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EXAMINING DIFFERENCES IN PARENT KNOWLEDGE ABOUT PEDIATRIC FOOD
ALLERGIES (39 pp.)

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Pediatric food allergy (FA) is a serious health condition that has become increasingly prevalent, as have rates of FAs self-diagnosed by parents and not medical professionals. Parents often play a primary role in assessing and managing risk for their child's FAs. As such, it is increasingly important for parents to possess knowledge about the most recent guidelines for FA management. This study aimed to examine the frequency of medical vs. parent reported diagnoses source as well as investigate levels of FA knowledge among parents using a comprehensive measure. The Food Allergy Knowledge Test (FAKT) was administered to parents ($N=518$) of children aged 3-17 years with ($n=349$) and without ($n=169$) FAs using internet sampling. These FA and Control groups were partitioned into four subgroups: FA group parents of children diagnosed by an allergist ($n=77$) or a pediatrician ($n=209$), and Control group parents who did ($n=106$) or did not ($n=63$) endorse knowing someone with a FA. Findings were analyzed to provide composite knowledge scores and examine the effects of participant groups and predictor variables on FAKT scores. There were significant group differences on the overall FAKT score as well as on four FAKT subscales: Avoiding Exposure, EpiPen Knowledge, Symptoms, and Anaphylaxis. Exploratory analyses found parent age, gender, time since diagnosis, emergency action plan possession, and parental anxiety to be significant predictors of total FAKT score among participants in the FA group. Knowledge of FA was poor across all groups. Education for both caregivers with and without food allergic children is important to

ensure FA safety in multiple settings. Future directions and limitations are discussed.

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ALLERGIES

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By

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INTRODUCTION

Pediatric food allergy (FA) is an immune-based disease that affects approximately 8% of children in the United States (Zelig, Harwayne-Gidansky, Gault, & Wang, 2016). There has been a dramatic increase in both the prevalence and the severity of pediatric FAs in recent decades, with the Center for Disease Control (CDC) reporting an estimated 50% increase between 1997 and 2011 (Branum & Lukacs, 2008). During that time, FA-related hospitalizations more than tripled, making FAs the most common cause of anaphylactic shock (i.e., the most severe reaction that can lead to life-threatening symptoms) in children (Branum & Lukacs, 2008; Lanser, Covar, & Bird, 2016). An estimated 40% of affected children report a history of severe reactions that could lead to hospitalization or death if not treated immediately with proper medication (Chow, Pincus, & Comer, 2015). In addition to morbidity (Abrams & Sicherer, 2016), FAs are associated with overall reduced quality of life and impairments in academic, social, and psychological domains (Valentine & Knibb, 2011; Chow et al., 2015) making pediatric FAs a serious health concern.

While a number of therapeutic treatments are being researched, no preventative treatments for FAs currently exist. The primary course of management is thus limited to avoidance of allergenic food, checking food ingredient labels, and ensuring against cross-contamination. The elimination of foods or food groups puts children with FAs at increased risk for nutritional deficits, and it is therefore recommended that they receive an evaluation and dietary guideline adherence plan from a professional (Groetch & Nowak-Wegrzyn, 2013). This is increasingly important for children with one or more of the ‘big eight’ allergens (i.e., milk, eggs, fish,

shellfish, peanuts, tree-nuts, wheat, soybeans) given recent shifts in FA guidelines from the American Academy of Pediatrics (AAP) and National Institute of Allergy and Infectious Diseases (NIAID). There has been an accumulation of research showing that up to 70% of children can well-tolerate baked forms of milk and eggs (Groetch & Nowak-Wegrzyn, 2013), which can improve tolerance to the uncooked food form (Kim et al., 2011; Leonard et al., 2012). Therefore, children are now advised to regularly consume baked-forms of allergens (if tolerated) to increase their dietary intake (Abrams & Sicherer, 2016; Mazzocchi, Venter, Maslin, & Agostoni, 2017). Similarly, it is now not advised to eliminate all nuts, only those that provoke a reaction (Mazzocchi et al., 2017). The changes in our understanding of FA development and the resulting guideline shifts mean parents and/or legal guardians (henceforth referred to as parents) must remain informed and up-to-date on FA management.

Should a reaction occur, FA treatment requires quick recognition and prompt response to symptoms (La Greca & Mackey, 2009), which can occur immediately, within minutes, or up to several hours after food allergen exposure (NIAID, 2010). Additionally, FA manifestations may be cutaneous (e.g., rashes, itchy throat), gastrointestinal (e.g., vomiting) and/or cardiovascular (e.g., difficulty breathing; Abrams & Sicherer, 2016). Reactions are treated pharmacologically, with antihistamines for mild symptoms and epinephrine auto-injectors (EAI) for severe ones (Gupta, Dyer, Jain, & Greenhawt, 2013a). It is recommended that these medications be carried at all times. Incorrect administration of epinephrine can lead to adverse effects ranging from mild (e.g., tremor, anxiety) to serious (e.g., hypertension and angina; Abrams & Sicherer, 2016). For younger children and often into adolescence, the burden of avoiding allergens, recognizing symptoms, and understanding the appropriate treatment response falls on the parent. Beginning at diagnosis, parents of children with FAs must have a detailed understanding of how to manage

diets, the importance of doing so, and what to do in case of accidental exposure. Research indicates that while fathers share some responsibility, mothers typically carry out the bulk of FA management (King, Knibb, & Hourihane, 2009), which is consistent with parenting literature showing that mothers traditionally play a greater role in childcare (Cummings, Knibb, King, & Lucas, 2010).

FA Management Adherence

It is clear that informed awareness of FA symptomology is essential for proper management of the condition, yet research indicates there are alarming deficiencies in parental knowledge of FA facts and guideline adherence. For example, studies looking at parental epinephrine-use showed that parents often do not carry the medicine at all times as is recommended, carry expired EAI's, and/or incorrectly administer the medication (Sicherer, Forman, & Noone, 2000; Posner & Camargo, 2017). Further, many parents possess a number of FA misconceptions such as the belief that FAs are curable and that allergy medicine can be taken as a preventative measure (Gupta et al., 2009a; Gupta et al., 2010). Beliefs such as these, as well as deficits in medication adherence, may worsen their child's FA symptoms or even increase the risk of a severe reaction occurring. As a result, researchers have begun looking at parent FA knowledge and how it may be impacted. There is evidence to suggest that parents' FA knowledge can be predicted by the FA diagnosis source (e.g., allergist, pediatrician; Gupta et al., 2010). Of note, there are a number of diagnostic methods for FA that may differ by practice such as skin-testing, measurement of serum food-specific IgE levels, or a combination (Abrams & Sicherer, 2016). The gold-standard is medically-supervised food challenges that are double-blind and placebo-controlled (Collins, 2016). However, approximately 30% of reported FAs are those diagnosed by a parent (not physician; Gupta et al., 2013b) and it is believed that parent-

diagnosed FAs are much higher than the true occurrence (Abrams & Sicherer, 2016). Thus, it is possible that a large number of children and parents never received diagnosis and management information from a medical expert.

