

Peanut Allergy in Children:

Relationships to Health-Related Quality of Life, Anxiety, and Parental Stress

By

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Submitted to the Clinical Child Psychology Program and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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### Acknowledgements

The author wishes to acknowledge the funding support received from the Food Allergy Initiative that enabled the completion of this project.

## Abstract

Although peanut allergy in children has gained increasing amounts of media attention over recent years, very little scientific study has been done regarding the emotional/behavioral impact that peanut allergy may have on children. The potential psychological effects have been mentioned by many medical researchers, but few studies have systematically investigated the link between peanut allergy and non-medical consequences. This study examined relationships between Health Related Quality of Life (HRQOL), child anxiety, and parental stress in a sample of children with peanut allergy. Families were recruited to complete a series of measures wherein 51 parents completed a demographic questionnaire, the Parenting Stress Index, a Pediatric Quality of Life Inventory (PedsQL 4.0), and a series of questions regarding their child's peanut allergy. The 48 participants, ages 6 to 12 years, completed a Revised-Children's Manifest Anxiety Scale, a PedsQL 4.0, and some specific questions regarding their peanut allergy. Regression analysis showed that child anxiety and parenting stress were found to significantly predict parent proxy-report of their child's health related quality of life. Regression analysis also found that child anxiety, parenting stress, length of diagnosis, and not requiring an epinephrine shot for treatment predicted self-report of health-related quality of life in children with peanut allergy. Health-related quality of life in children with peanut allergy was affected not only by the severity of the allergy, but family reactions to the allergy. High levels of parenting stress and high levels of child anxiety seem to contribute to the experience of the allergy and should be considered when treating these families. Both medical personnel and mental health practitioners will need

to be aware of the potential impact of non-medical variables in order to assist families in dealing with this life-threatening and life-changing allergy.

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Peanut Allergy in Children: Relationships to Health-Related Quality of Life, Anxiety,  
and Parental Stress

Food allergy, the negative physiological reaction to proteins in food, is estimated to affect 20 percent of the world's population (Anderson, 1997). In the United States, the three most common foods that cause allergic reactions in children are milk, eggs, and peanuts. Double-blind placebo-controlled food challenges, often considered the "gold standard" in food allergy testing, have been used to ascertain the current prevalence of food allergy in children. These studies indicate that the prevalence of true food allergy during the first three years of life is approximately 8% (Smith & McGhan, 2002). In older children and adults the rate is estimated to be 1 to 2 percent of the population (Anderson, 1997). Seventy percent of people with food allergies are under the age of thirty and most of those people are under the age of six (Smith & McGhan, 2002).

The majority of food allergies and intolerances in children appear to be "outgrown." Foods which are not tolerated early in life can sometimes be ingested with no difficulties at an older age; examples of this include dairy products and eggs. How quickly this developmental shift happens is often dependent on the severity of the initial allergic reaction. Less severe reactions such as hives usually mean that the allergy subsides sooner than if a more systemic reaction to the food occurred initially (Anderson, 1997). Unfortunately, this tendency for symptoms to subside naturally is not true for all food allergies. Some surveys have found that individuals who have exhibited an allergy to peanuts have been found to still be allergic 14 years later, much is the same for allergies to tree nuts, fish, shellfish and some seeds, which also seem to be lifetime allergies (Anderson, 1997). Other researchers have found that peanut allergy does resolve

in approximately 20% of patients (Fleischer, Conover-Walker, Christie, Burks, & Wood, 2003). That is, some children who were at one time found to be allergic to peanuts were able to tolerate peanuts and peanut substances in allergy tests several years later.

### *Peanut Allergy*

The prevalence of peanut allergy is thought to be increasing. A survey in 1989 estimated the prevalence at 0.6% in the United States (Sampson & Burke, 2000), while more recent surveys place the U.S. rate for adult allergy to peanuts and other nuts between 1.1 and 1.3% (National Institute of Environmental Health Sciences, 2002; Sampson, 2001).

Emmett, Angus, Fry, and Lee (1999) studied both a cohort of children with peanut allergy and an adult group. They found that not only was the child cohort more sensitive, but they had had their first allergic reactions at a younger age. Fifty-six percent of the children had had their first allergic reaction to peanuts in the first two years of life, while 75% of the adult sample did not have a reaction until after the age of 10 (Emmett et al., 1999). It is not known if the difference in the average ages of onset between the two age groups is due to earlier exposure to peanut products in the younger age cohort. A group of French researchers (Moneret-Vautrin et al., 1998) found that, in their sample, 46% of those allergic to peanuts had their first symptoms before the age of 1 year (for 11 babies before the age of six months), and 34% between the ages of 1 and 3 years of age.

A more recent study (Green et al., 2007) found that the mean age of first exposure to peanut proteins and the mean age of first reactions to peanuts have decreased over the last decade from means of 22 months at first exposure and 24 months at first reactions to

14 months at first exposure and 18 months at first reaction. Eighty three percent of the sample had an allergic reaction the first time they ingested peanuts.

Peanuts are a difficult food to avoid because they are commonly added to many pre-packaged food items or processed in the same manufacturing plants as other foods. Yu et al. (2006) found an accidental annual ingestion rate for children with previously diagnosed peanut allergy to be 14.3%. Despite the vigilance of their parents, 29 children (of the 252 children followed) had 35 accidental exposures to peanuts over a period of 244 patient years (most of the children had been followed for at least one year). Given the physiological impact, increasing numbers of medical researchers are investigating peanut allergies (Sampson, 2002). However, despite this enhanced research on the physiological and epidemiological characteristics of peanut allergy, less research has been done on the possible effects of having a peanut allergy in terms of these children's quality of life and psychosocial functioning. In some cases, due to lack of research and information, researchers have simply proceeded with the belief that peanut allergy is probably very similar in its effects to other chronic illnesses like asthma, while acknowledging that peanut allergy may have different effects (Masia, Mullen, & Scotti, 1998).

#### *Symptoms and Types of Reactions*

Symptoms of peanut allergy can range from gastrointestinal distress to hives and rashes to respiratory problems (Smith & McGhan, 2002). Green et al. (2007) found that 92% of a sample of 140 children had some type of skin change during their first allergic reaction to peanuts, 27% had gastrointestinal reactions (vomiting or diarrhea) and 17% reported respiratory symptoms. Sampson (2002) pointed out that severe allergic reactions to peanuts, including anaphylaxis, are often mistaken for a severe asthmatic reaction or

an acute cardiovascular event. This misdiagnosis can be complicated by the fact that people who have life-threatening reactions often also have a history of asthma. The rate of co-morbid asthma in people with peanut allergy has not been systematically measured, but has been found to affect anywhere between 41 to 68% of children with peanut allergy participating in research studies (Fleischer et al., 2003; Primeau et al., 2000; Simonte, Ma, Mofidi, & Sicherer, 2003) .

The most frightening and serious consequence of exposure to an allergen such as peanuts is anaphylaxis. The course of an anaphylactic reaction in the case of food allergy can develop within minutes or up to a few hours after ingestion. Early anaphylactic symptoms may include oral tingling, a sensation of tightening airways, abdominal pain, nausea, vomiting, and skin flushing. These symptoms can progress into greater respiratory difficulty, hypotension, and dysrhythmias if left untreated, as typically develop in fatal and near-fatal cases. To qualify as a true anaphylactic reaction, the reaction is multi-systemic (involving more than one organ system) (Foucard & Malmheden-Yman, 2001). One study conducted in England found that almost four out of five patients suffering from anaphylaxis were under the age of 18 years old. In this under eighteen age group, three out of four anaphylactic reactions were caused by peanuts or tree nuts, compared with one out of four reactions in those over eighteen (Foucard & Malmheden-Yman, 2001). Anaphylactic reactions should always be taken seriously and even if symptoms appear to dissipate after use of an epinephrine shot and a dose of diphenhydramine (Benadryl®), the person should be taken directly to the emergency room and be treated aggressively with intramuscular epinephrine, histamine H<sub>1</sub> and H<sub>2</sub> receptor agonists, oxygen, inhaled albuterol, and systemic corticosteroids. It is also

suggested that, after an observation period of at least four hours, the person be put on a three-day course of oral prednisone and an antihistamine (Sampson, 2002). In a study by Sampson, Mendelson, and Rosen (1992), in 13 cases of fatal or near fatal anaphylactic shock, the difference between survival and death appeared directly related to the timing of the epinephrine shot. All deaths occurred in children or adolescents who did not receive an epinephrine shot within an hour of the accidental ingestion.

In an estimated one third of allergic reactions to peanuts (Sampson, 2002), a “biphasic” reaction occurs, where symptoms that have seemed to dissipate come back in full force sometimes hours later and are more severe than the initial presentation. This second severe reaction often requires intubation and mechanical ventilation. For this reason someone who has had a reaction should go to a hospital even if the standard epinephrine shot appears to eliminate the reaction. As noted, someone who has had an allergic reaction to peanuts or other foods should be observed by qualified medical personnel for at least four hours after the initial reaction.

