
# Focus on Babies: Evidence on Parental Attitudes Towards Pesticide Risks

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## Working Paper Series

Working Paper # 04-02
March, 2004


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**Abstract:** Studies that estimate the benefits of reduced environmental exposure typically assume that individuals know the true magnitude of the risk reduction. However, the accuracy of risk perception assumptions may be questionable. This issue has not been resolved with respect to adult risk reductions and becomes even more complicated when considering risk reductions to small children. We report results from focus groups with parents of small children regarding their risk perceptions over organic and conventional babyfood. Our results yield surprisingly consistent results between scientific and perceived risks. Previous literature reports a scientific risk reduction estimate of 1.98 per million, reflecting the reduced risk of death from cancer by avoiding pesticides in foods during the first year of life. The results from our focus groups show that parents estimate that the median risk reduction ranges from 1 to 8 per million, depending on specific demographic characteristics. Individuals with less than a four-year college degree provide the highest estimates, while women, those with more education and purchasers of organic babyfood provide lower estimates. We use these results to estimate parental willingness to pay for pesticide risk reductions to their children. Results show that parents in our focus groups who purchase organic babyfood express a value of a statistical cancer of approximately $9 million. These results provide a lower bound on the estimate for the value of reduced cancer risk from pesticide exposure in the first year of life.

**Keywords:** risk perceptions, children's health, health valuation, organic foods

**Subject Areas:** (11) Health, (62) Valuation, (63) Children's Health

## I. Introduction

Assessing the health benefits of reduced health risk often involves the use of valuation estimates derived from observed risk-dollar tradeoffs. In applying these estimates, it is generally assumed that individuals know the true magnitude of the risk reduction (1,2). However, if individuals consistently overestimate small risks and underestimate large ones (3), then the accuracy of risk perception assumptions in assessing benefits accruing to adults may be called into question. Reasons for risk perception disparities include unbalanced media coverage of high visibility events and personal experience associated with a particular risk (4). This is borne out in studies that show that workers tend to overestimate their risk of fatal injury on the job (5).

The importance of these issues in estimates of willingness to pay for adult risk reductions has not been completely resolved. These issues become even more complicated when considering health benefits to children since children are not responsible for their own health and safety decisions but rely on a third party – namely parents or care-givers – to make decisions regarding the relevant risk-dollar tradeoffs (6). As the number of studies that focus on valuing risk reductions to children increases, it is important to understand parental perceptions of children's health risks and the degree to which these comport with scientific measures.

Although children's risks are disparate, all children face some food-related risks. Because jarred babyfoods are available in organic and conventional varieties, attitudes toward this broad product class may provide some insight regarding parental perceptions of risks to their children posed by exposure to pesticide residues. Concern with

pesticides usually stems from their potential cancer causing properties. While the U.S. Environmental Protection Agency (EPA) certifies the use of pesticides in the U.S., they are not completely without risk. Some individuals may avoid consumption of affected products in order to avoid potentially harmful substances. These concerns may be magnified when considering children because of their developing systems and high food to body-weight ratio (6).

This study explores parental attitudes toward reduced dietary exposures to pesticide residues for their children from babyfood consumption. To the extent that parents perceive the risks to be different across organic and conventional babyfood, purchases of the "safer" product (i.e., organic) may provide a means for estimating parental willingness to pay for children's health risk reduction for purchasers. Specifically, we investigate whether parents perceive there to be a risk difference associated with the two types of babyfoods and the extent to which various demographic factors influence this perception. We estimate the perceived risk reduction associated with consuming organic jarred babyfood and use this information to estimate parental willingness to pay for reduced lifetime cancer risk to babies.

## II. Background

The motivation behind purchases of organic products is not necessarily straightforward. Avoiding health risks associated with exposure to pesticide residues is one of several potential joint products obtained through the purchase of a unit of the good. Consumers may also purchase organic products for other reasons, including concern for the environment, concern for the health of farm workers who handle

pesticides, or because they perceive the taste of organic products to be better than conventionally grown products.

Although we could find no study that focuses on parental attitudes toward children's exposure to pesticide residues, several studies examine risk perceptions associated with adult exposure to pesticide residues from the consumption of conventionally grown produce. By comparing purchasers and non-purchasers of organic produce, these studies lend support to the notion that purchasers of organic foods perceive the risks of exposures to pesticide residues associated with consuming conventionally grown foods to be greater than non-purchasers.