Even among parents who received a diagnosis from a medical provider, the source appears to matter. In the first known attempt to assess levels of FA knowledge, beliefs, and perceptions, Gupta and colleagues (2009b) developed a series of *Chicago Food Allergy Research Surveys* to measure knowledge and perceptions of FA among the general public (CFARS-GP), primary care physicians (CFARS-PHYS), and parents of children with FAs (CFARS-PRNT). The CFARS-PRNT consists of 15 knowledge questions to discriminate between high and low knowledge levels in five domains: definition and diagnosis, symptom and severity, environmental triggers and risk factors, prevalence and susceptibility, and healthcare treatment. The questionnaire was administered in a 2010 survey of 2,945 parents whose children had either a physician or allergist-diagnosed FA. The authors found that parents of allergist-diagnosed children scored higher on FA clinical knowledge questions than those who received a diagnosis from a pediatrician (Gupta et al., 2010). Having more than one child with a FA and visiting an allergist four or more times a year also predicted higher scores. This study highlighted an important deficit in parent comprehension and potential predictors of FA knowledge; however, respondents were limited to parents who were a) recruited from FA support groups and resource websites and b) whose children had received a FA diagnosis from a medical professional.

The rate of parent-diagnosed FA is rising (Keet et al., 2014) but estimates of current rates are unknown. More information is thus needed on rates of medical- versus parent-diagnosed FA, as well as if – and how – FA knowledge may differ among them. In addition, in the 10 years since the CFARS-PRNT was developed there have been important updates in FA knowledge

concerning diet, cross-contamination, and label-reading that are not reflected on the measure. Using the CFARS-PRNT as a guide, Hahn, Dahlquist, Hoehn, & Bollinger (2017) aimed to address these gaps by developing the 39-item Food Allergy Knowledge Test (FAKT) which updated and included questions to assess the domains identified as most clinically-relevant in FA management: general clinical FA knowledge, avoiding exposure, EAI use, anaphylaxis, and symptoms. When Hahn and colleagues administered the FAKT to parents recruited from an academic pediatric allergy clinic ($n=77$), they found that parental age, education, and socioeconomic level (as measured by private insurance status) were predictive of higher FAKT scores. However, the potential impact of diagnosis source was not examined. Given the changing guidelines on FA management, the present study aims to utilize this updated measure on a larger and more diverse sample along with examining these and other demographic factors that may be predictive of FA knowledge.

Worryingly, inadequate FA knowledge has also been demonstrated in medical professionals and the general public. Knowledge deficits have been noted in restaurant workers, teachers, pediatric dietitians, and most alarmingly, emergency response providers and primary care physicians (National Academies of Sciences, Engineering, & Medicine, 2017). Further, Gupta and colleagues (2008; 2010; 2014) found that primary care physicians had gaps in knowledge on CFARS-PHYS items measuring knowledge of FA definition and diagnosis, symptom severity, and triggers/environmental risk. Physicians also expressed concern that they did not feel adequately trained to care for FA patients and felt uncomfortable interpreting FA results. Other studies have demonstrated that physicians report feeling uncomfortable training patients on EAIs (Wang, Young, & Nowak-Węgrzyn, 2014) and endorse providing suboptimal treatment of anaphylaxis (Stukus, Green, Montandon, & Wada, 2015). Given that formal medical

training for FA management is rare (Springston et al., 2012), it is possible that primary care physicians are less likely to remain up-to-date on the changing guidelines and recommendations than allergists (Stukus et al., 2015).

Shortfalls of FA care do not go unnoticed by parents as shown in a study by Blumenstock et al. (2016) that assessed how 849 parents perceived pediatric FA medical management. They found that the parents who saw non-specialty physicians (i.e., non-allergists) were significantly less likely to report receiving FA education (e.g., when and how to use epinephrine) during visits compared to parents who had seen allergists. However, parent-reports of many important components were still low for both groups, such as for discussion of long-term prognosis and management (59% of allergists; 26% of pediatricians). Further, only 56% of the parents who received allergist care reported receiving an emergency action plan (EAP), which are considered the standard for providing school FA care. EAPs are physician-signed, individualized outlines that contain the child's recommended treatment and emergency contact information. They are expected to be updated as needed by the physicians and be kept in the child's school file (Burks et al., 2012). These sup-optimal rates from allergists and pediatricians alike paired with the recent changes in FA guidelines highlight the need to examine if FA diagnosis source is linked to differences in knowledge utilizing an assessment tool (i.e., FAKT) that has been updated from those used previously.

The Current Study

Given previous research, FA diagnoses from both parents and non-allergist physicians could provide misleading information. Clearly, FA is an important and growing problem among youths that necessitates lifelong management. However, little research exists to provide the public and scientific community with up-to-date information regarding if and how source of diagnosis is

associated with FA knowledge among a diverse sample of parents. Additionally, although FAs have become increasingly prevalent, less is known about rates of parent-diagnosed FA. As such, using internet-sampling procedures, the proposed study seeks to a) assess the frequency of differing pediatric FA diagnosis sources among parents of food-allergic children (Aim 1) and b) provide an update to Gupta et al. (2010) in comparing if there are differences by diagnosis source in parent FA knowledge using the overall score of the comprehensive FAKT (Aim 2). It is expected that a portion of parents of healthy controls may know someone with a FA given the disease's high prevalence. This study will therefore also investigate if FAKT scores differ between two groups of healthy control parents, those who either do or do not know someone with a FA. It is hypothesized that FAKT scores will be highest among parents in the Allergist-diagnosed group and that those in the Pediatrician-diagnosed group will have higher scores than the Control groups. Among the Control groups, parents that report knowing someone with FAs are hypothesized to have higher FAKT scores than those who deny knowing anyone with FAs. Similar patterns are expected in the tertiary objective, which is to examine if group differences exist among individual FAKT domains as measured by the subscales of General Knowledge, Avoiding Exposure, Symptoms, Epinephrine, and Anaphylaxis Knowledge (Aim 3).

