Are children rational decision makers when they are asked to value their own health?

A contingent valuation study conducted with children and their parents.

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Abstract

Despite the importance of including children's preferences in the valuation of their own health benefits no study has investigated the ability of children to understand willingness to pay questions. Using a contingent valuation methods 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-paternalistic 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' and children's WTP suggests that parents are willing to sacrifice for their child's health risk reduction an amount that is approximately twice that 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.

1. Introduction

Stated preference studies are increasingly being used to assign a monetary value to the benefit of health care interventions affecting children (Alberini A et al., 2010; Adamowicz W. et al., 2014; Alberini A and Ščasný M, 2011; Hammitt JK. and Haninger K., 2010b). 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 using an adult perspective (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 may have different preferences 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's 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, 2006b).

Despite the common belief that children are not mature enough to speak for themselves, there are studies suggesting that that even at younger ages, children might be able to comprehend health risks, and understand and use money (Berti AE. and Bombi AS., 1981; Beutler I.and Dickson L., 2008; 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 WTP for reductions in the risk of asthma attack. Asthma attack was selected as a 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 answers 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 first tested for scope sensitivity. A further internal validity test is performed by including the children's demographic characteristics and attitudinal variables to verify whether they influence WTP

estimates in the expected manner. A unique feature of the data is that they include parent-child dyads from the same household. The second objective of this study is to compare children's and their parent's preferences for the child's health risk reduction and to investigate potential differences/similarities between the two perspectives using matched pairs of WTP answers.

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 were obtained from parents and children respectively.

The pilot studies and the final survey were conducted between February and April 2013 in Naples (Italy). Parents were not present when the children completed the questionnaire during school time. To avoid any influence of the parents on children's answers we administered the children's questionnaire first and, two weeks later, we administered the parents' questionnaire. Common pitfalls in stated preference studies conducted with adults are that respondents may fail to understand the health risk reduction and/or lack experience to trade money for health risk reductions (OECD, 2006a). As suggested by previous authors, there may be an additional problem that children may not understand how to use money and lack financial resources (Alberini A et al., 2010). In order to address these problems, before administering the CV questionnaire, we conducted two other studies: the first investigated the understanding of health risk among younger children and the best visual aids to use to communicate risk to younger ages groups (Guerriero C. et al., 2017). The second assessed the understanding and use of money among young children (Guerriero C. and Cairns J., 2017). Fundamental to the success of this study was the scenario being realistic to children of different ages and to their parents. Pre-tests and class discussions involved younger children to ensure that they understood the questionnaire, the scenario presented, the elicitation format and to improve the wording.

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 children were asked about their attitudes and behaviours. Most of the

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questions were simple psychometric ones developed for adults and adapted to children. The attitudinal and behavioural variables are described briefly in Table I (for further details see the Appendix).

Asthma health status. The health status of respondents has been shown to affect 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 asthma experience of the child influences the WTP of children and parents, 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. Since previous authors found that risk perception significantly affects WTP estimates (McDaniels et al., 1992; Vassanadumrongdee S and Shunji M., 2005), the children were asked to rate the relationship between environmental hazards and health using 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, and, in particular, the 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 questions ascertained 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 focus on children, 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 are anticipated 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) (See Table I).

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 behavior domains: health/safety and the recreational domain were investigated. As far as possible, parents and children were asked identical questions in order to reduce potential biases arising from the measurement of risk attitudes via different questions. Two generic questions investigated parental concern for their own health and their attitude to their children's health using five point Likert scales. The attitudinal and behavioural variables are described in the Appendix.

2.3 The Scenario valued

An asthma attack was described using a graphic pathography – an illness narrative in graphic form - to display the health condition being valued. By using the same picture to describe asthma effects in both questionnaires, asymmetric information between children (both those with and without experience of asthma) and between children and parents is reduced.

