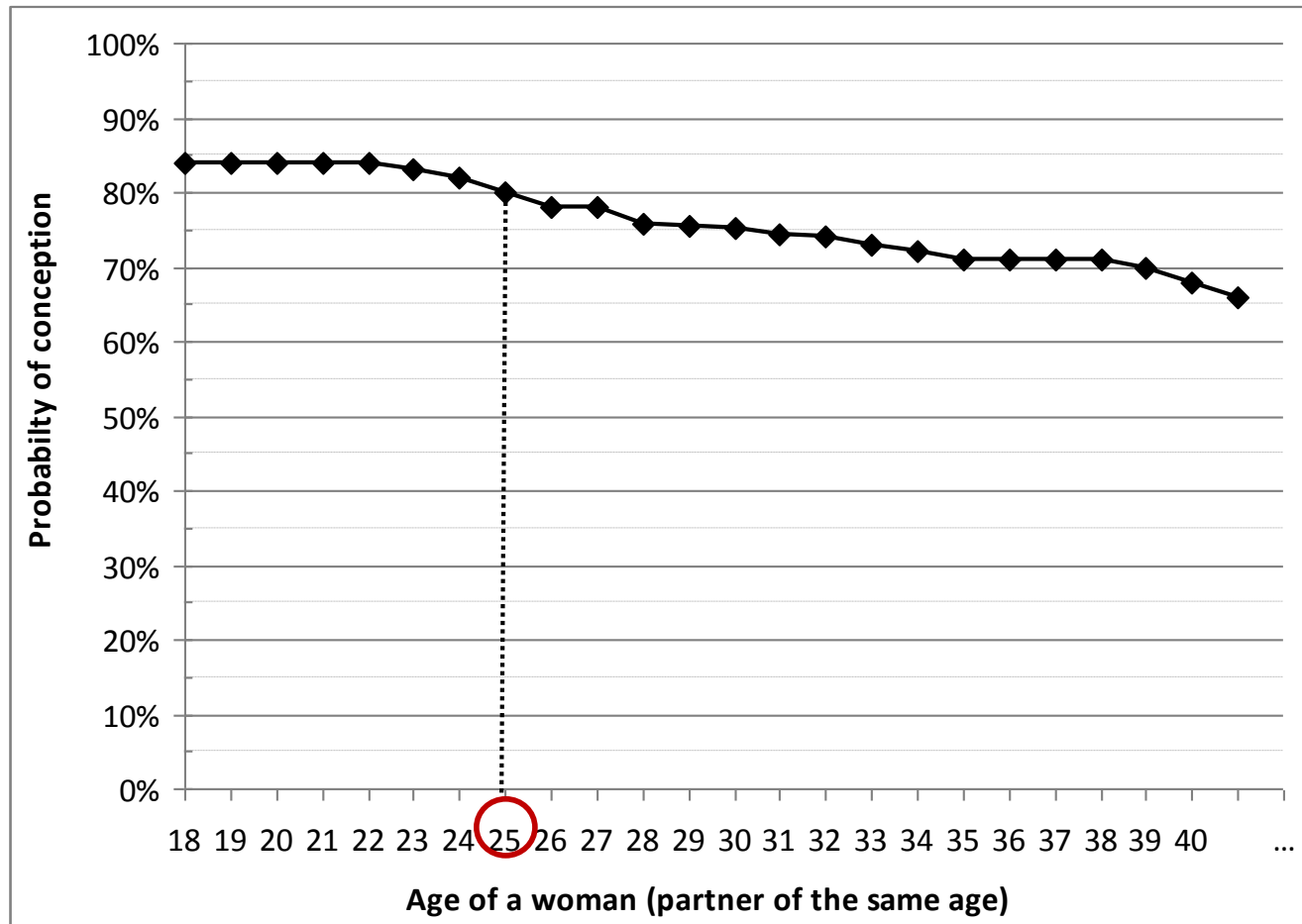
- only one study (*van Houtven & Smith, 1999* published in a workshop proceedings)
- *ex ante*: individuals are asked to assume that they **do not know their fertility status** and are asked to state their WTP for **insurance programs**
- WTP for a **delay the increase in infertility risk** for up to five years
- VSC: **\$16,500 to \$49,400**
- issues: small restricted sample; *ad hoc* assumption on the discount rate and the timing of the medication

Problem

Although the conception of a child seems to be a natural part of life, it is not certain and it depends on many factors.

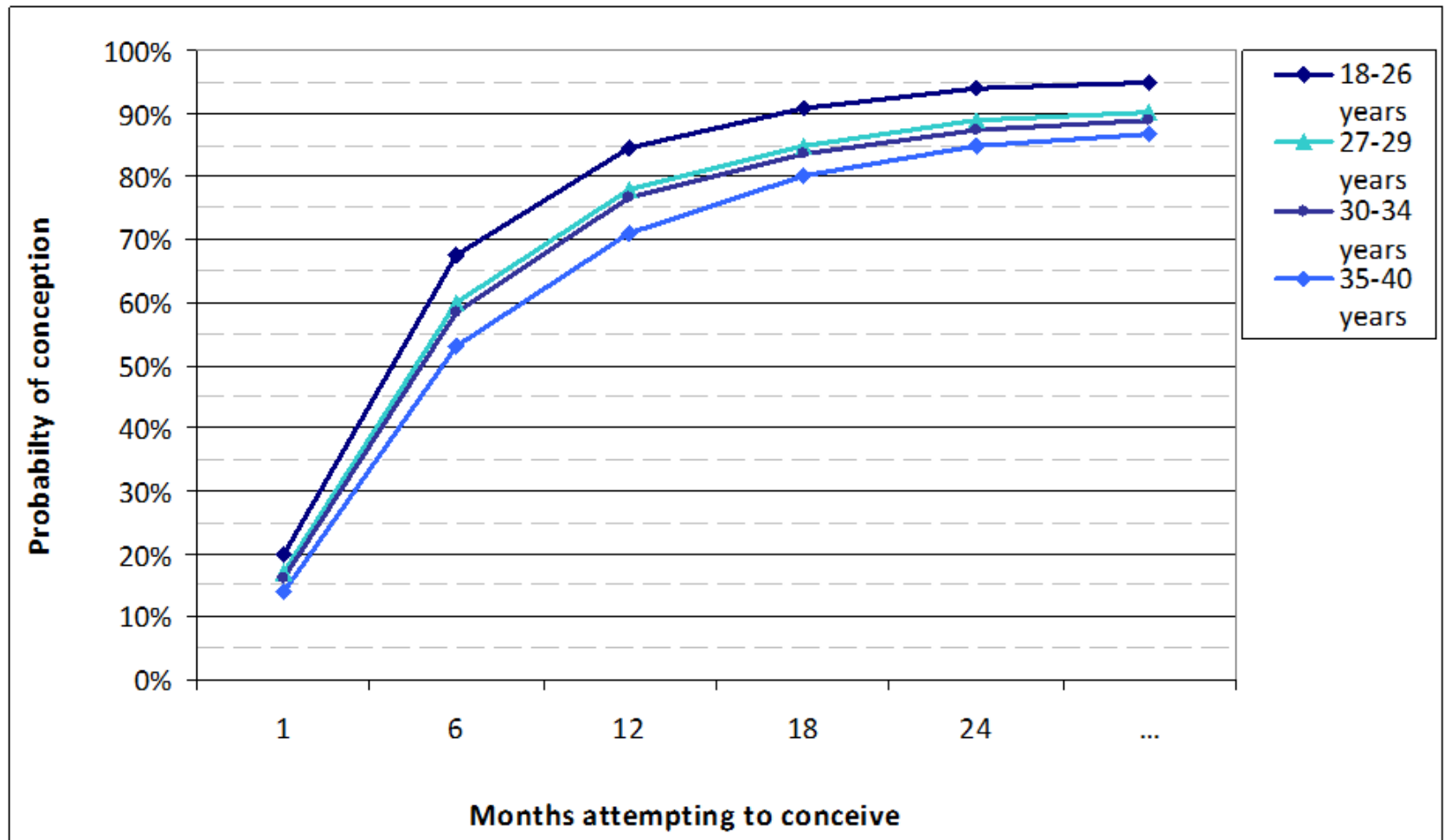
The probability of conceiving	<ul style="list-style-type: none">- decreases with the age- increases with the time a couple is trying to conceive- increases with frequency of sexual intercourse,- is also determined by lifestyle and other factors
Infertility	<ul style="list-style-type: none">- failure to conceive after 12 months or more of regular unprotected intercourse
Treatment of infertility	<ul style="list-style-type: none">- drug treatments that alter levels of reproductive hormones in tablets or injections- medical procedures involving the manipulation of sperm, eggs and embryos, such as in vitro fertilization, sometimes referred to as a "IVF conceived baby"
Quality of life impact of infertility	<ul style="list-style-type: none">- difference in the sexual life of the couple, such as the planning of the intercourse- sexual dysfunction, depression, anxiety

