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# Novel Approaches to Food Allergy Management During COVID-19 Inspire Long-Term Change



Douglas P. Mack, MSc, MD<sup>a</sup>, Edmond S. Chan, MD<sup>b</sup>, Marcus Shaker, MD, MSc<sup>c,d</sup>, Elissa M. Abrams, MD<sup>e</sup>, Julie Wang, MD<sup>f</sup>, David M. Fleischer, MD<sup>g</sup>, Mariam A. Hanna, MD<sup>a</sup>, and Matthew Greenhawt, MD, MBA, MSc<sup>g</sup>  
Hamilton, ON, Canada; Vancouver, BC, Canada; Hanover, Lebanon, NH; Winnipeg, MB, Canada; New York, NY; and Aurora, Colo

The SARS-CoV2 pandemic has prompted a re-evaluation of our current practice of medicine. The seemingly abrupt worldwide spread of this disease resulted in immediate changes and a reduction in many allergy-focused services and procedures. The reality of the long-term circulation of this virus in our communities requires us to evolve as a specialty. In this article, we outline current and future challenges in the management of food allergy in light of coronavirus disease 2019 (COVID-19). We focus on infant food allergy prevention, management of anaphylaxis, accurate diagnosis with oral food challenges, and active management of food allergy with oral immunotherapy. This article identifies the challenges of conflicting guidelines, shortcomings of acute management approaches, and inherent system deficiencies. We offer perspectives and strategies that can be implemented now, including an evaluation of virtual care and telemedicine for the management of food allergy. The use of a shared decision-making model results in novel approaches that can benefit our patients and our specialty for years to come. COVID-19 has forced us to re-evaluate our current way of thinking about food allergy management to better treat our

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The pandemic spread of SARS-CoV-2 has affected all aspects of medical practice. An estimated 4.7 million are infected worldwide.<sup>1</sup> Mortality estimates vary with grossly disproportionate case fatality rates across demographic groups and at-risk populations. In light of a closure of nonessential ambulatory medical and surgical care, recommendations regarding the management of allergic disease in the setting of coronavirus disease 2019 (COVID-19) have been recently published.<sup>2</sup> Many allergic/immunologic diseases, such as asthma or primary immunodeficiency, were initially prioritized to reduce risk of morbidity directly related to contracting SARS-CoV-2. However, because the virus will circulate for the next 18 to 24 months, the management of other allergic diseases that were initially deprioritized, such as food allergy, must

<sup>a</sup>Department of Pediatrics, McMaster University, Hamilton, Ontario, Canada

<sup>b</sup>Department of Pediatrics, University of British Columbia, Vancouver, British Columbia, Canada

<sup>c</sup>Section of Allergy and Immunology, Dartmouth-Hitchcock Medical Center, Lebanon, NH

<sup>d</sup>Department of Pediatrics, Geisel School of Medicine at Dartmouth, Hanover, NH

<sup>e</sup>Department of Pediatrics, University of Manitoba, Winnipeg, Manitoba, Canada

<sup>f</sup>Division of Allergy and Immunology, Jaffe Food Allergy Institute, Icahn School of Medicine at Mount Sinai, New York, NY

<sup>g</sup>Section of Allergy and Immunology, Children's Hospital Colorado, University of Colorado School of Medicine, Aurora, Colo

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Corresponding author: Douglas P. Mack, MD, Halton Pediatric Allergy, 5500 North Service Road, Suite 106, Burlington, Ontario L7L 6W6, Canada. E-mail: dougpmack@gmail.com.

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*Abbreviations used**COVID-19- Coronavirus disease 2019**ED- Emergency department**EMS- Emergency medical services**FDA- Food and Drug Administration**LEAP- Learning Early About Peanut**NIAID- National Institute of Allergy and Infectious Disease**OFC- Oral food challenge**OIT- Oral immunotherapy**PPE- Personal protective equipment*

now be creatively addressed. In the setting of ongoing deferment of many food allergy services, alternative management strategies exist to provide care.

