The impact of the COVID-19 pandemic on multicultural families with food allergy

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Background: Families with food allergy, in particular, have faced numerous challenges, often in the setting of financial and emotional stress during the coronavirus disease 2029 (COVID-19) pandemic.
Objective: We examined the impact of the pandemic in a diverse population of families with food allergy.
Methods: An online survey was administered between October 2020 and January 2021 through recruitment of adult caregivers of at least 1 child with food allergy. Survey responses were summarized by frequencies with proportions and medians with interquartile ranges or means plus or minus SDs.
Results: Of the 307 individuals who completed questionnaires, 96% were female and 4% were male, with 24% classified as African American, Hispanic or Latinx, Asian, or "other." Of the respondents, 52% experienced a decrease in household income during the pandemic. Financial stress ($P < .001$) and lack of access to allergen-free foods ($P = .032$) was seen in significantly more caregivers with an income less than $200,000. Of the respondents, 76% experienced increased stress or discord within the home. Although becoming a member of a food allergy support group increased over time, significantly fewer African American respondents were members of a support group. The hospitalization rate for COVID-19 did not differ significantly between racial/ethnic groups.
Conclusion: Our questionnaire has characterized the significant impact of economic as well as psychological stressors of the pandemic in a diverse population. Further studies on this topic are needed to help minimize the impact of future pandemics in a multicultural population. (J Allergy Clin Immunol Global 2025;4:100438.)

Key words: *Stress, survey, support group, food allergy, impact of the pandemic, social isolation, domestic and international travel*

Abbreviations used
AR: Artificial intelligence
COVID-19: Coronavirus disease 2019

Since it was first identified in 2019, the novel coronavirus disease 2019 (COVID-19) virus has had a significant impact on health care systems worldwide. In November of 2020, various drug companies were beginning to announce the efficacy of their COVID-19 vaccines. The US Food and Drug Administration first granted authorization for emergency use of the Pfizer-BioNTech vaccine on December 10, 2020, with mass vaccinations beginning 4 days later.

Global responses to this virus have varied, with many countries implementing "lockdowns" limiting social interactions and freedom of movement outdoors. These responses have affected health care utilization and quality of life. Further study of the extensive consequences of the pandemic is needed. More reports are examining the impact of the COVID-19 pandemic specifically on children and adolescents.[1-5]

Families with food allergy faced numerous challenges in the pandemic, including limitations on access to appropriate foods, possible delay in introduction of foods, and avoidance of emergency care, along with drug shortages often in the setting of financial and emotional stress. The mental health effects of the pandemic on children have been particularly challenging.[6] Currently, the highest rate of increase in food allergy prevalence is among non-Hispanic Black children.[4] The shortages of foods such as baby formulas that occurred during the pandemic may have exacerbated disparities in formula access for such already vulnerable infants. We particularly wanted to examine the impact of the pandemic in multicultural patients and families with food allergy, as well as the impact of vaccine availability on quality of life. This study utilized a survey to better understand the impact of the COVID-19 pandemic on the lives of people of diverse backgrounds in the broader food allergy community.

METHODS

We aimed to examine the impact of the COVID-19 in an American population. An online survey was created by adapting the Johns Hopkins University Community Response Survey and the validated survey Chicago Food Allergy Research Surveys for Parents of Children with Food Allergy. The survey, which was administered online between October 26, 2020, and January 15, 2021, through recruitment of adult caregivers of at least 1 child with food allergy examined the impact of the COVID-19 pandemic on their family (see Fig E1 in this article's Online Repository at www.jaci-global.org). The survey was distributed via e-mail to food allergy caregivers in the Food Allergy Research and Education network, the Texas Children's Hospital Family Network, and the Asthma and Allergy Foundation newsletter

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and completed through RedCap (Research Electronic Data Capture). Flyers containing a QR (quick response) code to the survey were also posted in our clinics. Survey responses were summarized by frequencies with proportions, median interquartile ranges, or means with SDs. Respondents who did not have at least 1 child younger than 18 years who had been diagnosed with food allergy or who were younger than 18 years were excluded from the analysis. Duplicate responses were also excluded from the analysis. Foods to which children had allergy were categorized in the survey as peanut, egg, cow's milk, tree nuts, seafood, fruits or vegetables, wheat, soy, spices, and other foods. One respondent omitted the sex response.