Hammitt (8), through a series of focus groups, finds that purchasers of organic products believe them to be substantially less hazardous than conventionally grown products. This finding is bolstered by Govindasamy et al. (9) who show that not only are purchasers of organic produce more risk averse toward exposure to pesticide residues, but also that females are 9 to 14% more likely to be risk averse than males. Also, households with two or more children are more likely to be risk averse to the tune of 22% compared to those with fewer or no children. Furthermore, Govindasamy et al. (9) find that households with higher income and higher education tend to exhibit lower risk aversion to pesticide residues than other households.

In a survey of food shoppers Williams and Hammitt (10,11) also find that purchasers of organic produce associate a large risk reduction with switching from conventionally grown products to organic. However, they did not observe substantial differences in demographic characteristics across purchasers and non-purchasers of

organic produce. Jolly (12) conducted a survey of California households and finds that purchasers of organic products tend to be more concerned about pesticide residues than non-purchasers. Jolly also finds that occupation, age and size of the community are significant predictors of the purchase decision.

It is not clear, however, whether these collective findings on risk perceptions extend easily to babyfood products. Several of the large manufacturers of babyfoods made from conventionally grown produce advertise that they have strict guidelines concerning the source of agricultural inputs and the manner in which they are grown (13-15). In some cases, manufacturers' explicitly assert that their guidelines are stricter than those imposed by government standards (13,15). Whether consumers are aware of these assertions, or more importantly, whether they perceive their effect to be reductions in exposures to pesticide levels for their children to a negligible level remains an open question. Regardless of manufacturers' claims, if purchasers of organic babyfoods still perceive a risk difference between organic and conventional varieties, then health concerns associated with exposure to pesticide residues may still be motivating their purchase decisions. Using results from focus group discussions with parents of young children, we explore parental risk perceptions associated with conventional and organic babyfoods and examine the determinants of these perceptions.

## III. Subject Recruitment and Data

Between August 2001 and February 2002, we conducted ten focus groups in five cities - San Jose, CA; Baltimore, MD; Philadelphia, PA; Richmond, VA; and

Washington, DC. There were two focus groups in each city and each group consisted of no more than nine subjects. The full script used to guide the discussions differed across all ten focus groups, but this analysis concerns a small subset of questions and issues common across the groups.

For each city we contracted with local marketing research firms to recruit subjects and arrange logistical details for the focus group discussions. The screener questions used for recruiting varied somewhat across cities as we identified different needs and improved on the type of subject best suited for the research. We recruited subjects who had at least one child ages two to five or younger. Since jarred babyfood is typically fed during the first 12 months of life, the cap on age ensured recruitment of individuals who could better recall babyfood purchase decisions. In our first city (San Jose), subjects with children older than two seemed to have a more difficult time recalling their jarred babyfood consumption decisions. In addition, organic babyfoods were not as prevalent when children close to age five were consuming jarred babyfoods (i.e., approximately 1997).[1] In later focus groups, we changed the child age restriction to subjects with at least one child age two or younger. We also recruited people who were responsible for household grocery purchase decisions since these individuals were most likely to think about the types of food to buy and the various risk components.

Common questions across focus groups consisted of queries about organic products and the food supply in general, such as how participants defined the term organic and if organic foods were healthier than conventional foods. Much of the discussions, however, were focused on babyfoods, including whether their child was fed

jarred babyfood, the brands that were used, how much jarred food their child was fed, and whether or not they fed their child organic foods and why. We also included some discussion of other risks their children face and how they felt these risks compared to pesticide-related risks. Finally, participants were asked to complete a risk ladder where they ranked the lifetime mortality risk from eating conventional versus organic babyfood and produce. These results are discussed in more detail below.

A total of 87 subjects participated in the ten focus groups. Two observations are excluded from our analysis because the participants did not appear to understand the risk ladder exercise and provided perverse results (i.e., negative risk reductions). We also exclude seven additional observations due to missing risk or demographic data. The final dataset consists of 78 observations. Table I reports the descriptive statistics for the participants. Approximately 54% of the sample is female and the average age is 34 years. There is some racial diversity in the sample; 71% of the sample is Caucasian and the remaining 39% of the sample identify themselves as African American, Hispanic, or Asian or Pacific Islander. Approximately 54% of the sample have a four year college degree and live in households with approximately two children. The average age of the oldest child in the household is four years and a little more than half the sample have purchased organic foods at some point in time.