Patient concerns and priorities must be incorporated into a model of shared decision making regarding alternatives to traditional care and management. Key paradigms of food allergy management affected by COVID-19 include food-allergy prevention in infants, anaphylaxis treatment, provision of oral food challenges (OFCs), and oral immunotherapy (OIT). The constraints of the pandemic that have been forced upon the specialty provide an opportunity for food allergy management to evolve. Although these changes may not have occurred under ideal circumstances, given the evidence suggesting that such modifications may promote better outcomes, it is important to avoid reversion once the pandemic ends. Leveraging virtual care and incorporating more allowances for parents to facilitate food allergy management are strategies that can improve outcomes while balancing risk.

## FOOD INTRODUCTION DURING COVID-19

Before the pandemic, international variance already existed regarding pre-emptive screening recommendations for peanut introduction in infants. Although the National Institute of Allergy and Infectious Diseases (NIAID) 2017 Addendum Guidelines for the Prevention of Peanut Allergy in the United States recommend that high-risk infants (those with severe eczema and/or egg allergy) have screening before peanut introduction,<sup>3</sup> this recommendation is not endorsed by the Australian, British, or Canadian guidelines, nor has screening been proven to be cost-effective.<sup>4-6</sup> Importantly, the Learning Early About Peanut (LEAP) trial showed only that early introduction in a screened population was effective for prevention but did not evaluate whether screening a population was necessary for early introduction. The constraints of COVID-19 have further highlighted the barriers of significant health service utilization inherent to screening approaches such as referral, testing, and in-office OFCs. All of these procedures are currently reduced and deprioritized during the pandemic. Reliance on such a screening-dominated pathway could negate the benefits of early introduction strategies because services have shifted to predominantly virtual clinics.<sup>7-10</sup>

Limited access to in-person visits will restrict diagnostic testing availability in all but the most urgent circumstances. Regardless, any form of food allergy testing has low specificity in the absence of a clinical reaction (which is the context of an infant being screened) and could inadvertently result in overdiagnosis due to high false-positive rates.<sup>11,12</sup> This would be particularly concerning if combined with poor access to infant OFCs during a pandemic.<sup>13,14</sup> Compounding this issue further, recent

evidence suggests a “screening creep” extending to non—at-risk groups. This phenomenon was demonstrated in a recent study at a large tertiary care center, where less than half of screened infants met NIAID criteria.<sup>15</sup> Although home peanut introduction was successful in 93% of those with negative tests, only 50% of those children with a peanut skin prick test wheal size of 3 to 7 mm were offered supervised OFCs—clearly a deviation from the NIAID guidelines.<sup>15</sup> With the current testing and visit limitations resulting from COVID-19, it is highly likely that even fewer children could be evaluated for food allergy prevention and offered supervised OFCs.

Under current financial constraints resulting from the pandemic, cost-effective care is a priority. Pre-emptive screening for food allergy in infants is not cost-effective compared with a nonscreening approach of careful home introduction. From an American perspective, annual screening before introduction costs \$654,115,322 when downstream consequences are considered and results in 3208 additional peanut allergy diagnoses.<sup>14</sup> Moreover, although levers for cost-effectiveness for screening were identified, none were considered feasible. Although screening prevents an index reaction in a true peanut allergy infant, the trade-off is significant and does not outweigh the risk of automobile fatality in traveling to the office for screening and OFC.<sup>16</sup> Indeed, unless a family is willing to trade the equivalent of 21% of a year of life for any peace of mind afforded by in-clinic versus at-home peanut introduction, screening is not cost-effective.<sup>13</sup> These figures are unlikely to improve given the significant access limitations clinicians are currently experiencing.

Most importantly, no data have ever shown that a screening strategy is safer, or even necessary, compared with at-home introduction recommended outside the United States. Large randomized controlled trials (such as LEAP) and large observational studies (such as the HealthNuts study) demonstrated that early introduction is safe, with low rates of reactions (approximately 2%) that are typically exclusively cutaneous.<sup>17-19</sup> First-ingestion life-threatening reactions with early introduction are unlikely, and no infant fatalities have been reported with early peanut introduction. As a result, emergency department (ED) visits during COVID-19 from home introduction reactions would also be unlikely, and cautious introduction of new foods can be safely recommended in lieu of screening to facilitate food allergy prevention.<sup>20</sup>

During and beyond COVID-19, at-home versus in-office early introduction should be a preference-sensitive care option as more data accumulate. At-home introduction will not be acceptable for some families. An option to consider for these families would be pre-emptively prescribing an epinephrine autoinjector to improve comfort with at-home introduction.<sup>13</sup> Others will prefer a virtually supported home peanut introduction.<sup>21</sup> Still, for some, screening may be preferred after engaging in a shared decision-making paradigm. Physicians must keep an open mind when educating patients and gain a clear understanding about what matters most to them.<sup>22,23</sup> The COVID-19 pandemic is an opportunity to better understand early introduction trade-offs and to find a balanced approach to enhance implementation.

