Averting Behaviour and Parental Altruism in Infant Morbidity Valuation: A CV Survey in the Czech Republic

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ABSTRACT:

The contingent valuation method is used here to estimate mothers' willingness to pay to protect their children and themselves from selected respiratory illnesses in two regions in the Czech Republic. Three hypotheses are tested. The first of them, speaking about the inequality of WTP in the two localities which differ in ambient air pollution and children's respiratory morbidity, is refused. Testing of the second hypothesis, stating that respondents negatively affecting their and their children health status in their everyday lives report a lower WTP, is partly refused. Only a positive relation between WTP and averting behaviour is proved. The third hypothesis, saying that a higher WTP for avoided infant morbidity is stated by respondents governed by altruistic motives cannot be rejected. To conclude, the results of the presented CV study show that besides economic situation of the family, other respondent's characteristics such as behavioural attitudes and lifestyle are as well significant predictors.

KEYWORDS: contingent valuation, willingness to pay, infant morbidity, respiratory illness, parental altruism, averting behaviour, benefit transfer

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1. INTRODUCTION

The main objective of this paper is to examine factors that influence individual behaviour where health effects on own children are concerned. To achieve this aim, we use data from a contingent valuation survey that elicit a parent's willingness to pay for avoiding four respiratory symptoms his/her child can suffer and one symptom affecting himself/herself. Three hypotheses in particular are tested: on dependence of stated willingness to pay on locality where the respondent lives, on actual averting behaviour patterns, and on altruistic motives followed in consumer choice. It is a partial aim of our paper to summarise the survey results and provide the first estimate of welfare change in the field of infant morbidity conducted in Central Europe.

There are several motives for our empirical research. Air pollution causes significant negative effects on human health and as ascertained in the ExternE project series (EC 2000) and Clean Air for Europe Programme[2], effects on children do not represent a negligible portion. Results from welfare measurement in human health can thus be used whenever regulation in the energy, transport, environmental or public health sectors is suggested.

Our study particularly refers to and follows up on epidemiological research conducted in the Czech Republic in which children's health status has been monitored since the prenatal period until now. One of the main findings of the epidemiological study, which we used for the design of the data collection, was a "strong association of both PAHs and fine particulates with lower respiratory illnesses in children between birth and 4 years of age that are unlikely to be confounded, unless by other components of ambient air pollution. The effects are plausibly causal, and appear to be especially pronounced for bronchitis." (Hertz-Picciotto 2005). Except for the association of lower respiratory symptoms with ambient air pollution, the results of the previous study indicated a certain connection with indoor pollution caused by heating type and smoking as well as lifestyle-related characteristics of the surveyed families.

The research presented here aims at deriving monetary values for such symptoms which can be caused by airborne pollution and for which exposure-response functions can be provided by epidemiological research. As we follow up on a longitudinal epidemiological research which has been conducted for more then 10 years in the Czech Republic, we chose the symptoms conditional to its outcomes. Specifically, we focus on two symptom variants of acute bronchitis, acute laryngitis and acute asthma.

Despite a great importance of previous valuation studies on infant morbidity (e.g. Liu et al. 2000; Agee and Crocker, 2003, 2004, Dickie and Ulery, 2001 or Rabl 2004), there still is a lack of empirical literature in the field of infant health benefit measurement waiting to be filled (EPA 2003; OECD 2002). Previous research covers a limited number of regions and a limited number of causes. If a policy-maker likes to follow the Pareto optimality criterion, he/she needs to rely on benefits transferred from regions with different socio-economic and cultural conditions, or even from different subject areas. However, as benefit transfer research suggests (e.g. Rozan,

[2] Holland et al. (2004) reviews the health end-points and methodological guide for cost-benefit analysis provided in CAFE Programme.

2004), there is very limited room to do so. Our research intention therefore aims to fulfil partially the gap with outcomes from empirical research.
The paper is structured as follows. Section 2 introduces the conceptual framework we follow. Section 3 describes the survey: selection of localities and illnesses, questionnaire structure and sampling method. Section 4 summarises WTP estimates for the entire sample. Then hypotheses are introduced in Section 5 and tested in the following section. Section 7 concludes.

2. CONCEPTUAL FRAMEWORK

During our research, we were exposed to an interesting and challenging ethical question we had to solve. The underlying assumption of welfare measurement is what might be called the consumer sovereignty normative perspective of welfare economics. Each individual is the best judge of how well-off he/she is in a given situation and will choose rationally among alternatives subject to his/her constraints. Then, as Freeman (2003) summarises, three alternative normative perspectives can be followed when welfare effect on children is aimed at. It is firstly an extension of consumer sovereignty to children; secondly, the so-called parental sovereignty meaning that parents' values for changes in the health of the child are considered; and thirdly, the "child as adult" approach meaning that adults tend to base their values on what they would have chosen for themselves in childhood. As Freeeman notes, children's sovereignty or „child as adult", although consistent with individual basis for and principles of welfare economics, can be hardly ethically attractive and implemented. Then, one must rely on the risk reduction actions/behaviour that parents show on behalf of their children. We therefore follow the parental perspective in measuring the change in social welfare associated with risk reduction for children assuming guardianship and altruistic behaviour of the parent on account of his/her child (see also Scapecchi 2004).

Another conceptual problem rises when following the parental sovereignty perspective. If an avoided own infant health effect behaved as a normal good, the marginal utility of the child would be decreasing and the parent's value of avoiding the health risk would depend on the number of children in the parent's family. We feel compelled to point out here that we aim at only one child in a family participating in the cohort epidemiological study that we follow, even if more than one child live in the family. We therefore underlined in the questionnaire that the stated value should be related only to the child explicitly named. Due to our research objective, we do not further examine the marginal utility fit.

The few studies that value parental WTP to reduce environmental risks to children's health use the unitary household model (Dickie and Nestor 1999, Agee and Crocker 1994). The unitary model assumes a unified household preference function, complete income pooling and, where household production is relevant, a completely pooled time constraint. We follow a rather restricted model which does not consider the household production function and intra-household behaviour (see e.g. Bateman and Munro, 2005). However, we introduce a variable that measures whether the respondent considers that the payment is made by him/herself or paid by both partners. We use the variable in order to test the possible effect of behaviour more appropriate to unitary household model in our explanatory models.