We developed a "cheap talk" script, with the assistance of a child psychologist, to inform the children about the issue of hypothetical bias, and to stress how important for the study it was that they report amounts that they would genuinely pay (Murphy J. et al., 2005; RG. and Taylor L., 1999). Before answering the CV questions, children were specifically asked to answer considering their own budget constraint. They were reminded twice, during the cheap talk, and just before answering the CV questions, about the opportunity cost of money. The following sentence was used: "*Keeping in mind that you cannot ask for additional money once you have paid for the health risk reduction and that any additional euro spent on the health risk reduction means less money to buy other things you need.*"

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: the largest (WTP1): from 20 in 100 to 1 in 100 children

having an asthma attack each month, a medium risk reduction (WTP2): from 20 in 100 to 10 in 100 each month, and the smallest reduction (WTP3): from 20 in 100 to 16 in 100 each month. As in Guerriero et al. 2017 pictographs were used to display the health risk reduction to be valued (Guerriero C. et al., 2017). 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 in CV studies. 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 (80%) 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 payment card format. As with previous studies conducted to test children's understanding and use of money, the pilot results indicated that, for younger children, it is necessary to use payment cards that are based on a budget constraint with which they are familiar (Furnham A., 2008; Furnham A. and Gunter B., 1997; Guerriero C. and Cairns J., 2017b). Even if, as pointed out by Webley, younger children are very active and rational economic agents, they understand money up to the value of their own budget (Webley P. et al., 2001). For the same reason we asked children to consider their own budget when answering and we did not investigate their WTP using a household budget constraint. Eliciting median monthly budget from young children during the same day as the CV and asking them to consider it when replying to the questionnaire would have been too tiring. Given that the children (aged 6-13) interviewed in Guerriero & Cairns (2017) (Study B) were the same as those included in the present study, we used median monthly budget by class to select the range for the payment cards. Further information on how their budget was estimated can be found in Guerriero and Cairns (2017). For older children, the highest value on the payment card was set as twice the value of the highest budget reported by children in a pilot asking about sources and amount of income. All of the children in the pilot studies agreed that the payment card approach was easier to understand than the open-ended format. There is no consensus on the appropriate number of cells to use in payment card questionnaires. If a limited number of entries is

provided it is easier/faster for the respondent to reply because the choice is limited, however, a lower number of cells reduces the efficiency of the approach (Rowe DR. et al., 1996). Given the low value of the youngest group's budget constraint (7.5 euros), we used a 12 cell payment card list. For older children, however, we included a larger number of cells to allow respondents greater precision in their replies. An exponential response scale was used to reduce range and centering bias (Rowe DR. et al., 1996). For ease of respondent review, the actual values listed on the payment card were rounded to one decimal place.

2.6 Debriefing questions

Children were asked if, in principle, they would be willing to pay 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 reasons for being unwilling to pay for health risk reductions (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 (WTP1<WTP2<WTP3). Test 2 checks whether WTP is completely insensitive to health risk change WTP1=WTP2=WTP3, and Test 3 investigates 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 explored (See the Appendix).

Logistic regressions were estimated to identify whether any individual characteristics were associated with 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 for parents and for children. Logistic

regression analysis was also used to investigate whether children's and parents' characteristics, attitudes and behaviors influence the likelihood of agreeing to pay for health risk reductions.

Mean WTP estimates were estimated using mid-point values. This approach assumes that true WTP is the mid-point between the cell ticked by the respondent and the following one. The main advantage of this estimation method is that it does not make assumptions about the functional form of the utility function and the appropriate method of analysis (Cameron TA., 1987; Ryan M. et al., 2004). In order to compare children's answers, and children and parents' answers, we estimated the mean proportion of the budget that parents and children are willing to pay for the three risk reductions. 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 generalised linear model (GLM) with a 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' socio-economic characteristics and attitudinal and behavioral indicators, by investigating whether they influence WTP in line with *a priori* expectations. The analysis was undertaken for all respondents excluding protest answers, and separately for those who passed Tests 1, 2 and 3. To investigate whether parent and child 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 an explanatory variable.

3. Results

3.1 Descriptive statistical analysis

Only three children refused to take part in the study. Table II 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 group. Information about asthma status was missing for 7 children. Parents confirmed the majority of the children's answers. Some degree of disagreement especially with the oldest children would be expected.

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 whom 43 percent were 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). Estimated WTP as a proportion of budget is reported by size of health risk reduction in Figures 2 and 3 for children and parents respectively.

3.2 Willingness to pay anything for health risk reduction

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 "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 (Carson et al., 1997).