**IV. Discussion of Issues**

We led participants through a discussion of several major issues surrounding food risks in general and babyfood in particular. Participants were asked their opinions about the meaning of an organic label, health risks from the food supply in general and

babyfood in particular and, for those who chose organic babyfood, we explored the reasons behind this decision.

*What does the label 'organic' mean?* Most participants were able to provide reasonable descriptions of organic foods. They used phrases such as 'pesticide-free,' 'chemical-free,' 'all natural,' 'antibiotic-free,' 'additive-free,' 'healthier,' 'more nutrients,' and 'more expensive' to describe organic foods. However, many participants expressed skepticism as to the extent to which organic foods were regulated or monitored.[2] Many participants were unsure what exactly was implied by the labels (e.g., did 'organic' mean 100% pesticide-free or just fewer pesticides), although some participants did note that they thought the labeling referred more to the farming methods than to the actual pesticide contents of the food. Some people thought that by peeling or washing produce well you would remove most of the pesticides.

*Health risks from food supply.* We queried participants about their thoughts regarding risks of the food supply, in particular health risks. Most participants felt that the food supply in the U.S. was generally very safe and that many of the risks came from handling and preparation as opposed to farming practices. Several participants did mention concerns about the depletion of nutrients in the soil. Those who felt that the food supply was unsafe believed that they had little control over these risks and how to avoid them. Participants also admitted to not spending much time thinking about these types of risks.

Participants also expressed concerns about genetically modified foods, cloning of animals, and antibiotics given to animals; most seemed uncertain about what these

technologies implied, but they knew that they wanted to avoid them. One participant raised the issue that hormones given to animals could induce the early onset of puberty in girls. Other participants said that the short-term issues were not as big a concern as long-term effects, such as cancer. Participants were also concerned about the diseases such as heart disease, cancer, and high blood pressure and tried to make efforts to eat wisely to avoid these health effects. With regard to children, many participants reported concerns with food allergies in their children.

*Risks and issues associated with babyfood.* Approximately 83% of the participants fed their children jarred babyfood at some point. Most used jarred babyfood as the primary means of feeding their child during the first year of life; other means of feeding included making babyfood using grinders or mashers or cutting up table food into small bites. Participants perceived jarred babyfood to be safer than the general food supply for a variety of reasons, including the use of special processing techniques to kill bacteria, reduced preservatives, and greater monitoring. For those who did not use jarred babyfood, a few did so to avoid chemicals, preservatives, and fillers, to have more control over the content of their child's diet or because of cost and convenience.

Participants were divided as to whether or not the consumption of conventionally produced jarred foods posed a risk to babies. Some participants thought that the period of time during which a child ate jarred babyfood was so short that it would not cause harm. However, others felt that because of babies size and developing bodies, the risks were greater at that age.

*Choosing organic babyfood.* For those participants who chose organic babyfood

for their child, many did so on an experimental basis. For example, they thought the flavors were interesting, they were exploring other options for their baby, or they had a coupon to try a particular brand. However, most participants who were experimenting with organic babyfood felt that the pesticide-free farming methods were also an important part of their purchasing decision. For some, the purchase decision was in response to health-related issues, e.g., allergies or reflux, and an attempt to control them through diet. For participants who chose organic babyfood deliberately or exclusively, they did so because of the health risk reductions.

In summary, the issues surrounding food safety and the choices between organic and conventional babyfood were not immediate and high priority concerns. With regard to the general food supply, participants perceived organic foods to be safer, but they were uncertain about the true effects and therefore often chose to purchase conventional varieties. With regard to babies, parents listed traumatic injuries as being their most important risk concern, health or otherwise. Participants were concerned about falls, head injuries, sudden infant death syndrome (SIDS), kidnaping, guns, and eating healthy and some participants stated that these were the types of risks they felt they had the most control over. However, several participants did state that long-term health risks were of primary concern.