## ANAPHYLAXIS MANAGEMENT AT HOME DURING THE PANDEMIC

In the joint COVID-19 guidance, a major adjustment to home anaphylaxis management was recommended in response to

anticipated surges in acute care needs, which in some areas included overwhelmed emergency medical services (EMS) and hospitals.<sup>2</sup> Although pre-existing instructions on most anaphylaxis action plans normally recommend “immediately calling 911” after epinephrine use, new recommendations during this pandemic suggest that patients experiencing anaphylaxis should watch and observe for the response to epinephrine. If symptoms do not promptly resolve after epinephrine, EMS should be activated.

The recommendation was based on a previously published cost-effective analysis by Shaker et al<sup>24</sup> that modeled immediate EMS activation versus a wait-and-see approach after using an epinephrine autoinjector at home in peanut-allergic children in preventing fatality. This study revealed an incremental cost per life year saved of \$142,943,447 for immediate EMS versus the wait-and-see approach and a cost per death prevented of \$1,349,335,651, both greatly exceeding cost-effectiveness thresholds. Immediate EMS activation was only cost-effective with exceptionally high fatality risk (500-fold) combined with 75% of children requiring additional care in the ED.<sup>24</sup>

Food Allergy Research and Education, in response to a surge of COVID-19 cases in several US cities, provided a modified action plan to be used for select patients, echoing the recommendations in the COVID-19 guidelines to not immediately seek care.<sup>25</sup> This modified algorithm could be appropriate for patients without a history of anaphylaxis requiring intubation or multiple epinephrine doses, in areas with high COVID-19 health care burdens. The plan recommends that if severe symptoms do not resolve after a second dose of epinephrine, then EMS should be activated. This plan necessitates that the patient/family is capable and willing to follow the modified algorithm and has access to at least 2 epinephrine autoinjectors. Proactive discussion with the patient and family via telehealth is prudent to ensure a clear understanding of the risks and benefits of this approach and to emphasize that immediate activation of EMS after epinephrine administration is still appropriate if there is concern for a severe, life-threatening reaction.

Changing the guidance to de-emphasize reflex EMS activation after epinephrine use serves 2 needs: preventing overburdening of emergency health care services and reducing the risk of contracting SARS-CoV-2 while in the ED setting.<sup>2</sup> Although the change in recommendation resulted from highly nuanced contextual circumstances of a pandemic, this change should arguably endure once the pandemic risk passes. Prior data demonstrate that 12% or fewer of pediatric patients receiving 1 dose of epinephrine before arrival in the ED receive an additional dose, and no data ever substantiated that immediate ED evaluation after epinephrine use is associated with reduced fatality.<sup>26,27</sup> True biphasic reactions in children are rare, as opposed to needing a second epinephrine dose to effectively treat an initial reaction. Furthermore, studies have suggested that food triggers are a negative predictor for biphasic reactions.<sup>28-30</sup> The requirement to reflexively activate EMS after epinephrine use is, ironically, a noted barrier to epinephrine use to treat anaphylaxis.<sup>31</sup> Decoupling the mandatory recommendation for immediate ED assessment after epinephrine treatment may help increase rates of appropriate epinephrine use in the community setting.

Unfortunately, clinical trials are lacking to confirm the clinical utility of a “watch-and-wait” recommendation, but until then the risks and benefits of both approaches need to be recognized by

clinicians and families. At minimum, the choice to reflexively activate EMS is preference-sensitive, wording should be modified to say this is “not required,” and clinicians should discuss values and preferences of the family in emergency situations. Accordingly, given that there is no evidence to suggest that reflex activation is necessary, cost-effective, or associated with clear universal health benefits, the instructions on the action plan for the COVID-19 pandemic could become permanent. Ultimately, the decision to implement a watch-and-wait action plan still depends on a physician’s assessment of the individual patient and an understanding of the family’s desires and capabilities.

