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Are Children Rational Decision Makers when they are Asked to Value their own Health? A Contingent Valuation Study Conducted with Children and their Parents

Carla Guerriero, John Cairns, Fabrizio Bianchi and Liliana Cori

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University of Naples Federico II



University of Salerno



Bocconi

Bocconi University, Milan

CSEF - Centre for Studies in Economics and Finance
DEPARTMENT OF ECONOMICS - UNIVERSITY OF NAPLES
80126 NAPLES - ITALY
Tel. and fax +39 081 675372 - e-mail: csef@unisa.it

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Carla Guerriero^{*}, John Cairns[♦], Fabrizio Bianchi[♥] and Liliana Cori[♠]

Abstract

Despite the importance of including children's preferences in the valuation of their own health benefits no study investigated the ability of children to understand willingness to pay questions. Using a contingent valuation study we elicit children's and parents' willingness to pay (WTP) to reduce children's risk of an asthma attack. Our results suggest that children are able to understand and value their own health risk reductions and their ability to do so improves with age. Child age was found to be inversely related to parents' and children's WTP. The results also suggest that non-paternal altruism is predictive of children's WTP. For parents, care for their own-health, was found to be inversely related with their WTP for children's risk reductions. Comparison of parents' vs. children WTP suggest that parents are willing to sacrifice for their child's health risk reduction an amount that is approximately twice the size of their children. The analysis of matched pairs of parents and children suggest that there are within-household similarities as the child's WTP is positively related to parents' WTP.

Keywords: willingness to pay, contingent valuation, children's preferences, children's rationality

^{*} Università di Napoli Federico II and CSEF, Department of Economics and CSEF, Via Cintia (Monte S. Angelo), 80126 Napoli, Department of Public Health and Policy, London School of Hygiene and Tropical Medicine, Tavistock Place WC1H 9SH London UK , e-mail: Carla.Guerriero@lshtm.ac.uk

[♦] London School of Hygiene and Tropical Medicine, Department of Public Health and Policy, London School of Hygiene and Tropical Medicine, WC1H 9SH Tavistock Place London UK e-mail: John.Cairns@lshtm.ac.uk

[♥] IFC CNR Pisa, Italy e-mail: Fabrizio.Bianchi@ifc-cnr.it

[♠] IFC CNR Pisa, Italy e-mail:Liliana.Cori@ifc-cnr.it

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1. Introduction

Stated preference studies are increasingly being used to assign a monetary value to the benefit of health care interventions affecting children (Barner J.C. et al., 1999; Liu T.J., 2000). Because of the vulnerability of children to environmental hazards, a substantial number of willingness to pay studies (WTP) have also been conducted to elicit monetary benefits of pollution control interventions affecting children's health (Alberini A et al., 2010a; Alberini A. and Scansy M., 2011; Dickie M. and Messman V.L., 2004; Gerking S. and Dickie M., 2013).

Children and adults might be heterogeneous populations with respect to health risk preferences, however, to the best of our knowledge, there are no studies investigating child preferences for health risk reductions. According to previous authors, the main obstacle in the evaluation of child health benefits using a children perspective is that children do not possess the necessary cognitive abilities to formulate preferences for their own health risk reductions (Alberini A et al., 2010b; Harbaugh TW., 1999; OECD, 2006). Further, children are also not able to understand health risks and have no control over financial resources. Excluding the child perspective, previous studies have used three other types of perspectives to elicit estimates of the WTP for risk reductions for children: the societal perspective, the adult as a child perspective and the parental perspective (EPA, 2003). The societal perspective consists of asking a representative group of the society (parents and non-parents ¹) how much they are willing to pay for child health risk reductions (OECD, 2006). The second perspective asks adults to imagine themselves as children and to assign a value to the health risks they faced when they were children (OECD, 2006). The third, and most commonly adopted, perspective asks parents how much they are willing to pay to reduce child health risk.

These approaches have two main weaknesses. First, in welfare economic theory, the individuals affected by the policy are usually regarded as the best judges of their own welfare. Any third person, e.g. parent speaking on behalf of their child, may fail to express the child's preferences for their own health risk reductions (Dockins C et al., 2002). The second main limitation arises from difficulty of distinguishing between different types of altruism (paternalistic and non-paternalistic) that may have influenced the WTP estimates (Dickie M. and Gerking S., 2007; Viscusi WK. et al., 1988).

Despite the common belief that children are not mature enough to speak for themselves, there

¹Paternalistic altruism refers to the situation in which the individual utility function depends on the consumption of other individuals of a particular merit good (e.g. size of the health risk reduction to the child). The non-paternalistic altruist's utility function depends instead on the others' welfare (e.g. child's utility level).

are studies suggesting that that even at younger ages, children might be able to understand health risks and understand and use money (Berti AE. and Bombi AS., 1981; Beutler I. and Dickson L., 2008; European Commission and DG Environment, 2000; Harbaugh TW. et al., 2001). To the best of our knowledge there is only one previous study investigating whether children (aged 7 and 11 year old) choices satisfy the generalized axiom of revealed preference. The study conducted by Harbaugh et al. in 2001 suggests that children as young as seven year old show rational preferences and they ability to choose rationally improves with age and with their mathematical skills (Harbaugh TW. et al., 2001).

This paper reports the results of the first contingent valuation (CV) study conducted with children aged 7-19 years, together with their parents, to estimate willingness to pay WTP for reductions in the risk of asthma attack. Asthma attack has been selected as health outcome because asthma is the most common non-communicable disease among children.

The objective of the research is to provide preliminary evidence on an important and unexplored area. First, it investigates whether children are able to provide rational answer to WTP questions and in particular whether they are able to make trade-offs between money and health risk reductions. The study investigates child rationality by testing the theoretical validity of child WTP estimates. Answers are firstly tested for scope sensitivity. A further internal validity test is also performed by including in the analysis children's demographic characteristics and attitudinal variables to verify whether they influence WTP estimates in the expected manner. The second objective of this study is to elicit parents' WTP estimates and to compare children's' vs. parents' preferences for children's health risk reductions.