As seen in Table III 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. Most of those refusing to pay said that the Mayor should deal with the problem. As with children, the proportion willing to pay zero slightly increased with the decreasing 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, belief 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

Twenty-four parents did not pass at least one of the three tests (14% of the sample) while for children the proportion giving "incorrect" answers is considerably lower, only 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 logistic regression results 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 likelihood of providing scope 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' mean WTP

Mean WTP, using a child and a parent's perspective, were estimated using the mid-point approach. Considering the entire sample of children the mean WTP is €28.3 (sd: 28.5), €18.9 (sd: 19.2), €14.6 (sd: 21.8) for WTP1, WTP2 and WTP3 respectively. Taking into account age differences, the mean WTP ranges between €12.1 (WTP3) and €18.3 (WTP1) for the youngest age group (7-13 years), and €16.3 (WTP3) and €35.0 (WTP1) for the oldest age group. For children's estimates, however, WTP depends on the underlying theoretical model assumed (Hoffman S. et al., 2006). If we assume children face the budget constraint of their parents, the WTP ranges between €44 (WTP3) and €88 (WTP1). If on the other hand, we assume that parents are the sole decision makers, WTP for children's health ranges between €115.3(sd: 132.4) and €173.1 (sd: 138.0).

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

Table IV 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 11 and 22

percent for the lowest and highest reductions respectively. The proportion of their budget that parents were willing to give up was significantly higher - ranging from 19 percent to 35 percent of the available budget. Table V, 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 VI compares the WTP estimates for parents, divided by child WTP, for the same health risk reduction. Parental WTP estimates always exceed those of their children, however, the difference narrows for largest health risk reduction.

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

Table VII 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. Although, older children are willing to pay more in absolute terms, they have a lower WTP when the proportion of budget is considered. The statistically significant, negative coefficient and marginal effect 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.

As seen in Table VII, children who experience frequent asthma attacks have a higher WTP compared with those who seldom suffer from asthma. Model 2 of Table VII 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. 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 VIII). Interestingly, the model finds that the age of the child is negatively related with parental WTP. Results show that parents employed in a highly skilled job have a higher WTP compared with unemployed parents. Model 2 results shows the effect of parental attitudes and beliefs on their WTP. 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. An interesting finding of Model 2 of Table VIII 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 their child's asthma risk.

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

Table IX 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 X 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 that of their parents for high and medium risk reduction but not for the lowest health risk reduction. This result 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 children rationality as economic agents and their ability to trade-off 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 WTP questions. We prompted children to consider their own budget but, as with adults, we do not know if they considered it while answering. Results do not suggest that children considered their parents' budget or that they assume that someone else was paying on their behalf. Indeed, compared to their parents, children are less likely to be willing to pay the highest bid on the card for reducing health risk (proportion of children willing to pay the highest bid:1.18% versus 17% parents) (Meyerhoff J. and Liebe U., 2006). Consistent 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. In the case of children, there has been much debate on whether to use higher WTP values for children to reflect their longer life expectancy (Dockins C. et al., 2002). Our research suggests that, as with parents, also children's WTP (in terms of budget proportion) decreases with child age (Bloomquist G.C. et al., 2010; Hammitt JK. and Haninger K., 2010a). Interestingly, both boys and fathers are willing to pay more compared to girls and mothers. As expected, 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 WTP estimates (Bateman IJ. et al., 2002). Children and parents 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.

Our findings also suggest that non-paternalistic altruism does influence WTP estimates in children.

To the best of our knowledge this study is the first investigating the similarities/differences between parental and child preferences. The analysis of matched pairs of parent-child answers also suggest that there are intra-household similarities in preferences, the child WTP for high and 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 (e.g. whether children's preferences are influenced only by the mother) using a larger sample.

CBA is the recommended regulatory instrument to gauge the feasibility of public health interventions affecting children's health. Given the vulnerability of children to environmental hazards the estimate of the monetary benefits of reducing children's health risk is essential to perform CBA (Pruss-Ustun A. and Corvalan A., 2006). The present study shows that even younger children might be rational decision makers when they are asked to value their own health and that their ability to do so improves

with age. In addition, given the difference found between child and parent WTP estimates, excluding children *a priori* might significantly bias CBA.