**V. Risk Analysis**

In addition to exploring attitudes and preferences, we also queried participants about their risk beliefs. In order to gather the risk information, we gave participants a risk ladder to complete. The purpose of risk ladders is to provide individuals with

information on the probability of experiencing a range of risks and then to ask them to identify where they believe a particular risk lies on the continuum. We used a modified risk ladder derived from the Williams and Hammitt (11) study. The risks are divided into three categories, corresponding to high (>50 deaths per million), medium (>2 to 50 deaths per million), and low (≤ 2 deaths per million) risks. Participants were asked to mark their responses to the following statements:

> *a. Suppose you fed your child conventional jarred babyfood exclusively. Estimate the risk of your child eventually dying from cancer or other disease caused by pesticide residues as a result of eating the conventional jarred babyfood.*
> *b. Suppose instead that you fed your child organic jarred babyfood exclusively. Estimate the risk of your child eventually dying from cancer or other disease caused by pesticide residues as a result of eating the organic jarred babyfood.*

Some participants felt that the task was difficult, but most were able to provide a justification for their responses that comported with our earlier discussions. That is, those who felt the risks were negligible stated that babies do not eat jarred food long enough to result in significant risks, while those who expressed higher risks were more concerned about the food to body-weight ratio in babies and the effects of pesticides on a child's developing, fragile systems. Next we discuss the results according to four characteristics of the sample: gender, eduction, age, and purchaser status.

*Gender.* There is little evidence in the literature regarding how men and women view organic foods to guide our expectations. One study found that males were less likely to purchase organic foods, which could indicate that males do not believe organic foods are safer or they do not believe dietary exposure to pesticides to be of concern (16). However, another study found inconclusive evidence regarding gender attitudes toward

pesticides; in one sample females thought pesticides were very risky, whereas in a second sample the opposite was true (9).

In our sample, 46% of the participants are male. For men, the risk estimates for conventional babyfood range from 0 (n=1) to 2.5 in 1000, with a median value of 5 in 1 million. For organic babyfood the range is from 0 (n=7) to 5.35 in 10,000, with a median value of 3 in 10 million. Among the women, the risk estimates for conventional babyfood range from 0 (n=2) to 3 in 1000, with a median value of 3 in 1 million. For organic babyfood, the estimates range from 0 (n=5) to 4 in 10,000, with a median value of 7.25 in 10 million. Men estimate the conventional babyfood to be slightly riskier than do women, whereas women estimate organic babyfood to be slightly riskier than do men, though the differences are small. As for the risk reduction conferred by organic babyfood, Table II provides information on the distribution of the estimates across men and women. Men believe the median risk reduction is 3 in 1 million, whereas women believe the median risk reduction is 2 in 1 million. Therefore, men believe the risk reduction to be slightly higher than women, however the differences between the groups are very modest. Using a chi-squared test, the differences between the proportion of men and women who fall into each category is not significant (test-statistic = 6.60, p-value = 0.25, $\chi^2_{0.05,5} = 11.07$).

*Education.* We hypothesize that there is an inverse relationship between education and the risk estimates. Individuals tend to over estimate the occurrence of low probability events, such as the risk of eventually dying from cancer due to pesticide exposure in the first year of life (3). As education increases, we expect people to better

understand risks and therefore to provide more accurate responses, which in this study we assume means lower risk estimates. Indeed, Govindasamy et al. (9) found that people with only a high school degree were 10% more likely to say that pesticides were very risky to human health as compared to those with more education.

In our sample, 46% of the participants have less than a four year college degree. For this group the minimum risk for conventional babyfood is 4 in 100 million, whereas three participants in the group with more education estimate the conventional risk to be zero. Further, the group with less education estimated the median organic risk to be 2.8 in 100,000 compared to 2 in 1 million among those with more education. The group with more education clearly provides lower risk estimates for organic and conventional babyfood.

As for the estimated risk reduction conferred by organic babyfood, Table II provides information on the distribution of the estimates across the two groups. The group with less education estimates the median risk reduction to be 8 in 1 million, whereas the higher educated group estimates the median risk reduction to be 1 in 1 million. A chi-squared test, however, indicates that the proportion of participants in each category is the same across educational status (test-statistic = 8.24, p-value = 0.14, $\chi^2_{0.05,5} = 11.07$).[3]

*Age.* Turning now to age differences, as people get older they become more risk averse, which could imply that older people associate higher risk reductions with organic babyfood. However, as people get older they also become more aware and knowledgeable of risks, which could imply lower risk reductions for organic babyfood

(i.e., relative risk rankings change). Dunlap and Beus (17) find that younger people are more anti-pesticides and Bryne et al. (16) find that older people are less likely to purchase organic foods. However, Govindasamy et al. (9) find that older people are more likely to believe that pesticides are very risky.