Webster's *English Dictionary* defines stress as a physical, chemical, or emotional factor that causes bodily or mental tension and may be a factor in disease causation. We sought to determine the degree to which stress was experienced by families with food allergy before introduction of COVID-19 vaccines versus after vaccine implementation. The Wilcoxon rank sum test and Fisher exact test were used to compare respondents living in Texas with those living elsewhere, as well as to compare those who completed the survey before versus after mid-December. We used these tests to compare respondents with incomes less than, equal to, or greater than the following cutoffs: $50,000, $100,000, and $200,000 to encompass different socioeconomic levels as defined by the US Census Bureau. The Kruskal-Wallis test and Fisher exact test were used for comparisons among different races/ethnicities. The pairwise Fisher exact test with Holm P value adjustment was used to see which racial/ethnic group was significantly different from other categories for categoric variables. Pairwise Wilcoxon rank sum tests with Holm P value adjustment were used with continuous variables. A significance level of .05 was used. The study was approved by the Baylor College of Medicine institutional review board (approval no. H-47943).

RESULTS

Demographics

In all, 337 individuals responded to the questionnaire; 24 individuals who were either younger than 18 years or did not have a child with food allergy were excluded. Of the 307 respondents who completed questionnaires, the majority were female (n = 294 of 307 [95.8%]). Approximately 75% of respondents were non-Hispanic White, 6% were African American, 8% were Hispanic/Latinx, 7% were Asian, and 3% were designated as other (Fig 1). All respondents were from the United States. Of the respondents, 67% were non-Texas residents and 33% were from Texas. The age range of the respondents was 26 to 63 years, with a mean age of 41.39 years (SD = 6.9 years). The majority of respondents had a 4-year college degree (n = 268 of 307 [85.7%]).

The most commonly reported food allergies in children included peanut (68%), tree nuts (61%), egg (41%), cow's milk (34%), seafood (22%), fruits or vegetables (19%), wheat (8%), soy (7%), spices (3%), and other (34%). Interestingly, there was a highly significant difference in incidence of seafood allergy based on race. With a Holm *P* value adjustment, more African American respondents were found to have seafood allergy than Hispanic respondents (58% vs 12%, [$P = .023$]) or than non-Hispanic White respondents (58% vs 18% [$P = .003$]).

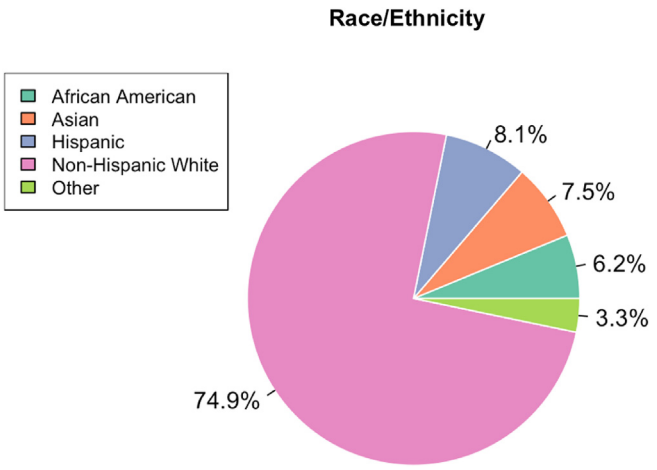

FIG 1. Race/ethnic distribution of the respondents.

Finances

In all, 160 respondents (52%) experienced a change in household income during the pandemic. Families with incomes less than $50,000 were significantly more likely to believe that having a child with food allergy was associated with more financial problems (38% vs 21%, [$P = .03$]) (Table I). Families at this income level also experienced more severe stress related to the pandemic. Families with incomes higher than $50,000 also had different traveling patterns than those families with incomes lower than $50,000 (Table I). Families with incomes higher than $50,000 were also found to have more tree nut allergy, with 63% of respondents in that income bracket having a child with tree nut allergy versus 42% of those with an income less than $50,000 ($P = .017$).

Families at the $100,000 income level and including a child with food allergy were also affected by the pandemic. For families with an income of $100,000 or less, having a child with a food allergy was also associated with more money problems for the family (44% vs 15% [$P < .001$]). Parents at this income level experienced some negative effect on their career (data not shown) and also had travel patterns different from those of families with incomes less than $100,000 (92% vs 68%) (Table I). However, there was no significant difference seen in strain in the parental relationship caused by a child's food allergy (9% vs 5% [$P = .26$]).