A unique feature of the data is that they include matched pair of parents and children living in the same household. The third objective of this research is to compare child vs. parental responses to investigate potential differences/similarities between the two perspectives using matched pair of WTP answers. The remainder of this paper is organized as follows. The Methods section describes the study design and the questionnaires (parental and child) used to elicit WTP values for reducing the risk of asthma attack, and also the methodology for analyzing the responses. The Results Section presents the main results of the study. The final section offers a discussion and some implications for further studies. A more detailed description of the questionnaire is also provided in the Appendix.

2. Methods

The research received ethical approval from the Italian National Research Council and the London School of Hygiene and Tropical Medicine. Informed written consent and informed assent was obtained from parents and children respectively. The pilot study and the final survey were conducted between February and April 2013. The final survey was administered in class using a paper questionnaire with 370 children aged between 7 and 19 years living in Naples (Italy). Parents of children who agreed to participate in the study were given a brief questionnaire which they were asked to return within two weeks. Pre-tests and class discussions were conducted with younger children to ensure that they understood the questionnaire, and to improve the wording and format of the final version.

2.1. *Children's Questionnaire*

The first part of the children's questionnaire collected basic demographic information, such as age, gender, and school year. Next information was collected on children's attitudes and behaviours. Most of the questions were simple psychometric ones developed for adults and adapted to children. A brief description of the attitudinal and behavioral variables included in the questionnaire is reported below (for further details see the Appendix).

Asthma health status. It has been shown that the health status of respondents affects the WTP for health risk reduction (Agee M. D. and Crocker T. D., 2008; Alberini A et al., 2010b). In order to investigate whether the WTP of children and parents was influenced by the asthma experience of the child, pupils were asked if they experienced asthma attacks frequently, seldom, or if they had never before suffered from asthma attacks.

Belief in the relationship between environmental hazards and health. Previous authors suggest that risk perception significantly affects WTP estimates (McDaniels et al., 1992; Vassanadumrongdee S and Shunji M., 2005). To account for this children were asked to rate the relationship between environmental hazards and health based on a five point Likert scale. The aim of this question was to gather information regarding the relationship between ratings and the degree of belief in the possibility that environmental hazards influence child health. Altruism. Altruism, i.e. devotion to welfare of others, includes non-use values such as benevolence towards friends and relatives, which may play a significant role in determining WTP estimates (Agee M. D. and Crocker T. D., 2008; Alberini A. and Scansy M., 2011; Bateman IJ. et al., 2002; Jones-Lee M.W., 1991). Previous studies suggest that altruism, and in particular non paternalistic altruism of parents towards children, may substantially increase WTP estimates and lead to a higher than efficient provision

of safety compared with other goods (Bloomquist G.C. et al., 2010; Dickie M., 2005; Dickie M. and Gerking S., 2007) Four different questions were used to ascertain the child's altruism towards others. The first question tests generic altruism: "If my classmate is in a difficult situation, I would try to help him". In order to test health/welfare related altruism, two questions were asked: "I feel sorry if my classmate cannot come to school because he/she is not feeling well"; and "If my classmate has nothing to eat during the break, I will share with him/her". Finally, non-paternalistic altruism was measured using: "I will lend money to my classmate if he/she needs money to buy something".

Risk behaviours. Weber et al. (2002) developed a specific attitude scale to test risk behaviours in four different domains related to risk: health/safety, recreational, social and ethical domains. Given the difference between children and adults a shorter version of the attitude scale was developed and tested. The health and safety, and the recreational domains were considered relevant to children and thought to influence their WTP. In the analysis, each question was treated independently given that the content specificity of responses suggests that they should not be combined in a single score across and within content domains (Weber E. et al., 2002). Risk attitude was measured with ten statements. Five of these explored risk preferences in the health and safety domains (e.g. "I always brush my teeth before going to bed"). The remaining five statements referred to preferences for recreational risk (e.g. "I would go on safari in the jungle"). Finally, a five point Likert scale was used to measure children's concern for their own health. It was expected that children who cared more for their own health would be willing to pay more for small risk reductions.

2.2. *Parents' questionnaire*

The parental questionnaire begins with questions about age, gender, occupation, and family income and family size. Then information on parental attitudes is collected in order to explore their role in determining WTP for children's health risk reductions. Two risk behaviour domains: health/safety and the recreational domain were investigated. As far as possible, identical questions were asked of parents and children in order to reduce potential biases arising from the measurement of risk attitudes via different questions. Two generic questions were used to investigate parental concern for their own health and their attitude to their children's health using five point Likert scales. A detailed description of the attitudinal and behavioural variables is reported in the Appendix.

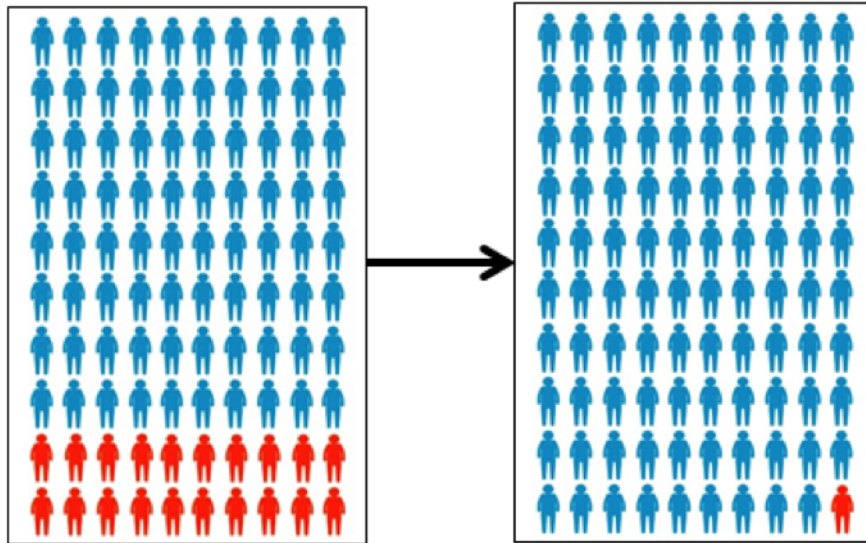


Fig. 1. Visual Aid used to communicate health risk reduction.