The Problem: Probability of conceiving



Source: Medical study conducted in Europe (Dunson D.B., Baird D.D., Colombo B. (2004): [Increased infertility with age in men and women](#). *OBSTETRICS AND GYNECOLOGY*, Volume: 103, Issue: 1, 51-56)

Time a couple is trying to conceive



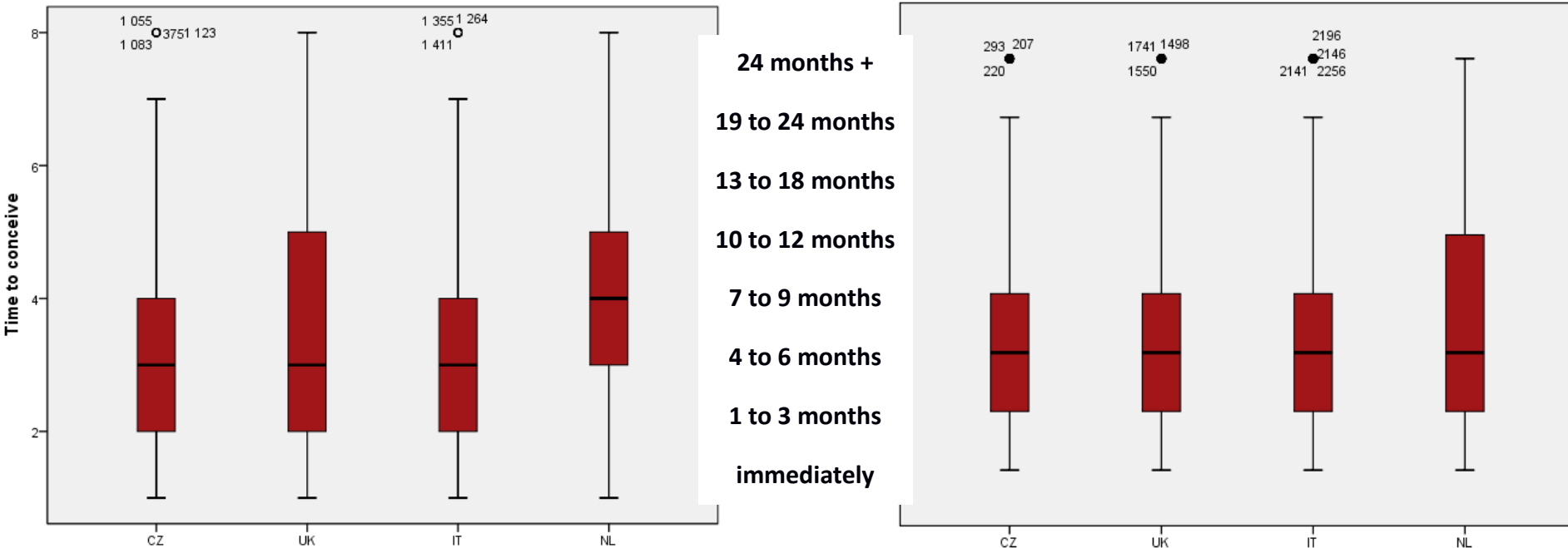
Note: **Infertility** = failure to conceive **after 12 months or more** of regular unprotected intercourse

Source: Medical study conducted in Europe (*Dunson D.B., Baird D.D., Colombo B. (2004): Increased infertility with age in men and women. OBSTETRICS AND GYNECOLOGY, Volume: 103, Issue: 1, 51-56*)

How long do you think will it take you and your (future) partner to conceive?

General population

People who want children

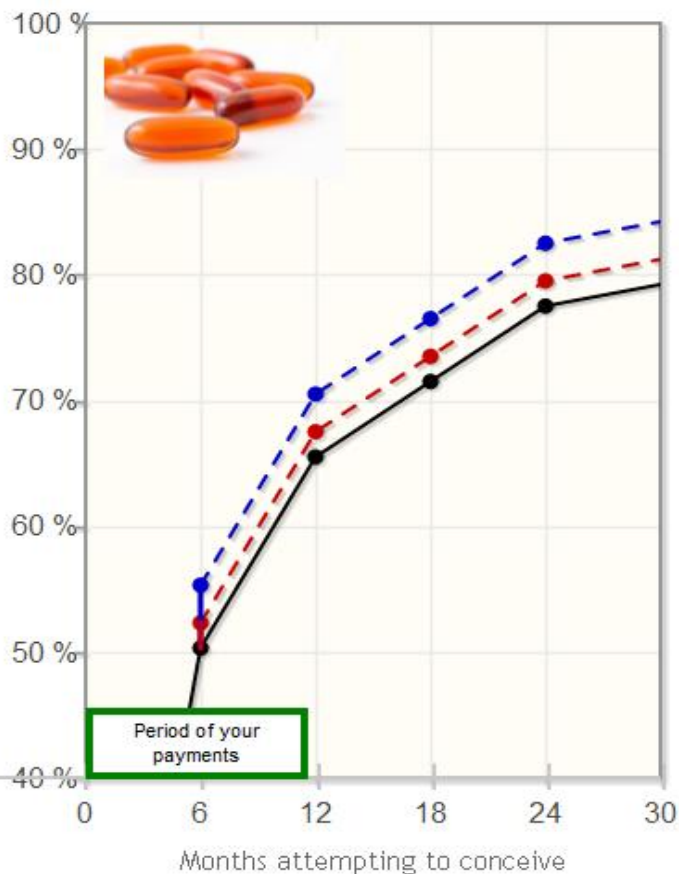


Note: black line in the red bar indicates **median**; the red bar highlights **the first and the third quartile**, the bands in black show **min-max**. Source: ECHA survey (Ščasný and Zvěřinová, 2014)

DCE example of choice card

First choice

Would you choose Vitamins A, Vitamins B, or neither?