In the $200,000 income bracket, significantly more caregivers with an income less than $200,000, responded that having a child with food allergy causes money problems for their family (29% vs 9% [$P < .001$]) than did caregivers whose income was more than $200,000. Families with incomes higher than $200,000 also had travel patterns different from those of families with incomes lower than $200,000 (Table I). Compared with their counterparts in families with incomes less than $200,000, significantly more parents in families with an income of $200,000 were married (99% vs 89% [$P = .002$]) and had a graduate degree (71% vs 38% [$P < .001$]). Interestingly, there was a significant difference in incidence of cow's milk allergy in this demographic as well, with 24% of respondents having a child with cow's milk allergy versus 38% of respondents with income less than $200,000 ($P = .018$).

Stress

The majority of respondents experienced some degree of stress, with only 2% of respondents reporting not having experienced any stress related to the pandemic since March 2020. Social isolation was also prevalent in our population, with only 6% responding that they had not experienced any change in access to extended family and trusted friends since March 2020.

Timing of the survey

Opinions changed before the introduction of COVID-19 vaccines in mid-December versus after introduction of the vaccinations after mid-December. Interest in becoming a member of a food allergy support group increased after mid-December compared with before introduction of the vaccine, as did stress levels in the household, whereas support from family members appeared to have decreased after mid-December. More respondents in the group that completed the survey close to vaccination (after mid-December) were members of a food allergy support group than in the group of those respondents who completed the survey before mid-December (54% vs 38% [$P = .009$]). Also, more respondents who completed the survey after mid-December as opposed to before mid-December had relatives who did not accommodate their child's food allergy (57% vs 43% [$P = .04$]), perhaps suggesting less support from family over time. Also, strain in the relationship between spouses increased over time with more respondents who completed the survey after mid-December admitting that "since the COVID-19 pandemic started on March 1, 2020, my child's food allergy has caused a strain on my relationship with my spouse or significant other" (14% vs 3% [$P = .002$]) than respondents who completed the survey before mid-December. Not surprisingly, with the strain noted in spousal relationships, more respondents who completed the survey after mid-December as opposed to before mid-November found that it had "been stressful because of issues related to food allergy" (56% vs 36% [$P < .003$]).

Specific limitations due to the diagnosis of food allergy

In addition to financial and psychological stress along with limited access to the health care system, families with food allergy encountered significant challenges with access to food during the pandemic. In all, 45% of the respondents (n = 135) reported a change in access to all foods. More specifically, 48% of respondents reported a change in access to allergen-free foods.

Racial differences

Several differences were noticed among different racial groups. With Holm P value adjustment, more participants in the category "other race/ethnicity" than in the category African American (80% vs 21% [$P = .022$]) were members of a food allergy support group. More African American respondents than Hispanic respondents (58% vs 12% [$P < .001$]) or non-Hispanic White respondents (58% vs 18% [$P < .001$]) had seafood allergy. More Asian and non-Hispanic White participants than African American respondents agreed that having a child with food allergy affects the daily lives of their other children (76% Asian and 77% non-Hispanic White vs 20% African American [$P < .001$]). Also, traveling during the pandemic appeared to differ in the different ethnic groups. Significantly more Asian respondents than non-Hispanic White respondents avoided or canceled international travel (83% vs 51% [$P < .001$]); in addition, significantly more Asian respondents than African American patients avoided or canceled international travel (83% vs 42% [$P < .001$]). More Hispanic respondents than non-Hispanic White respondents reported disinfecting or wiping down groceries (84% vs 53% [$P = .012$]). However, cleaning in the home did not appear to differ across ethnic groups, because the percentage of respondents who did "more disinfecting surfaces of their home than usual" did not differ significantly between racial/ethnic groups.

COVID-19 testing and diagnosis

Overall, access to the medical care changed, with 65% of respondents experiencing a mild, moderate, or severe change in access to medical care. However, after adjustment for multiple comparison, among the respondents who were hospitalized, the percentage of those who responding that they had been hospitalized for COVID-19 because of difficulty breathing or a respiratory infection, did not differ significantly between racial/ethnic groups.