2.3. *The Scenario valued*

Given that children might have diverse levels of understanding of the hypothetical health scenario, an asthma attack was described using a graphic pathography - an illness narrative in graphic form - to display the health condition being valued; secondly, by using the same picture to describe asthma effects in both questionnaires, asymmetric information between children (those who have asthma and those have not) and also between children and parents is reduced.

Consistent with the recommendations of Brown et al.(2003) before being surveyed children were prompted to provide their true WTP (Brown TC. et al., 2003). During the talk the problem of hypothetical bias was also explained to the respondents (Brown TC. et al., 2003).

2.4. *Communication of health risk reduction.*

The baseline risk of asthma attack and the three risk reductions were communicated with the use of visual aids (Corso et al., 2001) (See Figure 1). The baseline risk reduction was 20 in 100, which was close to the average proportion of children experiencing asthma in the overall sample. Each respondent was asked to value three health risk reductions. Largest health risk reduction (WTP1): from 20 in 100 to 1 in 100 children having an asthma attack each month. Medium health risk reduction (WTP2): from 20 in 100 to 10 in 100 each month. Smallest health risk reduction: from 20 in 100 to 16 in 100 (WTP3) each month. As in Guerriero et al. 2015 pictographs were used to display the health risk reduction to be valued(Guerriero C et al.). Given that the order of the

three questions might influence the responses, three different versions of the questionnaire were administered to explore ordering bias.

2.5. The elicitation format

To the best of our knowledge, there is no existing evidence on which elicitation format is more appropriate for children. Before constructing the final questionnaire an open-ended CV questionnaire was piloted with fifteen children aged 7-10 years. The pilot questionnaire was administered in class and the majority of children (76 percent) asked further questions about how to answer the three open ended questions, with some making the comment that it was difficult to guess an exact value. Following this preliminary study, a second pilot study was conducted using a range of 15 payment card cells. All of the children agreed that this was easier to understand.

Pilot test results indicated that, for younger children, it is necessary to use payment cards that are based on a budget constraint they are familiar with. For children aged between 7 and 13 years, the median monthly budget available by school class group was retrieved from a questionnaire administered to the same children involved in this study and used to design age specific payment card sets(Guerriero C and Cairns J, 2016).

2.6. Debriefing questions

Children were asked if in principle they would be willing to pay a part of their pocket money to reduce the risk of having an asthma attack before the three risk reductions were presented. If they were willing to pay, they were asked the three payment cards questions. If they were unwilling to pay, they were asked about their reasons. Children and their parents were asked the same six debriefing questions to assess their motivations for being unwilling to pay for health risk reduction(Bateman IJ. et al., 2002) (See Table 2 in the Appendix).

2.7. Estimation Strategy

Three tests were used to identify those respondents who did not understand health risks and/or did not pay enough attention to the WTP questions. Test 1 verifies whether individuals displayed a decreasing WTP for higher health risk reduction ($WTP_1 < WTP_2 < WTP_3$). Test 2: checks whether WTP is completely insensitive to health risk change $WTP_1 = WTP_2 = WTP_3$ and Test 3 tests whether individuals are willing to give up their entire budget for reducing health risk (high protest bids)(Bateman IJ. et al., 2002). Other types of inconsistencies associated with the scope test were

also conducted (See the Appendix). Logistic regressions were also performed to test whether individual's characteristics influence the likelihood of having higher WTP estimates for higher health risk reductions ($WTP1 > WTP2 > WTP3$). The proportion of protest answers and Yes/No answers to the preliminary WTP question ("Are you willing to pay for reducing your risk of having an asthma attack?") was analysed in parents and children. Logistic regression analysis was also used to investigate whether children's and parents' characteristics, attitudes and behaviours influence the likelihood of agreeing to pay for health risk reductions. Then the mean proportion of the budget that parents and children are willing to pay for the three risk reductions was calculated. The price bids selected by respondents were transformed from absolute numbers (e.g. €5) into proportions using the assigned budget constraint (e.g. if the budget constraint is €32, the amount selected, €5, corresponds to 16 percent of the budget). A generalized linear model (GLM) with logit link function was used in order to ensure linearity and binomial family distribution since the dependent variable is bounded between 0 and 1 (Aitchison, 1986; Ferrari SLP. and Cribari-Neto F., 2004; Paolino, 2001). Beta and Zero Inflated Beta models were also tested but lead to poorer model estimation.

After estimating mean WTP with a constant only model, the internal validity of the WTP responses was tested by including respondents' characteristics (socio-economic characteristics and attitudinal and behavioral indicators) to investigate how they influence the WTP and if they conform to a priori expectations. The analysis was run for all respondents excluding protest answers, and separately for those who passed Tests 1, 2 and 3. To investigate whether the parents and children WTP estimates are related to each other GLM regression was performed on children's WTP for the three risk reductions including their parents' WTP (for the same size health risk reduction) as explanatory variable.

3. Results

3.1. Descriptive statistical analysis

Only three children refused to take part in the study. Table 1 provides descriptive statistics of the demographic characteristics of children and parents who agreed to participate in the study. The mean age of children is 14 years. The proportion of children who experienced occasional or frequent asthma attacks in the study sample is high, 29 percent, and does not vary by age groups. Information about asthma status was missing for 7 children.

The average age of mothers and of fathers was 45 and 47 years respectively. The majority

of respondents to the parental questionnaire were females, of which 43 percent are unemployed. Information on income was missing for 33 parents who completed the questionnaire. 50 percent of the sample who provided income information had a mean available income excluding food and accommodation expenditure equal to or higher than €600 per month. However, only 15 percent of the families spend more than €1200 per month. As expected monthly income and profession are found to be highly correlated 0.43 ($p < 0.001$).

3.2. *Willingness to pay for health risk reduction: Yes or No*

Only 34 children (9 percent) were unwilling to pay for health risk reduction. At the debriefing, the majority of the children who refused to pay for health risk reduction said that "The Mayor should deal with this problem". The second most popular reason for not paying for health risk reduction was a commitment to other priorities. According to Bateman et al. these answers were classified as protest answers and excluded from the analysis (number of children excluded 34)(Carson et al., 1997).