Attribute	Complex of vitamins A	Complex vitamins B	Current state
Beneficiary	You and your partner	You and your partner	You and your partner
Percentage of increase of the probability of conceiving as shown in the graph	+ 1%	+ 5%	0% no increase
Number of months of trying to conceive after which the probability will increase	after 6 months	after 12 months	
Costs	£ 120	£ 2400	£ 0
(Monthly payment over 1 year period)	(£ 10 per month for 1 year)	(£ 200 per month for 1 year)	
Which option would you prefer?	Vitamins A	Vitamins B	Current State

DCE Design – FERT-VIT

Attribute	Levels	Description
Percentage increase in the probability of conceiving	0 - no change (SQ only)	<i>percentage increase in the probability of conceiving as shown in the graph</i>
	+2%	
	+3%	
	+4%	
	+5%	
Number of months of trying to conceive after which the probability will increase	0 - no change (SQ only)	<i>the number of months during which the couple is trying to conceive before the vitamins take effect and increase the probability of conceiving</i>
	6 months	
	12 months	
	18 months	
Costs	0 - no change (SQ only)	<i>total costs (monthly payment over 1 year period)</i>
	€ 120 (€ 10)	
	€ 360 (€ 30)	
	€ 600 (€ 50)	
	€ 1200 (€ 100)	
	€ 3000 (€ 250)	

“Private Good“ vs. “Public Good“ Scenario

“Complex of vitamins and minerals“

- private good
- only people **who intend to have a baby**
- **a new and novel complex of vitamins and minerals** would be taken by you once a week for a year while trying to conceive
- **approved** and is just on the market
- has **no side (positive or negative) effects**
- not available from the **National Health Service** nor covered by any private health insurance
- will not affect your **working abilities** and thus will not have any effect on your earnings
- will reduce the amount of money you can spend on other things
- WTP per month **over one year** (Fert, BD), over **eight months** (VLBW), as **one-time payment** (IVF)

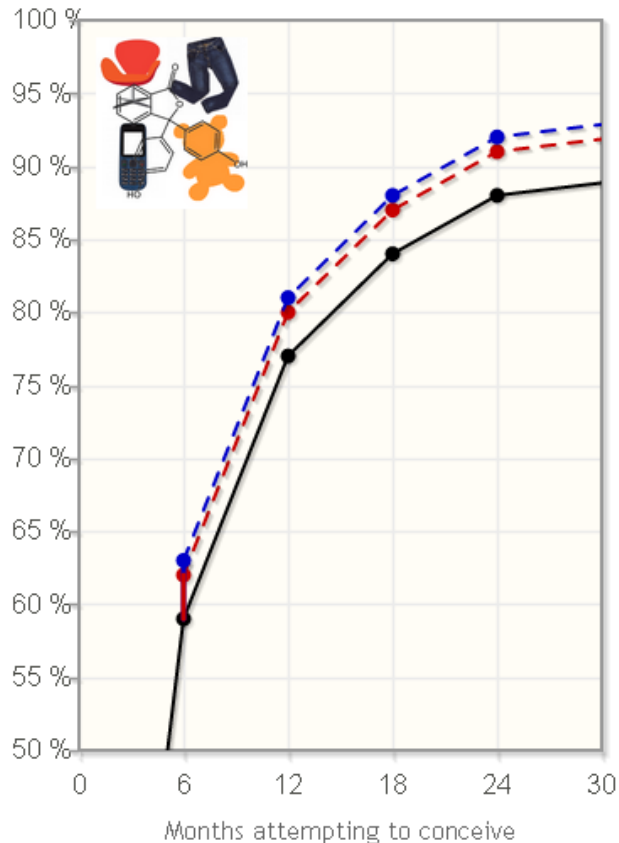
“Chemical-free products“

- public good
- **general public**
- studies have shown that people exposed to some chemicals have lower probability of conception. Various **products**, such as clothes, textile, furniture, and electronics contain such chemicals.
- **a new, stricter regulation** that will restrict problematic chemicals in products in the EU will be introduced in order to decrease concentration of such chemicals
- **certificated chemical-free products** at the EU
- cost for the regulatory service and additional costs of companies to make product chemicals-free will lead to **higher product prices** and will reduce your spending on other things
- WTP monthly **over 10 years**

Conception of a Child (CHEMPOL scenario)

First choice

Would you choose „chemical-free products“ A, B, or neither?



Attribute	Chemical-free products A	Chemical-free products B	Current state
Beneficiary	All people in the EU	All people in the EU	All people in the EU
Percentage of increase of the probability of conceiving as shown in the graph	+ 3%	+ 4%	0% no increase
Costs	£ 120	£ 3000	£ 0
(Monthly payment over 10 year period)	(£ 1 per month for 10 years)	(£ 25 per month for 10 years)	
Which option would you prefer?	Chemical-free products A	Chemical-free products B	Current state

DCE Design FERT-CHEMPOL

Attribute	Levels	Description
Percentage increase in the probability of conceiving	0 - no change (SQ only)	percentage increase in the probability of conceiving as shown in the graph
	+2%	
	+3%	
	+4%	
	+5%	
Costs	0 - no change (SQ only)	total costs (monthly payment over 10 year-long period)
	€ 120 (€ 1)	
	€ 360 (€ 3)	
	€ 600 (€ 5)	
	€ 1200 (€ 10)	
	€ 3000 (€ 25)	

Efficient design with 8 choice sets in 2 blocks (20 choice sets in 5 blocks in the pilot) (NGENE software). Contribution by Mikolaj Czajkowski acknowledged.