The standard approach to valuing acute illnesses relates an individual's willingness to pay with a reduction in pollution. Then WTP equals to the amount that must be taken away from the individual's income while keeping his/her utility unchanged, or the amount that must be given to him/her to ensure his/her utility level as high as it would be after the change. Then compensating surplus or equivalent surplus respectively is derived. The compensating surplus that we derive here is the given difference between the indirect utility functions *V* for the initial and new levels of pollution *P* (assuming environmental improvement, i.e. $P_0 < P_1$):

$$V(y - WTP, w, p_m, p_a, P_1) = V(y, w, p_m, p_a, P_0)$$

where p_m and p_a present the prices of mitigation and averting measures respectively, *w* is the wage and *y* is individual income (see Alberini and Krupnick, 2003). In other words, change in pollution affects, via change in health status, mitigation and averting measures as well as participation in labour market. As shown by Harrington and Portney (1987), marginal WTP for a small change in pollution comprises marginal lost earnings and medical expenditures, and marginal cost of the averting activity. On top of these expenditures and loss earnings is dis-welfare due to discomfort, pain and suffering from the illness (Ready and Navrud, 2004). We do not follow the health production function in our study and do not treat the effects caused. Rather, we encourage the respondent not to consider possible change in his/her lost earnings and mitigation and averting expenditures while stating WTP for avoiding the infant's or his/her own respiratory illness.[3] We, however, test the effect of actual averting expenditures such as using vitamins, doing sports, caring about children's diet and lifestyle. These variables enter into our second hypothesis testing.

Then, we pay special attention to zero treatment. First we detect protest responses allowing us to distinguish them from true zero values of WTP. We define protest as a situation when the respondent *is not used to making such decisions* that are presented in the hypothetical scenario or if *he/she considered paying for avoiding the health effect in an (ethically, morally) inappropriate way*. We apply a Logit discrete model in order to predict which respondent is more likely to be protesting against our scenario. Then we exclude such observations from further statistical analysis. Braun Kohlová, Ščasný et al. (2005) applied a Probit discrete model also for true zeros in order to test the stochastic process behind the switch between stating zero value and any positive one. The result does not strongly refuse possible use of a Tobit model in the WTP model estimation. Moreover, it is possible to assume a negative WTP – the nature of Tobit distribution, as one can value avoiding the illness of his/her child, if benefit from staying at home and missing classes would bring him/her a higher benefit than dis-welfare due to pain and suffering.[4]

The valued product was the possibility that the respondent's child would experience one such episode less during the following year (no matter how many he/she would

[3] Cost-of-illness for four examined symptoms including lost earning (productivity loss), costs of medical treatment and consumed drugs and medicaments paid for by public health insurance system and individual off-pocket are calculated in Braun Kohlová et al. 2005.

[4] We agree that this is not a standard way of behaviour. Most presumably, this case is just theoretical or fits better to developing countries, where the family can be strongly dependent on the labour of a child who should be at school instead.

experience otherwise). It would be possible thanks to a preventive measure recommended by the child's physician. The valuation scenario does not include detailed information about what has caused the described illness episode or how exactly the occurrence could be reduced. The good being valued is a private good.

The amount a respondent would be willing to pay to avoid one episode is elicited using a scale of possible amounts (payment card format). The respondent is asked either to pick up one closest amount from the suggested bids as the maximum he/she is willing to pay, or to say any other amount. The proposed amounts are not accompanied by a list of everyday goods as in e.g. Ready et al. (2004) because the results of pre-test interviews indicated a strong anchoring effect (positive as well as negative) to the listed goods. The chosen monetary sum from the scale is taken as a lower bound on the respondent's maximum WTP, while the lowest sum of money with no tick mark next to it is taken as an upper bound. The elicitation procedure is repeated for each illness episode.

As shown by Cameron and Huppert (1988) or Alberini and Krupnick (2003), payment card responses are correctly interpreted as bounding WTP between the amount chosen/circled that refers to the lower bound and the next bid at the card refers to the upper bound. Consequently, we apply interval-data maximum likelihood estimation in our WTP models. That is the reason why we also report mid-points of WTP in descriptive statistics of observed WTP.

For ethical reasons - because the survey data are accompanied by sensitive medical and other data regarding the quality of living – no direct question on personal or family income is included in the questionnaire. Instead, two questions querying the family allowances eligibility are asked. First we ask for the so-called social allowance, which can be claimed when a family income does not exceed 1.6 of the living minimum annually set out by a governmental decree, and a second query is made regarding the so-called child allowance, which can be claimed when a family income does not exceed 3 times the living minimum. The amounts of both the allowances vary depending on the family size and children's ages and can thus be consequently re-calculated.[5] We however use these variables as dummies as they better reflect the relative wealth of a family, although given arbitrarily. As another proxy of available financial means, respondents are asked to express their subjective wealth status (choosing one out of four categories).

3. SURVEY DESCRIPTION

Choice of locality and sampling

Measured outdoor ambient air pollution is associated with incidence of selected respiratory illnesses. The county of Teplice, which is one of the concerned populations in the survey, has been considered one of the most air-polluted areas in the Czech Republic and the effect of this on children's health status (including other inborn disabilities) has been intensively discussed in the public over the period of late

[5] Compared to experience with using direct questions on income, both the questions on allowances eligibility were characterised by very low numbers of missing responses (less than 1%).

eighties and early nineties.[6] We use the county of Prachatice located in Southern Bohemia as a control group similarly to the epidemiological research we refer to.

770 children from the epidemiological database were selected for the sample of our survey according to their health status. All the children with less than three diagnosed respiratory illnesses (N=204) and more than ten respiratory illnesses, asthma or a hospitalisation for respiratory illness (N=190) within the first three years of age were addressed. Children with medium respiratory morbidity were selected randomly (N=350 out of 555). From each family only the child with medical data was concerned in the survey scenario.

Interviews were conducted in respondent's homes after sending an information letter about a follow-up survey of the previous epidemiological research. It increased significantly the willingness of the addressed respondents to participate in the survey.[7] Interviews were conducted by a professional survey company in the period from May 9th, 2005 to June 30th, 2005. The average duration of an interview was 33 minutes. Respondents were given small in-kind incentives to participate.

