

Baked Milk and Baked Egg Survey: A Work Group Report of the AAAAI Adverse Reactions to Foods Committee



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Most milk- and egg-allergic children can tolerate milk and egg in baked forms. Some allergists have extended the use of baked milk (BM) and baked egg (BE) to advocating for the stepwise introduction of small amounts of BM and BE to children who are reactive to larger amounts of BM and BE. Little is known about the practice of introducing BM and BE and existing barriers to this approach. The purpose of this study was to gather a current assessment of the implementation of BM and BE oral food challenges and diets for milk- and egg-allergic children. We conducted an electronic survey of North American Academy of Allergy, Asthma & Immunology members offering BM and BE introduction in 2021. The response rate was 10.1% of distributed surveys (72 of 711). Surveyed allergists had a

similar approach to both BM and BE introduction. Demographic features of time in practice and region of practice were significantly associated with the odds of introducing BM and BE. A wide variety of tests and clinical features guided decisions. Some allergists determined BM and BE to be appropriate for home introduction and offered this for BM and BE more often than other foods. The use of BM and BE as a food for oral immunotherapy was endorsed by almost half of respondents. Less time in practice was the most significant factor associated with offering this approach. Published recipes were used and written information was widely provided to patients by most allergists. The wide practice variabilities reveal a need for more structured guidance about oral food challenges, in-office versus home

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Abbreviations used

AAAAI- American Academy of Allergy, Asthma & Immunology

BE- Baked egg

BM- Baked milk

OFC- Oral food challenge

OIT- Oral immunotherapy

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INTRODUCTION

Cow's milk allergy is a common allergy that affects 1% to 5% of children.¹ In the past 15 years, the recognition that most milk- and egg-allergic children can tolerate milk² and egg³ in baked forms such as muffins and waffles has led to significant practice changes. Up to 70% to 80% of milk- or egg-allergic children will develop tolerance to baked milk (BM) and baked egg (BE) before tolerance to unheated milk and lightly cooked egg (scrambled, boiled, or fried).^{4,5} If tolerated, eating BM and BE offers nutritional benefits and fewer dietary restrictions. Although it may hasten the resolution of milk and egg allergies,^{6,7} a disease-modifying effect has not been conclusively shown. It is possible that tolerance to the baked form may identify children with a milder phenotype that would outgrow the allergy at a younger age regardless of any dietary intervention.⁸⁻¹¹

Eating BM and BE may have risks. Because it is difficult to predict which milk- or egg-allergic individuals will tolerate BM and BE based on measures of sensitization,⁴ introducing these foods is generally recommended using an observed oral food challenge (OFC). Home introduction may be considered for some carefully selected patients who are deemed to be at low risk for a severe reaction, but both methods carry a risk of reaction, including anaphylaxis. Oral food challenges have been performed safely by allergists for decades,^{12,13} but reactions to BM and BE may take longer to develop and may be more severe than those seen during OFCs to other foods.¹⁴ Although severe reactions to BM and BE OFCs are not observed in all reports,¹⁵ the only known fatality during an OFC in North America was to BM, reported in 2017.¹⁶ In addition, although full details are not known, a BM-allergic 9-year-old child recently died from home ingestion of BM, reportedly undergoing what was referred to as a desensitization approach.^{17,18} The difficulty in predicting the reactivity to BM and BE demonstrates the importance of providing allergists and patients with guidance about BM and BE OFCs and incorporation into the diet.¹⁹⁻²¹

Data are limited regarding many aspects of allergists' practices related to BM and BE, including patient and location selection for introduction, recommendations for dietary inclusion, and methods to progress beyond BM and BE. A 2017 survey assessed factors considered by 114 health care providers when deciding where BM introduction should occur. They considered laboratory, clinical, and patient preference factors and highlighted the need for further guidance.²² Multiple guidelines recognize the practice of introducing

BM and BE to milk- and egg-allergic children.^{1,21,23-25} In one approach, commonly called a milk or egg ladder, patients are advised to eat foods progressing from baked within a flour matrix (eg, muffins or waffles) to lesser cooked forms, until unheated milk or lightly cooked egg is tolerated.^{25,26} However, the ladders were first developed for use in non-IgE mediated allergy, so there is little granularity to guide their role in managing IgE-mediated food allergy.