The amount of exposure necessary to create an allergic reaction varies between individuals. A food allergy is said to be “severe” if the reactive exposure dose is less than 100mg, and it is said to be “important” if the reactive dose is between 100mg and 1g, and “moderate” if the person can tolerate 10g or more (Moneret-Vautrin et al., 1998). According to a French study of 142 people who were allergic to peanuts, 87.5% of these people were in the important or severe range, and no people with peanut allergy could tolerate 10 grams or more (Moneret-Vautrin et al., 1998). While some people who are allergic to peanuts only have a reaction after eating them directly, some extremely sensitized individuals have reported reactions after contact with someone else who has

ingested or handled peanut products, and there have even been some reports of allergic reactions to peanuts when peanuts were merely in the room with the allergic individual (such as peanut dust in the ventilation system of an airplane) (Sampson, 2002). This potential for incidental exposure is especially of concern for children who often spend large amounts of time with other children and may not be able to control their environments, such as in school, daycare, or extracurricular activities. In fact, children who have a peanut allergy tend to be more sensitive than adults, exacerbating the difficulties in management. Emmett et al. (1999) reported that in a British sample of peanut allergic adults and children, 43% of the children reacted to smell, touch or taste of a peanut, while only 9% of the adults were this sensitive. In contrast, Simonte et al. (2003) found that in a sample of 30 children who had previously been categorized as strongly allergic to peanuts, none of the children experienced an allergic reaction after smelling peanut butter and only a handful of children experienced allergic symptoms (3 with redness/swelling, 5 with itchiness) with direct skin contact with peanut butter. The authors concluded that peanut butter may be too oily to cause such indirect reactions, unlike peanuts that are roasted.

Most children spend much of their time during the week in school, therefore recognition of allergic reactions and treatment is often in the hands of teachers and school nurses. Recently the magazine *Newsweek* (Kalb, 2007) reported that 18% of schools in the United States now ban peanuts entirely, but many schools try to manage each child's allergy individually instead of instituting school-wide bans. For the years 2001-2003, the state of Massachusetts collected data on the administration of epinephrine in schools (McIntyre, Sheetz, Carroll, & Young, 2005). They found that 48 school districts reported

a total of 115 administrations of epinephrine in which 31% of the shots were administered to children with known multiple allergies and 25% to children with an allergy to peanuts or tree nuts only. In 24% of cases, the individual was not known to have any life threatening allergies. And in cases of food allergy, the food substance causing the reaction was only identified in 43% of cases.

Weiss, Munoz-Furlong, Furlong, and Arbit (2004) found that of 400 school nurses that they surveyed, 94% of the nurses reported having at least one student in their school with a severe food allergy; 32% reported having up to 4 students; 25% reported having up to 9 students; 37% reported having ten or more students to care for with severe food allergies. Ninety percent of the nurses reported that epinephrine was kept primarily in their offices, with only 19% reporting that students with food allergy were allowed to carry their own epinephrine. Nurses also reported epinephrine kept in a variety of other locations in their schools including: administrative offices (12%), allergic child's classroom (5%), cafeteria (4%), every classroom (4%), and passed along from adult to adult as the child changed classrooms (10%). This lack of consistency among school nursing practices may reflect the lack of consistent emergency planning for children with life-threatening food allergies, that can vary across states, districts, and even school to school.

There is some evidence that for the youngest sufferers, peanut allergy may not be a life-long problem. Although infants who have peanut allergy do tend to have more severe reactions as they get older, some studies have indicated that 20% of infants who have allergic reactions to peanuts may outgrow their allergy, especially if they have low levels of IgE antibodies in infancy (less than 5 kU per liter) (Sampson, 2002). In people

who are allergic to peanuts, one of the allergic mechanisms appears to be driven by antibodies in the body that are built up against IgE proteins, which are found in peanuts. Because of these low levels of antibodies in the bloodstream, Sampson (2002) recommended that infants with low IgE levels should be tested periodically to ascertain their allergy status. Fleischer et al. (2003) recommended that not only infants, but older children be periodically re-tested for allergic reactions to peanuts, because an estimated 20% of children will outgrow the allergy.

In 1998, Great Britain advised pregnant and nursing women with a history of atopy (asthma, hives, hay fever, and eczema) to avoid peanut products (Dean et al., 2007). Women were recruited and their children were followed for two years in order to ascertain whether precautions were taken and whether or not this precautionary avoidance was helpful in reducing the number of children with peanut allergy. At two year follow-up of the 545 families still in the study, 65% of the mothers had followed the advice, but personal or family history of atopic conditions was not related to avoidance. At two year follow-up, the rate of allergy to peanuts in the children was not reduced by avoidance of peanuts during pregnancy and lactation, holding steady at 2%.

### *Diagnosis*

Zepf (2002) reported guidelines and recommendations on peanut allergy in children and acknowledged that the diagnosis of a food allergy is not always straightforward. Diagnosis may include a careful taking of the patient's history as well as a skin-prick test for peanuts or radioallergosorbent testing (RAST), which looks for the blood concentration of IgE. IgE is one of five classes of antibodies found in the human body. As it circulates through the blood and lymph tissue, it binds to receptors on the

surface of mast cells (a type of white blood cell). Once it binds, IgE it acts as an antenna, picking up signals of nearby allergens. When an allergen is present, in this case a peanut protein, IgE tells the mast cell to release histamine, which causes an inflammatory response in the nearby tissues. Mast cells are most concentrated in the skin and in the nasal and lung linings which are exposed to outside allergens. Inflammation of these tissues can cause rashes, runny noses, watery eyes, and respiratory distress (National Institute of Environmental Health Sciences, 2002). Patients who have an IgE level of at least 15 IU (International Units) per mL have a 95% or greater incidence of peanut allergy, which makes a potentially dangerous oral food challenge unnecessary as a diagnostic assessment. For people with an IgE level of below 15 IU per mL and no clear history of peanut induced symptoms, a physician supervised food challenge is necessary to make a definitive diagnosis. Because such challenges can lead to severe anaphylactic symptoms, they should only be conducted in a hospital setting by an experienced specialist (Sampson, 2002). This risk may lead parents to choose to follow a peanut free diet for their child without an actual confirmation of diagnosis.

### *Medical Treatment*

Management of peanut allergy consists of avoidance of all peanut products, including label reading of every ingested product and hyper vigilance regarding peanut products in one's environment, training in recognition of early allergy symptoms, and training in the use of epinephrine shots (such as EpiPen® or Epi-EZ-Pen®) (Anderson, 1997; Sampson, 2001; Zeph, 2002). According to the current standards of care and allergy management for people allergic to peanuts, medical practitioners recommend that every person who is allergic to peanuts have a written emergency plan and kit with

appropriate doses of diphenhydramine (Benedryl®) and epinephrine on hand at all times in case of accidental ingestion or exposure (Sampson, 2002). Also recommended is education for parents of children allergic to peanuts on possible methods of exposure, early signs of reactions and use of epinephrine shots (Jackson, 2002). These recommendations and daily vigilance over foods ingested and possible environmental contamination not only take time out of the day, but may affect quality of life.

### *Health-Related Quality of Life*

While the broad definition of quality of life encompasses a wide variety of areas including; home, work, school, and environmental factors; health related quality of life (HRQOL) refers to domains of a person's health that are potentially within in the scope of the healthcare system (Seid, Varni, & Jacobs, 2000). Researchers and clinicians have begun to use quality of life measures to investigate total impact of illness on an individual as well as how the individual feels about their illness (Starfield & Riley, 1998).

According to Levi and Drotar (1998), HRQOL assessment has several uses: (a) providing useful descriptive information regarding the health status of children with chronic conditions, (b) facilitating the identification of children with different levels of morbidity, and (c) increasing the understanding of children's and adolescents' perspectives on consequences and experiences of chronic illness.

While self reports of HRQOL have been deemed important by researchers, some researchers (Seid et al., 2000) emphasize that proxy report by caregivers is also important for two reasons; because (a) children rarely refer themselves for treatment, the parent's perceptions are often the impetus to seek treatment and (b) very young and very ill children may not be able to fill out measures of HRQOL. There is also the question of

whether to use disease specific versus general measures of HRQOL. General measures of HRQOL are useful if one is assessing the differences between two illness groups. More illness-specific measures of HRQOL may be more useful clinically in comparing children with the same disease. Levi and Drotar (1998) suggested a comprehensive approach that includes assessment of both general illness and level of functioning as well as more illness-specific information to evaluate smaller changes associated with specific diseases. While there are several general HRQOL scales that could be used with children with peanut allergy and their parents, currently there are no illness-specific measures of HRQOL for children with peanut allergy.

#### *Non-medical Impact*

While recent research has focused on the medical aspects of the effects of peanut allergy on children, there have been relatively few investigations into possible non-medical effects specifically related to peanut allergy. In one such article (Masia et al., 1998) a case study of a seven year old boy was described, who was referred due to symptoms of Obsessive-Compulsive Disorder secondary to a peanut allergy. In fact, all of the boy's reported symptoms of OCD were centered around managing his allergy and the extreme lengths to which he was going in order to feel safe including; reported frequent thoughts of contamination, hand-washing, repeatedly asking his mother if items were safe to consume, refusing to eat food that had been in the vicinity of closed containers of peanut products, refusing to eat lunch at school, and avoiding all people (including school personnel) who might be contaminated. The child also reported waking up early in the morning, experiencing anaphylactic shock-like symptoms at the very sight of peanuts, and his pediatrician reported "a disturbing number of emergency situations"

that had required epinephrine shots (Masia et al., 1998, p. 516). The authors acknowledged that this case seemed particularly extreme, but also emphasized that experiencing severe allergic reactions can be quite traumatic. In this case the authors noted that the child's mother was possibly not taking her son's allergy seriously enough. She continued to consume peanuts and have them around the home.