## OFCs DURING COVID-19

Barriers to OFC implementation have been longstanding, and the limited delivery of allergy services during the COVID-19 pandemic will further impair access to this gold-standard procedure. A 2009 survey of 670 American allergists noted that only 5.6% performed more than 10 OFCs a month (70% performing only 1 to 5 OFCs monthly) and identified major barriers including lack of time, staff, space, and experience.<sup>32</sup> More recently, a mixed-methods study comprising surveys of Canadian allergists, pediatricians, and parents was performed to further explore barriers and solutions to OFC implementation.<sup>8</sup> This study echoed similar practitioner barriers and identified parental barriers such as fear and anxiety.

COVID-19 has further constrained OFC availability, given the postponement of elective procedures. The joint COVID-19 guidance has recommended postponing all OFCs except for highly specific, nutritionally relevant challenges in infants.<sup>2</sup> This guidance will potentially lengthen already long OFC waiting lists. Also, parent and clinician concern of acquiring COVID-19 from exposure during an elective procedure in settings such as clinics or hospitals may complicate resumption of OFCs if there is hesitancy to reschedule care even as COVID-19 restrictions lift.

Practically, the decision to reopen OFC capacity must include consideration of personal protective equipment (PPE) and staffing needs, because OFCs could result in vomiting and/or coughing. Staffing considerations will be essential, given issues with reuse of PPE or exposure of the same PPE to multiple patients. Because OFC patients occupy a room for many hours, space and time limitations will negatively affect the ability to perform simultaneous OFCs while still complying with physical distancing measures. Thus, being able to reduce the number of OFCs conducted in the office through the use of risk stratification and telemedicine utilization will be crucial.

Importantly, this pandemic may represent an opportunity to reprioritize risk stratification to help facilitate the use of home challenge of foods considered lower for a reaction. This approach may reduce the need for in-office OFCs to clarify sensitization in situations with a low-to-moderate pretest probability of allergy (eg, randomly drawn panel testing, low sensitization noted on testing for potential cross-reactivity [eg, nuts, fish, etc.], when the diagnosis of allergy has been made solely on the presence of low-positive allergy tests and not on history, or when food introduction is in-office due to anxiety or reluctance) and reserving the office for high-risk OFCs. The use of OFC as the initial test, rather than obtaining skin/serum testing in circumstances of low pre-test probability, would further limit misdiagnosis attributable to false-positive sensitization. Pathways



to use telemedicine visits for patients who have an epinephrine device at home and who understand the signs and symptoms of a reaction and when to treat could be designed to allow for OFCs to be supervised virtually. This additional support may assist in parental comfort, in particular, when the expectation is high that the procedure will be tolerated. This virtual approach may also help to increase access to OFCs given that space and time have been recurrently cited as major constraints. Shared decision making should be used to the greatest extent possible.

### OIT DURING COVID-19

As per current COVID-19 recommendations, OIT initiation and dose escalation are generally recommended to be held in areas of high viral transmission or where legislation recommends limitation of nonessential or elective medical procedures.<sup>2</sup> However, unique challenges in providing OIT existed before the pandemic.

Ensuring that patients and families are properly evaluated, prepared, and educated is vital before initiating OIT.<sup>35</sup> As part of their evaluation, many patients undergo OFCs before initiation of OIT for diagnostic or threshold determination. Access to OFCs before starting OIT, to ensure that only those who are truly allergic undergo OIT, may not be possible under pandemic ambulatory care constraints.<sup>34</sup>

Once OIT is initiated, ensuring that these families are safely monitored, provided with continued education, and that parental/patient concerns are addressed are essential steps to maintaining safety and long-term success.<sup>33</sup> Recurring and prolonged in-person visits for OIT counseling and up dosing during the build-up phase or in follow-up during the maintenance phase will challenge clinicians facing significant limitations of service. In the setting of clinical practice altered by COVID-19, clinicians who are naïve to the practice of OIT may wish to consider delaying initiating OIT programs until they can ensure that they have the capacity to effectively and safely support their patients at baseline. This is particularly important for the recently Food and Drug Administration (FDA)-approved product, which is regulated under a stringent regulatory program to be administered by certified allergists in an office-based setting only.<sup>35</sup>