Econometric model: Conception of a child

Discrete choice experiments → random utility model and conditional logit

$$V_{ij} = \alpha_1 \cdot PROB_{ij} + \beta \cdot (y_i - COST_{ij}) + \varepsilon_{ij}$$

$$\Pr(Yes_{ij}) = \Pr(WTP_{ij}^* > COST_{ij}) = \Phi(\alpha_1 \cdot PROB_{ij} + \beta \cdot COST_{ij})$$

$$\Pr(k) = \frac{\exp(\bar{V}_k)}{\sum_{j=1}^K \exp(\bar{V}_j)}$$

$$VSP = (\hat{\alpha}/\hat{\beta}) \cdot 12 \cdot 100 \quad \text{i.e. Value of a Statistical Pregnancy}$$

Econometric model: Conception of a child

To allow a non-constant marginal utility of probability to conceive across different times when the probability will begin to increase

$$V_{ij} = \alpha_1 \cdot PM6_{ij} + \alpha_2 \cdot PM12_{ij} + \alpha_3 \cdot PM18_{ij} + \beta \cdot (y_i - COST_{ij}) + \varepsilon_{ij}$$

where $PM6=PROB$, if the probability would begin to increase from 6 month, otherwise $PM6=0$; same strategy to define PM12 and PM18

To control for the effect of socio-demographics or other respondent-specific indicators, such as past experience, perception about time to conceive etc., we interact the probability of conception with these indicators

$$V_{ij} = \alpha_1 \cdot PROB_{ij} + \alpha_2 \cdot PROB_{ij} \cdot \mathbf{X}_i + \beta \cdot (y_i - COST_{ij}) + \varepsilon_{ij}$$

Sampling

- Data collection within three waves (Febr–March, April, and June 2014) resulted in **4,300 obs.** (2,514 in A + 1,812 in B).
- **Quota-based** sampling (age, gender, region, employment/A, income/B)
- 71% response rate (89% after excluding those not satisfying the quota)
- Two populations
 - A = people who has a steady life partner and **intend to have a baby** within next three years (the base to compile WANT)
 - B = **general population** (about 600 duplicated and used in WANT sample as well)
 - Gave us two representative samples: „**WANT A CHILD**“ and „**GENERAL**“

	WANT A CHILD	GENERAL	TOTAL
CZ	898	502	1,400
UK	540	279	819
ITA	771	472	1,243
NL	472	247	719
Total	2,681	1,500	4,181

Sample cleaning

Speeders excluded based on the time length

- median **30 min** (32 min for WANT, and 27 min for GENERAL)
- A (want a child): 16 min and less → 10% (4% CZ, 14% UK+NL)
- B (general population): 14 min and less → 15% (9% IT, 23% NL)
- *Note: Survey Sampling International (2013) defines speeders who complete the survey in 48% of the median time. This definition of speeders led to similar numbers of speeders; the speeder conducted the interview between 12 and 17 min (A), or between 11 and 15 min resp. (B).*

Protesters

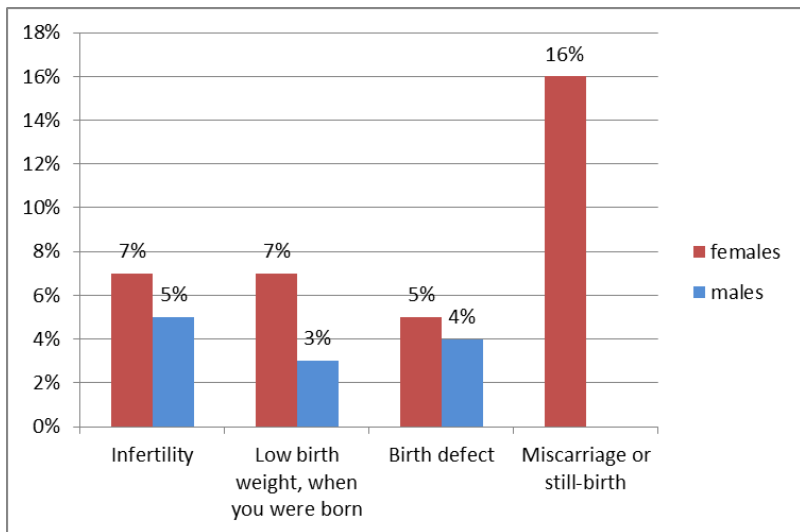
- Always (4-times) **status quo**
- choose at least one option that identifies a protester rather than true zero (e.g., no trust in info or no believe in effect, unethical or unacceptable, dislike to take vitamins, worried about adverse effect, like to conceive naturally, etc.)

Data

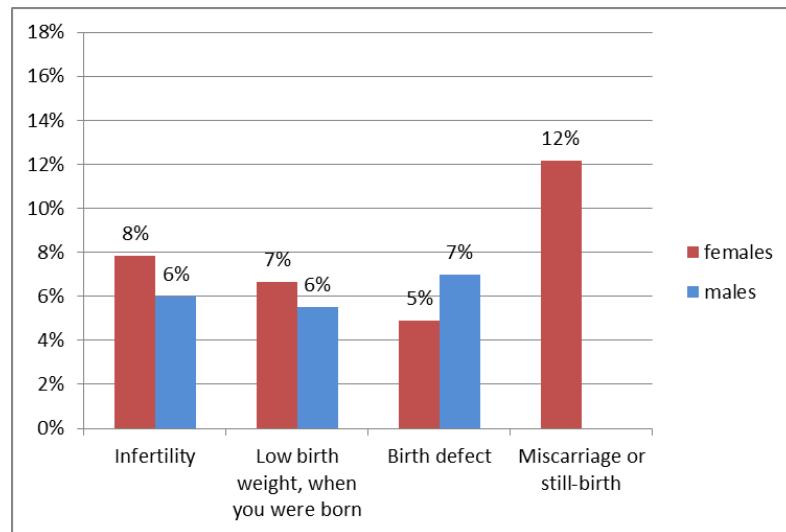
Variable	Description	WANT	GENERAL
cze	1 if respondent is from the Czech Rep	0.34	0.35
uk	1 if respondent is from the UK	0.18	0.18
lta	1 if respondent is from Italy	0.31	0.30
nl	1 if respondent is from the Netherlands	0.16	0.16
Age	Age of respondent	31.35	41.56
Age30less	=1 if younger than 30	0.52	0.30
Male	=1 if respondent is male	0.50	0.49
Spouse	=1 if respondent has a spouse	0.92	0.79
children	=1 if at least one child younger than 18 is living in a family	0.78	0.67
hincpps	Household monthly net income, in EUR PPS	2 087 €	1 819 €
hincmiss	=1 if no information about household income	0.135	0.15
When3	=1 if they like to have a child within next 3yrs	0.74	0.29
infertility	=1 if respondent has experienced infertility	0.08	0.08
abortion	=1 if respondent has experienced abortion	0.10	0.12
contracept	=1 if hormonal contraceptives has been used last 5 years	0.28	0.11