State of residency

The respondents who lived outside Texas were older than those who lived in Texas (median age 42 vs 38 [$P < .001$]). More respondents who lived outside Texas than in Texas were members of a food allergy support group (49% vs 28% [$P < .001$]). Also, respondents living outside Texas also had more stress, less family support with respect to their child with food allergy, and more strain with their other children. More respondents who lived outside Texas admitted to life being stressful because of issues related to food allergy than respondents who lived in Texas (48% vs 29% [$P = .002$]). More respondents who lived outside rather than in Texas agreed with the statements "I have relatives who do not accommodate my child's food allergy" (53% vs 32% [$P < .001$]) and "having a child with food allergy affects my other children's daily lives" (80% vs 54% [$P < .001$]). Desire to travel also differed in respondents based on geographical area, with more respondents living outside Texas rather within the state avoiding or canceling domestic travel (89% vs 76% [$P = .004$]).

DISCUSSION

We report a comprehensive multinational multicultural quality of life survey conducted in families with food allergy during the peak of the COVID-19 pandemic. To date, there has been a paucity of literature on the impact of the COVID-19 pandemic on children and adolescents with food allergy.[7,8] Some studies have looked at the negative impact of the pandemic on children, including depression and anxiety in China,[9,10] India,[11,12] Brazil,[13] Spain,[14] and Germany.[3] Specifically, there are not many studies such as our survey that look at the burden of this pandemic on children with food allergy and their families. We were also able to compare the impact of the pandemic in respondents who live in Texas versus in those who do not. The residents of Texas with food allergy had more family support and less general stress than did those who resided outside of Texas.

The global impact of the pandemic and widespread economic fallout is particularly prevalent among people of color regardless of

TABLE I. Survey reponses based on income

Question	Response	Income > $50,000	Percentage	Response	Income < $50,000	Percentage	*P* Value	Response	Income > $100,000
Food allergy causes money problems	Yes	21% (n = 56)	21%	Yes	38% (n = 13)	38%	.03*	Yes	15% (n = 33)
Household income change	Yes	49% (n = 132)	49%	Yes	76% (n = 28)	76%	.003*	Yes	44% (n = 98)
Access to care	Yes	52% (n = 142)	52%	Yes	35% (n = 13)	35%	.001*	Yes	38% (n = 85)
Experienced stress related to pandemic	Yes	38% (n = 102)	38%	Yes	30% (n = 11)	30%	.009*	Yes	36% (n = 80)
Have relatives who do not accommodate my child's food allergy	Yes	48% (n = 130)	48%	Yes	33% (n = 11)	33%	.14	Yes	46% (n = 104)
Worry more about my child's food allergy than my spouse does	Yes	21% (n = 58)	21%	Yes	18% (n = 6)	18%	.82	Yes	19% (n = 43)
More domestic travel avoidance	Yes	89% (n = 245)	89%	Yes	57% (n = 21)	57%	.001*	Yes	92% (n = 207)
More international travel avoidance	Yes	59% (n = 163)		Yes	32% (n = 12)	32%	.003*	Yes	66% (n = 149)

their geographic location. These disproportionate impacts reflect long-standing inequities in education, employment, housing, and health care, often stemming from structural racism. Disproportionate environmental exposures in people of color resulting in differential health outcomes have been well documented.[15] We noted, for example, that African Americans were less likely than members of other ethnic groups to be members of a food allergy support group, and they had a significantly higher prevalence of seafood allergy than any other ethnic group. An increased prevalence of seafood allergy in African Americans has recently been reported in several studies.[16-18] As a result, this demographic may particularly benefit from the added support of a food allergy support group. Thankfully, in general, interest in becoming a member of a food allergy support group increased over the course of the pandemic, although it appeared that as time went on during the pandemic and after vaccines were introduced, more families reported increasing stress levels and decreased support from family members. This increase in stress or anxiety is a common threat in similar studies of families with children with food allergy.[7,8]

The Center on Budget and Policy Priorities reported that in April 2020 the unemployment rate jumped to a level not seen since the 1930s, standing at 4.9% in October 2021 compared with 3.5% in February 2020.[19] Not surprisingly, our survey found a change in household income in more than half of our respondents (n = 157 [52%]). Job loss was a common occurrence, particularly during the peak of the pandemic, with a recent US study finding that more than half of the families surveyed having experienced job loss and more than two-thirds having experienced income loss.[20] In our survey, around a quarter of parents of children with food allergy also reported that their career had suffered because of having a child with food allergy. In addition, for these families, accessing allergen-free foods was also limited, making them more vulnerable to systemic reactions and morbidity as well as to mortality associated with such complications. Several studies of previous economic downturns reveal that adults' mental health worsens when economic conditions deteriorate.[21-23] In our study, with a decrease in income during the survey period both before and after introduction of COVID-19 vaccination, 98% of families also experienced stress, with 94% of respondents reporting increased social isolation on account of reduced access to both friends and family. Interestingly, non-Hispanic White patients avoided or canceled domestic travel at a significantly higher rate than African American patients did (87% vs 58%). Also of interest was our finding that patients from families with incomes higher than $50,000 had more tree nut allergy than those with an income less than $50,000. It is possible that parents with higher income may be more educated, have higher literacy rates, and thus be more likely to seek consultation for food allergy, thus increasing the rate of allergy to all foods. However, the mechanism underlying the specific isolated association between higher income and tree nut allergy in our study is not known.