As seen in Table 2 consistent with economic theory, the percentage of zero answers to WTP questions increases with the decreasing size of the health risk reduction.

In the parents sample only 8 subjects refused to pay for the highest health risk reduction. All those refusing to pay said that the Mayor should deal with the problem. As for children, the proportion willing to pay zero slightly increased with the size of the health risk reduction, and for all risk changes the proportion was higher for parents compared with children. The results of the logistic regression investigating possible factors influencing WTP (yes or no) suggest that for children, trust in the relationship between environmental hazards and health was a strong predictor for deciding whether, in principle, they were willing to pay for a health risk reduction (Odds Ratio: 2.10; $p = 0.003$). None of the covariates were statistically significant in the case of parents.

3.3. *Scope sensitivity of children's and parents' answers*

The overall number of parents that did not pass at least one of the three tests is 24 (14% of the sample) while for children the proportion of incorrect answers is considerably lower, 15, corresponding to 4% of the overall sample. Three children, 1 percent of the overall sample failed to pass Test 2, for parents, this proportion was significantly higher (10 percent of the overall sample). The results of logistic regression analysis suggest that among children age was a significant predictor of the probability of providing scope sensitive WTP estimates (higher WTP values for higher health risk reduction). For parents, type of job seemed to be important in determining the likeli-

hood of providing risk sensitive estimates. In particular, parents employed in a profession requiring a university degree are almost twice as likely to provide increasing WTP for increasing health risk reductions (OR:2.33 p=0.034).

3.4. Children's and parents' WTP as percentage of the available budget

Table 3 shows the results of GLM constant-only model for the entire sample (excluding protest answers) and separately for those who passed Tests 1, 2 and 3. As expected, the mean WTP is significantly larger for higher risk reduction than lower risk reductions for both parents and their children. Among children who satisfied the rationality test, the mean WTP ranged between 22 and 11 percent for highest and lowest reductions respectively. Among parents, the proportion of the budget they were willing to give up was significantly higher, ranging from 35 percent to 19 percent of the available budget. Table 4, reports the ratios of WTP estimates for different health risk reductions. As shown, both children and parental WTP estimates do not exhibit proportionality in relation to the size of the health risk reduction. Table 5 compares the WTP estimates for parents, divided by child WTP, for the same health risk reduction. As shown, parental WTP estimates always exceed those of their children, however, the difference narrows for highest health risk reduction. Parents WTP estimates (calculated by multiplying the parents' proportion of the budget by the budget constraint used in the experiment €400) for 19, 10 and 4 in 100 risk reduction are euro140, €96 and €76 respectively. For children, however, WTP depends on the theoretical model used. Where it is assumed that children faced parental budget constraints (€400), the WTP is euro88 (19 in 100 risk reduction), €56 (10 in 100) and €44 (4 in 100 risk reduction).

3.5. The effect of children's and parents' socio-demographic characteristics, attitudes and behaviors on WTP

Table 6, presents the results of GLM for those children who passed Tests 1, 2 and 3. Marginal effects are also reported for children and parents respectively. Marginal effects provide information about the amount of change in WTP that will be produced by a 1-unit change in the independent variables.

Model 1 examines the effect of size of risk reduction and socioeconomic characteristics such as age, gender and child asthma status on a child's WTP for asthma risk reductions. As expected the greater the health risk reduction the higher the WTP. The statistically significant, negative coefficient and marginal effects of age indicates that children are willing to pay less for health risk reduction as they become older. In particular, WTP is similar among those aged between 7 and 13 years and decreases significantly for those 14 years or older. WTP was estimated as the mean

proportion of the budget by fitting a constant only generalized linear model for the two broad age groups (7-13 years and 14-19 years). Results for these analysis are reported in the Appendix.

As seen in Table 6 children who experience frequent asthma attacks have a higher WTP compared with those who seldom suffer from asthma. However, no difference was detected between those who experience asthma attacks frequently compared with those who have never had asthma symptoms. Model 2 of Table 6 re-runs the regression to examine the effect of child attitudes and beliefs on their WTP. The trust in the relationship between environment and health is a predictor of WTP. Those who believe that environmental hazards seriously affect child health have a higher WTP for health risk reduction. Once all four dummies measuring the different types of altruism are included in the model, only non-paternalistic altruism increases the WTP for health risk reduction. As expected, the majority of the coefficients used to measure risk aversion show a positive sign, indicating that more risk adverse individuals have a higher WTP. However, none of the risk aversion measures are statistically significant.

As with children, parental WTP is also significantly related to the size of the health risk reduction confirming the validity of the study (See Table 7). Interestingly, the model finds that the age of the child is negatively related with parental WTP. Results of Model 1 also show that parents employed in a highly skilled job have a higher WTP compared with unemployed parents. Model 2 in Table 7 shows the effect of parental attitudes and beliefs on their WTP for childhood health risk reduction. As found with children, the stronger the parental belief that environmental hazards can affect child health, the more they are willing to pay for health risk reduction. In the case of parents, one measure of health risk aversion, 'using sunscreen when sunbathing' was significantly associated with higher WTP for child health risk reduction. The frequency with which parents smoke is negatively associated with WTP. However, smoking was not significant at conventional levels. An interesting finding of Model 2 of Table 7 is the contrasting sign of the two coefficients: care for own health and care for child health. The negative sign on care for one's own health indicates that the less parents care for their own health, the more they are willing to pay (sacrifice part of their budget, given a fixed budget constraint) for reducing child asthma.

3.6. Analysis of WTP estimates from children and parents living in the same household.

Table 8 reports the cross-tabulation results of the intentions to pay for the policy from parents and children living in the same household. In 88% of pairs, the child and parent stated the same intention to pay for the policy. McNemar test statistic results also suggest that the null hypothesis

in which parents and children show the same intention is not rejected (chi square with 1-degree of freedom = 3.86, exact significance probability = 0.08). Table 9 shows the results of GLM models investigating whether children's WTP is influenced by their parents' WTP. As seen, independently from children demographic characteristics, children's WTP is positively related to the one of their parents for high and medium risk reduction but not for the lowest health risk reduction. This results is consistent with the previous findings suggesting that the difference between parents' and children's estimates widen for low health risk reductions (parents being more risk averse than children for small reductions).