Sample characteristics: experienced conditions

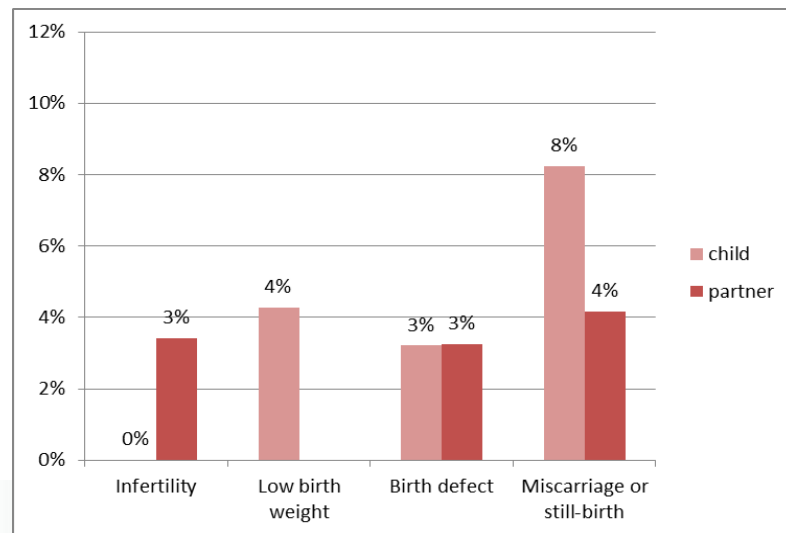
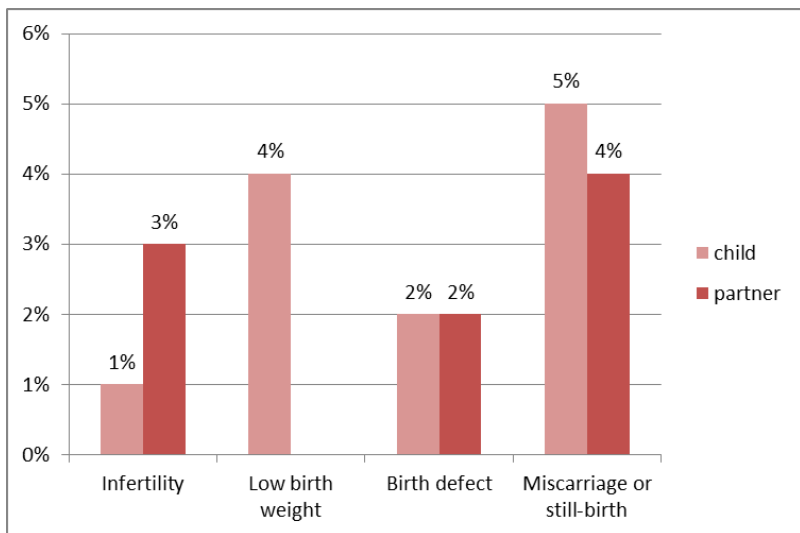
General population



Who intend to have a child



....of their child or partner



Results: Conception of a child, private good, pooled

	Estimate	p-value	Estimate	p-value	Estimate	p-value
PROB	0.1717	<.0001	0.1735	<.0001	0.1902	<.0001
cost	-0.005632	<.0001	-0.006252	<.0001	-0.005773	<.0001
VSP	37,972 €		34,747 €		39,536 €	
Data	non-protest(SQ=4)		non-protest(SQ=4) non-speeders		non-p. & non-s. & whenchild3	
N obs.	8366		7394		5606	
N ID	2092		1849		1402	
LL ratio	871.91		890.52		663	
Estrella	0.1013		0.1165		0.1145	
McFadden LRI	0.0474		0.0548		0.0538	

*Note: **protest(SQ=4)** are respondents who choose always the status quo option and selected at least once the protest option from the list of reasons for chosen SQ
whenchild3 are respondents who intend to have a child within next 3 years*

Results: Conception, private good, per country /2

	CZ		UK		IT		NL	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
prob	0.1472	<.0001	0.1761	<.0001	0.2461	<.0001	0.1027	<.0001
cost	-0.00611	<.0001	-0.00613	<.0001	-0.00581	<.0001	-0.00624	<.0001
VSP (€ PPS)	28 915 €		34 451 €		50 847 €		19 744 €	
VSP (€)	18 987 €		35 262 €		56 550 €		21 985 €	
N obs.	2460		1435		2275		1224	
N ID	615		359		569		306	
LL ratio	365.51		182.5		323.28		111.97	
Estrella	0.143		0.123		0.137		0.089	
McFadden LRI	0.068		0.058		0.065		0.042	

Other effects than the health outcome

When you were thinking about the payment for the vitamins did you consider any other effects, positive or negative, aside from the increase of the probability of conceiving?

- Yes. I considered mostly other effects (18%)
- Yes, I considered some other effects (37%)
- No. I didn't consider any other effects

If Yes → **Please indicate what other effects that you considered:**

- Improving the overall health
- Improving overall fitness
- Prevention from illness
- Possible negative side effects associated with the vitamin usage
- Worries about forgetting to take the vitamins
- Other

When you were thinking about the payment for price increase due to the chemical regulation policy did you consider any other effects, positive or negative, aside from the increase of the probability of conceiving?

- Yes. I considered mostly other effects.
- Yes, I considered some other effects.
- No. I didn't consider any other effects.

If Yes → **Please, indicate what other effects that you considered:**

- Improving the state of the environment
- Improving people's health
- Positive impacts on other plant and animal species
- Adverse impacts on the economy
- The increase in unemployment
- Possible effect on my income because I work in the affected industries
- Other

Results: Conception, private good, pooled /3

	Estimate	p value	Estimate	p value	Estimate	p value
PROB	0.1201	<.0001	0.1202	<.0001	0.1314	<.0001
p_cobenefit	0.0929	<.0001				
p_cbnmost			0.1330	<.0001		
p_cbnsome			0.0746	<.0001		
p_health					0.0611	<.0001
p_fitness					0.1082	<.0001
p_illness					0.0399	0.0291
cost	-0.006052	<.0001	-0.006059	<.0001	-0.006088	<.0001
VSP (prob)	23 814 €		23 806 €		25 900 €	
	18 420 € <i>p_cobenefit</i>		26 341 € <i>p_cbnmost</i>		12 043 € <i>p_health</i>	
			14 775 € <i>p_cbnsome</i>		21 327 € <i>p_fitness</i>	
					7 865 € <i>p_illness</i>	
N obs.	7394		7394		7394	
N ID	1849		1849		1849	
LL ratio	938.69		948.9		980.5	

Note: **Other effects** are not measured directly, but rather we control whether those who considered the side effects are ready to pay more or less than those who did not consider these effects.

Results: Conception, private good, pooled /4

	Estimate	t value	Contribution to VSP	Estimate	t value	Contribution to VSP	Estimate	t value	Contribution to VSP
PROB (PM6=base)	0.1393	12.25	29 076 €	0.0698	3.51	14 567 €	0.1141	5.69	23 787 €
PM12	0.0361	3.27	+7 535 €	0.0427	1.8	+8 911 €	0.0357	3.23	+7 443 €
PM18	0.0481	4.09	+10 040 €	0.0541	2.31	+11 290 €	0.0478	4.05	+9 965 €
pm6_when3				0.0923	4.3	+19 263 €			
pm12_when3				0.0835	3.75	+17 426 €			
pm18_when3				0.0846	4.09	+17 656 €			
p_hincpps							0.000032	6.43	+7 €
p_hincmiss							-0.0494	-2.19	-10 299 €
Cost	-0.00575	-25.03		-0.0058	-24.97		-0.005756	-25.00	
N obs.	7394			7394			7394		
N ID	1849			1849			1849		

*Remember: We informed our respondent that one is getting **infertile** when their attempt to conceive is failing **after 12 months or more** of regular unprotected intercourse.*