A few studies have been conducted with the purpose of examining different aspects of potential impacts of peanut allergy by the use of surveys. To determine the impact of knowledge, Lyons and Forde (2004) interviewed teenagers with and without diagnosed food allergies about their knowledge of food allergies. They found that the teenagers who had food allergies and who reported feeling competent in managing their health also reported higher levels of anxiety. This was in contrast to teenagers who did not have a diagnosed food allergy, who tended to report lower levels of anxiety if they reported feeling competent about managing their health. This higher level of reported anxiety was explained as an artifact of the food-allergic teens need to constantly "scan" their environments for potential hazards in order to manage their health effectively. The higher anxiety scores found for this sample, while statistically significant, were only slightly higher than established norms (45.51 versus 40.17).

In a different approach, Bollinger et al. (2006) asked the caregivers of 87 children with food allergies (85 with peanut allergy) what kind of impact their child's allergy had on their family. Half of the sample reported that their child's allergy significantly affected their family's social activities including their children playing at friend's houses, attending birthday parties and sleepovers, going out to eat, and parental relationships. A

small percentage, 10% of the caregivers, reported home schooling their children due to their child's allergy.

Also surveying caregivers, Mandell, Curtis, Gold, and Hardie (2005) found that parents restricted their child's independent activities long after other children were independent (e.g., accompanying their children to parties, making preparatory phone calls). They also reported that their children felt negatively about these restrictions, from not being able to eat birthday cakes to not being able to participate in school trips.

While there have been a few studies linking peanut allergy and higher levels of anxiety specifically, there are other studies in the general allergy literature. In the literature on allergies generally, evidence has been found for greater levels of anxiety in children with allergies. In a study by Kovalenko et al. (2001), two epidemiological samples were combined and a relationship between panic disorder and allergies in children was found. The authors proposed that, in some cases, food allergy may be initially misdiagnosed as panic disorder, and that their similar symptoms may have contributed to the relationship found in this study. Slattery et al. (2002) also found a relationship between atopic disorders and anxiety. This study looked at the children of adults with Panic Disorder, non-panic psychiatric disorders, and non-psychiatric controls. The researchers found that the children of parents with Panic Disorder had more atopic conditions than children of parents with non-panic disorders. They also found a higher rate of atopic conditions among children who had Separation Anxiety Disorder.

In addition to the possibility of psychological maladjustment related to peanut allergy including anxiety and depressive symptoms, Masia et al. (1998) outlined five more areas of functioning which may be important to investigate in the lives of children

allergic to peanuts, including: (a) family adjustment, (b) peer relations, (c) school issues, (d) adherence to medical regimens, and (e) adequate communication between the child's physician or specialist, the family and the affected child. All five of these areas can add stress for the child who has a severe allergy to peanuts and each should be evaluated to assess the level of functioning of an affected child.

### *Impact on Caregivers*

While the effects of a chronic illness on children can be difficult to cope with for a variety of reasons, the impact of the child's disease on the child's caretakers must be considered as well. While often the adult involved does not suffer from the same illness as the child, the adult must become an expert on their child's illness and its treatment. One study that systematically studied the impact of peanut allergy on both children and adults (Primeau et al., 2000) compared reports on quality of life by parents of children who were allergic to peanuts to those reported by parents of children with a rheumatological disease. The parents of children with peanut allergy reported more levels of disruption to their children's daily lives and more specific disruption in family and social interactions due to peanut allergy. The researchers used a modified version of the European Quality of Life questionnaire, in which respondents were asked to respond to questions with regards to the specific illness affecting different areas of their children's lives. To assess the impact of the illness on the family, the respondents were asked to complete the Impact on the Family Questionnaire, and again were asked to respond to questions in regards to their child's illness. Although the study did look at quality of life in children with peanut allergy, the questions were very specifically worded to elicit

responses regarding how the parents perceived peanut allergy was related to quality of life and not the child's health related quality of life overall.

In a survey of 17 parents of children with documented anaphylactic reactions (Mandell et al., 2005) parents reported that, when their child was initially diagnosed with peanut allergy, they felt that they had been given insufficient information regarding peanut allergy and they were left feeling anxious, fearful, and unclear about how to safely manage their child's allergy. When asked what information would have been sufficient suggestions included; the seriousness of anaphylaxis, a prescription for epinephrine and explicit instructions on how to use it, addressing adequate avoidance techniques including label reading, cross-contamination avoidance, and trace contamination, and referral to a support group or allergy-related organization. The study also found that parents initially felt high levels of anxiety over their child's anxiety which subsided as they felt that they had management strategies in place, while a high level of vigilance remained. Resurgences of anxiety were reported to occur whenever their child had another allergic reaction, when new information regarding mislabeling or new risk factors became known, or when their child reached a new developmental level which came with new experiences and new levels of independence.

Although a parent of a child with peanut allergy does not typically have to administer daily medications and treatment regimens, she may spend extra time with school personnel related to keeping her child safe in school, reading labels to ensure food safety and may spend more time at home because outside sources of food may not be safe for her child. It will be important to look at parental stressors in the study of peanut allergy in children.

### *Psychosocial Treatment*

Recently, professionals have begun to recognize some of the non-medical impacts of peanut allergy and the psychosocial effects on children and families. Coulson and Knibb (2007) reported on the use of online support groups for both individuals with food allergies and caretakers of children with food allergies. Online support group members cited advantages of this format including: easy accessibility of information, social support, and learning coping strategies from other members. One disadvantage cited was the anonymity of the format which sometimes made it difficult to trust information sources. Reactions to how online support groups affected individuals in their relationships with healthcare providers was mixed, with some citing that they felt more able to participate in treatment and discuss new information, and some reporting reluctance on the part of healthcare providers to listen to information retrieved from the online format.

Monga and Manassis (2006) gave advice to mental health care providers who might see children with anaphylactic conditions in their practices. They advised careful assessment of anxiety symptoms and to delineate which symptoms were above and beyond necessary precautions taken for avoidance of allergens. They also advised using cognitive behavioral therapy techniques for treatment of anxiety symptoms and helping children to more accurately identify anxiety symptoms as opposed to allergic reactions, because symptoms can often overlap. This is clearly a new area of treatment, because

children and parents must remain vigilant to allergen threats, but also need to be able to function in day to day life.

### *Current Study Aims*

While there have been several studies done with children and parents about their children's peanut allergy or other food allergy, studies have not looked simultaneously at both child and parent psychosocial functioning and how it relates to a child's overall quality of life. The current study aimed to gather both child and parent data in the areas of child anxiety and parental stress and to compare this to overall functioning of the children in terms of health-related quality of life.

The current study investigated the relationship between HRQOL, parental stress and child anxiety in children with peanut allergy. The first set of hypotheses regarded individual variables; it was hypothesized that compared to general population norms, children with peanut allergy would report higher levels of anxiety on the Revised Children's Manifest Anxiety Scale. It was hypothesized that parent reports of overall parenting stress would be higher than published population norms. It was hypothesized that children with peanut allergy would report lower Health Related Quality of Life than the norms for children without chronic illnesses and that parental report of their children's HRQOL will be similar to their children's self-report.

Second, it was hypothesized that these variables will be interrelated, such that child anxiety, parental stress, and the severity of illness reported would contribute to the overall reported HRQOL. It was hypothesized that children with more severe peanut allergy would experience higher levels of reported anxiety, that their parents would report higher levels of parenting stress, and would report feeling less "in control" of their child's

illness, and that these variables will be related to low HRQOL as reported by parents and children.

## Method

### *Participants*

Participants were 51 families with at least one school aged (6-12 years) child who had been diagnosed with an allergy to peanuts by a licensed physician or allergist. A total of 51 primary caretakers (50 mothers and 1 father) completed measures for the study. There were 48 children with peanut allergy who completed their own measures. Three children did not complete measures because their parents deemed the measures to be too stressful for their children before they attempted to complete them (2 children) or because the child began experiencing anxiety symptoms while completing the measures (1 child). Analysis of demographic variables found that the three children who did not participate directly did not differ from the children who did participate based on child age, parent age, gender, ethnicity, school placement, education level of the parents, length of diagnosis, use of epinephrine or hospitalization for allergic reactions, or reported levels of parenting stress, control or fear. They did differ from the other child participants on one variable, social functioning on the PedsQL™, with their parents rating their social functioning as lower than other children who participated ( $F(1, 49) = 6.41, p = .015$ ). The decision was made to keep the parent data of these three children in the analysis in order to preserve the variability in the sample. Although these subjects were kept in the sample, their data did not figure into the regression analyses, because the child anxiety variable was used in both models. Primary caretakers of children with peanut allergy

were recruited from peanut allergy support websites and allergy clinics across the United States.