4. Discussion

Using the results of a CV study conducted with a sample of 370 children aged 7-19 years, this study investigates, for the first time, children rationality as economic agent and their ability to trade-off between money and health risk. Our results suggest that children understand health risk information and are willing to sacrifice part of their budget to reduce their health risk. The majority of the children interviewed passed the scope sensitivity test and considered their budget constraint when answering to WTP questions. Consistently with Harbaugh et al, the results of this study show that children's ability to trade off money for risk reductions improves with age(Harbaugh TW. et al., 2001). The second main finding of this study is that child WTP is influenced by individual characteristics such as age, gender and health status. Younger children, boys and children suffering from frequent asthma attacks are willing to pay more for their health risk reductions.

Attitudinal and behavioural measures have also been found to affect child WTP estimates(Bateman IJ. et al., 2002). Children who believe in the causal link between environmental hazards and health are more likely to agree to pay for an environmental policy reducing health risks. This study investigates whether paternalistic and non-paternalistic altruism of children towards other children influences their WTP for health risk reduction. Our findings suggest that non-paternalistic altruism does influence WTP estimates in children. The ability of children to provide rational answers to stated choice questions and the influence of demographic variables on WTP is also confirmed in a Discrete Choice Experiment conducted with the same children included in the present study(Guerriero C. et al., 2016).

While the highest proportion of the environmental burden of disease falls on very young and very old individuals; it remains unclear whether WTP estimates should be adjusted for age. To the best of our knowledge this study is the first investigating the similarities/differences between parental and child preferences. In the case of children, there has been much debate on whether us-

ing a higher WTP values compared to adults to reflect individuals' longer life expectancy and lower morbidity (Dockins et al). This research findings suggests that, as with children, parental WTP also decreases with child age. This result is also consistent with previous studies conducted with parents (Bloomquist G.C. et al., 2010; Hammitt JK. and Haninger K., 2010). Interestingly, both boys and fathers are willing to pay more compared to girls and mothers. As for children, parental trust in the relationship between environment and health was found to influence WTP estimates. The analysis of matched pair of parent-child answers suggest that there are intra-household similarities in preferences, the child WTP for high an medium risk reductions is positively related to their parents' WTP. Future studies may explore whether the mother vs. the father exert different influence on children's preferences using a larger sample size (e.g. whether children's preferences are influenced only by the mother). Given the importance of including children's health benefit in CBA of environmental health interventions further research is needed to confirm these research findings.

Future research may also explore whether child preferences are considered in the household decision-making, and, if this is the case, which factors (e.g. age, whether the child works, cultural factors, household structure) influence children's decision power. The majority of previous theoretical models used in family economics did not include a child utility function(Bateman IJ. et al., 2002; Dauphin A. et al., 2011). Nonetheless, some studies show that children influence household choices, such as choice of holiday destinations and products to buy(Dauphin A. et al., 2011; Dosman D. and Adamowicz W., 2006). To investigate the decision making process within households and how decisions can be influenced by both household structure and the child's characteristics (e.g. age) is beyond the scope of this research, but constitutes material for further studies. ?

Competing Interests

The Authors declare that they have no competing interests.

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Table 1: CHILDREN'S AND PARENTS' DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

	Female	Male	Total (percent)
Children			370
Age			
7-9 years	22	16	38 (10 percent)
10-11 years	41	28	69 (19 percent)
12-13 years	11	30	41 (11 percent)
14-15 years	69	45	114 (31 percent)
16-17 years	45	25	70 (19 percent)
18-19 years	19	19	38 (10 percent)
Total	207	163	370
Asthma Attack			
Frequently	25	16	41 (12 percent)
Seldom	30	33	63 (17 percent)
Never	147	112	259 (71 percent)
Total	202	161	363
Parents			
Mean Age (SD)	45.41(7.49)	47.20(11.1)	173
Job type			
Unemployed	52	8	60 (35 percent)
Unskilled workers	14	21	35 (20 percent)
Skilled workers	54	24	78 (45 percent)
Total	120	53	173
Family Size	4.29(0.96)	4.28(0.98)	
Family monthly expenditure			
<€600	50	22	72 (50 percent)
€600-€1.200	35	15	50 (35 percent)
€1.200-€2.000	8	4	12 (8 percent)
>€2.000	8	2	10 (7 percent)
Total	101	44	144

Table 2: DESCRIPTIVE ANALYSIS OF CHILDREN’S AND PARENTS’ WILLINGNESS TO PAY FOR HEALTH RISK REDUCTIONS

	Children		Parents	
	Yes	No	Yes	No
Are you willing to pay for health risk reduction?	336 (91 percent)	34 (9 percent)	NA	NA
WTP1	334 (99 percent)	2 (1 percent)	165 (95 percent)	8 (5 percent)
WTP2	334 (99 percent)	2 (1 percent)	162 (93 percent)	11 (7 percent)
WTP3	326 (97 percent)	10 (3 percent)	160 (92percent)	13 (8 percent)

Note: WTP1: largest health risk reduction; WTP2:medium health risk reduction; WTP3: smallest health risk reduction; NA: not available

Table 3: MEAN (95 PERCENT CONFIDENCE INTERVAL) WILLINGNESS TO PAY AS PRO-PORTION OF THE AVAILABLE BUDGET.

	WTP1		WTP2		WTP3	
	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*
Children						
Mean	0.22 (0.20-0.24)	0.22 (0.14-0.17)	0.15 (0.13-0.15)	0.14 (0.10-0.13)	0.12 (0.06-0.12)	0.11
Parents						
Mean	0.41 (0.36-0.46)	0.35 (0.30-0.39)	0.31 (0.27-0.35)	0.24 (0.21-0.28)	0.27 (0.23-0.32)	0.19 (0.16-0.23)

Note: WTP1: largest health risk reduction; WTP2: medium health risk reduction; WTP3: smallest health risk reduction; *: The sample excludes protest answers.