Results: Conception of a child, private good, pooled /6

	Estimate	t value	Contrib to VSP
p_cz	0.0568	2.8	11 639 €
p_uk	0.0541	2.49	11 086 €
p_it	0.1394	6.82	28 566 €
pm6	-0.0848	-1.67	-17 377 €
pm12	0.002925	0.06	599 €
pm18	0.0173	0.35	3 545 €
p_cobenefit	0.0739	5.47	15 143 €
p_spouse	-0.0277	-1.04	-5 676 €
p_male	0.0445	3.24	9 119 €
p_age	0.000596	0.57	122 €
p_hincpps	3.12E-05	5.75	6 €
p_hincmiss	-0.0661	-2.84	-13 545 €
cost1	-0.00586	-25.09	
p_infertile	0.0401	1.67	8 217 €
p_pregnant0	-0.0945	-3.7	-19 365 €
p_pregnant16	-0.0152	-0.82	-3 115 €
p_pregnant612	0.0337	1.16	-6 906 €
p_pregnant1318	-0.00641	-0.1	-1 313 €
pm6_when0	0.0751	1.97	15 389 €
pm6_when12	0.0295	0.94	6 045 €
pm6_when34	0.009764	0.31	2 001 €
pm12_when0	0.0526	1.38	10 779 €
pm12_when12	0.008488	0.27	1 739 €
pm12_when34	-0.0444	-1.36	-9 098 €
pm18_when0	0.0146	0.39	2 992 €
pm18_when12	0.0336	1.11	6 885 €
pm18_when34	-0.0171	-0.55	-3 504 €

Results: Conception of a child, **public good**

Respondents who want a child

General population

	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
PROB	0.1733	<.0001	0.1784	<.0001	0.1285	<.0001	0.1351	<.0001
Cost	-0.0517	<.0001	-0.0552	<.0001	-0.0457	<.0001	-0.0491	<.0001
VSP	€ 40 224		€ 38 783		€ 33 742		€ 33 018	
Data	<i>non-protest(SQ=4)</i>		<i>non-protest(SQ=4) non-speeders</i>		<i>non-protest(SQ=4)</i>		<i>non-protest(SQ=4) non-speeders</i>	
N obs.	9 040		8 048		4 831		4 371	
N ID	2 260		2 012		1 208		1 093	

Results: Conception of a child, **public good**

	Want a child sample		General population	
	Estimate	p value	Estimate	p value
PROB	0.0926	<.0001	0.0453	0.0135
P x cobenefit	0.1798	<.0001	0.1726	0.0171
COST	-0.056	<.0001	-0.0499	0.0033
VSP (prob)	€ 19 843		€ 10 894	
cobenefits	€ 38 529		€ 44 507	
N obs.	8 048		4 371	
N ID	2 012		1 093	

	Want a child sample		General population	
	Estimate	p value	Estimate	p value
PROB	0.1141	<.0001	0.0488	0.0127
P x env	0.0958	<.0001	0.1186	0.0236
P x health	0.1089	<.0001	0.1295	0.0218
P x species	0.0081	0.6689	0.0416	0.0270
P x econ	0.0829	<.0001	0.0558	0.0236
P x unempl	-0.0063	0.7949	-0.0115	0.0317
P x income	-0.0338	0.4405	0.1838	0.0952
COST	-0.0561	<.0001	-0.0505	0.0033
N obs.	8 048		4 371	
N ID	2 012		1 093	

Valuation of Infertility



In Vitro Fertilization: Problem

Probability of conceiving a child could be increased by a fertility treatment such as in vitro fertilization.

<p>Treatment stages:</p>	<ol style="list-style-type: none"> 1. Suppressing natural monthly hormone cycle (daily injection or a nasal spray). 2. Boosting the egg supply (follicle-stimulating hormone as a daily injection for around 12 days). 3. Checking on progress (through vaginal ultrasound scans and, possibly, blood tests) + patient is given a hormone injection to help eggs mature. 4. Collecting and fertilising the eggs (cultured in the laboratory). 5. Embryo transfer (before a medication in the form of pessaries, injection)
<p>Possible side effects:</p>	<ul style="list-style-type: none"> - while taking fertility drugs female can suffer from stomach pains, hot flushes, mood swings, heavy periods, breast tenderness, insomnia, increased urination, spots, headaches, weight gain, dizziness, and vaginal dryness, restlessness, or feeling down and irritable - multiple birth (twins, triplets or more) - ovarian hyper-stimulation syndrome (nausea and vomiting, severe stomach pains and swelling, shortness of breath, faintness and reduced urine output).
<p>Probability of conceiving a child for one attempt:</p>	<p>x% (20% or 30% or 50% attributed at random)</p>

In Vitro Fertilization: CV design

Efficient design of DCEs

- Probability of conceiving a child for one attempt of IVF: [20%, 30%, 50%]
- Costs (in €): 1000, 2000, 3000, 5000, 7500
- Levels and choice sets based on the priors from the pilot study

Hypothetical ex post scenario

- **If you were diagnosed as infertile** and the in vitro fertilization was not fully or partially covered by public health insurance, **would you be willing to pay £ 5,000 in total for one attempt of in vitro fertilization** (Please include the medication, examinations and tests)?

Subjective perception of IVF success after CV question:

- Please try to estimate probability of conceiving a child on a scale from 0% to 100% for a person like you who undergoes one attempt of in vitro fertilization.
- **Mean=55%** and 72% think that the chance of one attempt of IVF is larger than the chance as stated in our CV scenario

Results: (ex post) infertility, IVF treatment

	WTP for 1 attempt of IVF (speed&prot excl)		WTP for %chance (speed&prot excl)		WTP for %chance (whenchild=3)	
	<i>Estimate</i>	<i>p-value</i>	<i>Estimate</i>	<i>p-value</i>	<i>Estimate</i>	<i>p-value</i>
Intercept/chance	0.989	<.0001	0.0248	<.0001	0.0249	<.0001
IVFbid1	-0.0001	<.0001	-0.00009	<.0001	-0.00007	<.0001
WTP (€ PPS)	9 890 €					
VSP (€ PPS)	28 994 €* 		27 556 €		35 571 €	
N obs.	1626		1626		1209	
2 Log L (wo/w)	-2107.839	-2082.97	-2585.44	-2416.77	-1932.49	-1752.11

* VSP computed from WTP for average success rate.