Predictors. In addition to hypothesized differences resulting from dissimilar diagnosis sources, a variety of research- and theory- (i.e., based on Bronfenbrenner's ecological model, 1994) driven predictors of FA knowledge may exist. Previous studies have examined the role of both demographic (i.e., parent gender, income, education level) and allergy-specific (i.e., number of children with a FA, yearly allergist visits) factors. Existing literature has also looked at the role of parental anxiety on certain FA management domains (e.g., EAI use), particularly since female parents of food allergic children report significantly higher anxiety levels compared to the

normal population (King, Knibb, & Hourihane, 2008; Cummings et al., 2010). This literature suggests that ‘adequate’ but not excessive levels of anxiety may serve to initiate and sustain vigilance in FA management (Polloni et al., 2015; Fedeles et al., 2016) and will thus be examined in the present study. Finally, two potential predictors not previously examined within the context of FA knowledge are time since diagnosis and EAP possession. Length of diagnosis may affect knowledge in that parents may gain more experience and FA awareness the longer their child has been diagnosed. Given that parents must meet and formulate EAPs with a medical doctor, one would expect that parents with EAPs would be more informed of FA medical information than parents without EAPs. A final, exploratory aim (Aim 4) is thus to investigate what theory- and research-based factors may predict FAKT scores among an internet-based sample of parents of children with FAs.

METHODS

Participants

Parents of children aged 3-17 ($N=725$) were recruited online using Amazon Mechanical Turk (mTurk). In order to be eligible for the current study, respondents were required to (1) be 18 years or older, (2) report English as their primary language, and (3) be the caretaker/guardian of a child between the ages of 3-17 who lived with them at least 50% of the time. Two parallel surveys were created: one for parents of children with a FA and one for parents of healthy controls (see Procedures). Respondents within the FA group were required to endorse that their child had a FA (inclusion criterion 4a). If they had multiple children with FAs, respondents were instructed to respond to the questions thinking of their youngest food-allergic child. Respondents within the healthy control group were required to deny having any children diagnosed with a FA, asthma, or any other potentially serious medical condition (e.g., cancer, autoimmune disorder; inclusion criterion 4b). Control respondents with multiple children were also asked to respond to questions thinking of their youngest child. Six validity check questions (e.g., “The sun is hot”) were included in the study. Respondents who did not correctly respond to all validity check items ($n=78$) or who completed surveys from more than one of the associated surveys (i.e., filled out both a control and FA survey, $n=91$) were excluded from further analyses, with a subsequent sample of 556 participants. ‘Seriousness checks’ were conducted by checking the plausibility and accuracy of certain questions, e.g., the combination of a child’s age and diagnosis length (Aust, Didenhofen, Ullrich, & Musch, 2013). In order not to confound FA knowledge with medical training, respondents were also excluded from the current study if they reported

employment as a healthcare professional ($n=38$). The resultant sample of 518 participants was used to address Aim 1 of the current study. Within the FA group, sample sizes for parents who received a diagnosis from a nurse practitioner ($n=3$), parent ($n=16$) or family doctor ($n=44$) were too small to include in subsequent analyses designed to address Aims 2 (FAKT total score differences by diagnosis source), 3 (FAKT subscale score differences by diagnosis source), and 4 (exploratory analyses), and were thus excluded for purposes of examining those aims. The resultant sample ($n=455$) utilized for purposes of addressing study Aims 2 and 3 consisted of 286 FA group respondents and 169 Control group respondents. The sample was further divided into four groups for analyses (see Analytic Plan). Finally, for exploratory aim 4, respondents ($n=15$) with missing data for the predictors were excluded from analyses, resulting in a total sample of 271 FA group respondents. Demographic characteristics for the entire sample as well as group characteristics can be found in Table 1.

Procedures

This study was part of broader research investigating differences in parenting practices between parents of children with and without FAs. The Kent State University Institutional Review Board approved this study. Parents were recruited through mTurk, an online task platform where individuals select potential surveys of interest (Human Intelligence Tasks; HITs) and are paid for HIT completion. Two corresponding surveys were created for the FA and Control groups. Respondents who did not meet the eligibility criteria (inclusion criterion 1-4a/4b) were not permitted to proceed. Respondents were compensated \$0.75 to complete the survey, which was expected to take approximately 45 minutes for the FA group and 25 minute for the Control group. Both groups completed the FAKT at the conclusion of their respective surveys. Previous studies have used mTurk to examine parenting practices and perceptions

(Flessner, Murphy, Brennan, & D'Auria, 2017; Darling, Fahrenkamp, Ruzicka, & Sato, 2018) and participant data illustrated psychometric qualities equal to or higher than data from more traditional samples as well as providing more diverse populations (i.e., greater ethnic/racial and economic diversity) compared to other internet-based samples (Buhrmester, Kwang, & Gosling, 2011).

Measures

The Parent Survey of Pediatric Health and Behavior (PSPHB). All respondents completed the PSPHB, a questionnaire designed to collect self-report data from parents in relation to their and their child's behavior. Data collected included questions regarding characteristics of the parent and child (e.g., age, gender, race/ethnicity). Of relevance to the current analyses, income was measured using a proxy question that asked if their child was eligible to receive free or reduced-price lunch, which previous research has used as a substitution measure for socioeconomic status (Hobbs & Vignoles, 2010). All respondents completed the same PSPHB items in the same order, which included measures of parent psychopathology, child quality of life, and family functioning. At the end of the survey FA group respondents answered additional items embedded within the survey concerning their child's FA. These included questions asking about FA type, diagnosis source and time, and severity (e.g., occurrence and frequency of mild or severe reactions at home and/or school), as well as the perceived impact on domains such as familial (e.g., "Within the past 12 months, has your family avoided going on trips or vacations as a result of your child's FA?"), social (e.g., "How much do you think your child's FA gets in the way of his/her ability to participate in social activities?"), and academic (e.g., "How much do you think your child's FA gets in the way of his/her school performance?") functioning.

The Food Allergy Knowledge Test (FAKT; Hahn et al., 2017). The FAKT is a 39-item

measure intended to comprehensively assess FA illness knowledge for parents of children with FAs. The FAKT includes questions organized into the following domains: general FA knowledge, avoiding exposure (i.e., diet, cross-contamination, reading labels), recognizing FA symptoms, EAI use, and anaphylaxis (i.e., signs, symptoms, and treatment). Respondents are given one point for each correct answer of 57 items. The overall score is created by summing the total of each correct item answered. In this instrument, all items require responses in the form of *True*, *False*, or *I don't know*. All responses of *I don't know* received a score of 0. Two questions have multiple-choice answers listing symptoms (e.g., “Please indicate whether each of the following is a symptom of FA: mouth itching, hyperactivity, lip swelling...”) for a possible score of 20 points. Prior research has shown the FAKT to demonstrate excellent internal consistency (Hahn et al., 2017). The internal consistency (Cronbach’s alpha) in the current study was calculated to be .88 for the overall FAKT scale. The internal consistency was strong on the Symptoms subscale (item $n=18$, $\alpha = .81$), and adequate for the Avoiding Exposure (item $n=11$, $\alpha = .7$) and EpiPen (item $n=13$, $\alpha = .73$) subscales. There was poor internal consistency on the General (item $n=6$, $\alpha = .35$) and Anaphylaxis (item $n=9$, $\alpha = .5$) subscales.