Table 4: INTERNAL SCOPE TEST: IS WILLINGNESS TO PAY PROPORTIONAL TO THE SIZE OF THE HEALTH RISK REDUCTION?

	Ratio WTP1 to WTP2		Ratio WTP1 to WTP3		Ratio WTP2 to WTP3	
	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*	All Respondents (N=336)*	Respondents passing all the three tests (N=321)*
Children Ratio	1.46	1.57	1.83	2	1.25	1.27
	All Respondents (N=165)*	Respondents passing all the three tests (N=141)*	All Respondents (N=165)*	Respondents passing all the three tests (N=141)*	All Respondents (N=165)*	Respondents passing all the three tests (N=141)*
Parents Ratio	1.32	1.45	1.50	1.84	1.14	1.26

Note: WTP1: largest health risk reduction; WTP2: medium health risk reduction; WTP3: smallest health risk reduction; *: The sample excludes protest answers.

Table 5: ARE THE CHILDREN'S WILLINGNESS TO PAY VALUES DIFFERENT FROM PARENTS?

	Ratio WTP1 to WTP2		Ratio WTP1 to WTP3		Ratio WTP2 to WTP3	
N, Children	All Respondents	Respondents passing all the three tests	All Respondents	Respondents passing all the three tests	All Respondents	Respondents passing all the three tests
	336*	321*	336*	321*	336*	321*
N. Parents	All Respondents	Respondents passing all the three tests	All Respondents	Respondents passing all the three tests	All Respondents	Respondents passing all the three tests
	165*	141*	165*	141*	165*	141*
Ratio	1.86	1.59	2.06	1.71	2.25	1.72

Note: WTP1: largest health risk reduction; WTP2: medium health risk reduction; WTP3: smallest health risk reduction; *: The sample excludes protest answers.

Table 6: INTERNAL VALIDITY OF WILLINGNESS-TO-PAY ESTIMATES: CHILDREN SAMPLE.

Variable	Model 1 Coeff.(S.E.)	Model 1 dy/dx(S.E.)	Model 2 Coeff.(S.E.)	Model 2 dy/dx(S.E.)
Risk Reduction				
Small risk reduction vs. Medium risk reduction	0.30(0.06)***	0.03(0.01)***	0.31(0.07)***	0.03(0.01)***
Small risk reduction vs. Large risk reduction	0.81(0.07)***	0.10(0.01)***	0.84(0.08)***	0.10(0.01)***
Child Age				
7-9 vs. 10-11	0.01(0.23)	0.00(0.04)	0.22(0.22)	0.03(0.03)
7-9 vs. 12-13	-0.13(0.28)	-0.02(0.04)	0.09(0.30)	0.00(0.05)
7-9 vs. 14-15	-0.85(0.21)***	-0.11(0.03)***	-0.72(0.25)**	-0.11(0.04)**
7-9 vs. 16-17	-0.79(0.22)***	-0.10(0.03)***	-0.67(0.25)**	-0.10(0.03)**
7-9 vs. 18-19	-0.72(0.27)**	-0.09(0.03)**	-0.62(0.33)	-0.10(0.04)
Asthma attacks				
Frequently vs. Seldom	-0.25(0.12)*	-0.03(0.01)*	-0.34(0.14)	-0.03(0.01)
Frequently vs. Never	-0.28(0.19)	-0.03(0.02)	-0.27(0.20)	-0.03(0.02)
Child Gender				
Natural Log of Pocket Money	0.06(0.13)	0.01(0.01)	0.23(0.12)*	0.02(0.01)*
Environmental-hazards-on-children's-health				
General-altruism			0.21(0.07)**	0.03(0.01)**
Health-related-altruism			-0.37(0.35)	-0.05(0.03)
Welfare-related-altruism			0.17(0.13)	0.02(0.02)
Non-paternalistic-altruism			-0.00(0.14)	-0.00(0.02)
Recreational-risk-aversion-(1)			0.44(0.15)**	0.05(0.02)**
Recreational-risk-aversion-(2)			0.02(0.14)	0.00(0.02)
Recreational-risk-aversion-(3)			0.14(0.13)	0.02(0.02)
Recreational-risk-aversion-(4)			-0.28(0.13)	-0.03(0.02)
Recreational-risk-aversion-(5)			-0.12(0.12)	-0.01(0.02)
Health-risk-aversion-(1)			0.08(0.17)	0.01(0.02)
Health-risk-aversion-(2)			-0.15(0.23)	-0.02(0.01)
Health-risk-aversion-(3)			0.17(0.13)	-0.00(0.03)
Health-risk-aversion-(4)			-0.10(0.16)	
Health-risk-aversion-(5)			0.03(0.12)	0.01(0.03)
Care-of-children-for their own-health			0.16(0.18)	-0.07(0.05)
Constant			-0.11(0.07)	-0.09(0.02)***
Log Likelihood			-1.21(0.59)*	0.12(0.06)
AIC			-264.53	-246.59
BIC			553.16	549.18
			610.71	685.12

Notes: Coeff: Coefficient S.E. Standard Error; *p<0.05; **p<0.01; ***p<0.001; the analysis includes only Respondents passing all the three tests.

Table 7: INTERNAL VALIDITY OF WILLINGNESS-TO-PAY ESTIMATES: PARENT SAMPLE.