Decisions about child health are made within a household context and even if children are rational decision makers their preferences might not be considered. Guerriero et al. 2016 used the values estimated in the present study to estimate the monetary benefit of reducing indoor NO_2 exposure in London primary schools (Guerriero C. et al., 2016). To address the gap in information about the context of household decision making the study assumed three possible perspectives for the monetary valuation: a child perspective, a parental perspective and a child WTP adjusted for parental budget. Compared with previous CBAs, Guerriero et al. included for the first time a child perspective in the economic evaluation, however, more research is needed to investigate whether children influence directly or indirectly household decisions about their health. Future research may also explore whether child preferences are considered in 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, 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 given the importance of the topic to inform CBA it constitutes an important research question for the future.

Competing Interests

The Authors declare that they have no competing interests.

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TABLE I. DESCRIPTION OF THE ATTITUDINAL AND BEHAVIOURAL QUESTIONS USED WITH CHILDREN.

Name of the Variable	Description	Range
Environmental-hazards-on-children's-health	"Can the environment influence your health?"	Influence 1=no to 5=high
General-altruism	"If my classmate is in a difficult situation I try to help him/her"	0=No, 1=Yes
Health-related-altruism	"I am sorry if my classmate cannot come to school because he/she is not feeling good".	0=No, 1=Yes
Welfare-related-altruism	"If my classmate has nothing to eat during the break I will share mine with him/her"	0=No, 1=Yes
Non-paternalistic-altruism	"I will lend money to my classmate if he/she needs money to buy something"	0=No, 1=Yes
Health-risk-aversion-1	"I always wear a helmet when riding a motorbike"	0=No, 1=Yes
Health-risk-aversion-2	"I always brush my teeth before going to bed"	0=No, 1=Yes
Health-risk-aversion-3	"I always use sunscreen to avoid sun burn"	0=No, 1=Yes
Health-risk-aversion-4	"I always wash my hands before going to eat because I am afraid of germs"	0=No, 1=Yes
Health-risk-aversion-5	"I always use the seatbelt when I am in a car"	0=No, 1=Yes
Recreational-risk-aversion-1	"I would do a safari in the jungle"	0=No, 1=Yes
Recreational-risk-aversion-2	"I am scared when the motorbike goes fast"	0=No, 1=Yes
Recreational-risk-aversion-3	"I like going on holiday to places that I know because it is safer"	0=No, 1=Yes
Recreational-risk-aversion-4	"I don't like to do dangerous sport (e.g. Bungee Jumping)"	0=No, 1=Yes
Recreational-risk-aversion-5	"I pay careful attention when I cross the street"	0=No, 1=Yes

TABLE II. CHILDREN'S AND PARENTS' DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

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

TABLE III. 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%)	34 (9%)	NA	NA
WTP1	334 (99%)	2 (1%)	165 (95%)	8 (5%)
WTP2	334 (99%)	2 (1%)	162 (93%)	11 (7%)
WTP3	326 (97%)	10 (3%)	160 (92%)	13 (8%)

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

TABLE IV. WILLINGNESS TO PAY AS PROPORTION OF THE AVAILABLE BUDGET.

MEAN (95% CI)	WTP1	WTP2	WTP3
CHILDREN			
All (N=336)*	0.22 (0.20-0.24)	0.15 (0.14-0.17)	0.12 (0.10-0.13)
Those passing the three tests (N=321)*	0.22 (0.20-0.24)	0.14 (0.13-0.15)	0.11 (0.06-0.12)
PARENTS			
All (N=165)*	0.41 (0.36-0.46)	0.31 (0.27-0.35)	0.27 (0.23-0.32)
Those passing the three tests (N=141)*	0.35 (0.30-0.39)	0.24 (0.21-0.28)	0.19 (0.16-0.23)

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

TABLE V. 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
CHILDREN			
All (N=336)*	1.46	1.83	1.25
Those passing the three tests (N=321)*	1.57	2.00	1.27
PARENTS			
All (N=165)*	1.32	1.50	1.14
Those passing the three tests (N=141)*	1.45	1.84	1.26

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

TABLE VI. ARE THE CHILDREN'S WILLINGNESS TO PAY VALUES DIFFERENT FROM PARENTS?