The purpose of this study was to gather a current assessment of North American allergists' practices regarding BM and BE patient selection, the rationale discussed with the patient and family, criteria used to identify candidates for home introduction, how allergists perform BM and BE OFCs, and supporting instructions for the progression of diet and safety. Results were considered according to whether there was a practice difference between milk and egg, as well as according to physician characteristics. This information will contribute to understanding barriers to the successful implementation of BM and BE diets and unmet needs on which to concentrate in future guidance documents.

METHODS

The Baked Milk and Egg Work Group was formed within the Adverse Reactions to Foods Committee of the American Academy of Allergy, Asthma & Immunology (AAAAI). The group developed a survey that was reviewed by the work group co-chairs (J.E.M.U. and B.J.L.) and Adverse Reactions to Foods Committee vice chairs who created the Baked Milk and Egg Work Group (J.A.B. and A.N.-W.). The survey was pilot-tested with seven allergists and one non-allergist, which revealed it could be completed within 10 minutes. It was easy to follow, but one question was revised and two were removed, resulting in a 30-question survey. It was administered using SurveyMonkey (Portland, Ore), after approval by the AAAAI Practices, Diagnostics, and Therapeutics Committee. No author was involved in survey distribution or data collection.

In the summer 2021, a random sample of 711 active US and Canadian AAAAI members and fellows (fellow-in-training members were excluded) received an initial survey invitation by e-mail from the AAAAI with three follow-up reminders. Survey response attrition occurred selectively because of skip logic, and some questions were optional. The term OFC was defined to refer to an observed, medically supervised challenge, typically involving at least two different doses. It was required that respondents offered OFCs (to any food) themselves or via referral, and that they recommended BM and BE introduction in any location (home or medically observed) to their patients (see [Table E1](#) in this article's Online Repository at www.jaci-inpractice.org). Descriptive statistics summarized the results; relationships between BM and BE practices and other characteristics were analyzed using univariate or multivariate logistic regression. We performed statistical analyses using Stata software (version 15.1 for Windows, Stata Inc, College Station, Texas) with GraphPad Prism 8.

RESULTS

Survey response

The randomly generated sample included 711 active AAAAI members, 30 of whom had invalid e-mail addresses and 313 of whom did not open the e-mail. At least one question was answered by 86 members; 14 did not complete the initial questions or did not offer BM or BE introduction and were excluded from the analysis. The final evaluable sample was 72 of 711 (10.1%).

TABLE I. Description of respondents

Characteristic	n (%)
Time in practice, y	
<10	23 (32.0)
11-20	23 (32.0)
21-30	16 (22.2)
>30	10 (13.9)
Degree	
Doctor of Medicine/Doctor of Osteopathic Medicine or international equivalent	72 (100)
Specialty training	
Pediatrics	49 (68.1)
Internal medicine	17 (23.6)
Combined internal medicine/pediatrics	6 (8.3)
Proportion of patients seen, by age	
All children	12 (16.7)
More children than adults	18 (25.0)
About equal mix of adults and children	29 (40.3)
More adults than children	13 (18.1)
North American region of practice	
US Northeast	21 (29.17)
US Midwest	10 (13.89)
US South	19 (26.4)
US West	15 (20.8)
Canada	7 (9.7)
Practice setting	
Private group practice	36 (50.0)
Academic practice	22 (30.6)
Private solo practice	12 (16.7)
Hospital practice (nonacademic)	1 (1.4)
Other	1 (1.4)
Offer oral food challenges (to any food, self, or via referral)	72 (100)
Oral food challenges to baked milk or baked egg performed in typical month (before COVID-19 pandemic), n	
1-6	39 (54.2%)
6-10	28 (38.9%)
11-15	32 (44.4%)
>15	7 (9.7%)
None	3 (4.2%)

Demographics

Table 1 lists characteristics of the respondents. All respondents had a Doctor of Medicine/Doctor of Osteopathic Medicine or international equivalent degree, and nearly two-thirds completed primary training in pediatrics. Moreover, 10% had combined training in internal medicine and pediatrics. The time in practice was well-distributed, with 23 of 72 in practice for 10 years or less. Approximately one-third of respondents were in an academic practice setting (30.6%).