Illness episodes selection

For the valuation scenario used, four respiratory diseases were selected: acute bronchitis in two variants differing in the seriousness of symptoms, acute laryngitis, and acute asthma.[8] The descriptions of illness episodes used in the adult morbidity survey (Ready et al. 2004) were adjusted for children. Based on the results of expert interviews with paediatricians, the length of described episodes was extended and two variants of bronchitis were distinguished. 'Severe' differs from 'mild' by having fever and demanding antibiotics. For the description see Table 1.

[6] The survey is a part of a follow-up epidemiological research done in the collaboration with Institute of Experimental Medicine AS CR (IEM), and Health Institute of Central Bohemia, Prague, Czech Republic. The follow-up study links up to a study on ambient air pollution effects on children's health. The subject of the study is two cohorts of children born in 1994 -1996 and 1997-1998 coming from two different regions in the Czech Republic which have differed substantially in their air pollution levels (PM2.5, PM10, PAH – except for years 1995-1996) since before 1989. The concerned region is the county of Teplice situated near the north-west border of the Czech Republic with the former German Democratic Republic. The region, abundant in brown coal mining, energy generation and heavy industry was part of the so-called black triangle. The county of Prachatice was used as the reference region. It is situated at the foothills of the Bohemian Forest Mountains on the border with the German federal country of Bavaria.

[7] Participation rate was 60%. There were only 2.8% of refusals, the rest were non-contacts.

[8] Asthma was included because of comparability of the one-day respiratory symptom with another survey of adult morbidity conducted by the same team.

Table 1: Illness episode descriptions

Illness episode – diagnosis	Symptoms	Restriction	Duration
CHILD			
Illness K – mild bronchitis	- phlegmy cough - breathing difficulties - slight fever - headache and tiredness	- child must stay at home in bed for 5 days - medicines: antitussive medicines, light analgesics, - mother or another relative stays at home with child	- fever, breathing difficulties and other symptoms last for 5 days
Illness T - severe bronchitis	- persistent phlegmy cough - breathing difficulties - fever - headache and tiredness	- medicines: antibiotics - a visit to a doctor or emergency room is necessary - mother or another relative stays at home with child for a week	- child must stay at home in bed for 10 days, afterwards avoids strenuous activities for 1 more week
Illness O - Asthma attack	- dry hacking cough - breathing problems caused by respiratory distress, occasional coughing fits, - wheezing - tiredness	- a visit to a doctor is necessary - child gets medicines to assist breathing problems (inhalator or spray) - child does not attend school for 1 day - mother or another relative stays at home with child 1 day	- symptoms described last for 1 day
Illness H – Laryngitis	- breathing problems caused by respiratory distress, - croup - fever	- admission to hospital for oxygen and medicines to assist breathing problems - afterwards must stay at home in bed - mother or another relative stays at home with child for 5 days	- 3 days hospitalization - afterwards at home in bed for 5 days
ADULT			
Illness KR – mild bronchitis	- phlegmy cough - breathing difficulties - headache and tiredness	- at home in bed for 5 days - cannot work or engage in ordinary daily activities	- 5 days in bed

Structure of the questionnaire

The questionnaire is divided in 7 sections. In Section 1, after a brief query of the child's health status and the family anamnesis (asthma or bronchitis), the episode descriptions are introduced. The respondent is asked respectively whether their child has experienced the described episode during previous six months (two years for an asthma attack). The respondent ranks the ill-health episodes based on how serious they are. The ranking exercise is similar to that in Ready et al. (2004) and was designed to make people consider differences in episodes in order to minimise the ordering effect.

The episodes are valued in Section 2. In all the interviews, elicitation starts with the illness episode which was ranked previously as the most serious. WTP illness questions eliciting the respondents' main reasons for zero and positive WTP are included (for answer categories see Ready et al. 2004).

The *mild bronchitis* episodes concerning adult respondents are described in Section 3. A question eliciting WTP for avoiding their own illness follows and, where needed, also an explanation of why the WTP for him/herself differs from that stated for their child.

Section 4 contains a question on averting behaviour, such as vaccination or expenditures on vitamins, and details concerning the type of care for the child in case he/she is ill.

Section 5 includes questions concerning healthy lifestyle behaviour and attitudes of parents and their children.

Section 6 collects standard socio-demographic information about the respondent and his/her family. Finally, debriefing questions follow.

The data collected in interviews are completed with data collected since the start of the epidemiological study by IEM. These include: the child's respiratory health status, number of visits to a physician, number of hospitalisations, heating at home, type of dwelling, humidity in the flat/house, fungal growth at home, number of cigarettes smoked by the mother in each year of the child's life.

Descriptive statistics

The final sample size is 464 equally recruited from the populations of both the regions. The sample is specific in gender and age – about 90% of respondents are mothers of children[9] at the average age of 33 years. Regarding their places of residence, 77% is urban and 23% is rural population. More than 80% of the respondents are married or live in a relationship, 14% are divorced or separated. The appendix reports on the descriptive statistics of the sample.

Regarding the respiratory health described in the medical database, 24% of concerned children are diagnosed with allergies and 2.5% with asthma. Surprisingly, when asked directly about the child's previous experience with asthma-like symptoms described in the valuation scenario, 25% of responses were positive.[10]

The two counties differ in their education levels and economic situations. The Teplice county has fewer respondents with a university degree (4.3 compared to 7.9%) and more with primary education (14.9 compared to 6.6%); more unemployed (17.1 compared to 6.6%) and more respondents eligible for social allowances (35.6 compared to 23.3%). These characteristics follow the known statistical distribution.

4. OBSERVED WTP AND MODEL WTP ESTIMATION

To obtain estimates of willingness to pay for a reduction in the occurrence of children's diseases, we used each respondent's answer to form an interval around the respondent's unobserved WTP amount. WTP estimates for the middle of the interval, the reported WTP and theoretical WTP constructed using Tobit model parameters are displayed in Table 2.

[9] The reason for such a restriction was the practice of the previous phases of the epidemiologic study, in which only mothers participated. Therefore it was not possible to test the hypotheses about the equality of WTP between parents.

[10] An explanation could be the practice among physicians not to diagnose all asthma-like symptoms as asthma and the general lack of precise diagnoses in general practitioners' treatment.