Depression, Anxiety, and Stress Scale, Short Version (DASS-21; Antony, Bieling, Cox, Enns, & Swinson, 1998). The DASS-21 is brief version of the DASS, a self-report measure designed to assess adult levels of depression, anxiety, and stress. The three DASS-21 scales are composed of seven questions each that ask to what extent symptoms are present within the past seven days. The questions are ranked on a four-point Likert scale that ranges from 0 (not at all) to 3 (all or most of the time). Each result is multiplied by two to obtain the final score for each category, with higher scores indicating greater symptomatology. The DASS-21 has demonstrated high internal consistency and concurrent validity with the DASS and other validated measures of

depression and anxiety (Chow et al., 2015; Henry & Crawford, 2005). The internal consistency (Cronbach's alpha) of the DASS-21 anxiety scale was calculated as .87 in the current study.

Data analytic plan

Statistical analyses were conducted using the IBM Statistical Package for the Social Sciences (SPSS version 24.0). For the purposes of addressing Aims 2 and 3 and to provide a more comprehensive examination of differences in FA knowledge, the FA and Control samples were partitioned into four subgroups. Specifically, the FA group was divided into parents of children with a FA diagnosis either obtained from an allergist (Allergist group; $n=77$) or a pediatrician (Pediatrician group; $n=209$). The Control sample was sub-divided into parents who either denied knowing anyone with a FA (Controls; $n=63$) or who endorsed knowing someone with a FA (Controls with FA Relation; $n=106$). See Table 1 for respondent characteristics. For Aim 4, the sample size was refined to include only FA group parents ($n=286$).

Aims 2 & 3. Prior to conducting analyses, statistical assumptions of one-way analysis of variance (ANOVA) were examined. Skewness and kurtosis were within normal limits. Preliminary analyses revealed no significant differences between groups on selected demographic variables (i.e., age, sex, race, family income). Appropriate effect sizes were based on a previous study by Goossens et al. (2013) that examined FA knowledge (i.e., CFARS-PRNT) cross-culturally. A priori power analysis using G*Power version 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2009) indicated that in order to detect a medium effect size ($d=.5$; $\alpha=.05$) and achieve power of 0.80, a total sample size of 76 was required. The obtained sample of 455 was thus deemed sufficient for addressing this study's aims.

Aim 4. Prior to conducting multiple linear regression analyses, bivariate Pearson correlations were used to examine associations between FAKT and predictors of interest, which

were selected based on theory and prior research. Initial variables consisted of parent age, gender, education level, number of food-allergic children, income, number of urgent care trips in the past year due to FA, time since diagnosis, parent anxiety, and possession of an EAP. Any variables with α of 0.1 or less based on two-tailed Pearson Correlations were included in the next step of the analysis. Only one variable, education level, was thus excluded; all other variables were significantly correlated with total FAKT score at levels of $p < .05$ (see Table 3). Using correlation coefficients, no variables demonstrated inter-correlations with absolute values greater than .2. A multiple linear regression model was then used to examine the best predictor(s) of FAKT scores among parents with children with FAs. Predictors were included in the subsequent regression analysis using a forced-entry method.

RESULTS

Aim 1: Diagnosis Source Characteristics

In total, 349 eligible respondents completed the FA survey. The majority of these respondents (59.9%) reported that their child received a FA diagnosis from a pediatrician ($n=209$), while 22.1% of respondents reported receiving a diagnosis from an allergist ($n= 77$). Of the remaining respondents, 12.6% received a diagnosis from a general family doctor (i.e., non-pediatrician; $n=44$) and 4.6% ($n=16$) reported diagnosing their child themselves. Less than one percent (.9%) of respondents received a diagnosis from a nurse practitioner ($n=3$).

Aim 2: FAKT Differences by Diagnosis Source

A one-way ANOVA was used to examine group differences in overall FAKT scores. The results of the comparison between the four conditions yielded a statistically significant effect, $F(3,451) = 4.89, p = .002, \eta^2 = .03$. Post-hoc comparisons using Gabriel's pairwise test procedure indicated that the Pediatrician group ($M = 30.68, SD = 8.68; p = .001, d = .55$) and Controls with FA Relations ($M = 30.3, SD = 8.99; p = .011, d = .5$) demonstrated significantly higher FAKT scores than the Control Group ($M = 25.81, SD = 9.14$). FA knowledge among those in the Allergist group was not significantly different from Pediatrician group respondents ($p = .73, d = .16$) or from either Control groups of respondents that knew ($p = .95, d = .18$) or did not know ($p = .17, d = .34$) someone with a FA. There were also no statistically significant differences between the scores of the Pediatrician and Controls with FA Relations ($p = 1.0, d = .04$) groups. All group FAKT scores can be found in Table 2.

Aim 3: FAKT Subscale Differences by Diagnosis Source

One-way ANOVAs were used to examine group differences across individual FAKT domains. Results indicated statistically significant differences between groups with respect to four subscales: Avoiding Exposure, $F(3,451) = 3.31, p = .02, \eta^2 = .02$; EpiPen Knowledge, *Welch's* $F(3,183.17) = 10.27, p < .001, \eta^2 = .06$; Symptoms, *Welch's* $F(3,167.97) = 5.92, p = .001, \eta^2 = .04$; and Anaphylaxis, $F(3, 451) = 3.17, p = .02, \eta^2 = .02$. There were no statistically significant differences on the FAKT: General Knowledge subscale ($p = .273$). All group subscale scores can be found in Table 2. Group response percentages by item are provided in Table 4.

To examine group differences on FAKT subscale scores, post-hoc analyses were conducted using Gabriel and Games-Howell tests. With respect to the Avoiding Exposure subscale, Gabriel's post-hoc analyses indicated a trend towards significance such that the Controls with FA Relations ($M = 7.03, SD = 2.34$) outperformed the Allergist ($M = 6.06, SD = 2.46; p = .053, d = .4$) and Control ($M = 6.05, SD = 2.63; p = .07, d = .4$) groups. No other significant differences between groups were noted.

In regards to the EpiPen Knowledge subscale, Games-Howell post-hoc tests indicated that the Allergist group ($M = 5.23, SD = 3.11$) scored significantly higher than all three groups: Pediatrician ($M = 4.14, SD = 2.79; p = .04, d = .37$), Controls ($M = 2.83, SD = 2.2; p < .001, d = .89$), and Controls with FA Relations ($M = 3.75, SD = 2.81; p = .01, d = .5$). The Pediatrician group also significantly outperformed the Controls ($p = .004, d = .52$). There was trend towards significance such that the Controls who endorsed knowing someone with a FA had higher scores than the Controls that did not ($p = .09$). Results indicated no other significant group differences.