In our sample, 53% of the participants are under the age of 34. We find little difference in the estimates of risks between those under age 34 and those 34 and older. The ranges are similar for both types of babyfood and the median estimate for conventional babyfood is 4 and 5 per 1 million for the older and younger groups, respectively. The median estimate for the organic babyfood is 6.5 and 4 in 10 million for these same groups. It could be the case that parents of young children fall into such a tight age distribution that there is little distinction in their preferences by age.

As for the risk reduction conferred by organic babyfood, Table II provides information on the distribution of the estimates across the two age groups. Younger parents believe the risk reduction is 2 in 1 million, whereas older parents believe the risk reduction is 3 in 1 million. It could be the case that younger parents focus on other, more immediate risks, such as traumas. However, older parents, whose own health concerns may be more apparent, are considering other long-term risks more seriously. Interestingly, according to a chi-squared test the proportion of participants in each category does differ across age groups (test-statistic = 11.40, p-value = 0.04, $\chi^2_{0.05,5}$ = 11.07); these differences are likely to be driven by the lower risk categories where the differences between older and younger participants are more drammatic.

*Organic purchasers.* A common question discussed during our focus groups was

whether or not participants fed their children organic babyfood. There were few exclusive purchasers in our sample; most of the purchasers also used conventional brands. We hypothesize that purchasers (regardless of their intensity) have a higher estimate of the risk reduction conferred by organic babyfood than non-purchasers. In fact, some of the qualitative responses provided regarding why participants purchased organic babyfood include, health reasons, lack of preservatives, all natural properties, and the lack of pesticides. This portion of the analysis focuses on the 62 people who provided information on whether or not they fed their children organic babyfood.

In our sample, 58% of the participants had purchased organic babyfood. The risk estimates for conventional babyfood among this subset range from 0 (n=1) to 3 in 1000, with a median value of 1 in 1 million. For organic babyfood the risk range is much smaller, from 0 (n=5) to 4 in 10,000, with a median value of 1.75 in 10 million. As expected, the risk from organic foods is estimated to be much smaller than the risk from conventional babyfood, in this group. Among the 42% of the participants who have never purchased organic babyfood, the risk estimates for conventional babyfood range from 2 in 100 million to 2.5 in 1000, with a median value of 8 in million. For organic babyfood, the estimates range from 0 (n=3) to 4 in 10,000, with a median value of 4 in 10 million. The purchasers rate babyfood in general as less risky than the non-purchasers. As for the risk reduction conferred by organic babyfood, Table II provides information on the distribution of the estimates across the two groups.

Interestingly, the purchasers estimate the median risk reduction to be 1 in 1 million, whereas the non-purchasers estimate the risk reduction to be 4 in 1 million. This

is counter-intuitive in that we expect that those who purchase the organic babyfood do so at least partly because of risk reduction features. Indeed, the qualitative responses support this hypothesis. However, it could be the case that the purchasers also understand the risks to be small, albeit present. In addition, the chi-square test finds no difference in the proportion of participants in each category across the two groups (test-statistic = 4.04, p-value = 0.54, $\chi^2_{0.05,5} = 11.07$).

In summary, we find that organic purchasers estimate the risk reductions from organic jarred babyfood to be smaller than non-purchasers. We should note that organic purchasers are identified as anyone who had ever purchased organic jarred babyfood, even once. Therefore, the method in which we categorize participants is a loose approximation to actual purchasing behavior. Participants who are more highly educated, younger, and male all estimate that the risk reduction from consuming organic jarred babyfood as lower than their counterparts in the corresponding categories. However, these differences are only significant by educational status.