Practice of BM and BE introduction

Frequency and rationale for offering BM and BE introduction. Introduction of BM as well as BE was recommended by the majority of allergists for most children with milk or egg allergy. However, roughly 15% of allergists (11 of 72) recommended introducing BM for one-quarter or fewer milk-allergic patients, and about 11% (eight of 72) recommended

TABLE II. Rationale and approach to introducing baked milk and baked egg

Discussion points	n (%)
Reasons to introduce discussed with patients (n = 72)	
To liberalize the diet	66 (91.7)
Improve quality of life	61 (84.7)
Eating baked milk or egg may accelerate outgrowing the milk or egg allergy	61 (84.7)
Nutritional benefits	37 (51.4)
To help determine the milk or egg allergy phenotype (ie, severity and persistence)	21 (29.2)
Other	1 (1.4)
Instructions given for home introduction of baked milk and baked egg	
Not applicable; I never or almost never recommend	32/72 (44.4)
Start eating small amount of milk or egg in baked goods and slowly increase to serving size over weeks to months	15/40 (37.5)
Advise eating age-appropriate serving in incremental doses over hours or a few days	20/40 (50)
Advise eating age-appropriate serving in one dose	3/40 (7.5)
Other/no answer	2/40 (5)

introducing BM for one-quarter or fewer egg-allergic patients. One allergist did not offer BM introduction but did offer BE, and one did not offer BE but did offer BM.

Allergists reported discussing with patients several reasons for considering introducing BM and BE; all chose at least one. The most common rationale discussed was liberalizing the diet (91.7%), followed by improving quality of life (84.7%). The same percentage recommended the possibility of accelerating time toward full tolerance of milk and egg allergy by eating BM and BE (84.7%). Less commonly discussed were the nutritional benefits (51.4%) and helping to determine an allergy phenotype to predict the severity and persistence of milk and egg allergy (29.2%) (Table II).

Patient selection for BM and BE introduction: testing and clinical features. Most allergists used specific IgE (sIgE) and skin prick test (SPT) to cow's milk or egg white in deciding whether to recommend initial BM or BE introduction, with similar responses for both foods (Figure 2). Over half used components (casein for milk and ovomucoid for egg), and just under half used other sIgE component testing. Clinical features of severity, time since the last reaction, and patient age also factored prominently.

Allergic phenotype (IgE or non-IgE), foods used, location, and food preparation guidance provided for BM and BE introduction and subsequent escalation to less-cooked forms. Almost all respondents (69 of 72; 95.8%) indicated that they offered BM and BE introduction or OFC for IgE-mediated allergy. The minority, about one-fifth, also offered BM and BE for food protein-induced enterocolitis syndrome, eosinophilic esophagitis, or other non-IgE mediated allergies (eg, proctocolitis), with similar results for both BM and BE for each condition (Figure 1). Almost all respondents used a muffin or waffle for BM and BE OFCs. About one-quarter offered baked cheese challenges (26.1%) using pizza, whereas no respondents offered rice pudding. For BM and BE OFCs, 63 of 72 respondents (87.5%) provided a recipe (published in the allergy literature or