With respect to the Symptoms subscale, Games-Howell post-hoc analyses showed that the Pediatrician group ($M = 12.57, SD = 3.37$) scored significantly higher than the Allergist ($M = 10.94, SD = 4.25; p = .02, d = .42$) and Control ($M = 10.59, SD = 4.26; p = .006, d = .52$) groups.

The Controls with FA Relations ($M = 12.23$, $SD = 3.81$) also outperformed the Controls, $p = .035$, $d = .41$. Other group differences on the Symptoms subscale were non-significant.

Finally, in regard to the Anaphylaxis subscale, results of Gabriel's post-hoc analyses indicated that the Pediatrician group ($M = 5.04$, $SD = 1.84$) scored significantly higher than the Control group ($M = 4.22$, $SD = 1.87$), $p = .011$, $d = .44$. No other groups differed significantly.

Aim 4: Exploratory Analyses

A simultaneous multiple regression was conducted to analyze predictors of FAKT scores for parents in the FA groups ($N = 286$). The total FAKT score was entered as the dependent variable. Eight variables were included as predictors: age, gender, income, diagnosis length, number of urgent care trips, parental anxiety, number of food allergic children, and EAP possession. Regression analyses indicated that the overall model was significant, $F(8, 262) = 11.1$, $p < .001$, and accounted for 23.0% of the variance in predicting parental FAKT score. The model showed a significant positive association between total FAKT score and four predictors: parent age ($\beta = .13$, $p = .037$), gender ($\beta = .19$, $p = .001$), time since diagnosis ($\beta = .13$, $p = .042$), and possessing an EAP ($\beta = .24$, $p < .001$). Specifically, higher FAKT scores were associated with female gender, increased parent age, increased length of FA diagnosis, and possession of an EAP. Total FAKT scores were negatively correlated with parental anxiety report ($\beta = -.16$, $p = .009$) such that greater parental anxiety predicted lower scores. Income ($\beta = .10$, $p = .068$), urgent care trips ($\beta = -.06$, $p = .33$), and number of food-allergic children ($\beta = .04$, $p = .472$) were not statistically significant predictors of FAKT. Regression, coefficients (B , β), and standard error of the regression coefficient (B) can be found in Table 4.

DISCUSSION

Pediatric FA is a growing health concern in which proper management is essential. The physical and psychosocial implications of FAs make accurate diagnosis and medical guidance critical to prevent misconception and mismanagement. As awareness of the condition has increased, so has the number of FAs diagnosed by parents (not professionals), who have been shown to overestimate true allergies (Baricic et al., 2015). However, even medical professionals have deficits in FA knowledge, with variable recognition and management skills reported (Keet et al., 2014). In order to help circumvent barriers to proper care, more information is needed on if diagnosis source relates to how informed parents are on the subject of FA medical information. The aim of the current study was thus three-fold: to contribute to the literature by examining the frequency of pediatric FA diagnoses sources within a sample of parents with food-allergic children; to examine FA knowledge among parents of differentially-diagnosed children using an updated, comprehensive measure; and to provide exploratory results as to what other potential predictors of FA knowledge may exist. What follows is a brief review and discussion of these findings and their implications for science's understanding as it relates to parent management of pediatric FAs.

In the present study, the majority of parents reported that their child received a pediatric FA diagnosis from a pediatrician, while approximately a quarter of the sample received a diagnosis from an allergist. Among the FA group, the frequency of parent-diagnosed FA, 4.6%, is consistent with a previous study conducted by Keet et al. (2014) that found roughly 3-6% of FAs

are self-reported, both of which are much lower than the 30% found by Gupta et al. (2013b). Although the sample of parents reporting self-diagnosed FAs was too small for analyses in the present study, this area warrants further research as children with parent-diagnosed FAs may be an especially vulnerable sub-population of pediatric FAs. Parents who self-diagnosed may not receive appropriate FA education and management from a medical professional, which could affect access to appropriate medication or nutritional guidance (Gupta et al., 2013b). In addition, emerging evidence suggests that rates of parent- and non-professional diagnosed FAs are higher in minority populations; as such, future research should continue to explore if racial/ethnic identity influences diagnosis rates and knowledge (Gupta et al., 2013a).

Results from the present study showed a main effect of diagnosis source on overall FA knowledge scores, but the directionality of this main effect was not entirely as expected. Strikingly, all groups scored below 60% on the FAKT, with respondents in the Pediatrician (57.33%) and the Control with FA Relations (56.32%) groups scoring significantly higher than the Control group (48%). Contrary to hypotheses, the overall FAKT scores of the Allergist group (54.09%) did not differ from the scores of any other group. Our findings – which indicate a poor sense of FA knowledge for all respondents, regardless of group – are somewhat contradictory to those by Blumenstock et al. (2016) that found parents reported receiving less FA education and guidance from non-specialty physicians. However, this and other studies have found that parents reported sub-optimal medical information from pediatricians and allergists alike (Xu et al., 2010). In addition, while allergists report higher rates of adherence to FA education guidelines, research from general healthcare suggests that the distribution of practice guidelines does not significantly affect physician or patient behavior on its own (Fineman, Dowling, & O'Rourke, 2013). Further, these results may highlight a possible discrepancy – and thus potential area of

improvement – between the amount of information that parents receive versus what is retained.

The overall poor performance of both FA groups in the current study may relate to previous findings that suggest that parents of children with chronic health conditions often have poor recall of associated disease details, such as possible complications and treatment/medication instructions (Birtwell & Sandberg, 2014). While Bangash & Bahna (2005) found an increase in parental FA management knowledge following visits to pediatric allergist clinics, other studies found that patients immediately forget between 40-80% of information given by medical practitioners (Kessels, 2003). This reduced memory for medical information may be due to several possible determinants as discussed by Birtwell & Sandberg (2014). Parents attending pediatric consultation visits often receive much more medical-information than can be realistically retained given memory capacity. In addition, delivering health information that covers multiple, broad domains (e.g., disease type, complications, treatments, instructions) has been linked to worse memory compared to delivering information with a narrower topic breadth. Further, the proximity of a young child during a medical visit might serve as an environmental distraction that further impedes memory. Given that providing large amounts of broad information is inherent to pediatric health visits, the authors reinforced the need for providing additional methods to communicate health information to parents, such as educational booklets, note-taking, and having the parent verbally repeat the information (Birtwell & Sandberg, 2014). Using auxiliary methods of communication may also be especially important for parents of young children, which made up the majority of the current sample. One additional explanation for our results may be that the source of diagnosis differed from the source of care such that parents who received a pediatrician-diagnosis may have been subsequently referred to – and received care from – an allergist. This is in line with previous work that found that the majority

of pediatricians reported referring patients with FA symptoms to an allergist (Gupta et al., 2014). However, the present study did not measure potential referrals (i.e., those who received an initial diagnosis from a pediatrician and then switched to an allergist) or temporal factors such as the timeline of pediatrician and/or allergist visits yearly. Additional, longitudinal research is needed to examine general and temporal relationships between FA education received and the parent's self-perceived and objective retention of said information.