	WTP1parents/ WTP1children	WTP2parents/ WTP2children	WTP3parents/ WTP3children
All Children (N=336)* & Parents (N=165)*	1.86	2.06	2.25
Those passing the three tests Children (N=321)* & Parents (N=141)*	1.59	1.71	1.72

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

TABLE VII. INTERNAL VALIDITY OF WILLINGNESS-TO-PAY ESTIMATES: CHILDREN'S 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	0.06(0.13)	0.01(0.01)	0.23(0.12)*	0.02(0.01)*
Natural Log of Pocket Money	0.10(0.06)	0.01(0.01)	-0.12(0.01)*	-0.01(0.01)*
Environmental-hazards-on-children's-health			0.21(0.07)**	0.03(0.01)**
General-altruism			-0.37(0.35)	-0.05(0.03)
Health-related-altruism			0.17(0.13)	0.02(0.02)
Welfare-related-altruism			-0.00(0.14)	-0.00(0.02)
Non-paternalistic-altruism			0.44(0.15)**	0.05(0.02)**
Recreational-risk-aversion-(1)			0.02(0.14)	0.00(0.02)
Recreational-risk-aversion-(2)			0.14(0.13)	0.02(0.02)
Recreational-risk-aversion-(3)			-0.28(0.13)	-0.03(0.02)
Recreational-risk-aversion-(4)			-0.12(0.12)	-0.01(0.02)
Recreational-risk-aversion-(5)			0.08(0.17)	0.01(0.02)
Health-risk-aversion-(1)			-0.15(0.23)	-0.02(0.01)
Health-risk-aversion-(2)			0.17(0.13)	-0.00(0.03)
Health-risk-aversion-(3)			-0.10(0.16)	0.03(0.03)
Health-risk-aversion-(4)			0.03(0.12)	0.01(0.03)
Health-risk-aversion-(5)			0.16(0.18)	-0.07(0.05)

TABLE VII (CONTINUES). INTERNAL VALIDITY OF WILLINGNESS-TO-PAY ESTIMATES: CHILDREN SAMPLE.

Care-of-children-for their own-health			-0.11(0.07)	-0.09(0.02)***
Constant	-0.44(0.24)		-1.21(0.59)*	0.12(0.06)
Log Likelihood	-264.53		-246.59	
AIC	553.16		549.18	
BIC	610.71		685.12	

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

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(017)	-0.00(0.03)
Recreational-risk-aversion parents (1)		-0.08(0.05)	0.14(0.18)	0.03(0.03)

TABLE VIII (CONTINUED). INTERNAL VALIDITY OF WILLINGNESS-TO-PAY ESTIMATES: PARENT SAMPLE

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 IX. MATCHED PARENT & CHILD INTENTION TO PAY FOR RISK REDUCING INTERVENTION.

| | | PARENT | | |
		Yes	No	Total
CHILD	Yes	145	6	151
	No	16	2	17
	Total	160	8	168

TABLE X. CHILDREN WILLINGNESS TO PAY GLM RESULTS INCLUDING SAME-HOUSEHOLD PARENTS' WILLINGNESS TO PAY AS COVARIATE.

	WTP1	WTP2	WTP3
	Coeff.(SE)	Coeff.(SE)	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