Patient adherence has been an ongoing concern amongst OIT practitioners, and the lack of regular in-office visits during COVID-19 may negatively affect this important aspect of care.<sup>36,37</sup> A lack of adherence may be further exacerbated amongst teens and complicated by psychosocial factors including rising mental health challenges during “stay-at-home” orders. The use of telehealth visits may allow clinicians to monitor individual patients and any reaction-related issues virtually.<sup>2</sup> If such resources are available, referral to a food-allergy counselor via telehealth to address intercurrent anxiety, distaste, or compliance concerns should be considered. Similarly, the use of a dietitian has also been demonstrated to improve adherence and should also be considered during this extended time at home.<sup>38</sup> The incorporation of allied health as an adjunct for OIT practices should persist even after the pandemic.

Because the length of this pandemic may be prolonged, recent recommendations suggest that as viral transmission wanes and nonessential medical services resume, clinicians may continue up dosing for OIT.<sup>39</sup> For patients who have started an OIT protocol and have been held at their current dose in build-

**TABLE I.** Lower-risk food allergy procedures and scenarios for which virtual health could be considered during and after COVID-19, especially for patients living in areas with limited access to these procedures (eg, rural settings)

1. Virtually supervised early allergen introduction in infants
(a) Infants with mild-to-moderate eczema
(b) Infants with an older sibling with peanut allergy
(c) Infants with a first-degree relative with an atopic condition (eczema, food allergy, asthma, or allergic rhinitis)
(d) Hesitancy in infants with no eczema or current food allergy
(e) Infants who have negative or weakly positive screening skin prick and/or sIgE testing without a history of ingestion of the food
2. Virtually supervised oral food challenges
(a) Any patient with an unconvincing history of food allergy in combination with negative or weakly positive skin prick and/or sIgE testing
(b) Food sensitization tested as a panel and/or the absence of a history suggesting symptomatic ingestion, including testing done for evaluation of atopic dermatitis
(c) Reintroduction of foods in children who had food allergy testing for eczema (where the food has been avoided for more than 2 y starting in infancy)
(d) Reintroduction of foods avoided due to eosinophilic esophagitis
3. Virtually supervised oral immunotherapy
(a) Peanut OIT for lower-risk preschoolers
(b) OIT counseling/education before initiation of OIT
(c) OIT follow-up to assess adherence

OFC, Oral food challenge; OIT, oral immunotherapy; sIgE, specific IgE.

up, there may be potential benefit from this extended period of holding. For example, in an attempt to counter presumed eosinophilic gastrointestinal disease, clinicians may hold patients at static or low doses for extended periods to gradually build tolerance.<sup>40</sup> This is further supported by sublingual immunotherapy and low-dose OIT studies that demonstrated acceptable safety and reduction in accidental reactions, even at low doses.<sup>34,41</sup> Patients need to be reminded that the final OIT dose is likely not the most important determinant of success, but rather that each dose contributes to building tolerance, irrespective of the time taken to reach the predetermined target. Although there has been no direct comparison of standard versus slower buildup approaches, the incorporation of slower approaches to OIT up dosing in select patients may be considered even after this pandemic.

### CONSIDERATION OF VIRTUAL HEALTH FOR FOOD ALLERGY PROCEDURES DURING AND AFTER COVID-19

Since the beginning of the COVID-19 pandemic, health systems and physicians worldwide have been implementing virtual health at an unprecedented pace across many medical disciplines, rapidly transforming health care delivery.<sup>42</sup> Despite this promise of improved access to care, significant barriers remain in many countries preventing lasting widespread adoption of virtual care, including proper regulatory frameworks to authorize, integrate, and crucially reimburse telemedicine services.<sup>43</sup>

Even before COVID-19, a “Virtual Care Task Force” was created in Canada to address regulatory barriers.<sup>44</sup> Key aims of

this effort were to help practitioners scale up virtual health in their practices through recommendations in 4 key areas: interoperability between different jurisdictions and governance, licensure and quality of care, payment models, and medical education. This report's publication has fortuitously coincided with the COVID-19 pandemic, resulting in a timely response on May 3, 2020, from the Canadian government of \$240.5 million to develop, expand, and launch virtual care and mental health tools to support Canadians.<sup>45</sup> American efforts have been similar, and clinician access to telehealth was rapidly expanded in March 2020, with relaxation of multiple fairly stringent regulations, including out-of-state licenses, use of a home office, expansion of usable video and phone platforms, and payment parity for telehealth with in-office visits.<sup>46</sup> However, many of these rules are set to expire within a few months.