Overall, our results indicated inadequate rates of FA knowledge among all parents, including parents of children with FAs. The greater degree of FA knowledge exhibited by Control group respondents who endorsed knowing someone with a FA was also unexpected. One possible explanation for this finding relates to an inherent limitation of the study. Although respondents in the Control group were excluded if they reported having a child with a FA, the survey only assessed if respondents knew a non-offspring with FAs and not the nature of the relationship that was endorsed. As a result, it is possible that the respondents themselves had a FA or had a close relationship (e.g., spouse or sibling) with a person who had one, both of which may lead to increased familiarity with FA and FA management. Also not assessed was previous FA training or education. While individuals who worked in a healthcare setting were excluded, it is still possible that respondents worked in an environment that necessitated FA training. For example, school and daycare employees are increasingly expected to be proficient in recognizing FA symptoms and carrying out EAPs (Tsuang & Wang, 2016), which could also explain some of the results from analyses henceforth explained.

Analyses examining FAKT subscale scores produced mixed results, with significant group differences on all subscales but General Knowledge. Of note, the poor internal consistency of the General Knowledge and Anaphylaxis subscales suggests caution should be used when

interpreting the associated results. With respect to the EpiPen subscale, the Allergist group outperformed all three groups, while the Pediatrician group outscored the Controls. These results were not surprising given the clinical necessity of Epi-pen use for treating reactions and the need for training before use. The Pediatrician group similarly outscored the Controls on the Anaphylaxis subscale and both the Control and Allergist groups on the Symptoms subscale. Contrary to our hypothesis, the Allergist group did not outperform other groups on the Anaphylaxis subscale. However, recognition and treatment of anaphylaxis is known to be under-recognized (Abdurrahman et al., 2013). In addition to the impact of poor internal consistency, it is possible that allergists and pediatricians cover different facets to FA knowledge, with allergists focusing less on general symptoms beyond the child's specific presenting problem. Although the Allergist group did not outscore the other groups as hypothesized, as mentioned, Blumenstock et al. (2016) found that even parents who went to an allergist reported sub-optimal education in some domains, indicating that quality of care received might be variable. When taken together with previous research, our results suggest that diagnosis source does not predict FA knowledge among parents of children with pediatric FAs.

Several predictors of FA knowledge were significant in this study. Our finding that EAP possession predicted higher scores on the FAKT was not surprising, as in order to obtain one families must meet with a physician to discuss their child's FA. Both temporal factors (i.e., parent age and time since diagnosis) were significantly positively correlated with FAKT scores. Our finding that older parent age predicted higher FAKT scores was also found by Hahn (2017) and may be due to the increased exposure (and/or experience with healthcare providers in general) that likely comes with aging. Similarly, parents of children who have had FA diagnoses for longer periods would have more years of experience with FA management and possibly more

contact with allergy specialists, both of which may result in a greater degree of FA education. The finding that higher reported levels of anxiety predicted lower scores was somewhat surprising as there is evidence to suggest that high anxiety levels promote information gathering and adherence, while low levels may be associated with decreased vigilance (Mandell, Curtis, Gold, & Hardie, 2005; Fedele et al., 2016). However, Cummings et al. (2010) found that although mothers reported decreased anxiety when their child was prescribed an EAI, anxiety levels were not associated with the likelihood that the child carried the EAI or avoided allergens. Additionally, Mackenzie et al. (2007) found that elevated trait anxiety was associated with impaired working memory performance in parents of terminally-ill children, indicating that parent anxiety may not have constructive effects on FA health literacy and may even impair it. Others have argued that detrimental effects on parent FA management are more likely to occur if the parent's anxiety does not fluctuate over time as expected, but instead remains at a chronically high level that leads them to feel 'paralyzed' by fear (Klennert & Robinson, 2008). More research is needed to better understand how parent anxiety may impact memory for FA-related information. Our final exploratory result, that female parents had significantly higher FAKT scores than males, was in line with previous findings that mothers report higher levels of allergy-related care and childcare in general (Hoehn et al., 2016). Clinical implications for these results suggest that parents who are male, young, and/or have newly diagnosed children may be particularly vulnerable to FA mismanagement. However, the low FAKT scores of our sample overall suggests that, regardless of gender or temporal factors, there is a concerning lack of retention and/or recall of FA health facts among parents in general.

Several limitations to the current study are worth noting. This study used self-report measures which are vulnerable to responder misinterpretation and bias (Gupta et al., 2013b). The

sample could not be verified, although eligibility criteria were incorporated into the surveys. The accuracy of FA diagnosis, evaluation, or treatment could not be confirmed as no other data on diagnostic testing or biological samples were collected. While the use of online sampling enabled broader samples, it also has several notable disadvantages such as potential selection bias via the exclusion of those without the access or skill level needed to use mTurk. Pay-per-rates are based on number and not time of task completion, which may incentivize respondents to quickly complete measures without deliberation, and researchers have limited ability to control for environmental factors that might diminish respondents' attention (Work, 2011; Coles et al., 2009); to minimize this risk, validity check items were added to check if respondents were paying attention (see Participants). A final limitation is the study's cross-sectional design, which limited the ability to draw causal and directional influences of the observed effects. As mentioned, future research is needed to explore how temporal factors may impact FA knowledge over time. While these limitations should be considered in subsequent research, online sampling provided an easily obtained and cost-effective method by which to test the current hypotheses and inform future research. As a result, methodological strengths of this study include the large sample size and minimal missing data.

Overall, the findings of this study support prior research indicating suboptimal FA knowledge among parents. This study has several notable implications for future research on FA management. Although awareness of and advocacy for pediatric FAs has grown, misperceptions of the disease still clearly exist among both affected parents and the general public. An improved understanding of predictors of parent knowledge can potentially be used to help strengthen FA education and related health literacy, which in turn lessens the chance for the negative physical – as well as potential psychosocial – impact of FAs on parent-child dyads. Given that adequate FA

knowledge is essential in FA management, more research should continue to explore risk factors for deficits in FA knowledge and how those deficits can be addressed. While replication is necessary within a clinically ascertained sample, these results highlight potential areas for which targeted interventions may be useful. For example, there is a need for more effective methods for delivering and verifying retention of FA medical facts, particularly for families with young and/or newly diagnosed children. Although research should continue to focus on identifying vulnerable families, the need for increased FA fact retention and competence extends to the general population. Targeted education and checking for comprehension will help to increase FA knowledge, which may in turn improve both disease management and the overall quality of life for both food allergic children and their parents.