Table 2: WTP estimates (protests excluded)

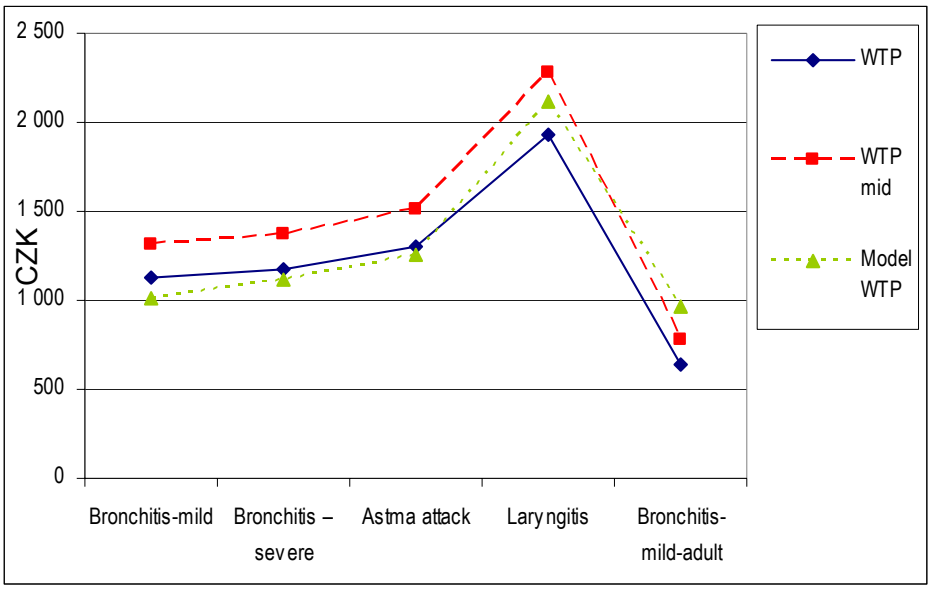
	Empirical WTP						Model WTP	
	N	Mean (CZK)	Mean (Euro)*	Std. Dev.	Missing	Protests	Mean (CZK)	Mean (Euro)*
CHILD								
Bronchitis – mild	415	1 129	38	3 275	10	39		
Bronchitis – mild mid**	415	1 319	44	3 523	2.4%	8.4%	1012	34
Bronchitis – severe	412	1 179	39	3 240	11	41		
Bronchitis – severe mid	412	1 372	46	3 429	2.7%	8.8%	1113	37
Asthma attack	407	1 306	44	3 544	9	48		
Asthma attack mid	407	1 515	51	3 755	2.2%	10.3%	1257	42
Laryngitis	412	1 935	65	4 261	9	43		
Laryngitis mid	412	2 276	76	4 577	2.2%	9.3%	2115	71
ADULT								
Bronchitis – mild	459	635	21	1 945	5	0		
Bronchitis – mild mid	459	779	26	2 209	1.1%	0.0%	960	32

* To display the WTP amounts in Euro, an exchange rate of 30 CZK for 1 EURO was used.
** WTP estimated as middle of the interval

Figure 1 gives a graphic presentation of the WTP estimates. As expected from the results of individual interviews done in the pre-test phase, the mean WTP values do not differ for episodes according to the duration but to the severity of symptoms and the medical treatment required. Thus, the WTP for an asthma attack lasting for one day is significantly higher than the WTP for a mild bronchitis lasting for five days; and the WTP for a laryngitis requiring three days of hospitalization plus five days at home is higher than for a severe bronchitis lasting for ten days.

Pair-wise differences between episodes were tested using Wilcoxon's non-parametric tests. The differences between all the pairs except for severe bronchitis and asthma attack were significant (at the 0.05 level).

Figure 1: Mean WTP estimates – children – adult



Note: the exchange rate is approx. 30 CZK for 1 EUR.

The mean WTP for the adult respondents in order to avoid the same illness episode (mild bronchitis) as his/her child was significantly lower: the ratio was 0.45, which

corresponds to the results of similar studies. Dickie and Ulery (2002) showed that "overall odds of treating the (respiratory) illness are more than twice as large for the child as for the parent". Liu et al. (2000) reported approximately the same value for a minor illness - cold. Agee and Crocker's (2003) results for one-hour-per-day reduction in environmental tobacco smoke exposure vary from 0.73 to 0.77.

The Tobit model used yields-significant parameter estimates for partially different independent variables according to the illness episode being valued. Nevertheless, following variables capturing respondent's economic situation and the aspects of the payment are significant in almost all the models. Eligibility for both social and children allowances have a negative effect; subjective wealth is significant and positive only when valuing mild bronchitis. The child's discomfort taken into account, regarding the child's health as more important than one's own also has a positive effect on WTP. Also, asthma in the family and the respondent's previous experience with the valued episodes has a significant and positive effect on reported WTP for a child to avoid the episode. A positive effect on the stated WTP is also associated with the fact that the respondent is single and that the sum expresses payment for both partners in the household (for more see the appendix).

5. HYPOTHESES FORMULATION

Three major hypotheses resulting from the characteristic features of the survey were tested. The first hypothesis is based on the assumption that an infant population living in a more polluted area is more affected by a certain respiratory morbidity. It was therefore further tested whether such objective discomfort is perceived via differences in WTP reported by parents.

Since the survey is based on a connection to a previous epidemiologic study providing a lot of additional data about the respondent's family's lifestyle, the relation between WTP for reduction in a child's morbidity and actual health-related behaviour (direct and indirect) is tested. Thus it is tested whether WTP to avoid certain respiratory illnesses is a mere indicator of the respondent's economic situation (wealth or income) or reflects the respondent's and his/her family's lifestyle.

Finally, altruistic behaviour is examined. It is tested whether the fact that a parent prefers his/her child's health to his/her own health explains the amount he/she is willing to pay. Variables explaining parental altruism as well as self-concern are identified.

The hypotheses to be tested are:[11]

Hypothesis 1

WTP to avoid certain respiratory illnesses is higher in regions with a higher prevalence of the respective illnesses and ambient pollution levels. Non-rejection of this hypothesis would prove that stronger preference for preventing children's illnesses fits those people whose everyday life is more affected by illnesses. Regarding the statistical respiratory morbidity and the way we test the hypothesis the

[11] For the purpose of this paper, only the valid WTP (positive and non-protest zeros) is used and presented.

counties are assumed to differ. A significantly higher occurrence of children's bronchitis and laryngitis was measured in Teplice compared to Prachatice (see Hertz - Picciotto 2005). Teplice County has also been a highly polluted area, while Prachatice belongs to relatively clean areas.