### *Procedure*

A general message asking for interested volunteers was posted on a peanut allergy support website ([www.peanutallergy.com](http://www.peanutallergy.com)) instructing the volunteers to contact the researcher by e-mail if they were interested in participating. The announcement was updated every two months and questions on the discussion board or received by e-mail about the study were answered within 48 hours of posting. For recruitment from allergy clinics, a search on the American Academy of Allergy and Immunology website was completed for allergists with specialties in children and food allergy. Two allergists were chosen for each state. Allergists' names were chosen from different practices and different cities if possible. When a search yielded no pediatric allergists with a specialization in food allergy, an allergist serving children was chosen. For states with major metropolitan areas (New York City, Los Angeles, etc) three allergists were chosen, with one outside the major metropolitan area. Information regarding the study with a flyer was included in a mailing to each allergist. Allergists were asked to explain the study to their patients with peanut allergy and/or post the flyer in their waiting room. After an initial explanation of the study via e-mail or by their physician, a packet of consent forms and questionnaires was mailed to the participant's homes by the principal investigator. Included in the packet of measures were a written consent form for the child's primary caretaker and a written assent form for the child, a reimbursement form, and self-addressed stamped envelope for sending the packet back to the investigator. Out of the 90 packets that were mailed, 51 were returned, yielding a response rate of 56.67%.

The primary caretakers were asked to fill out several questionnaires about their child and family including; a demographic information page, the Pediatric Quality of Life Inventory™ Version 4.0 (PedsQL), the Parenting Stress Index (PSI), and a list of quality of life questions geared specifically towards peanut allergy (Appendix A). These questionnaires took approximately one hour to complete. The child participants were asked to fill out the PedsQL, the RCMAS, and the peanut allergy specific questions. The child questionnaires took approximately 30 minutes to complete.

### *Measures*

#### *The Pediatric Quality of Life Inventory™ Version 4.0*

The 23-item Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales (PedsQL 4.0) encompass four domains: physical, emotional, social and school functioning. Child self-report includes versions for 5-7, 8-12, and 13-18 years of age. Parent report includes versions for children 2-4, 5-7, 8-12, and 13-18 years of age (Varni, Seid, Knight, Uzark, & Szer, 2002). A five point Likert scale is used for most self and proxy reports, except for the 5-7 year old self report version which was simplified to a 3 point scale. All items are reverse-scored and transformed to a 0-100 point scale so that higher scores indicate better HRQOL.

Validation studies done on the PedsQL™ have shown that the scale is able to differentiate between healthy children and those with acute or chronic health conditions (Varni, Seid, & Kurtin, 2001). Healthy children have shown higher scores than acute and chronically ill children by self-report. By proxy report, acutely ill children have also consistently shown higher scores than chronically ill children. Across all age groups, internal consistency and reliability were found to be  $\alpha = 0.88$  for self report and 0.90 for

proxy report. School functioning exhibited the lowest reliability coefficients at 0.68 for self report and .76 for proxy report, but was increasingly consistent with increased age of the child across both types of report. The current study found overall reliability estimates ( $\alpha$ ) of 0.89 for the self report and 0.87 for the proxy report.

#### *Parenting Stress Index*

The Parenting Stress Index (PSI) is a 120 item questionnaire for parents of children aged one to 12 years old (Abidin, 1995). Most items require a response on a 5 point scale ranging from strongly agree, agree, and not sure, to disagree and strongly disagree. Items that require different answers are preceded by a cue. Items 102-120 require yes/no responses to a list of life events that may have occurred in the past 12 month period. The items assess a variety of areas, including child characteristics that may increase parental stress and parent characteristics that may increase stress. Reliability coefficients for internal consistency for the Parent and Child domains and the Total Stress score are reported at .90 or greater (Abidin, 1995). Test-Retest reliability obtained for an interval of 1 to 3 months was .63 for the Child Domain, .91 for the Parent Domain, and .96 for the Total Stress score (Abidin, 1995). For the current study a reliability coefficient of  $\alpha = .78$  was found for the entire scale.

#### *Revised Children's Manifest Anxiety Scale*

The Revised Children's Manifest Anxiety Scale (RCMAS) is a 37 item scale for children age 6 to 19 years old (Reynolds & Richmond, 1985). The scale is a dichotomous yes/no scale that assesses three factors of anxiety; physiological, oversensitivity, and fear/concentration aspects. It also contains a lie scale to assess whether the child is answering in a manner that suggests a need to portray their behavior as ideal. For Total

Anxiety scores, reliability estimates were .82 across all age groups, ranging from .79 to .85. The anxiety subscales by themselves are less consistent, with reliability estimates across all age groups, male and female, black and white subjects ranging from .64 for the Social Concerns/Concentration subscale, .67 for the Physiological subscale, to .76 for the Worry/Oversensitivity subscale. For the current study, the reliability coefficient for the whole measure was found to be  $\alpha = .71$ .

#### *Peanut Allergy Experiences Questions*

A series of specific peanut allergy questions were asked of both parents and child participants (see Appendix A). These questions, generated by the principal investigator, included issues pertaining to illness severity (number of allergic reactions, number of emergency room visits, etc.), illness length (age of diagnosis/first reaction), illness experience (allergy symptoms, epinephrine training, etc.), and parental feelings of control over their child's illness. For parent's feeling of control and fear, the three items yielded a Cronbach's alpha of .76. During the course of the study, two additional questions were added, including; "Does your child also have a diagnosis of asthma?" and "Please list any additional food allergies that your child has."

## Results

#### *Sample Characteristics*

Fifty one families were recruited through online discussion groups and solicitation of allergy clinics throughout the United States. Fifty mothers and 1 father acted as respondents for their children (26 female and 25 male). The sample was 94.1% Caucasian, with the remainder identifying as Asian American (1 child) or Bi-racial (2 children). Many of the families reported higher than average incomes (37.3% =

\$100,000/year or more, 21.6% = \$80-100,000/year, 15.7% = \$60-80,000/year, 17.6% = \$40-60,000/year, 2% = 20-40,000/year, and 2% = 0-20,000/year). Parental education was also higher than the general population (35.3% = Graduate degree, 43.1% = Bachelor's degree, 9.8% = Associate's degree, 7.8% = some college, 3.9% = High school). Of the parent respondents, 94.1% were married. The responding parents' ages averaged 39.5 years ( $SD = 4.3$ ), with their partners averaging 41.5 years of age ( $SD = 4.2$ ).

The children in the study ranged from 6 to 12 years old ( $M = 8.1$ ,  $SD = 1.8$ ). The average age at which they were diagnosed with peanut allergy was 1.8 years (range = 1 to 5 years,  $SD = 1.1$ ). The average length of diagnosis was 6.4 years (range = 2-11 years,  $SD = 2.3$ ). The children in the sample had experienced an average of 2.3 reactions to peanuts (range = 0-5,  $SD = 1.5$ ). Regarding initial reactions, 62.7% occurred with peanut butter and 19.6% with peanuts. Three of the children in the study had been diagnosed with a peanut allergy by a blood test or skin prick test and therefore had never had a reaction outside the doctor's office. Of the 39 parents who provided an answer to the question of whether or not their child had a diagnosis of asthma, 25 reported that their child did indeed also have asthma. Of the 42 parents who answered the question of whether or not their child had any additional food allergies, 29 responded that their child was allergic to one or more additional foods.

During their first reaction, 49% of children received only Benedryl®, 3.9% received a shot of epinephrine but were not hospitalized, and 15.7% went to the hospital after treatment with Benedryl® or epinephrine. An alarming 27.5% received no treatment for their first reaction. For subsequent reactions, 21.6% of children went to the hospital. Thirty five percent of the children had had an allergic reaction requiring treatment with a

shot of epinephrine, and the average number of lifetime epinephrine shots was less than 1, between 0 and 3 ( $SD = .90$ ). Nearly seventy five percent of the children reported that they had been shown how to use an Epipen®. The average age of training was reported as 5.68 years ( $SD = 1.8$  years). The majority of the children attended public schools (72.5%), with some children attending private schools (17.6%) and some being home schooled (9.8%).

A series of ANOVAs were completed to ascertain whether or not the main variables differed based on recruitment method, asthma status, or multiple allergy status. Of the 51 participants, 35 were recruited through the internet discussion group, 12 from allergists, and 4 from informal referrals. The different referral groups did not differ significantly on any of the major study variables or demographic variables.

Thirty-nine parents reported on whether or not their child also had a diagnosis of asthma, with 25 reporting that their child also carried a diagnosis of asthma. For asthma status, the asthma group and non-asthma group significantly differed on the following measures; self-report total score on the PedsQL, proxy-report total score on the PedsQL, and PSI parenting stress score. The asthma group had lower scores on the PedsQL measures, indicating lower health-related quality of life, and lower scores on the PSI, indicating lower parental stress levels for children diagnosed with asthma.

For multiple allergy status, 42 parents reported on this variable, with 29 parents reporting that their child suffered from multiple food allergies, most often tree nut allergy. The multiple allergy group differed significantly from the peanut allergy only group on two variables, self-report of social functioning on the PedsQL and parenting stress on the PSI. The parents of children with multiple food allergies reported higher

levels of parenting stress and their children reported lower levels of social functioning ability on the PedsQL.