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Table 1. *Demographic Characteristics of Sample With and Without Food Allergies*

	Total Sample (<i>N</i> =518)		By Sub-group (<i>n</i> = 455)			
	With (<i>n</i> =349)	Without (<i>n</i> =169)	Pediatricians (<i>n</i> =209)	Allergists (<i>n</i> =77)	Controls (<i>n</i> =63)	Controls + FA Relations (<i>n</i> =106)
<u>Parent Characteristics</u>						
Biological Sex, Female, <i>n</i> (%)	202 (58)	102 (60.4)	129 (61.7)	41 (53.9)	38 (60.3)	64 (60.4)
Age, <i>M</i> (<i>SD</i>)	34.83 (7.02)	35.16 (6.52)	34.94 (6.84)	33.68(6.59)	35.67 (6.86)	34.86 (6.32)
Race, <i>n</i> (%) ^a						
White	258 (74.8)	115 (68.5)	158 (77.1)	58 (75.3)	41 (65.1)	74 (70.5)
Black or African American	30 (8.7)	18 (10.7)	19 (9.3)	5 (6.5)	10 (15.9)	8 (7.6)
Asian or Pacific Islander	43 (12.5)	30 (17.9)	18 (8.8)	12 (15.6)	10 (15.9)	20 (19)
American Indian or Eskimo	14 (4.1)	5 (3.0)	10 (4.9)	2 (2.6)	2 (3.2)	3 (2.9)
Marital Status, Partnered, <i>n</i> (%)	284 (81.4)	149 (88.2)	174 (83.3)	60 (77.9)	54 (85.7)	95 (89.6)
Education Level, <i>n</i> (%)						
High School or GED	67 (19.2)	31 (18.3)	42 (20.1)	12 (15.6)	15 (23.8)	16 (15.1)
Associate's	70 (20.1)	82 (48.5)	44 (21.1)	16 (20.8)	28 (44.4)	54 (50.9)
Completed $\geq$ 4-year college	212 (60.7)	56 (33.1)	123 (58.9)	49 (63.6)	20 (31.7)	36 (34)
Eligible for reduced lunch, <i>n</i> (%)	125 (35.8)	105 (62.1)	66 (31.6)	32 (41.6)	26 (41.3)	38 (35.8)
Children with FAs $\geq$ 2, <i>n</i> (%)	53 (15.2)		31 (14.9)	14(18.2)		
<u>Child Characteristics</u>						
Biological Sex, Female, <i>n</i> (%)	136 (39)	64 (37.9)	79 (37.8)	32 (41.6)	26 (41.3)	38 (35.8)
Age, <i>M</i> (<i>SD</i>)	7.32 (3.93)	6.96 (3.73)	7.09 (3.81)	7.01 (3.58)	7.47 (3.67)	6.66 (3.76)

Race, <i>n</i> (%) ^a						
White	252 (73)	115 (68)	155 (75.2)	57 (74)	40 (63.5)	75 (70.8)
Black or African American	38 (11)	21 (12.4)	25 (12.1)	6 (7.8)	12 (19)	9 (8.5)
Asian or Pacific Islander	42 (12.2)	28 (16.6)	19 (9.2)	12 (15.6)	9 (14.3)	19 (17.9)
American Indian or Eskimo	13 (3.8)	5 (3)	7 (3.4)	2 (2.6)	2 (3.2)	3 (2.8)
Type of FA, <i>n</i> (%) ^a						
Peanuts	101 (28.9)		54 (25.8)	30 (30.9)		
Milk/Dairy	134 (38.4)		83 (39.7)	29 (37.7)		
Egg	52 (14.9)		26 (12.4)	17 (22.1)		
Tree nut	29 (8.3)		16 (7.7)	10 (13)		
Fish	25 (7.2)		11 (5.3)	8 (10.4)		
Shellfish	54 (15.5)		34 (16.3)	13 (16.9)		
Wheat	21 (6)		12 (5.7)	7 (9.1)		
Soy	46 (13.2)		30 (14.4)	9 (11.7)		
Other (e.g., Citrus)	46 (13.2)		12 (5.7)	7 (9.1)		
FA-Related ER Trips, ≥ 1 , <i>n</i> (%)	97 (25.2)		47 (22.6)	30 (39.5)		
EAP Possession, <i>n</i> (%)	132 (37.8)		102 (48.8)	45 (58.4)		
Years Since Diagnosis, <i>M</i> (<i>SD</i>)	3.99 (3.28)		4.1 (3.30)	3.7 (3.36)		

Note: ^aRespondents could select more than one answer

Table 2. *FAKT Sum and Subscale Scores by Group from One-Way Analysis of Variance*

FAKT Scores, <i>M (SD)</i>	Pediatrician	Allergist	Control	Control + FA Relations
Total Sum	30.68 (8.68) ^a	29.16 (10.3)	25.81 (9.14) ^{a,b}	30.3(8.99) ^b
Subscales				
Avoiding Exposure	6.64 (2.46)	6.06 (2.46) ^{T1}	6.05 (2.63) ^{T2}	7.03 (2.34) ^{T1, T2}
General Knowledge	2.29 (1.37)	2.23 (1.39)	2.13 (1.23)	2.51 (1.26)
EpiPen Use	4.14 (2.79) ^{a,b}	5.23 (3.11) ^{a,b}	2.83 (2.2) ^{a,b, T1}	3.75 (2.81) ^{b,T1}
Anaphylaxis	5.04 (1.84) ^a	4.69 (2.1)	4.22 (1.87) ^a	4.79 (1.87)
Symptoms	12.57 (3.37) ^{a,b}	10.94 (4.25) ^a	10.59 (4.26) ^{b,c}	12.23 (3.81) ^c

Note: ^{a,b,c}: denotes statistically significant difference between groups

Note. ^{T1} & ^{T2}: denotes a trend towards statistical significance between groups

Table 3. *Pearson Correlation Coefficients for FAKT Predictor Variables (N=271)*

Variables	1	2	3	4	5	6	7	8	9	10
1. FAKT SUM	—									
2. Parent Age	.24**	—								
3. Parent Gender	.26**	.01	—							
4. Food Allergic Children	.13*	.04	.14*	—						
5. Reduced Lunch	.19**	.09	.07	-.01	—					
6. Time Since Diagnosis	.24**	.46**	.19**	.06	-.05	—				
7. FA Urgent Care Trips	-.20**	-.05	-.17**	-.05	-.24**	-.1	—			
8. Parent Anxiety	-.26**	-.21**	-.06	.01	-.22**	-.11	.4**	—		
9. FA EAP	.27**	.10	.1	.15**	.01	.02	.02	.01	—	
10. Degree	-.03	.10	-.25**	.09	.17**	-.07	.11	.11	-.03	—

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 4. *Regression Analyses for Variables Predicting FAKT Total Score*

Predictor	B	SE	Beta (β)
Parent Age	.18	.08	.13*
Parent Gender	3.50	1.03	.19**
Food Allergic Children	.86	1.2	.04
Reduced Lunch	1.97	1.08	.10
Time Since Diagnosis	.35	.17	.13*
FA Urgent Care Trips	-.26	.22	-.06
Parent Anxiety	-.18	.07	-.16**
FA EAP	-4.38	.99	.24***

Note. $R^2 = .253$ ($p < .001$).