Hypothesis 2
Those who affect negatively their own and their children's health status in their everyday life (e.g., by indoor pollution or nutrition) are less willing to pay for a non-specified preventive medical action which could improve their children's health. In this respect, the hypothetical product presents a mere substitute for another preventive action which is not demanded.

Hypothesis 3
The reported WTP for children to avoid an illness episode depends on the internal altruism[12] of a parent and does not only correspond to her/his budgetary restrictions. The reported WTP of the altruist is higher than that of the non-altruist. Non-rejection of the hypothesis described would support the interpretation that besides economic characteristics of the respondent (such as budgetary constraints), reported WTP displays a whole set of preferences determined by given living situation and a priori given attitudes.

6. HYPOTHESES TESTING

Hypothesis 1: Locality

WTP to avoid certain respiratory illnesses is higher in regions with a higher prevalence of the respective illnesses. Non-rejection of this hypothesis would prove that preferences for preventing children's illnesses are stronger in people whose everyday life is more affected by those illnesses. In respect of statistical respiratory morbidity, we assume that the two counties differ. The mean WTP values for regional sub-samples are displayed in Table III – in the appendix.

Pair-wise differences in mean WTP between sub-samples were tested using Mann Whitney's non-parametric test. None of the tests proved a significant difference between the two counties. Nevertheless, locality (county) entered as one predictor into the models explaining WTP protests and valid WTP values. Neither in the regression models was the effect of the county significant. We therefore reject the hypothesis that mean WTP in Teplice is significantly higher than in Prachatice. It means that in spite of actual statistically higher occurrence of relevant children's respiratory illnesses, people in Teplice are not willing to pay more for their children to avoid symptoms described.

The effects of individual predictors on WTP in both localities were compared. For this we ran three regressions (the Teplice sample, the Prachatice sample and the pooled model). None of them differed between the sites in the sign, but some of those

[12] The term "altruism" used here does not necessarily mean an existentially higher value of a child's health. There could be any reason for a parent to be willing to pay less for him/herself, e.g., the parent does not lose income being at home ill.

significant in one site are not significant in the other (for all the coefficient estimates, see Table IV in the appendix). The hypothesis that the parameters for the two regression equations (for Teplice and Prachatice) are identical cannot be rejected.

As a next step, we conducted a test of validity of the benefit transfer described in e.g. Rozan (2004). A mean comparison between the mean transferred WTP and the mean WTP obtained directly by the CV study was done. Table 3 provides the results for both sites seen as study and policy sites. Empirical WTP for two of the analysed symptoms – mild bronchitis and laryngitis, is reported in italics, confidential interval for transferred value below. The last line provides the error rate, based on a formula by Kirchhoff et. al. (1997) used by Rozan (2004):
$[WTP_{transfered} – WTP_{predicted}]*100/WTP_{predicted}$.

In the case of mild bronchitis, the empirical WTP exceeds the 95% confidential intervals (CI) for transferred WTP, in the case of laryngitis the empirical WTP is confined to the 95% CI. The error rates (4% – 19 %) are even smaller than in the case of Rozan's benefit transfer between Strasbourg and Kehl (2004), where it reached up to 30%. Thus the null hypothesis of equality between the transferred and the predicted WTP is not rejected.

Table 3: Results of the transfer between Teplice and Prachatice (CZK)

		POLICY SITES			
		Teplice		Prachatice	
STUDY SITES		Bronchitis - mild	Laryngitis	Bronchitis - mild	Laryngitis
Teplice	Mean WTP	*1319*	*2223*	*1320*	*2329*
	95% CI	[827 - 1810]	[1557 - 2888]	[853 - 1787]	[1744 - 2914]
Prachatice	Mean WTP	*1107*	*2102*	*1119*	*2248*
	95% CI	[971 - 1242]	[1963 - 2241]	[944 - 1293]	[1973 - 2522]
Error rates		- 19%	- 6%	- 18%	- 4%

Hypothesis 2: Health related behaviour

Statistical evaluation of the hypothesis that WTP reflects a respondent's and his/her family's lifestyle was done using Tobit model. For testing the hypothesis, we distinguish between two types of health-related behaviour. The first, called *averting behaviour*, is done purposely to reduce health risks (sports, vaccination, purchasing of vitamins), and is associated with additional expenditures; the other one, called *self-damaging behaviour*, is done for other reasons (heating, living) and has a negative health impact as its side-effect. The health effect of the former is positive and generally known, the effect of the latter is latent and negative.

The following variables describing *averting behaviour* entered into the tested model: vitaminexp, vitadummy, vaccine, lifestyle, sport. The variables describing *self-damaging behaviour* were: humid, fungi, fungichild, smoke, heatsolid. Socio-demographic variables teplice, college, age, single, person, children entered the initial model. Variables indicating economic situation of the family (social, childallow and wealthy) were temporarily excluded from the model for their dominant influence. Table V in the appendix displays parameter estimates.

Within the health-relevant variables, the following had no significant effect on WTP: number of cigarettes smoked by the mother, giving vitamins to the child, measures moistening indoor environment, heating with solid fuels and care about children's diet and lifestyle. A positive effect was significant for expenditures on vitamins, care that children practice sports, vaccination against flu or viral encephalitis (but only for adult episodes). Less significant and ambiguous is the effect of fungal growth presence in the household. Within the socio-economic variables entering the model, only university education has a positive effect on WTP; the number of persons in the household has a negative effect.

A conclusion could be drawn from the observed results that not all health-related variables are good predictors of WTP. While self-damaging behaviour, including smoking, was not proved to be a significant predictor, averting behaviour (vitamins expenditures, vaccination, and sports) had a positive significant effect on reported WTP. It indicates that there are people who are willing to pay for whatever measure reducing morbidity risks, be it vaccination or a hypothetical medical measure. The decisive aspect of their behaviour is the (general) knowledge or conviction that these actions improve their health status.