**VI. Willingness to Pay for Reduced Pesticide Exposure**

The information collected during our focus groups can be combined with babyfood prices to estimate parental willingness to pay for reductions in lifetime cancer risks from dietary exposure to pesticide residues in infancy for purchasers of organic babyfoods. From our focus groups, it is apparent that parents who purchase organic babyfood do so in part to reduce their child's exposure to pesticide residues due to health concerns. If, in fact, the health risk reduction is their sole reason for purchasing organic varieties, this decision would signal that their value for the risk reduction is at least as

great as the price they pay for the organic babyfood; but, we would not know their maximum willingness to pay.[4] Discussion and presentation of these estimates is useful, in spite of their limitations, given the paucity of such information for infants and specifically for reduced cancer risk. Estimates of parental willingness to pay for those purchasing organic babyfood can be calculated by following Freeman (18). That is,

$$WTP \geq \frac{\rho_O}{\pi_C - \pi_O}, \tag{1}$$

where *WTP* is the willingness to pay value revealed through the purchase of the organic babyfood, $\rho_O$ is the price premium for organic babyfood, $\pi_C$ is the perceived risk for conventional babyfood, and $\pi_O$ is the perceived risk for organic babyfood. The value revealed by equation 1 provides an estimate of the value of a statistical risk reduction, or cancer, for a child reflected through the consumption of organic babyfood. By implication, willingness to pay for those who do *not* purchase organic babyfood is less than the right hand side of the equation.[5]

*Estimating the annualized price premium*

Estimating the annual price premium associated with the purchase of organic babyfood (i.e., the numerator in equation 1) requires information on the per jar price premium associated with organic babyfood and the per infant consumption of babyfood.

In the U.S., approximately nine out of ten babies eat some commercial babyfood (19); we found similar results during our focus group discussions. Consumption of jarred babyfood can vary dramatically depending upon when table foods are introduced and tolerated. Some infants may consume little jarred babyfood once grasping skills are mastered while others may consume virtually no table food until after 12 months of age. Based on our focus group discussions, we estimate that the average infant consumes approximately 600 jars of babyfood.[6]

In a previous paper (20), we estimate the price premium associated with organic babyfoods using hedonic techniques and find the per jar price premium to be approximately 12.5 cents per jar.[7] We estimate the annual price premium associated with the purchase of jarred organic babyfood is $75.00 (600 jars*$0.125).

The premium associated with organic babyfood may exist for a variety of reasons including a reduction in health risks (e.g., cancer), the perception that organic foods are better nutritionally, the fact that organic foods cost more to produce, and the perception that organic brands have more interesting flavors (21). As discussed previously, parents felt that health benefits were an important reason to choose organic babyfood, though we recognize that it may not be the only reason for their choice. Hence, we make a variety of assumptions concerning the portion of the price premium associated with reduced risk of cancer. First, we assume that the premium is evenly distributed across the four reasons noted above (health, nutrition, production, and flavor). We also assume that one half of the premium is attributable to reduced risk of cancer and that the entire premium is attributable to reduced risk of cancer. While these are somewhat arbitrary assumptions,

they do provide a sensitivity measure in our results.

*Risk Reduction*

In order to estimate the denominator of equation 1, we need a measure of the risk reduction conferred by organic babyfood. Typically, studies rely on a scientific measure to proxy for risk perceptions. However, as mentioned earlier, risk perceptions are not always a close approximation to the risk reduction individuals perceive. A recent study used intake data from the U.S. Food and Drug Administration's Total Diet Study to calculate the one year cancer risk from consuming a typical basket of food (22). They use food diaries to determine the content of a typical American diet and then test these foods for pesticide residues, which are then converted into cancer risks. The authors estimate the one year cancer risks for babies under age 1 to be 1.98 per 1 million. This estimate provides one option for the denominator in equation 1.

Using our results from Table II purchasers of organic babyfood estimate the risk reduction to be in 1 in 1 million, or about half of the scientific estimate. While we are comforted by the degree to which perceptions mirror the scientific estimate, the differences for valuation estimates are significant and therefore we rely on the perceived risk reduction in our calculations.

*Estimating Willingness to Pay*

In addition to the assumptions regarding reasons for purchasing organic babyfood, we also calculate our estimates assuming that an infant consumes either all organic babyfood or all conventional food, or half of each. While several participants in our focus groups fed their child organic babyfood exclusively, more often parents used

both organic and conventional babyfood. Estimates of parental willingness to pay for cancer risk reduction are presented in Table III.