Portnoy et al<sup>46</sup> recently described how telemedicine adoption amongst allergists remained low before COVID-19 despite patient willingness to use it, due to patient barriers such as inertia and awareness, as well as systemic barriers such as reimbursement. During the pandemic, using telemedicine services helps provide stable access to care while reducing in-office risk of transmitting COVID-19. Our task is to try to maintain these services and integrate telehealth more permanently, in particular, to food allergy care. Table I summarizes low-risk food allergy procedures where virtual health could be considered during and after COVID-19.

The joint COVID-19 guidance published recently suggested virtual elective early allergen introduction in any non-high-risk infant.<sup>2</sup> Indeed, some clinicians have already begun to incorporate virtually supported home introduction for at-risk infants.<sup>21</sup> This approach may represent a reasonable, timely option for families or clinicians who have hesitancy about food introduction, despite their infants being at lower risk.

For OFCs, the joint COVID-19 guidance described several clinical scenarios where virtual approaches could be considered. A primary example is the evaluation of children with food sensitization tested as a panel and/or the absence of a history suggesting symptomatic ingestion, including testing done for evaluation of atopic dermatitis.<sup>2</sup> Other examples in the guidance include the reintroduction of foods in children who received food allergy testing for eczema and reintroduction of foods avoided due to eosinophilic esophagitis.

Virtual care may also benefit patients before beginning OIT. As part of a shared decision-making process, the ability to counsel families about OIT entails an extensive discussion and this may lend itself well to a virtual meeting.<sup>47,48</sup> Adjunctive aids may need to be developed to improve education and patient understanding, and decision aids will play a unique role.<sup>49</sup> A recent study demonstrated improved parent and patient knowledge about OIT with the use of a counseling video combined with pre- and post-testing.<sup>50</sup> These tools can readily be applied to a virtual counseling approach. These educational aids may benefit patients after pandemic as well.

For those patients held in build-up or maintenance phases, clinicians should attempt to optimize adherence with routinely scheduled virtual visits to address compliance, side effects, and any other concerns and to help ensure that home dosing records are being completed. The strategy of online dose monitoring was reported before pandemic and may also improve dose adherence and reaction reporting.<sup>51</sup> Although reactions are most common in the build-up phase,<sup>52</sup> clinicians may choose to use home-based

anaphylaxis management strategies as were recently published and reviewed.<sup>2,25</sup> Because most clinicians offering OIT offer after-hours access, the ability to virtually support these families during a reaction in real time may be a consideration for those who are able as familiarity and comfort levels with virtual care increase with time.

Some experienced clinicians may wish to employ strategies that use virtually supported home dose escalation for those patients already in the build-up phase. A pilot study demonstrated the acceptability of home-based OIT amongst patients with mild reactions at high thresholds of peanuts.<sup>53</sup> Similarly, a recent article supports the safety of home-based subcutaneous immunotherapy in select patients.<sup>54</sup> A virtually supported, home-based approach may be appropriate in areas that are remote or where access to clinicians is limited, but cannot be recommended for the FDA-approved product due to its Risk Evaluation and Mitigation Strategy program.<sup>35</sup> Virtually supported home-based peanut OIT dose escalation may be primarily considered among the following preschoolers: high thresholds of reactivity, low specific IgE, absence of asthma, and stable preceding OIT course.<sup>37,52,55</sup> Discussion about whether to use the strategy must include a comprehensive discussion about the risks and benefits for this elective procedure. If physicians and parents decide jointly to pursue this option, all efforts must be maintained to evaluate, educate, and train patients throughout the process to ensure safety.

## CONCLUSIONS

The COVID-19 pandemic has presented many challenges to the practicing allergist. However, as we respond to this international emergency with fresh ideas, medical practice may benefit from a period of rapid evolution. New paradigms of care aimed at delivering lower-risk food allergy procedures via virtual health and incorporating shared decision making will be crucial as we move through and beyond these challenging times. There is a reason for renewed optimism for the ability of health care systems to address longstanding implementation inadequacies of prevention and management of food allergy. The time has come for rational, constructive discussion to enable clinician-patient partnerships to deliver contextual care to each food allergy patient.

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