Hypothesis 3: Parental altruism

The reported WTP for children and parents to avoid an illness episode depends on implicit altruism of each respondent and does not only correspond to her/his budgetary restrictions.

The ratio between reported WTP in order that his/her child and the parent him/herself avoid a mild bronchitis episode is taken as a proxy of a respondent's altruism. The hypothesis is separately tested for two (altruist – non-altruist) and three (altruist – indifferent – self-concerned) sub-samples. Those who reported higher WTP for the child than themselves were considered altruists, those who reported equal WTP for their child and themselves were seen as indifferent.

Differences in mean WTP between groups were tested using Mann-Whitney's and Kruskal-Wallis' non-parametric tests. All the tests for 2 and 3 groups resulted in significances below 0.05. Mean WTP estimates are shown in Table VI in the appendix.

The examined differences in WTP between the sub-samples of respondents show that WTP for children to avoid illness as well as for the adult him/herself differ depending on the product that is more preferred (avoiding the child's or his/her own episode). Therefore, besides others, the variables *altruistic* and *self-concerned* entered the Tobit models explaining the effects of independent variables on reported WTP[13].

Eight socioeconomic variables (social, childallow, wealthy, person, children, single, college, and age), five variables specifying respondents' WTP (both, welfare, experience, school, childmore), three variables for his/her experience with episodes described (asthma, bronchitis, symptom occurrence: SO-bronchmild, SO-bronchsev,

[13] Protest answers were excluded from the sample for the purpose of the described analysis.

SO-asthma, SO-laryng) and 2 variables for altruism/self-concern (self-concern, altruistic) were included in the Tobit model.

Estimation results are summarised in Table VII in the appendix. The model for reported WTP to avoid certain respiratory illnesses yields significant parameter estimates for several independent variables. Observed signs support the tested hypotheses. Indicative variables for altruistic and self-concerned behaviour were significant in explaining reported WTP for adults and for children respectively. An absolutely higher WTP for children was reported by those who were willing to pay less for themselves and those who explicitly answered that "their children's health is more important than theirs" (variable *childmore*).

Among socioeconomic variables, positive effects on respondents' WTP are associated with subjective wealth, number of children in the household, and the respondent being single. A worse economic situation (measured by both types of social allowances) negatively influenced both types of WTP (for the child as well as for the parent).

In addition, selected aspects of a respondent's WTP answers (association with a hypothetical scenario) proved to be significant. Significant and positive effects on WTP were noted when a respondent reported an amount for him/herself and the spouse and when the stated amount took into consideration the child's pain and discomfort, previous experience with described illnesses, missing school and a diagnosis of asthma and bronchitis. University education only had a positive influence on WTP for parents' avoiding the illness.

When internal altruism or self-concern is a significant predictor of reported WTP, another question need be answered. What are the arguments for altruism revealed in answers? What determines it? A Probit model was used to identify variables explaining respondent's altruism. The following variables entered into the model: teplice, wealthy, social, childallow, asthma, college, age, mother, father, grandparent, single, person, children, both, airworse, SO-bronchmild, zivoto, sport, cobenef, hospital, diagnozy, vitaminexp, vitadummy and smoke. Estimation results are summarised in Table 4:

Table 4: Altruism and self-concern determinant - Probit model estimates

	Self-centred	Altruism
	Coefficients	Coefficients
Intercept	-0.61***	-1.03***
Social	-0.28*	
Lifestyle	-0.28	
Airworse	0.35**	-0.30
Teplice		0.49***
wealthy		0.62***
Asthma		0.58***
Cobenef		0.35**
Diagnose		0.04**
Loglikelyhood Ratio	9.28**	32.86***

*, **, ***: significant at 0.1, 0.05, 0.01 levels, respectively.

People from Teplice County were identified as more altruistic, i.e., paying more for a child's morbidity reduction. These people are, subjectively wealthier, their child has had more diagnosed respiratory illnesses in the past, and experienced asthma. In the payment, they took into consideration additional expenditures connected to their child's illness episode or expressed fear of having troubles at work.

Surprisingly self-centred are those who consider the air quality in their living place worse compared to the average of the Czech Republic. Also ambiguous is the effect of economic situation measured by social allowance eligibility. Although less significantly, people with a better economic situation are more likely self-centred.

Another conclusion could be drawn from the results. Previous experience with respiratory illnesses is a factor which may make parents report a higher WTP so that their child skips one illness episode.

7. SUMMARY AND CONCLUSION

The results of a CV study on children's respiratory morbidity conducted in two regions of the Czech Republic are presented. The study links up to a preceding epidemiological study on health effects of small particulates and PAHs on children's respiratory morbidity. Therefore the CV survey is conducted in two regions differing in their rates of respiratory illness occurrence. Three major hypotheses are tested:

H1: WTP to avoid certain respiratory illnesses is higher in regions with a higher prevalence of these illnesses;

H2: Those who affect negatively their own and their children's health status in their everyday life are less willing to pay for a non-specified preventive medical action which could improve their children's health;

H3: The reported WTP for children to avoid an illness episode depends on the internal altruism of a respondent (parent) and does not only correspond to her/his budgetary restrictions.

The first hypothesis is refused. Thus, no relation between the WTP and the baseline risk is proved. This means that WTP does not reflect ambient air pollution on the site but rather other socio-economic characteristics of respondents.

The second hypothesis is not refused. The results nevertheless indicate that a distinction need be made between self-damaging behaviour (latent with negative health effects) and averting behaviour (conscious risk reduction). While the former is not significant, the latter is a significant predictor of stated WTP with a positive sign in most models.

The reported estimates for mild bronchitis episodes experienced by a child and the parent respondent parent are compared. As in other CV studies on children's morbidity, WTP for children was approximately twice as high as that for parents. The third hypothesis, stating that parental altruism is a good predictor of stated WTP for children, is not refused. In addition, the predictors of parental altruism are identified.

Subjectively wealthier respondents from the Teplice region who have mediated experience with asthma are more likely to pay more in order that their child avoids a mild bronchitis than themselves. Reported higher WTP for respondents themselves cannot be interpreted as selfish decisions. Results from the focus-groups conducted in the pre-test indicate that especially mothers are willing to pay to be able to provide the entire family with care.