Figure1. Visual Aid used to communicate health risk reduction.
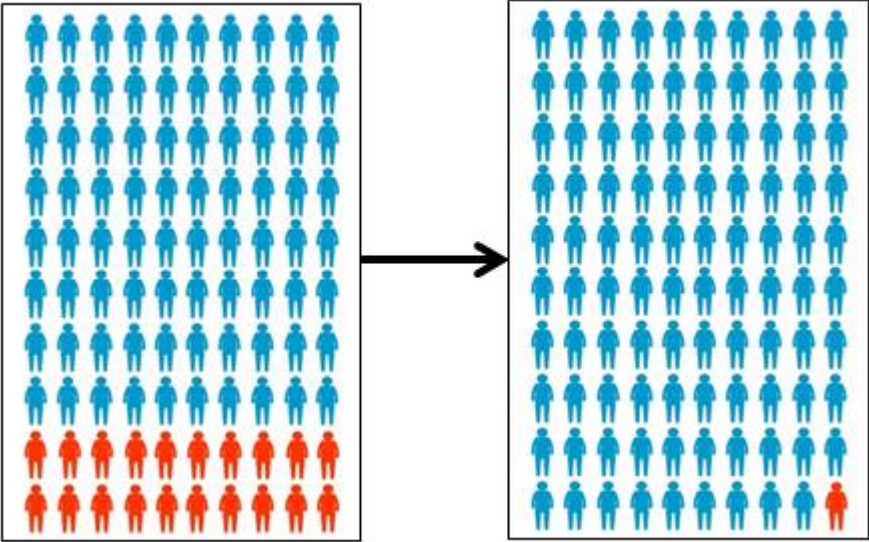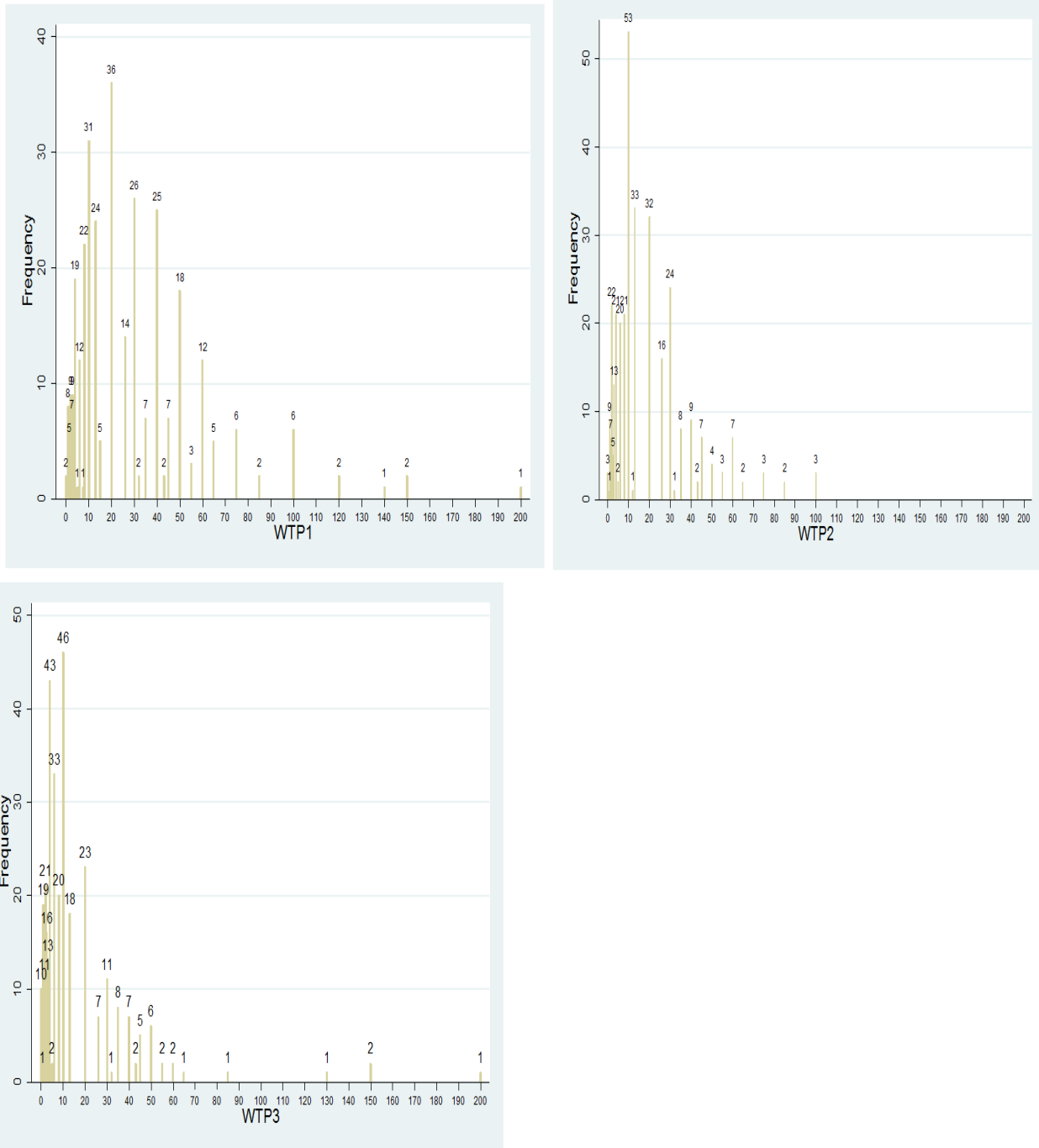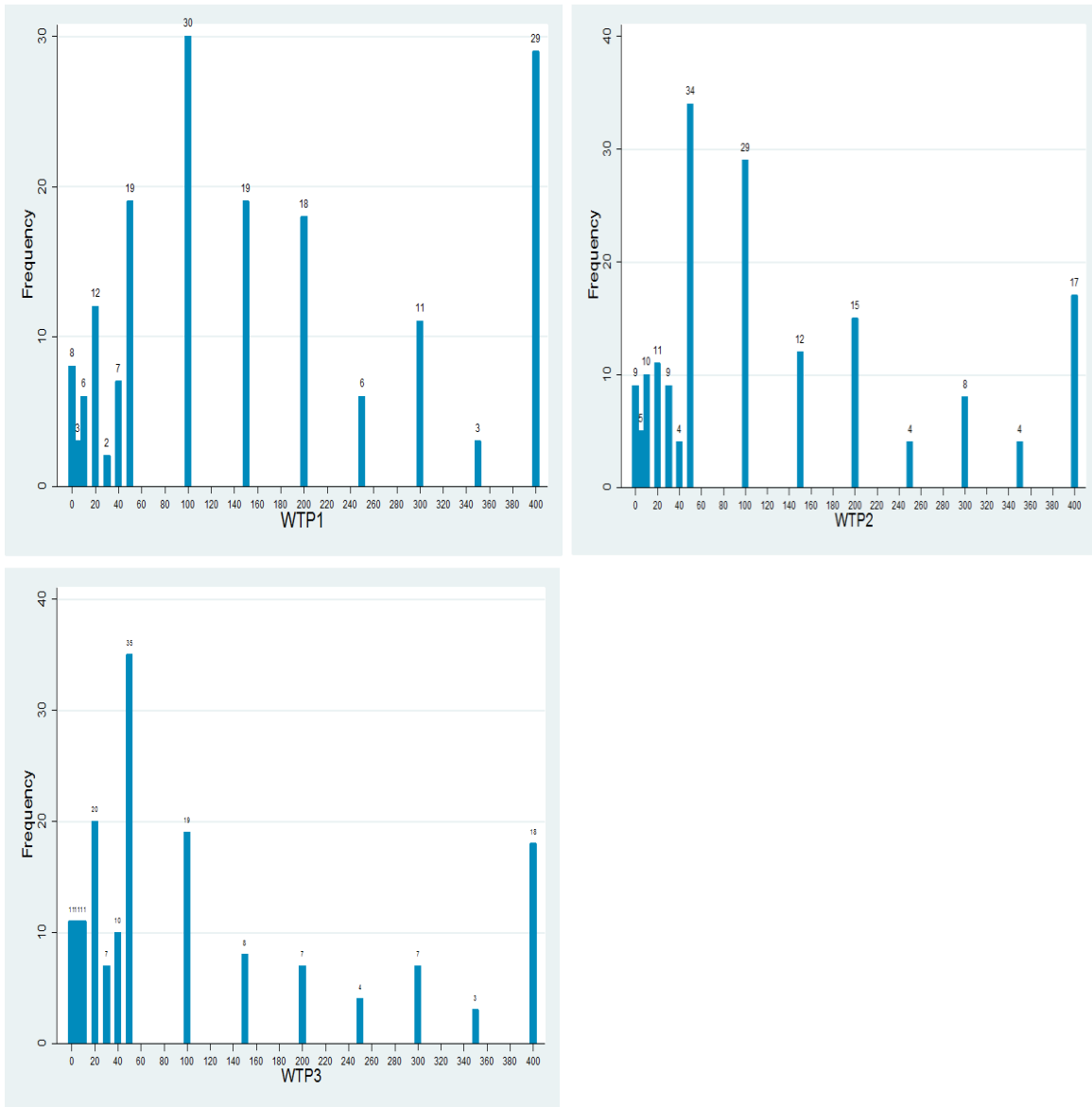
Figure 2. Children's willingness to pay by the size of the health risk reductions

Notes: WTP1: largest health risk reduction;WTP2: medium health risk reduction; WTP3: smallest health risk reduction

Figure 3. Parents' willingness to pay by the size of the health risk reductions.

Notes: WTP1: largest health risk reduction; WTP2: medium health risk reduction; WTP3: smallest health risk reduction