Variable	Model 1 Coeff.(S.E.)	Model 1 dy/dx(S.E.)	Model 2 Coeff.(S.E.)	Model 2 dy/dx(S.E.)
Risk Reduction				
Small risk reduction vs. Medium risk reduction	0.24(0.06)***	0.05(0.01)***	0.28(0.04)***	0.05(0.01)***
Small risk reduction vs. Large risk reduction	0.71(0.10)***	0.15(0.02)***	-0.82(0.11)***	0.16(0.02)***
Parent Age	-0.001(0.02)	-0.00(0.00)	-0.01(0.02)	-0.00(0.00)
Child Age	-0.12(0.06)*	-0.02(0.01)*	-0.07(0.06)	-0.01(0.01)
Parent Gender	0.29(0.27)	0.06(0.06)	0.74(0.32)	0.14(0.06)
Child Gender	-0.39(0.23)	-0.08(0.05)	-0.35(0.25)	-0.07(0.05)
Family size	0.02(0.12)	0.00(0.02)	0.07(0.13)	0.01(0.03)
Asthma status Child	-0.17(0.19)	-0.04(0.04)	-0.39(0.19)*	-0.08(0.04)*
Employment				
Unemployed vs. Unskilled Employee	0.17(0.37)	0.03(0.07)	0.09(0.36)	0.06(0.02)
Unemployed vs. Highly skilled Employee	0.88(0.41)*	0.19(0.08)*	1.01(0.43)*	0.20(0.08)*
Natural Log of Household budget	0.19(0.15)	0.04(0.03)	0.12(0.16)	0.02(0.03)
Environmental-hazards-on-children's-health-parents		0.05(0.01)***	0.56(0.23)*	0.10(0.04)*
Health-risk-aversion-parents		0.15(0.02)***	0.45(0.17)**	0.09(0.03)**
Health-risk-aversion towards-children		-0.00(0.00)	0.20(0.20)	0.04(0.04)
Smoking		-0.02(0.01)*	-0.08(0.13)	-0.02(0.01)
Exercising		0.06(0.06)	-0.02(0.17)	-0.00(0.03)
Recreational-risk-aversion parents (1)		-0.08(0.05)	0.14(0.18)	0.03(0.03)
Recreational-risk-aversion-parents (2)		0.00(0.02)	0.05(0.15)	0.01(0.03)
Recreational-risk-aversion-parents (3)		-0.04(0.04)	-0.35(0.28) -	0.07(0.05)
Care-for-their-own-health-parents			-0.46(0.12)***	-0.09(0.02)***
Care-for-children's-health-parents		0.03(0.07)	0.61(0.34)	0.12(0.06)
Constant	-0.01(1.11)	0.19(0.08)*	-4.19(2.84)	
Log Likelihood	-198.87		-160.55	
AIC	421.74		365.10	
BIC	469.60		450.60	

Notes: Coeff: Coefficient S.E. Standard Error; *p<0.05; **p<0.01; ***p<0.001; the analysis includes only Respondents passing all the three tests; Family size: number of family components

Table 8: MATCHED PARENTS' CHILDREN'S INTENTION TO PAY FOR RISK REDUCING INTERVENTION

		Parent		Total
		Yes	No	
Child	Yes	145	6	151
	No	16	2	17
	Total	160	8	168

Table 9: CHILDREN WILLINGNESS TO PAY GLM RESULTS INCLUDING SAME-HOUSEHOLD PARENTS? WILLINGNESS TO PAY AS COVARIATE.

	WTP1 Coeff.(SE)	WTP2 Coeff.(SE)	WTP3 Coeff.(SE)
Age	-0.003(0.05)	-.10(.04)**	-.15(.05)**
Gender	.22(.23)	.19(.22)	.31(.31)
Asthma (1=frequently;2=seldom;3=never)	-.40(.19)*	-.27(.15)	-.48(.17)**
Natural log of pocket money	.06(.11)	-.08(.08)	-.06(.11)
Parents? WTP for the same health risk reduction	.001(.00)*	.002(.00)**	.001(.00)
Constant	-1.53(.65)**	-.11(.59)	.50(.66)

Notes: WTP1: largest health risk reduction;WTP2:medium health risk reduction; WTP3: smallest health risk reduction; Coeff: Coefficient S.E. Standard Error; *p<0.05; **p<0.01; ***p<0.001.

1 Appendix

Table 1: Description of the explanatory variable: Children's and Parents' questionnaires.

Variable	Description	Original question in Weber et al. scale ¹	Rationale
Children's Questionnaire			
Gender	Respondent's gender	NA	WTP may vary by gender
Child Age	Children's age divided into age groups: 7-9; 10-11; 12-13; 14-15; 16-17; 18-19 years. Age groups correspond to the age composition of pupils in each class.	NA	WTP may vary with children's age.
Asthma status	Categorical variable for children's asthma health status: 1= Frequent asthma attack, 2= Rare asthma attacks; 3=Never experienced asthma attack	NA	Asthma health status may influence respondent WTP asthma health risk reduction.
Pocket Money	Monthly amount of pocket money received from the parents.	NA	Stated WTP may depend on pocket allowance children receive each month.

Environmental-hazards-on-children's-health	Children trust in the relationship between environment and health is measured using a categorical variable: 1 -No influence to 5- High Influence	NA	WTP may be related to the degree of belief in the possibility of environmental hazards of influencing children' health
General altruism	"If my classmate is in a difficult situation I try to help him/her"; 0=No, 1=Yes	NA	WTP may depend on generic altruistic predisposition
Health-related altruism	"I am sorry if my classmate cannot come to school because he/she is not feeling good". 0=No, 1=Yes	NA	WTP may depend on health/welfare related altruistic predisposition
Welfare-related-altruism	"If my classmate has nothing to eat during the break I will share mine with him/her" 0=No, 1=Yes	NA	WTP may depend on health/welfare related altruistic predisposition
Non-paternalistic-altruism	"I will lend money to my classmate if he/she needs money to buy something" 0=No, 1=Yes	NA	WTP may depend on non-paternalistic altruism.

Care-of-children-for own-health	Five point categorical variable indicating the degree of care/worry for own health: 5= High concern, 4=Concerned, 3= Indifferent, 2= Little concern, 1=Not concerned at all	NA	WTP may be influenced by respondent's concern for his/her own health.
Health-risk-aversion-1	"I always brush my teeth before going to bed" 0=No, 1=Yes	NA	WTP may depend on health and safety risk attitude.
Health-risk-aversion-2	"I always use sunscreen to avoid sun burning" 0=No, 1=Yes	" Never using sunscreen when you sunbathe"	WTP may depend on health and safety risk attitude.
Health-risk-aversion-3	"I always wash my hands before going to eat because I am afraid of germs" 0=No, 1=Yes	NA	WTP may depend on health and safety risk attitude.
Health-risk-aversion-3	"I always use the seat-belt when I am in a car" 0=No, 1=Yes	"Not wearing a seat-belt when being a passenger in the front seat"	WTP may depend on health and safety risk attitude.
Health-risk-aversion-5	"I always wear and helmet when riding the motorbike" 0=No, 1=Yes	"Not wearing a helmet when riding a motorbike"	WTP may depend on health and safety risk attitude.
Recreational-risk-aversion-1	"I would go on a safari in the jungle" 0=No, 1=Yes	"Going camping in the wilderness, beyond the civilization of a campground"	WTP may depend on recreational risk attitude.
Recreational-risk-aversion-2	"I am scared when the motorbike goes fast" 0=No, 1=Yes	NA	WTP may depend on recreational risk attitude.