A conclusion could be drawn from the results of the presented CV study that besides economic situation of the family (measured by allowance eligibility of the families), other characteristics of respondents such as their and their families' lifestyles and internal altruism are a significant predictor of the reported WTP. This means that although health (measured by WTP) is primarily a luxury good which wealthier people demand more likely than the poor, attitudinal aspects also play a significant role. Especially selected attitudes indicating willingness to pay for other goods improving health and the preference of improvement in a child's health status to a parent's health status were significant.

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APPENDIX

Table I: Variable descriptives

Variable	Type	Description	N	Mean	Std. Dev.	Min	Max
Altruistic	dummy	Altruistic behaviour: 1 - WTP adult < WTP child; 0 WTP adult = > WTP child	464	0.32	0.47	0	1
Self-centred	dummy	1 - 0 WTP adult > WTP child; WTP adult < =WTP child	464	0.22	0.41	0	1
Teplice	dummy	Locality: 1 – Teplice; 0 - Prachatice	464	0.51	0.50	0	1
Wealthy	dummy from categ. variable	Subjective wealth of respondent: 1 – answer "I have usually enough money for all I need"; 0 – categories 2, 3, 4	464	0.10	0.30	0	1
Social	dummy	Social allowance eligible: 1 – yes; 0 – no	464	0.29	0.45	0	1
childallow	dummy	Child allowance eligible: 1 – yes; 0 – no	464	0.59	0.49	0	1
Asthma	dummy	A member of the family is diagnosed asthma: 1 – yes, 0 – no	464	0.12	0.32	0	1
Bronchitis	dummy	Child is diagnosed bronchitis: 1 – yes, 0 – no	464	0.07	0.26	0	1
College	dummy	University education: 1 – yes; 0 - no	464	0.06	0.24	0	1
Age	continuous	Age of respondent	418	33.5	4.78	24	49
Single	dummy	Respondent lives without partner: 1 – yes; 0 – no	464	0.12	0.32	0	1
Person	continuous	Number of person in the household	464	3.93	0.92	2	9
Children	continuous	Number of children younger than 15	464	1.75	0.75	0	7
Both	dummy	Payment for both parents: 1- yes, 0 – no	464	0.74	0.44	0	1
Medicine	dummy	Taking price of medicine into consideration when stating WTP: 1 – yes, 0 - no	464	0.21	0.40	0	1
Lossinc	dummy	Taking loss of income into consideration when stating WTP: 1 – yes, 0 – no	464	0.15	0.36	0	1
Welfare	dummy	Taking child's pain and discomfort into consideration when stating WTP: 1 – yes, 0 - no	464	0.80	0.40	0	1
School	dummy	Taking into consideration the fact that child miss classes when stating WTP: 1 – yes, 0 - no	464	0.24	0.43	0	1
Experience	dummy	Taking previous experience with described episode into consideration when stating WTP: 1 – yes, 0 – no	464	0.64	0.48	0	1
Airworse	dummy	environment quality assessment by respondent: 1 – in the living place worse than average in the CR	464	0.25	0.43	0	1
SO-bronchmild	dummy	Child has had the described episode last 6 months: 1 – yes, 0 – no	464	0.50	0.50	0	1
SO- asthma	dummy	Child has had the described episode last 2 years: 1 – yes, 0 – no	464	0.25	0.43	0	1
SO-bronchsev	dummy	Child has had the described episode last 6 months: 1 – yes, 0 – no	464	0.23	0.42	0	1
SO-laryng	dummy	Child has had the described episode last 6 months: 1 – yes, 0 – no	464	0.09	0.29	0	1
Lifestyle	dummy – rec. from 5 cats.	Cares about own and child's lifestyle: 1 – strongly agrees and agrees, 0 – cats. 3 - 5	464	0.87	0.34	0	1
Sport	dummy - rec. from 5 cats.	Makes children to do sports: 1 – strongly agrees and agrees, 0 – cats. 3 - 5	464	0.67	0.47	0	1
Hospital	continuous	Number of hospital admissions of child for respiratory diseases	417	0.14	0.46	0	6
Diagnose	continuous	Number of diagnosed respiratory diseases for child	417	4.88	3.66	0	20
Childmore	dummy	Answering "child and its health is more important" as reason for different WTP child and respondent: 1 – yes, 0 – no	464	0.27	0.45	0	1
Cobenefit	dummy	Besides child's discomfort taking into consideration other aspects when stating WTP (medicine prices, troubles at work, etc.: 1 – yes, 0 - no	464	0.43	0.50	0	1
Vitaminexp	continuous (CZK)	Expenditures for vitamins for the entire family and 1 month	457	281.5	349.4	0	3 000
Vitadummy	dummy	Giving vitamins to the child – disregarding the frequency and type. 1 – yes, 0 - no	464	0.12	0.32	0	1
Humid	dummy	Measures moistening indoor environment: 1 – yes, 0 – no	464	0.38	0.49	0	1
Fungi	dummy	Fungal growth in the household / flat: 1 – yes, 0 – no	464	0.15	0.36	0	1
Fungichild	dummy	Fungal growth in the child's bedroom: 1 – yes, 0 – no	419	0.06	0.23	0	1
Smoke	continuous	Average number of cigarettes smoked by mother during the first 5 year of the child's age	417	2.87	5.21	0	30
Vaccine	dummy	Vaccination of child against flu or virus encephalitis: 1 – yes; 0 - no	454	0.31	0.46	0	1
Heatsolid	dummy	Heating with solid fuels in the flat (coal, timber): 1 – yes; 0 - no	464	0.52	0.22	0	1
Mother	dummy	Interviewed person – mother: 1 – yes; 0 - no	456	0.88	0.33	0	1
Father	dummy	Interviewed person – father: 1 – yes; 0 - no	456	0.07	0.26	0	1
Grandparents	dummy	Interviewed person – grandparents: 1 – yes; 0 - no	456	0.02	0.14	0	1