We find that the range of estimates is from approximately $9 million to $75 million depending on the assumptions we make regarding consumption and reason for purchase. As mentioned above, the correct interpretation of our estimates is a lower bound on parental willingness to pay for reduced cancer risk from infant exposure to pesticide residues for organic purchasers only. Our focus groups indicated that approximately 58% of parents purchased organic babyfood though the market share of organic food is much smaller. Thus, it is likely that the above estimates are slightly higher than the median estimate for all parents.

We believe $9 million represents the best estimate, based on our focus group discussions regarding reasons for purchase and the number of organic jars purchased. Participants in our focus groups provided a variety of reasons for choosing organic babyfood, including health, nutrition, flavor, etc. Hence, we believe the assumption that 25% of the purchase decision is for health related reasons is a more accurate reflection of parental behavior than our other assumptions. Second, while some parents purchased organic babyfood exclusively, most also included conventional varieties in their child's diet. Hence, the assumption that half of the jars are organic is likely to be a more accurate reflection of actual choices.

Of question is how this estimate compares to others. The literature regarding the value of reduced health risks to children and particularly infants is quite sparse. Two studies estimate the value of a statistical child's life; however, both deal with immediate,

accidental risks. Carlin and Sandy (23) examine mothers' purchase and use of child safety seats to estimate a value of statistical life for a child of $0.75 million (1997 dollars). Jenkins, Owens and Wiggins (2) estimate adult and child VSLs based on purchases of bicycle helmets. VSL estimates for the adults range between $2.0 and $4.0 million while estimates for children range between $1.1 and $2.7 million (2001 dollars). Mount et al. (24) estimate the average VSL for family members based on results from a survey on individual automobile usage. In families with both adults and children, the VSL of children ranges from $2.5 to $5.1 million.

We are not aware of any studies estimating willingness to pay for reduced cancer risks to children or infants. Gayer, Hamilton and Viscusi (25) use a repeat housing sale model to test whether prices respond to changes in information about cancer risk from Superfund sites. They find that the value of a statistical cancer case for adults is $5.1 to $9.7 million.

While not directly comparable, our estimates are generally higher than those obtained in other safety product market studies dealing with adult populations and are higher than those obtained for children. However, when taken together these studies may indicate that the value of reducing risks is highest for infants.

## VII. Conclusions

In estimating the value of health risk reductions, how individuals perceive those reductions is important. We know that individuals can both over and under estimate risks depending on a number of factors, including media coverage, knowledge, and awareness of the risks (3). The extent to which scientific and perceived risks comport is

complicated for children's risks. Decisions regarding risks to children are made by a third party - namely, parents or other care givers - and it is not clear how these third parties perceive risks for the children in their care.

Our results from focus groups with parents of young children yield surprisingly consistent results regarding the degree of similarity between scientific and perceived risks. One scientific estimate indicates that the reduction in cancer risks from pesticide exposure during the first year of life is 1.98 per million (6). Our focus group results indicate that the median risk reduction estimates range from 1 to 8 per million, depending on the demographic variable of interest. Individuals with less than a four-year college degree provide the highest estimates, while women, those with more education and purchasers of organic babyfood provide lower estimates.

We use the risk reduction estimate from purchasers of organic babyfood, combined with the price premium of organic babyfood to estimate a value of statistical cancer of approximately $9 million. This estimate reflects a lower bound estimate for purchasers exclusively and should not be extended to the rest of the population. The fact that this estimate is larger than those found in the literature may be due to the fact that it is a third party estimate for cancer, which carries with it feelings of dread. In addition, risks for children are not always well defined and this uncertainty may drive the higher result.

Health is just one of many risks parents must address when making decisions regarding their children. We find that often traumatic injuries and other more immediate risks are of more pressing concern to parents of young children. And, indeed, long-term

health risks are likely to be lower than those for other immediate fatalities. Nonetheless, parents do express concern for their child's health and make choices regarding the foods to feed their child that reflect those concerns. We find that individuals are able to estimate risk reductions for long-term health risks that comport with those found in the scientific literature. And, when combined with information regarding prices, parents who purchase organic babyfood reveal a value of a statistical cancer to their child of approximately $9 million, an estimate that may be greater than those found in the literature for older children.