Note: Lower-bound mean (Turnbul): mean WTP of €4,800 implies VSP of €14,000
(assuming the average of 34% success rate)

Results:

WTP for one attempt of IVF treatment

Model with WTP for one attempt of IVF treatment

	CZ		UK		IT		NL	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
intercept	0.8286	<.0001	1.1407	<.0001	1.1258	<.0001	0.7448	0.0011
IVFbid	-0.00012	0.0002	-0.00011	0.0213	-0.00005	0.2746	-0.0001	0.0827
WTP (€ PPS)	6 905 €		10 370 €		22 516 €		7 448 €	
VSP (€ PPS)	19 905 €		31 277 €		64 972 €		22 461 €	
N obs.	558		355		463		250	

Model with WTP for the probability to conceive after one attempt of IVF

	CZ		UK		IT		NL	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
chance	0.0182	<.0001	0.0327	<.0001	0.0274	<.0001	0.0187	0.0072
IVFbid1	-0.0001	0.0053	-0.00011	0.0242	-0.00003	0.5481	-0.00009	0.1648
VSP (€ PPS)	€ 18 200		€ 29 727		€ 91 333		€ 20 778	
N obs.	558		355		463		250	

BIRTH DEFECTS

Birth of unhealthy child: Problem

- About **164 of 1,000 children born** in the EU have a birth defect
- Pregnancy terminations following prenatal diagnosis and screening slightly reduce the number of children born alive with birth defects to **160 per 1,000 children**
- Out of these 160 children born alive with birth defects,
 - **15** have birth defects affecting **internal organs** or the neurological system
 - **6** have birth defects of **the external body parts**
 - **139** have **minor birth defects**
- **Nobody knows** which children will be born with or without defects

Birth of unhealthy child: Scenario

- WTP is not elicited to avoid specific defect, but for reducing the risk of one of the three birth defect groups
 - Detailed information provided about **description, the number of cases, treatment, quality of life impact** for each of the three groups of birth defects
 - Ranking severity
- Preferences elicited for within both **private good** and **public good** context, same as in the fertility study
- the baseline probabilities and the reductions shown on a **grid with 1,000 squares**

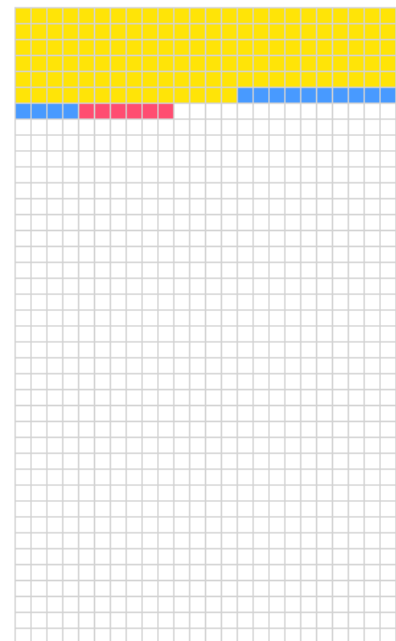
Birth of unhealthy child: Private good scenario



First choice

Would you choose Vitamins A, Vitamins B, or neither?

Attribute	Complex of vitamins A	Complex of vitamins B	Current state
Who is affected?	Your child	Your child	Your child
Type of birth defect	Birth defects of internal organs	Minor birth defects	All birth defects
Decrease in probability of birth defects to the resulting level			
– minor	no decrease 139 in 1,000	by 50 in 1,000 to 89 in 1,000	no decrease 139 in 1,000
– of internal organs	by 7 in 1,000 to 8 in 1,000	no decrease 15 in 1,000	no decrease 15 in 1,000
– of external body parts	no decrease 6 in 1,000	no decrease 6 in 1,000	no decrease 6 in 1,000
Costs	£ 180	£ 800	£ 0
(Monthly payment over 1 year period)	(£ 15 per month for 1 year)	(£ 50 per month for 1 year)	
Which option would you prefer?	<input type="button" value="Vitamins A"/>	<input type="button" value="Vitamins B"/>	<input type="button" value="Current state"/>



- – Minor birth defects
- – Birth defects affecting internal organs
- – Birth defects affecting external body parts
- – Children without birth defects

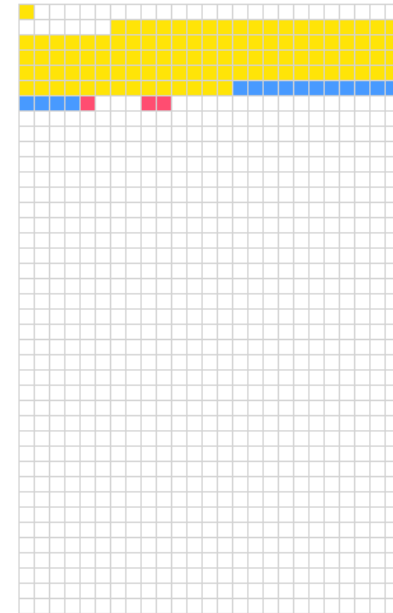
Birth of unhealthy child: Public good scenario



First choice

Would you choose „chemical-free products“ A, B, or neither?

Attribute	Chemical-free products A	Chemical-free products B	Current state
Who is affected?	All children in the EU	All children in the EU	All children in the EU
Type of birth defect	Birth defects of the external body parts	Minor birth defects	All birth defects
Decrease in probability of birth defects to the resulting level			
– minor	no decrease 139 in 1,000	by 30 in 1,000 to 109 in 1,000	no decrease 139 in 1,000
– of internal organs	no decrease 15 in 1,000	no decrease 15 in 1,000	no decrease 15 in 1,000
– of external body parts	by 3 in 1,000 to 3 in 1,000	no decrease 6 in 1,000	no decrease 6 in 1,000
Costs	£ 600	£ 6000	£ 0
(Monthly payment over 10 year period)	(£ 5 per month for 10 years)	(£ 50 per month for 10 years)	
Which option would you prefer?	Chemical-free products A	Chemical-free products B	Current state



- – Minor birth defects
- – Birth defects affecting internal organs
- – Birth defects affecting external body parts
- – Children without birth defects

VERY LOW BIRTH WEIGHT



Very low birth weight: Problem

Low birth weight

- high prevalence (one-in-fifteen babies born in the EU)
- smaller differences between LBW and normal birth weight infants in terms of health and developmental difficulties

Very low birth weight

- lower prevalence (1.5% children born in Europe)
- better evidence about health and developmental difficulties

Very low birth weight: The Good We Valued

- we do not value specific problem (such as IQ), but VLBW as an ‘umbrella’ outcome

...WTP for reducing the probability of your child having a very low birth weight

- problems related to VLBW described in detail (description, share of children, treatment, quality of life impact)
 - neurosensory problems
 - behavioral and social competence problems
 - intellectual and learning disabilities
- the three groups are ranked wrt their severity as perceived by a respondent (but not valued!)
- preferences elicited again for both **private good** and **public good**

Very low birth weight: Valuation scenario

- About **15 per 1000 children born** in Europe are born with a very low birth weight, meaning that a child weighs less than 1,500 grams at birth.
- Very low birth weight infants experience **many more health and developmental difficulties** than infants with normal birth weight.
- vitamins with the same basic characteristics as before, but they reduce the probability of very low birth weight **by 7 per 1,000 newborn children** and therefore they also lower the probabilities of above described adverse health effects
- **are taken during pregnancy** (for 8 months) once a week
- **will not affect working performance**, in the case that the pregnant woman has a job, and so it will not have any effect on her earnings.
- have an effect only during the period of usage but **no effect on future pregnancies**
- are **not available from the National Health Service** nor would be covered by any private health insurance,
- **respond on behalf of yourself and your partner**

Very low birth weight: Question

Would you pay **£50 per month** for 8 months (in total **£400**) *[10 years]* for this complex of vitamins and minerals *[these "chemical-free products"]* to reduce the probability of your child having *[children to be born in the EU with]* very low birth weight by 7 in 1,000?