#### *T-tests*

*T*-tests were conducted to ascertain whether the sample of children with peanut allergy and their parents as a whole had reported more anxiety symptoms, more parental stress, or lower health related quality of life than normal controls according to population estimates.

The RCMAS was used to assess child anxiety. Based on 48 child responses, the overall sample had a mean T-score of 41.15 (range = 24-63, *SD* = 9.2). This score was significantly less than the average T-score of 50 ( $t(47) = -6.67, p < .001$ ). The same was true for the majority of the subscales on the RCMAS which have an average scaled score of 10 with a standard deviation of 3. Physical symptoms averaged a scaled score of 7.4 (range = 2-14, *SD* = 2.8) and was significantly lower than average ( $t(47) = -6.46, p < .001$ ). Worry symptoms averaged a scaled score of 7.6 (range = 3-15, *SD* = 2.8), again significantly lower than the average ( $t(47) = -5.89, p < .001$ ). Social Anxiety symptoms averaged a scaled score of 7.1 (range = 4-11, *SD* = 2.2), significantly lower than the average scaled score of 10 ( $t(47) = -9.06, p < .001$ ). The exception was for the Lie scale, which yielded a mean scaled score of 10 for the sample (range = 5-17, *SD* = 3.2) which was not significantly different than the average scaled score of 10 ( $t(47) = 0.00, p = 1.0$ ).

For the Parenting Stress Index (PSI) the percentile for Total parental stress averaged 45.8% (range = 1-99, *SD* = 29.2), the average for Child related stress was 46.7% (range = 3-99, *SD* = 33.4), the average for Parent related stress was 45.7% (range

= 1-97,  $SD = 27$ ), and the average for Life event stress was 31.9% (range = 0-98,  $SD = 31.4$ ). Compared to an average at the 50<sup>th</sup> percentile, Total stress ( $t(50) = -1.0, p = .31$ ), Parent related stress ( $t(50) = -1.1, p = .26$ ), and Child Stress ( $t(50) = -.71, p = .48$ ) were not significantly different from average stress levels. Average life stress percentiles were significantly lower than average ( $t(50) = -4.11, p < .001$ ).

For the PedsQL 4.0<sup>TM</sup>, the average scores of healthy controls reported by Varni, Burwinkle, Seid, and Skarr (2003) were used to compare to the current sample (see Table 1). For the child report of health-related quality of life, the only comparison that showed a statistically significant difference was obtained for the comparison between the current sample and healthy controls on the emotional functioning scale. The current sample of children with peanut allergy had lower mean scores on emotional functioning when compared to the healthy control norms.

Table 1

Child Report on the Peds-QL versus Healthy Control Norms

	Current Peanut Allergy Sample M (SD)	Healthy Controls (Varni et al., 2003) M (SD)	Comparison result
PedsQL Total	82.38 (11.64)	83.91 (12.47)	$t(47) = -0.92, p < .36$
Peds QL: Physical	88.06 (11.67)	87.77 (13.12)	$t(47) = 0.18, p < .29$
PedsQL: Psychosocial	79.08 (13.03)	81.83 (13.97)	$t(47) = -1.48, p < .15$
PedsQL: Emotional	73.89 (16.04)	79.21 (18.02)	$t(47) = -2.33, p < .02$
PedsQL: Social	82.29 (15.60)	84.97 (16.71)	$t(47) = -1.19, p < .24$
PedsQL: School	81.33 (14.90)	81.31 (14.31)	$t(47) = 0.01, p < .99$

PedsQL: Pediatric Quality of Life Inventory

M: Mean score

SD: Standard Deviation

For the proxy-reports of child health related quality of life, there were more comparisons that were statistically significantly different (see Table 2). The current

sample of parents of children with peanut allergy reported higher scores for their children for physical functioning and school functioning and lower scores for emotional functioning compared to published norms for healthy controls (Varni et al., 2003).

Table 2

## Parent Proxy Report on the Peds-QL versus Healthy Control Norms

	Current Peanut Allergy Sample M (SD)	Healthy Controls (Varni et al., 2003) M (SD)	Comparison result
PedsQL Total	83.12 (10.47)	82.91 (15.55)	$t(50) = 0.57, p < .57$
Peds QL: Physical	89.95 (11.63)	84.08 (19.70)	$t(50) = 3.6, p < .001$
PedsQL: Psychosocial	79.48 (12.04)	81.24 (15.34)	$t(50) = -1.05, p < .30$
PedsQL: Emotional	70.49 (15.66)	81.20 (16.40)	$t(50) = -4.88, p < .001$
PedsQL: Social	84.41 (14.41)	83.05 (19.66)	$t(50) = 0.68, p < .50$
PedsQL: School	83.53 (14.05)	78.27 (19.64)	$t(50) = 2.67, p < .01$

PedsQL: Pediatric Quality of Life Inventory  
M: Mean score  
SD: Standard Deviation

Because of this variability, a further investigation of the most highly distressed third of the sample ( $N = 17$ ) versus the other two thirds was conducted. The most highly distressed members of the sample were identified by the 17 highest scores on the Parenting Stress Index. The average PSI total score for the highest distress group was 81.65 (range = 63-99,  $SD = 10.9$ ). The average child anxiety score for this group was 46.2 (range = 31-63,  $SD = 9.5$ ). The number of children in this group with multiple food allergies was 12 (70.6%), and 10 of these children had a diagnosis of asthma. This is in comparison to the least distressed group, the participants with the 17 lowest scores on the PSI, who had an average PSI score of 15.5 (range = 1-29,  $SD = 9.3$ ). The least distressed group had an average child anxiety score of 38.47 (range = 25-53,  $SD = 8.2$ ). The number

of children with multiple food allergies in the least distressed group was 9 (52.9%) and eight of the children had asthma.

### *Correlations*

An intercorrelational matrix was constructed to ascertain relationships between demographic variables and study variables. Child age, child gender, and child ethnicity were not significantly correlated with any other study variables. Due to the size of the intercorrelational matrix, only significant results are discussed here. Family income was significantly correlated with marital status ( $r = -.29, p = .04$ ), with higher income related to having married parents. Family income was also positively correlated with parents feeling in control of their child's allergy ( $r = .34, p = .02$ ) and parents less often feeling afraid that their child would have an allergic reaction ( $r = .30, p = .04$ ). The type of school a child attended (public, private, home school) was correlated with a child's self-report of their physical functioning ( $r = -.32, p < .03$ ) and parent report of their child's overall quality of life ( $r = -.279, p < .05$ ). For both variables, the children who were home-schooled had lower average quality of life scores (see Figures 1 and 2). The direction of this relationship is unclear, whether children who report more physical symptoms are more likely to be home-schooled or whether home-schooled children report more physical symptoms. Mean scores on physical symptom questions by school type are presented in Table 3. Children who were home-schooled reported lower scores on several questions such as hurting or aching, having difficulty lifting heavy items, and having trouble walking more than one block. It is unknown whether these children were home-schooled because of their peanut allergy, because of other ailments, or because of some other reason unknown to the researcher.