| Table I: Descriptive Statistics | | |
|---|---|---|
| **Variable** | **Mean** | **Standard Deviation** |
| Gender (Female = 1) | 0.54 | 0.50 |
| Age | 34.35 | 7.71 |
| Race (Caucasian=1) | 0.71 | 0.46 |
| Education (4 year college degree =1) | 0.54 | 0.50 |
| Number of children | 2.14 | 1.72 |
| Average age of first child | 4.05 | 3.73 |
| Average age of all children (n=66) | 2.46 | 1.70 |
| Purchase organic foods (yes=1; n=62) | 0.58 | 0.50 |
| n=78 | | |

**Table II: Risk Reduction from Organic Food by Selected Participant Characteristics**

| Participant Characteristic | Risk Reduction (in a million) | | | | | | Median Risk Reduction |
|---|---|---|---|---|---|---|---|
| | **0-0.1** | **0.1-1** | **1-10** | **1-100** | **100-1000** | **1000-10000** | |
| Gender: | | | | | | | |
| Male (N=36) | 33.33 | 5.56 | 22.22 | 16.67 | 13.89 | 8.33 | 3 in a million |
| Female (N= 42) | 16.67 | 23.81 | 19.04 | 19.05 | 14.29 | 7.14 | 2 in a million |
| Education: | | | | | | | |
| < than 4 yr degree (N=36) | 13.89 | 13.89 | 22.22 | 27.78 | 11.11 | 11.11 | 8 in a million |
| ≥4 yr degree (N=42) | 33.33 | 16.67 | 19.05 | 9.52 | 16.67 | 4.76 | 1 in a million |
| Age: | | | | | | | |
| < 34 years (N=41) | 19.51 | 26.83 | 14.64 | 19.51 | 9.75 | 9.76 | 2 in a million |
| ≥34 years (N=37) | 29.73 | 2.70 | 27.03 | 16.22 | 18.91 | 5.41 | 3 in a million |
| Organic Buyer Status: | | | | | | | |
| Purchaser (N=36) | 16.67 | 25.00 | 22.22 | 16.67 | 11.11 | 8.33 | 1 in a million |
| Non-purchaser (N=26) | 30.77 | 7.69 | 26.92 | 15.39 | 11.54 | 7.69 | 4 in a million |

| Table III: Estimate of Parental Willingness to Pay by Consumption and Premium Distribution Assumptions ($2002) | | |
|---|---|---|
| **Portion of Premium Attributed to Cancer Risk Reduction** | **Consumption Assumption** | **WTP for Cancer Risk Reduction ($ millions)** |
| 25% | half of jars consumed are organic | $9 |
| 50% | half of jars consumed are organic | $19 |
| 100% | half of jars consumed are organic | $38 |
| 25% | all jars consumed are organic | $19 |
| 50% | all jars consumed are organic | $38 |
| 100% | all jars consumed are organic | $75 |
| Note: Assumes consumption of 600 jars with an organic premium of 12.5 cents per jar. | | |

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## Endnotes

1.
Tender Harvest, a Gerber line of organic babyfoods was introduced in the late 1990s and by 1996 Earth's Best, a strictly organic brand of babyfood, was only sold in approximately 45% of supermarkets (see 20 and 21 for more information on the structure of the babyfood market).

2. New U.S. Department of Agriculture (USDA) guidelines went into effect in October 2002 requiring that producers and handlers be certified by a USDA-accredited agent to sell, label, or represent their products as organic (26). Therefore, at the time we conducted the focus groups these standards were not in effect.

3. The chi-squared test is limiting in that it depends on how the "bins" are selected. A different selection could provide different results.

4.It is important to note that our sample was not scientifically drawn and as a result our estimates are not representative of any population. Nevertheless, they do provide some insight into parental willingness to pay for reduced risk from exposure to pesticide residues.

5.While this may be true when looking at any one "safety product" it may not be the case when looking at the combined decisions of parents.

6.Focus group participants fed their children an average of 3 jars per day for 7 months (months 5 through 11, inclusive) or 630 jar, we rounded this to 600 in order to be conservative and for ease of exposition. This estimate is confirmed by the Environmental Working Group, which estimates that the average baby consumes 600 jars of babyfood (18).

7.In our earlier study (20) we find that the organic premium is 10 to 15 cents per jar. For this study we take the mid-point of that range for use in the valuation calculations.