Please mark below how certain you are that you would [not] pay this amount.

<i>Very uncertain</i>					<i>Very certain</i>				
1	2	3	4	5	6	7	8	9	10

DB-DC [if Yes]: Would you pay **£100** per month for 8 months (in total **£800**) for this complex of vitamins and minerals to reduce the probability of your child having a very low birth weight by 7 in 1,000?

DB-DC [if No]: Would you pay **£25** per month for 8 months (in total **£200**) for this complex of vitamins and minerals to reduce the probability of your child having a very low birth weight by 7 in 1,000?

EU28 WTP Values

People who want a child – private good

Health outcome	Conservative approach	Sensitivity analysis
Value of a statistical pregnancy	26,000	38,000
Value of a statistical infertility (in vitro fertilisation treatment)	31,000	
Value of a statistical case of Healthy Child: MINOR birth defects	13,000	20,000
Value of a statistical case of Healthy Child: defects in INTERNAL organs	216,000	246,000
Value of a statistical case of Healthy Child: defects on EXTERNAL body parts	151,000	204,000
Value of a statistical case of VLBW	132,000	

EU28 WTP Values

General population – public good

Health outcome	Conservative approach	Sensitivity analysis
Value of a statistical pregnancy	38,000	27,000 ^{cb} 29,000 ^{wcb} 46,000 ^w
Value of a statistical case of Healthy Child: MINOR birth defects	51,000	55,000 ^w
Value of a statistical case of Healthy Child: defects in INTERNAL organs	792,000	821,000 ^w
Value of a statistical case of Healthy Child: defects on EXTERNAL body parts	529,000	498,000 ^w
Value of a statistical case of VLBW	644,000	499,000 ^w

Note:

^{cb} The value based on WTP estimates after controlling respondent's perception of the side effects (**co-benefits**) while stating their WTP for improving health risks

^w Values estimated from preferences stated for the public good improvement by people who want a child.

Results

- using a novel stated preference survey, we provide WTP estimates for a range of health outcomes so far not being valued
- Policy relevance
 - Co-benefits likely considered while valuing reducing risks
 - If ***the public context*** is concerned, WTP should reflect ***all related benefits***, i.e. including co-benefits
 - if ***the private good context*** is more relevant, the benefit component attributable to ***the other effects might be subtracted*** from WTP values.
 - The estimates provided within **the private good** and **the public good context**
 - If the impacts of a public program with ***long-lasting effects*** are concerned, we recommend using the WTP estimates derived within ***the public good scenario***
 - If ***immediate effects*** are rather concerned, the WTP estimates as derived within ***the private good*** context might be used

Comparison of private WTP and public WTP?

A summary by ECHA > „...there is no reason in principle why the public and private good values are not comparable..." (p.22)

We caution against comparing the private WTP and public WTP, because the two differ (on the top to the size of the beneficiaries)

- **Contingent scenario** (vitamins vs. chemical policy)
 - acceptance and hence protesting may differ across the goods
- **Contingent good**
 - the side effects may be perceived differently for VIT vs. CHEMPOL
 - time-dependent (VIT) vs. timeless product (CHEMPOL)
- **Payment vehicle and duration of the payment**
 - price (VIT) vs. costs (CHEMPOL)
 - *Several months (VIT) vs. monthly over 10 years (CHEMPOL)*
- **Sample**
 - Only possible for WANT, but do not compare GENERAL and WANT

Thank you for your attention

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The Summary by ECHA

„...one would expect public good values to exceed private good values, had they been estimated based on answers of the same individuals, since they could expect to enjoy both types of value ...“ (page 23)

$$WTP_{priv}(i) \leq WTP_{publ}(i)$$

Sample	WANT		WANT
Good	private		public
fertility	34 675 €	≤	40 728 €
fertility (no co-benefits)	21 601 €	≤	20 838 €
minor defects	12 116 €	≤	41 757 €
defects in internal organs	177 955 €	≤	711 774 €
defects in external parts	108 343 €	≤	329 827 €
VLBW	126 193 €	≤	405 481 €

The Summary by ECHA

„...However, one would not expect the public good values of those who would not benefit from private benefits (those who did not plan to have a child) to exceed the public good values of those who would.“ (ibid.) It implies

$$WTP_{\text{publ}}(\text{WANT}) \geq WTP_{\text{publ}}(\text{nonWANT})$$

Sample	WANT		GENERAL
Good	public		public
fertility	40 728 €	≥	37 900 €
fertility (no co-benefits)	20 838 €	≥	12 500 €
minor defects	41 757 €	≤	50 700 €
defects in internal organs	711 774 €	≤	771 300 €
defects in external parts	329 827 €	≤	453 600 €
VLBW	405 481 €	≤	548 300 €

However

- GENERAL ≠ nonWANT (nonWANT comprises 60% of GENERAL)
- nonWANT may be still WTP more than what WANT are WTP, as nonWANT might be richer, care about grandchildren, have very different altruistic preferences, or have different preference structure in general

Birth of unhealthy child: DCE Designs

Attribute	Levels	Description
Type of birth defect	Minor birth defects; Birth defects of internal organs; Birth defects of external body parts	the type of the birth defect whose risk will be reduced
- Minor birth defects	no decrease (139 in 1,000) 20 in 1,000 (119 in 1,000) 30 in 1,000 (109 in 1,000) 50 in 1,000 (89 in 1,000) 70 in 1,000 (69 in 1,000)	decrease in the probability of minor birth defects by one of the levels (to the resulting level) as shown in the graph
- Birth defects of internal organs	no decrease (15 in 1,000) 2 in 1,000 (13 in 1,000) 3 in 1,000 (12 in 1,000) 5 in 1,000 (10 in 1,000) 7 in 1,000 (8 in 1,000)	decrease in the probability of birth defects of internal organs by one of the levels (to the resulting level)
- Birth defects of external body parts	no decrease (6 in 1,000) 1 in 1,000 (5 in 1,000) 2 in 1,000 (4 in 1,000) 3 in 1,000 (3 in 1,000) 4 in 1,000 (2 in 1,000)	decrease in the probability of birth defects of external body parts by one of the levels (to the resulting level)
Costs	0 - no change (SQ only) € 120 (€ 10) / € 600 (€ 5) € 180 (€ 15) / € 1200 (€ 10) € 240 (€ 20) / € 1800 (€ 15) € 600 (€ 50) / € 3000 (€ 25) € 960 (€ 80) / € 6000 (€ 50)	total costs VIT: monthly payment over 1 year CHEMPOL: monthly payment over 10 years

Efficient design:
24 choice sets in
6 blocks → 4
choice question to
each respondent
(20 choice sets in
5 blocks in the
pilot)