Table II: General WTP predictors – Tobit model – parameter estimates

Variable	WTP CHILD				WTP ADULT
	Bronchitis-mild	Bronchitis – severe	Asthma attack	Laryngitis	Bronchitis - mild
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	774.5380	367.3202	-760.088	-710.038	1308.590 ***
Wealthy	1187.606 *				
Childallow	-1698.41 ***	-1848.80 ***	-1984.55 ***	-2443.97 ***	
Asthma	1454.763 **	986.0700 *		1603.943 **	
Person	-407.575 *				
Welfare	2455.006 ***	2389.358 ***	1814.769 **	4179.378 ***	
Experience	929.4426 **		1032.914 **		
Social		-828.739 *	-1165.22 **	-1483.60 **	- 490.603 ***
Childmore		787.7416 *	1596.342 ***	1126.787 **	
Single			1750.136 *	2327.047 **	
Both			1364.653 *	1311.830 *	
SO_asthma			-850.191 *		
Teplice					-406.492 **
School				-1345.28 **	
Scale	3736.582	3640.391	3993.665	4683.996	1526.266
Loglikelyhood	-1738.65	-1685.11	-1644.6	-1696.98	-1307.44
Observation	410	408	403	409	383

Table III: WTP mean values for localities

	Locality	N	Mean	Std. Dev.	Median	Mann-Whitney test: p - value
CHILD						
Bronchitis-mild	Prachatice	207	1 085	3 048	250	
	Teplice	208	1 173	3 493	250	.339
Bronchitis – severe	Prachatice	207	1 161	3 000	300	
	Teplice	205	1 198	3 472	300	.806
Asthma attack	Prachatice	201	1 242	3 360	200	
	Teplice	206	1 370	3 723	300	.138
Laryngitis	Prachatice	208	1 895	3 862	500	
	Teplice	204	1 975	4 642	500	.249
ADULT						
Bronchitis - mild	Prachatice	228	646	2 103	200	
	Teplice	231	625	1 779	200	.553

Table IV: The benefit function for both sites

Variable	Bronchitis - mild		Laryngitis	
	Teplice	Prachatice	Teplice	Prachatice
	Coef.	Coef.	Coef.	Coef.
Intercept	-2422.12	-1308.77	-846.967	745.59
Childallow	-1419.30	-1974.81 ***	-4050.98 ***	-1971.39 **
Social	-2733.29 **	-2783.28 ***	-5440.23 ***	-2379.75 **
Asthma	450.1775	1824.393 **	2567.055 **	687.7130
Experience	30.1032	1382.226 **		
Welfare	3573.633 ***	1201.154	6887.241 ***	3451.426 ***
Altruistic	1239.183 **	1996.829 ***		
Single	1378.299	2041.613 *		
Both	1237.554	1094.478		
Scale	3903.973	3394.688	5182.394	4323.828
Loglikelyhood	-880.38	-815.89	-847.389	-851.08
Observation	208	207	204	208

Table V: Health related behaviour - Tobit model - parameter estimates

	WTP CHILD				WTP ADULT
Variable	Bronchitis-mild	Bronchitis – severe	Asthma attack	Laryngitis	Bronchitis - mild
	Coef.	Coef.	Coef.	Coef.	Coef.
Intercept	1759.34 *	2 088.74 **	-29.44	697.33	-410.02 **
Vitaminexp		0.89 *	1.15 *	1.85 **	0.72 **
Sport	917.98 **		973.07 **	939.98 *	
Vaccine					475.48 *
College		1 294.34		2 274.42 *	1 617.19 ***
Person	-410.84 *	-377.54 *			
Fungi				-1 254.35 *	
Fungichild				2 076.49 *	
Scale	3889.05	3 802.05	4 262.46	4 994.51	2 643.85
Loglikelyhood	1732.97	-1654.02	-1732.97	-1567.00	-1419.01
Observations	415	416	425	421	464

*, **, ***: significant at 0.1, 0.05, 0.01 levels, respectively.

Table VI: Mean WTP

		N	Mean (CZK)	Std. Dev.	Median (CZK)	Mann-Whitney test: p-value
CHILD						
Bronchitis-mild	Self-concerned	81	239	373	150	
	Indifferent	185	897	2 766	200	
	Altruistic	149	1 901	4 396	500	0.000
Bronchitis – severe	Self-concerned	83	447	614	250	
	Indifferent	186	1 078	3 096	300	
	Altruistic	143	1 737	4 127	500	0.001
Asthma attack	Self-concerned	83	987	3 119	250	
	Indifferent	182	1 007	2 792	275	
	Altruistic	142	1 877	4 473	300	0.009
Laryngitis	Self-concerned	85	1 370	3 176	500	
	Indifferent	188	1 680	3 992	500	
	Altruistic	139	2 626	5 057	500	0.007
ADULT						
Bronchitis-mild	Self-concerned	101	676	747	500	
	Indifferent	213	779	2 594	200	
	Altruistic	145	397	1 282	0	0.000

Table VII: Altruism – Tobit model – parameter estimates

	WTP CHILD				WTP ADULT
Variable	Bronchitis-mild	Bronchitis – severe	Asthma attack	Laryngitis	Bronchitis - mild
	Coef.	Coef.	Coef.	Coef.	Coef.
Intercept	2 012.33 *	663.38	-971.17	-649.49	967.22
Self-concern	-1 757.71 ***	-1 308.64 ***		-1 029.79 *	
Altruistic					-1 576.48 ***
Social	-2 637.33 ***	-2 881.80 ***	-3 194.38 ***	-4 090.76 ***	-2 007.29 ***
Childallow	-1 771.73 ***	-1 975.27 ***	-2 072.49 ***	-2 565.45 ***	-1 126.02 ***
Wealthy				1 326.49 *	
Person	-913.96 ***				
Children	584.16 *				
Single			1 813.03 **	2 319.97 **	1 101.00 *
Both	797.24 *		1 407.56 **	1 329.80 *	951.53 **
College					1 223.46 **
Age					-56.16 *
Welfare	2 014.45 ***	2 730.25 ***	1 986.68 ***	4 511.94 ***	1 325.36 ***
Experience	853.89 **		1 035.30 **		917.09 ***
School				-1 211.49 **	
Childmore	1 576.63 ***		1 487.42 ***		
Asthma		1 075.72 **	1 010.50	1 432.55 **	
Bronchitis				1 590.28 *	
Symptom occurrence			-941.31 **		
Scale	3 631.73	3 624.99	3 978.08	4 665.53	2 618.29
Loglikelyhood	-1695.50	-1684.60	-1644.40	-1695.87	-1240.29
Observations	428	426	419	424	467

*, **, ***: significant at 0.1, 0.05, 0.01 levels, respectively.