Access to health care providers was also limited. Patients with food allergy often require more frequent health care visits because of their diagnosis affecting their care. Despite a general decrease in access to the health care system, rates of hospitalizations for patients with COVID-19 were similar across groups. For those respondents who were hospitalized, the rates of hospitalization for COVID-19 did not differ significantly after adjustment for multiple comparisons between racial/ethnic groups.

Our study had some limitations, including survey respondents who were almost exclusively female, were in a higher income bracket, and had a higher education level. As a result, these results have some selection bias and may not be generalizable to different socioeconomic levels, education levels, or fathers. We did, however, have a diverse group of respondents, with around a quarter being from visible minority groups. Although our hospital serves all types of patients from different social classes and our survey results came from patients across the nation and included representation of different social classes, our highly educated survey respondents are consistent with many studies and reviews of food allergy research.[24-27]

Future pandemics are most certainly going to occur and will particularly affect families with food allergy, such as those represented in our study. Artificial intelligence (AI) models are already being developed to assist with such future pandemics.

Percentage	Response	Income < $100,000	Percentage	P Value	Response	Income > $200,000	Percentage	Response	Income < $200,000	Percentage	P value
15%	Yes	43% (n = 36)	43%	<.001	Yes	10% (n = 9)	10%	Yes	28% (n = 59)	28%	<.001
44%	Yes	71% (n = 62)	71%	<.001	Yes	40% (n = 38)	40%	Yes	57% (n = 122)	57%	.009
38%	Yes	61% (n = 53)	61%	<.001	Yes	52% (n = 49)	52%	Yes	50% (n = 106)	50%	.029
36%	Yes	38% (n = 33)	38%	.027	Yes	37% (n = 35)	37%	Yes	36% (n = 78)	36%	.03
46%	Yes	46% (n = 37)	46%	1	Yes	47% (n = 44)	47%	Yes	46% (n = 97)	46%	.9
19%	Yes	26% (n = 21)	26%	.27	Yes	18% (n = 17)	18%	Yes	23% (n = 47)	23%	.45
92%	Yes	68% (n = 59)	68%	<.001	Yes	93% (n = 89)	93%	Yes	81% (n = 176)	81%	.01
66%	Yes	30% (n = 26)	30%	<.001	Yes	71% (n = 68)	71%	Yes	49% (n = 106)	49%	<.001

*Significant values $P < .05$.

A recent publication by Ankolekar et al[28] examined the use of AI and predictive modeling for pandemic preparedness, concluding that AI and predictive modeling can complement the health care system, thus truly equipping it for impending pandemics. As a result, questionnaires such as ours presented here can provide some valuable insight into specific challenges that families with food allergy face during pandemics. We may perhaps consider a follow-up questionnaire for these respondents several years after the 2019 pandemic or after the next pandemic.

Conclusions

Through this questionnaire, we have characterized the significant impact of economic as well as psychological stressors of the pandemic in a diverse US population. The economic challenges and increased stress, although experienced in general with this pandemic, were particularly challenging for our respondents from families with food allergy owing to the finding of having fewer accommodating relatives with respect to their child's food allergy needs, decreased access to allergen-free foods, and increased strain in spousal relationships. Further studies on this topic are needed, as are interventions to help minimize the impact of future pandemics on this vulnerable population with food allergy.

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Clinical implications: The COVID-19 pandemic posed significant challenges for families with food allergy, including food insecurity, decreased access to allergen-free foods, inaccessibility of traditional support networks, and an overall increase in stress. Families with food allergy and lower household incomes experienced these challenges disproportionately during the pandemic. Tree nut allergy was also found to be more prevalent in families with an income higher than $50,000.

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