Figure 1

## PedsQL 4.0 Self-Report of Physical Functioning by Type of School Placement

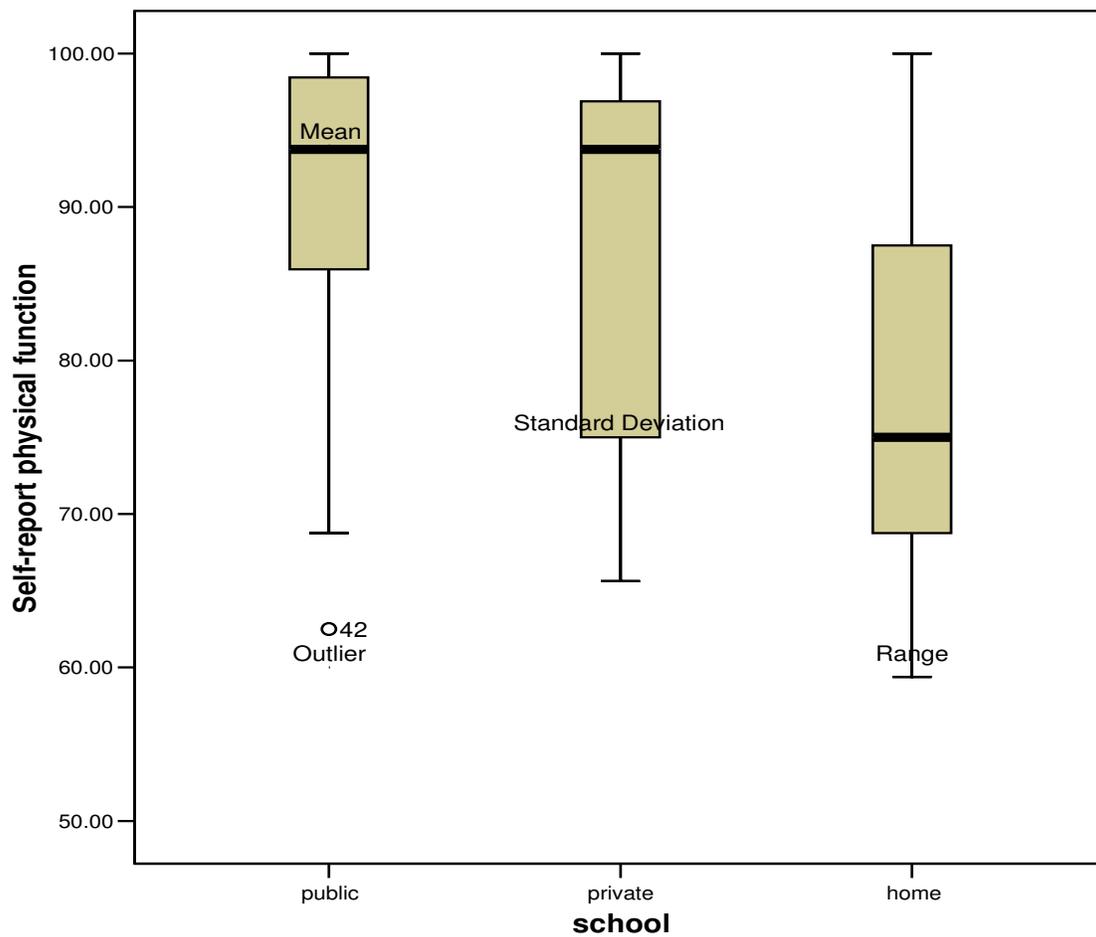


Figure 2

PedsQL 4.0 Total Score Parent Proxy Report by School Placement

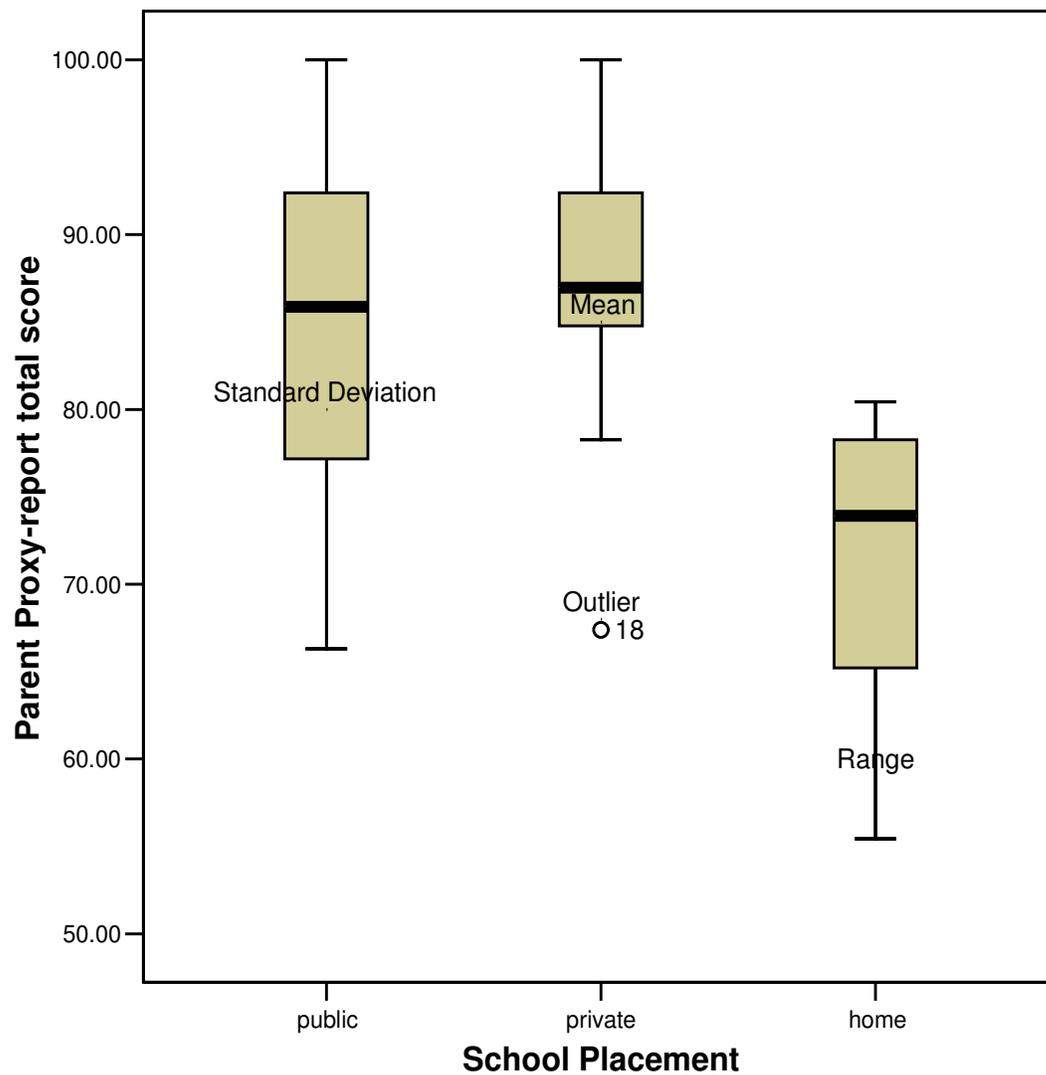


Table 3

## Self-report of Physical Symptoms on the PedsQL™ 4.0 by School Placement

<b>Physical Symptoms on the PedsQL™ 4.0</b>	<b>Public School N = 37 children M (SD)</b>	<b>Private School N = 9 children M (SD)</b>	<b>Home Schooled N = 5 children M (SD)</b>
<b>Hard to walk more than one block</b>	<b>95.14 (11.67)</b>	<b>100 (0)</b>	<b>80 (27.39)</b>
<b>Hard to run</b>	<b>93.06 (15.37)</b>	<b>83.33 (25.00)</b>	<b>90 (22.36)</b>
<b>Hard to do sports or exercises</b>	<b>93.75 (13.86)</b>	<b>88.89 (22.05)</b>	<b>80 (27.37)</b>
<b>Hard to lift something heavy</b>	<b>86.81 (20.25)</b>	<b>88.89 (18.16)</b>	<b>65 (22.36)</b>
<b>Hard to take a bath or shower</b>	<b>95.83 (12.68)</b>	<b>100 (0)</b>	<b>90 (22.36)</b>
<b>Hard to do chores around the house</b>	<b>90.97 (19.04)</b>	<b>80.56 (30.05)</b>	<b>75 (25)</b>
<b>Hurting or</b>	<b>79.51 (20.74)</b>	<b>77.78 (26.35)</b>	<b>60 (22.36)</b>

<b>aching</b>			
<b>Low Energy</b>	<b>85.07 (21.30)</b>	<b>66.67 (21.65)</b>	<b>85 (33.54)</b>

M: Mean total

SD: Standard Deviation

The number of allergic reactions as reported by parents was positively correlated with the number of epinephrine shots a child had over their lifetime ( $r = .39, p = .005$ ), with how often their parent was afraid of their child having a reaction ( $r = -.35, p = .01$ ) (reverse scored 1= always afraid), and how afraid their parents were that they would have a reaction ( $r = -.38, p = .007$ ) (1 = very afraid). There were also significant correlations between child anxiety, parenting stress, and health related quality of life variables (see Tables 4 and 5). Both child report and parent report of child health related quality of life were correlated to measures of parenting stress and child anxiety.

Table 4

Parent Report on the Peds-QL correlations with PSI and RCMAS

	PedsQL Total	PedsQL- Physical	PedsQL- Social	PedsQL- Emotional	PedsQL- School
PSI Total	-.43**	-.33*	-.39**	-.31*	-.30*
PSI Child	-.40**	-.23	-.41**	-.32*	-.32*
PSI Parent	-.32*	-.32*	-.24	.29	-.18
RCMAS Total	-.59**	-.50**	-.46**	-.52**	-.32*
RCMAS Physical	-.48**	-.52**	-.35*	-.29*	-.29*
RCMAS Worry	-.45**	-.38**	-.31*	-.47**	-.21
RCMAS Social	-.50**	-.36*	-.45**	-.36*	-.39**

\* $p < .05$ , \*\* $p < .01$

PedsQL: Pediatric Quality of Life Inventory

PSI: Parenting Stress Index

RCMAS: Revised Children's Manifest Anxiety Scale

Table 5

Child Report on the Peds-QL correlations with PSI and RCMAS

	PedsQL Total	PedsQL- Physical	PedsQL- Social	PedsQL- Emotional	PedsQL- School
PSI Total	-.48**	-.38**	-.37*	-.34*	-.37**
PSI Child	-.44**	-.37*	-.38**	-.32*	.33*
PSI Parent	-.37**	-.45**	-.20	-.29*	-.29*
RCMAS Total	-.67**	-.63**	-.53**	-.55**	-.52**
RCMAS Physical	-.51**	-.58**	-.41**	-.33*	-.37**
RCMAS Worry	-.55**	-.49**	-.36*	-.55**	-.42**
RCMAS Social	-.57**	-.44**	-.56**	-.39**	-.52**

\*p &lt; .05, \*\*p &lt; .01

PedsQL: Pediatric Quality of Life Inventory

PSI: Parenting Stress Index

RCMAS: Revised Children's Manifest Anxiety Scale

### *Regression Analyses*

Regressions were conducted using both Parental Proxy-report of child health related quality of life and Child Self-report of health related quality of life. It was hypothesized that child anxiety, parenting stress, and severity of illness would all contribute to health-related quality of life in children with peanut allergy.