Note. *** $p < .001$; ** $p < .01$; * $p < .05$.

Table 5. *Percent Correct of FAKT items by Group*

	Pediatricians	Allergists	Controls	Controls + FA Relations
Food companies are required to list all possible allergens in clear, bold type. ^{T/F}	12.4	15.6	11.1	14.2
Cross-contamination can occur when foods are being processed in manufacturing facilities. ^{T/F}	88.0	80.5	82.5	89.6
It's a good idea to give a child with a history of FA a small amount of the allergic food at home. ^{T/F}	50.7	42.9	42.9	53.8
Epinephrine frequently causes severe side effects in children. ^{T/F}	19.1	27.3	19.0	18.9
A severe allergic reaction typically is treated with antihistamine (e.g., Benadryl®) alone. ^{T/F}	54.1	51.9	41.3	50.0
Only children who are allergic to meat need to worry about potential allergens in meat purchased at a deli. ^{T/F}	61.7	51.9	44.4	67.9
Currently, no medicines can prevent the development of FAs. ^{T/F}	48.8	44.2	52.4	65.1
Children react the same way every time they are exposed to the same food allergen. ^{T/F}	75.6	61.0	58.7	68.9
At a restaurant, you need to inform the staff of a FA only if your child orders something that he or she has never eaten before. ^{T/F}	39.2	33.8	54.0	59.4
If you think your child is having a severe allergic reaction but you're not sure, you should go ahead and administer epinephrine. ^{T/F}	31.6	37.7	20.6	30.2
It's safe to assume that labels are identical on a large and small box of cereal. ^{T/F}	63.6	57.1	58.7	60.4
Allison is allergic to cheese. It's safe for her to eat pizza after picking the cheese off of her slice. ^{T/F}	79.9	77.9	71.4	78.3
Auto-injectors each contain 3 doses of epinephrine. ^{T/F}	19.1	36.4	9.5	13.2
It's a good idea to wait 10-15 minutes and see if your child's symptoms get worse before treating a suspected severe allergic reaction. ^{T/F}	57.9	61.0	41.3	45.3
A severe allergic reaction can take up to 2 hours to show up. ^{T/F}	38.8	44.2	41.3	50.0
Jason is allergic to fish. It's safe for him to eat French fries that have been fried in the same oil as fish. ^{T/F}	80.4	74.0	71.4	80.2
Taking an antihistamine (e.g., Benadryl®) before eating an allergic food can prevent a severe allergic reaction. ^{T/F}	45.9	49.4	46.0	43.4
Cosmetics and lotions may be a source of food allergens. ^{T/F}	67.5	62.3	52.4	67.9
Once you have determined that a product is safe,	67.5	64.9	65.1	74.5

you don't need to keep checking the label each time you buy it. ^{T/F}				
A child can have a reaction just by touching an allergic food. ^{T/F}	75.6	66.2	63.5	84.9
Most other countries have the same food labeling regulations as the United States. ^{T/F}	62.2	51.9	58.7	62.3
Children who have had a severe allergic reaction are less likely to outgrow their allergy. ^{T/F}	25.4	31.2	20.6	36.8
Epinephrine should be kept at room temperature. ^{T/F}	48.8	59.7	15.9	42.5
As long as the airplane flight is short (under 2 hours), it's okay to put your child's epinephrine auto-injector in your checked baggage. ^{T/F}	48.1	18.9	11.2	21.9
Symptoms ^{MC} :				
Mouth itching ^{T/F}	80.4	67.5	58.7	86.8
Hyperactivity	33.0	29.9	27.0	34.0
Lip swelling ^{T/F}	88.5	79.2	82.5	86.8
Tongue swelling ^{T/F}	90.0	83.1	82.5	87.7
Itchy bumpy rash ^{T/F}	90.0	77.9	82.5	87.7
Learning problems	42.6	41.6	60.3	54.7
Eczema ^{T/F}	41.1	45.5	33.3	56.6
Abdominal pain ^{T/F}	78.0	63.6	60.3	65.1
Nausea ^{T/F}	83.7	70.1	60.3	70.8
Hair loss	45.5	33.8	34.9	40.6
Vomiting ^{T/F}	84.7	72.7	60.3	77.4
Diarrhea ^{T/F}	78.0	62.3	55.6	68.9
Throat swelling (closing) ^{T/F}	89.0	77.9	81.0	83.0
Trouble breathing ^{T/F}	89.5	81.8	82.5	84.9
Fainting ^{T/F}	53.1	46.8	41.3	48.1
Which of the following foods is LEAST likely to cause FA in children? ^{MC}	38.8	32.5	33.3	35.8
Which of the following are scientifically proven treatments for FA? ^{MC}	57.4	62.3	60.3	67.0
When administering epinephrine, it's very important to do which of the following? ^{MC}	21.1	33.8	15.9	24.5
What is another term for a severe allergic reaction? ^{MC}	66.0	64.9	63.5	64.2
How long should you monitor your child after administering epinephrine? ^{MC}	21.1	35.1	19.0	19.8
Which of the following children with FAs are most likely to have a life-threatening allergic reaction? ^{MC}	31.1	24.7	22.2	20.8
A doctor provides your child increasing amounts of a certain food and monitors symptoms. What is this process called? ^{MC}	15.3	18.2	14.3	7.5
What's the best site for an epinephrine injection? ^{MC}	35.9	35.1	20.6	33.0

If a child is at risk for a severe allergic reaction, how many doses of epinephrine should be available? ^{MC}	15.8	20.8	12.7	16.0
Julie accidentally eats an allergic food. You give her an epinephrine injection. What is the best thing to do if symptoms continue and emergency care has not yet arrived? ^{MC}	69.9	58.4	81.0	72.6
How should new foods be introduced to a baby with FAs? ^{MC}	41.6	36.4	34.9	48.1
Your child is having a severe allergic reaction. Which of the following should you do FIRST? ^{MC}	34.0	44.2	22.2	29.2
Before using an auto-injector, what should you do? ^{MC}	38.3	45.5	20.6	28.3
Symptoms ^{MC}				
Difficulty breathing ^{T/F}	88.0	79.2	79.4	89.6
Coughing ^{T/F}	60.3	49.4	39.7	60.4
Fainting ^{T/F}	61.7	44.2	50.8	49.1
Fever ^{T/F}	26.3	28.6	25.4	24.5
Bruising ^{T/F}	51.2	45.5	39.7	46.2

Note. Superscript indicates type of question: ^{T/F}=true/false, ^{MC}= multiple-choice. FA= food allergies.