Recreational-risk-aversion-3	"I like going on holiday to places that I know because it is safer" 0=No, 1=Yes	"Going on a vacation in a third world country without prearranged travel and hotel accommodations"	WTP may depend on recreational risk attitude.
Recreational-risk-aversion-4	"I don't like to do dangerous sport (e.g. Banjee Jumping)" 0=No, 1=Yes	"Trying bungee jumping at least once"	WTP may depend on recreational risk attitude.
Recreational-risk-aversion-5	"I pay high attention when I cross the street" 0=No, 1=Yes	NA	WTP may depend on recreational risk attitude.
Rating	Feedback about the questionnaire: Very Easy=1, Easy, 3=Difficult, 4=Very difficult	NA	Ability to understand WTP questions may influence WTP estimates.

Parents' Questionnaire

Parent Age	Parent's Age. Continuous variable	NA	WTP may be influenced by respondents' age
Parent Gender	Gender of parent. 0=Female,1=Male	NA	WTP may change with gender
Family size	Number of family members. Continuous variable.	NA	Family size may affect WTP

Job type	Profession was used as a proxy of parent educational attainment. Parents answers were grouped into a three score categorical variable: 1= Profession requiring university degree, 2=profession not requiring university degree, 3= Unemployed.	NA	WTP may be related to parent's employment type
Family Budget	Family monthly budget excluding food and accommodation expenses was recorded using a categorical variable: 1= <600; 2=600-1200, 3=1200-2000; 4=>2000	NA	WTP for health risk reduction tends to increase with income
Environmental-hazards-on-children's-health-parents	Parents' trust in the relationship between environment and health is measured using a categorical variable: 0=Little influence; 1=Significant influence; 2= High Influence.	NA	WTP may be related to the degree of belief in the possibility of environmental hazards of influencing children' health

Care-for-their-own-health-parents	Five point categorical variable indicating the degree of care/worry for own health: 1= High concern; 2=Concerned; 3= Indifferent, 4= Little concern, 5=No concerned at all.	NA	WTP may be influenced by the respondent's concern for his/her own health.
Care-for-children's-health-parents	Five point categorical variable indicating the degree of care/worry for child's health: 1= High concern; 2=Concerned; 3= Indifferent, 4= Little concern, 5=No concerned at all.	NA	WTP may be influenced by the respondent's concern for their children's health.
Health-risk-aversion-parents	"I always use sunscreen to avoid sun burning" 1=Never, 2=Seldom, 3=Often	" Never using sunscreen when you sunbathe"	WTP may depend on health safety and risk attitude.
Smoking	"Do you smoke?" 1=Never, 2=Seldom, 3=Often	NA	WTP may depend on health and safety risk attitude.
Exercising	"Do you exercise?" 1=Never, 2=Seldom, 3=Often	NA	WTP may depend on health and safety risk attitude.
Health-risk-aversion towards-children	"I always use the helmet for my child when riding the motorbike" 1=Never, 2=Seldom, 3=Often	"Not wearing a helmet when riding a motorbike"	WTP may depend on health safety and risk attitude towards children.

Recreational-risk-aversion-1-parents	"I am scared when the motorbike goes fast" 1=Never, 2=Seldom, 3=Often	NA	WTP may depend on recreational risk attitude.
Recreational-risk-aversion-2-parents	"I like going on holiday in places that I know because is safer" 1=Never, 2=Seldom, 3=Often	"Trying bungee jumping at least once"	WTP may depend on recreational risk attitude.
Recreational-risk-aversion-3-parents	"I pay high attention when I cross the street" 1=Never, 2=Seldom, 3=Often	NA	WTP may depend on recreational risk attitude.

Note:NA: Not available; 1: Weber et al. (2002) A domain-specific risk-attitude scale: measuring risk perceptions and risk behaviors. J Behav. Dec. Mak. . Vol. 15 Issue 4 pp: 263-290.

Table 2: Debriefing questions used to test Scenario Acceptance

	Yes	No
I do not care about health		
The Mayor should deal with these problems		
I do not have enough money to deal with this problem		
I think there are other priorities		
The change in health risk was too low		
I needed more information to answer to the question		

Table 3: Test for inconsistencies to WTP questions. Children Sample (N=336)

	Yes	No
wtp1 > wtp2 and wtp2 = wtp3	17	319
wtp1 < wtp2 and wtp2 > wtp3	27	309
wtp1 > wtp2 and wtp2 < wtp3	29	307

Table 4: Test for inconsistencies to WTP questions. Parents Sample (N=165)

	Yes	No
wtp1 > wtp2 and wtp2 = wtp3	21	144
wtp1 < wtp2 and wtp2 > wtp3	5	160
wtp1 > wtp2 and wtp2 < wtp3	8	157

Table 5: Mean WTP values by age group and size of the health risk reduction

Variable	Mean WTP1 (95% CI)	Mean WTP2 (95% CI)	Mean WTP3 (95% CI)
Children (7-13 years) All Respondents	0.30 (0.26-0.34)	0.22 (0.19-0.25)	0.19 (0.16-0.22)
Children (14-19 years) All Respondents	0.18 (0.16-0.20)	0.12 (0.10-0.14)	0.09 (0.07-0.11)
Children (14-19 years) Respondents passing all three tests	0.18 (0.16-0.20)	0.11 (0.10-0.13)	0.08 (0.07-0.09)