The first set of regression analyses was conducted with Parental proxy-report of child health-related quality of life as the outcome variable. Variables were entered step-wise to assess their individual contributions to the regression model. Variables were entered in the following order: (1) length of diagnosis; (2) number of allergic reactions to peanuts; (3) whether or not the child had ever had a shot of epinephrine; (4) the three variables of how in control the parent felt about their child's allergy, how often and how afraid they were that their child would have a reaction; (5) parenting stress total score; and (6) child anxiety total score. Variables were entered in six blocks, with severity

variables entered first and psychosocial variables entered next in order to ascertain more accurately levels of variance accounted for. With the stepwise entry method, the model explained the most variance in health-related quality of life scores, explaining 53.7% of the variance. The regression model was significant,  $R^2 = .54$ , adjusted  $R^2 = .44$ ,  $F(8, 38) = 5.49$ ,  $p < .001$ . This model has a large effect size and a power estimate of 0.95 using GPower to calculate results. The significant predictors in the model included parenting stress and child anxiety, with very little contribution by the other predictors (see Table 6). A second analysis using only child anxiety and parenting stress as predictors found that these two variables counted for 39.9% of the variance in child health-related quality of life ( $B = (\text{parenting stress} = -.290)$ , ( $\text{child anxiety} = -.518$ )). Severity of illness and feelings of control or fear by the parents were not significantly predictive.

Table 6

*Summary of Regression Analysis Testing Parent report of Health-related quality of life*

Variable	<i>B</i>	<i>P</i>	F	$R^2$	$\Delta R^2$
Step 1			.007	.000	
Length of diagnosis	.040	.94			
Step 2			.968	.042	.042
Number of allergic Reactions	-.435	.63			
Step 3			1.626	.102	.060
Epinephrine shot Ever	2.246	.06			
Step 4			.914	.121	.019
Control over allergy	1.303	.07			
How often afraid	-.536	.49			
How afraid	-.099	.89			
Step 5			3.071	.355	.234
Parenting Stress	-.105	.03			
Total*					
Step 6			5.499	.537	.182
Child Anxiety	-.582	.001			
Total**					

\*  $p < .05$ . \*\*  $p < .01$ .

The second set of regression analyses used self-reported health-related quality of life as the outcome measure. Variables were again entered step-wise in the following order: (1) length of diagnosis, (2) whether or not the child had an allergic reaction requiring a shot of epinephrine (1= yes, 2 = no), (3) parenting stress, and (4) child anxiety. Again variables were entered in the above four blocks with severity variables entered first and psychosocial variables entered after to ascertain individual variance contributions. The regression model was significant,  $R^2 = .59$ , adjusted  $R^2 = .56$ ,  $F(4, 43) = 16.03$ ,  $p < .001$ . This model also yields a large effect size and has a power estimate of 0.98, using GPower. In the model, all of the variables contributed significantly ( $B$  (length of diagnosis = .225), (epinephrine required = .214), (parenting stress = -.233), (child anxiety = -.569), (see Table 7). Children's health related quality of life was negatively affected by their own anxiety and their parent's stress and positively affected by how long they had been living with their diagnosis and if they had not had a reaction requiring a shot of epinephrine.

Table 7

*Summary of Regression Analysis Testing Child reported Health-related quality of life*

Variable	<i>B</i>	<i>P</i>	<i>F</i>	$R^2$	$\Delta R^2$
Step 1			2.104	.044	
Length of diagnosis*	1.172	.03			
Step 2			2.837	.112	.068
Epinephrine shot Ever*	2.407	.04			
Step 3			7.555	.340	.228
Parenting Stress Total*	-.095	.04			
Step 4			16.032	.599	.259
Child Anxiety Total**	-.722	.001			

\*  $p < .05$ . \*\*  $p < .01$ .

## MANOVA

Further analyses were conducted comparing the least distressed and most distressed portions of the sample to see how they may have differed in overall functioning. A MANOVA was conducted to compare the highest, lowest, and middle third of the sample as delineated by their PSI scores. The overall MANOVA was significant for the three groups based on their Self-reported and Parent-reported PedsQL 4.0 scores, Wilk's  $\Lambda = .74$ , ( $F(2, 45) = 3.7, p < .008$ ). The multivariate  $\eta^2 = .87$  indicates that 87% of the variance of the PedsQL 4.0 score was accounted for by level of distress on the PSI. Post-hoc analysis using the LSD method and comparing the groups at the .008 level of significance revealed significant differences between the highest and lowest groups ( $p < .001$ ) for child report of health-related quality of life, with the more highly distressed group having significantly lower health-related quality of life scores. There was also a statistically significant difference between the highest and lowest distress groups based on parent report of health-related quality of life ( $p < .001$ ), with parents who were highly distressed reporting lower health-related quality of life in their children.

## Discussion

This study sought to look at the possible psychosocial effects of peanut allergy on children. Although peanut allergy has become an increasingly reported on topic in the media with countless news reports on increased prevalence and effects on school policies and procedures, to date most research on peanut allergy has focused on the medical impact of the illness. Peanut allergy is a chronic illness that affects all aspects of a child's life, restricting their activities and their family's activities and requiring a high level of vigilance to avoid contamination or accidental ingestion. Peanut allergy is most likely not

different than many other chronic illnesses found in children in its effects on families lives.

Overall, the sample was highly variable in their reported experiences, with some families reporting multiple reactions to peanuts and multiple reactions requiring shots of epinephrine and subsequent hospitalizations and some families having only experienced a diagnosis of peanut allergy by blood or skin test and no reactions. As a result, parental stress levels and child anxiety levels also varied. Although many of the t-tests did not show significant differences for the peanut allergy group compared to population norms, this is most likely due to the high variability of scores on each measure. For each subscale, scores ranged from very low to very high, which when averaged together yielded means that were consistent with average population means.

Although most measures did not show the sample as a whole to differ from a healthy population, this is most likely due to the variability in severity and experience of peanut allergy. Asthma and multiple allergy status as reported by part of the sample also indicated differences in functioning dependent on multiple determinants. While the parents who reported that their children also had asthma reported lower levels of parenting stress, parents of children with multiple food allergies reported greater levels of parenting stress. Both groups indicated that they had lower health-related quality of life across several different domains. It will be important in the future to compare asthma and multiple allergy status when discussing the impact of peanut allergy. Subsequent analyses of those in the sample who were more highly distressed versus those who were less distressed reinforced the findings that the more highly distressed members of the group had lower health-related quality of life.

As reported in other studies, some parents of children with peanut allergy are choosing to home school their children in order to reduce potential reactions in the school environment (Bollinger et al., 2006). The current study found approximately the same percentage of home-schooled children in this population at a rate of 10%. Interestingly, the children in this study who were home schooled reported lower levels of adequate physical functioning and their parents reported less overall health related quality of life. The direction of this relationship is unknown, it is possible that children with lower health-related quality of life are more likely to be home schooled, or that parents who home school their children see them as more disabled because of their allergy. It is also possible that the children who were home-schooled in this sample may have been suffering from another ailment besides peanut allergy. It will be important in future studies to delve deeper into the why of home-schooling for these particular children. If the reason for home-schooling is because their children have peanut allergy and they fear reactions at school, professionals need to help both parents and school districts learn to manage this chronic illness more effectively. Although many schools have medical action plans for their students as suggested by the American Academy of Pediatrics (2001), many parents have anecdotally reported difficulty in receiving appropriate precautions and care for their children who are allergic to peanuts. Some parents may believe that having a peanut-free lunch table or one peanut free classroom may not be enough to protect their child, while parents of children without peanut allergy may feel that banning all peanut products from a school is overzealous.

Parental feelings of control and feelings of fear of allergic reactions in their children were related to SES. Parents with higher levels of income and higher levels of

education felt more in control and reported being less afraid. Although this relationship is unclear, it could be that, as income increases, access to treatment resources increases and this increases feelings of control and decreases fear. Higher income often translates into higher quality of medical care in the United States and this may influence parents' perceptions of their children's medical care. It has been found that people with lower income levels and less education are often more skeptical of medical care and physicians' ability to treat their medical symptoms (Fiscella, Franks, & Clancy, 1998). If parents of children with peanut allergy feel frustrated because their physicians do not have answers for them and they do not feel as if their child is receiving quality medical care, they may feel more anxious and less in control of their child's allergy.

The results of this study strongly suggest that for children with peanut allergy, parental perceptions of their health-related quality of life are related to how much anxiety the child reports and how stressful parents perceive their lives to be. This study also found that children's perceptions of their own health-related quality of life are also related to how much anxiety they feel and how stressful their parents perceive their lives to be. It is quite easy to imagine why these parents feel more stress in their parenting role, because of the level of vigilance required to keep their children safe. They must read all food labels, ensure that their child always has an epinephrine shot available, and arrange for an adult to be with the child who knows how to use the shot at all times. This vigilance is a struggle every day, with decisions on where their child is allowed to go and whether or not their child can participate in normal school and extracurricular activities and still be safe. The parent may feel as if they need to supervise the child at all times and may not want to relinquish controls to other adults. Also, more concretely, children's

quality of life is also affected by how long they have had their diagnosis (and presumably how old they are) and if they have had to have an epinephrine shot to treat their allergic reactions. Self-injecting or having someone else inject epinephrine into one's body after accidentally ingesting something that is causing physical symptoms such as difficulty breathing could be considered a traumatic event, especially if the adults around the child are also experiencing high levels of stress and worry around the event. One thing to investigate in the future is whether or not these children are experiencing symptoms of post traumatic stress related to their experiences of emergency medical care for their allergy.

The effects of peanut allergy are not only medical and physiological they also affect children's health related quality of life. How much their quality of life is affected appears to be related to how children and their parents cope with their allergy and other parts of their lives. This is clearly a complex issue that merits not only continued investigation by researchers, but requires information dissemination to practitioners who will likely begin to encounter more of these children and their families in their practices. As children with peanut allergy feel heightened anxiety about having allergic reactions and their parents feel increased amounts of parenting stress related to their child's allergy, many mental health practitioners will find these cases being referred for treatment. As this occurs, mental health practitioners will need to understand the issues involved including the need for vigilance in avoiding peanuts while not becoming hypervigilant to the point of disruption of family life. Disease-specific interventions, focused on how to avoid peanut products while still living a relatively normal life may be needed. Specific interventions may need to be newly created, because typical cognitive behavioral therapy

protocols for the treatment of anxiety usually involve exposing the patient to the feared stimuli, which in this case would be life-threatening. Targeted group support and family treatments may be needed in order to foster a sense of community among parents and families and a sense of control for everyone involved.

It may also be useful to create a disease specific health-related quality of life scale for peanut allergies, as has been done for other illnesses (e.g., asthma, cancer; Varni, Burwinkle, Katz, Meeske, & Dickinson, 2002). Some of the effects of peanut allergy such as decreased opportunities for dining out and participation in birthday parties and sleepovers appear to be unique to the experience of children with peanut allergy. As a result, a health-related quality of life scale specifically geared towards peanut allergy would help practitioners and researchers to detect severity of the impact of the illness in particular children.

Over the past few years there has also been speculation in the medical community about the potential of creating a vaccine against peanut protein to help protect children allergic to peanuts against accidental exposure. In fact, a vaccine was in development, TNX-901, an anti-IgE therapy drug that reportedly allowed test subjects to ingest up to the equivalent of 6 to 8 peanuts without a reaction (Leung et al., 2003). The project was ended when two drug companies began trying to block a smaller company, the manufacturer of TNX-901, from continuing to make the drug in favor of an unproven drug, Xolair® (Hamilton, 2005). The decision to stop manufacture of the drug terminated the clinical trials and crushed the hopes of many parents. If and when the drug companies are able to overcome their arguments and begin the trials again, there may be an effective treatment for children of peanut allergy. This would relieve much of the fear, anxiety, and

stress that children with peanut allergies and their parents feel. If the vaccine does come into existence and use, the results of a follow-up to this study could be very different. If there were a viable treatment options to alter the effects of accidental ingestion, it is possible that many of the psychosocial impacts of this allergy could also be altered and even erased for most if not all children with peanut allergy. If a complete vaccine became available, one that erased all the effects of peanut allergy, these peanut allergic individuals might even be able to eat peanuts outright without the fear of an allergic reaction. In that case, a follow-up study of these and other peanut allergic children after the introduction of the vaccine would be needed to investigate the possibility of long-lasting psychological effects.

There would also need to be research done on the acceptability of these vaccines to children and their parents. Questions of whether childhood vaccines increase the rates of autism and whether vaccinating teenagers against sexually transmitted diseases increases promiscuity continue to be proposed in nightly news stories. Although a vaccine for peanut allergy is not likely to be as controversial as a vaccine against a sexually transmitted disease for teenagers, parents may be reluctant to have their children vaccinated for a variety of personal reasons (Dempsey, Zimet, Davis, & Koutsky, 2006). The vaccine may also have side-effects that are not known at this time and this may cause reluctance on the part of parents to have their children vaccinated. Risks and rewards of the potential vaccine will have to be evaluated as the vaccine becomes available and parents and their children will have to negotiate this decision together (Rupp, Rosenthal, & Middleman, 2006).

### *Limitations*

The sample in this study was primarily Caucasian, highly educated, and had substantial incomes. These sample characteristics may be due in part to recruitment techniques which used internet-based support groups and recruitment through specialty clinics. A more ethnically, educationally, and income diverse sample of participants may be found in hospital emergency rooms and general pediatric clinics. Due to the relatively low prevalence of peanut allergy overall, multi-site specific recruitment with a large number of hospitals and clinics will be required in the future. As the field moves forward and more mental health practitioners become aware of psychosocial problems in children with peanut allergy, this type of study may become more necessary and accordingly, more feasible.

### *Conclusion*

The results of this study have shown that peanut allergy is not only a topic for news outlets in the United States; peanut allergy is a real health problem that affects an increasing number of children and families in this country. Similar to many medical disorders that affect children (asthma, juvenile rheumatoid arthritis, cystic fibrosis, etc.) peanut allergy can affect a child not only medically, but psychosocially. This disorder has the potential to disrupt psychological functioning, increase parenting stress, and affect a child's entire family. As such, the impact of this ailment should not be underestimated by physicians or mental health professionals. As the incidence rate of this allergy continues to climb, pediatric psychologists need to be at the forefront of the research into the possible effects of this allergy on children's development and the treatments to help children and families cope with this life-altering diagnosis.

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Appendix A

Peanut Allergy Experiences Questions

**Peanut Allergy Impact: Parent version**

What is your child's age? \_\_\_\_\_ What is your child's gender? \_\_\_\_\_

1.) At what age was your child first diagnosed with an allergy to peanuts by a medical professional? \_\_\_\_\_ years old

2.) Has your child ever had an allergic reaction to peanuts/peanut products? **(Circle one)**

**Yes / No**

Regarding your child's first reaction:

a) What kind of product was involved? **Check all that apply**

Peanut       Peanut butter

Peanuts in a prepared dish (Describe \_\_\_\_\_)

Peanuts in a packaged food (Describe \_\_\_\_\_)

Unknown

b) What symptoms were exhibited? **Check all that apply**

Hives/rash       Trouble breathing/wheezing       Stomach ache

Anaphylaxis       Swelling of face or other body parts

Other, Please Describe \_\_\_\_\_

c) What treatment was used? **Check all that apply**

Benedryl®/Antihistimine     Epinephrine       No treatment

Active Charcoal       Intubation/Ventilation

Hospitalization: For how many days? \_\_\_\_\_

4) How many reactions has your child had? **Please check one**

**0**                       **2**                       **4-6**

**1**                       **3**                       **6 + (list number \_\_\_\_\_)**



In the past year? \_\_\_\_\_

- a) Has your child ever self-administered a shot of epinephrine for an allergic reaction to peanuts? **Circle one Yes / No**

How many times? \_\_\_\_\_

In the past year? **Yes / No**

How many times? \_\_\_\_\_

- b) Besides self-administration who has administered epinephrine to your child?

**Check all that apply**

- Doctor                       Mother                       Father
- Teacher                       School Nurse                       Babysitter
- Child's peer                       Child's older sibling
- Child's younger sibling     Other (Please list \_\_\_\_\_)

Regarding your child's illness, how often do you feel "in control" in managing his/her peanut allergy? **Please circle one number**

1	2	3	4	5	6	7	8	9	10
never in control			sometimes in control				always in control		

How often are you afraid that your child will have a reaction to peanuts? **Please circle one number**

1	2	3	4	5	6	7	8	9	10
always afraid			sometimes afraid				never afraid		

How afraid are you that your child will have a reaction to peanuts? **Please circle one**

1	2	3	4	5	6	7	8	9	10
very afraid			somewhat afraid				never afraid		

**Peanut Allergy Impact: Child Version**

What is your age?\_\_\_\_\_ What grade are in you in school?\_\_\_\_\_ Are you male or female?\_\_\_\_\_

Have you ever had a reaction to peanuts?\_\_\_\_\_ **Circle one Yes / No**

How many times?\_\_\_\_\_

What happened? Did you have... **Check all that apply**

- Itchy skin       Couldn't breathe       Stomach ache  
 Hot feelings       Red skin  
 Other, Please Describe \_\_\_\_\_

What did people give you for it? **Check all that apply**

- Allergy medicine     A shot       Nothing  
 Went to the hospital

Did you ever have to go to the hospital because of a reaction to peanuts? **Circle one**

**Yes / No**

How many times? \_\_\_\_\_

Have you ever had to have a shot because of peanuts? **Circle one Yes / No**

How many times?\_\_\_\_\_

Do you carry a shot with you when you go places? **Circle one Yes / No**

Do you know how to give yourself a shot? **Yes / No**

If yes...How old were you when you were taught how to give yourself a shot?\_\_\_\_\_ years old

Who taught you? **Check all that apply**

- Doctor     Nurse     Mom       Dad       Other \_\_\_\_\_