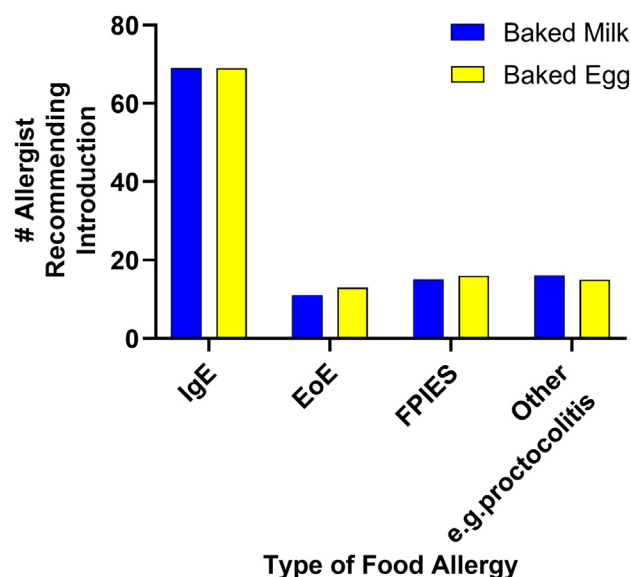


FIGURE 1. Types of food that allergy allergists consider for baked milk or baked egg introduction.

locally developed), whereas nine of 72 respondents (12.5%) provided general instructions for making the food, and one of 72 (1.4%) gave no specific instructions. No respondents recommended store-bought food for the OFC.

Location of BM and BE introduction

The initial introduction of BM or BE for a patient with milk or egg allergy was predominantly a medically supervised OFC (Figure 3, A). About one-third of allergists said that they were more likely to offer introducing BM and BE at home than they were for other foods for patients with a likely or suspected food allergy (Figure 3, B). Home introduction was not offered by 32 of 72 respondents (44.4%). A minority of allergists (4.2%) did not offer (personally or with a colleague) medically supervised OFCs to BM or BE (Table II). Among those who offered home introduction, the typical approach (50%) was an age-appropriate serving size in incremental doses (eg, over hours or a few days). Fewer respondents (15 of 40; 37.5%) advised starting to eat a small amount of milk or egg in baked goods for some time, and then slowly increasing it to a full serving (eg, over weeks or months), such as with a milk or egg ladder (Table II).

When deciding the location of the introduction (at home or a medically supervised OFC), cow's milk or egg white sIgE was the most commonly used test, followed by component testing and then SPT. Clinical features considered for choosing the location were the same as those used to decide whether to introduce baked products. Allergists indicated that parental preference for location also factored into this decision. Just over 20% offered BM and BE introduction in only one location, either at home or at a supervised OFC (Figure 2).

Follow-up after BM/BE introduction

Once a patient was tolerating a full BM/BE muffin, approximately three-quarters of allergists recommended eating the muffin a few times a week (55 of 72, 76.4% for BM; and 54 of 72, 75% for BE). Remaining responses were once or more a day, weekly, no specific frequency, and no answer (Figure 3, C).

Most respondents did not restrict the amount of BM or BE that could be eaten in a meal or snack (Figure 3, D), although 24 of 72 (33%) suggested some limit between less than one and two servings. Advancing the diet to include less cooked forms (eg, from a BM muffin to pizza to a glass of milk, or from a BE muffin to egg noodles and to a scrambled egg) was offered at home by about 20% of allergists. Approximately 30% offered progression in both locations (ie, home and a medically supervised OFC), and a similar number recommended advancing only by OFC (Figure 3, E).

Evaluation for resolution of milk or egg allergy

To determine when to assess for the tolerance of milk and egg once a patient is eating BM and BE, allergists predominantly considered repeat testing (57 of 72; 79%), how long a patient had been eating BM and BE (51 of 72; 79%), and the severity of previous allergic reactions (49 of 72; 68%). Additional factors considered less frequently, with different responses for milk and egg (unlike for the first three factors), were patient age (32 of 72, 44.4%; and 33 of 72, 45.8%, for milk and egg respectively) and initial test results (27 of 72, 37.5%; and 26 of 72, 36.1%, for milk and egg, respectively). For both BM and BE, one respondent (1.4%) was unsure what factors were used.

The survey included a question to ascertain the approach taken for a patient experiencing a mild allergic reaction to BM or BE (question 28, in Table E1). Respondents were nearly evenly split between advising patients to avoid BM and BE, with a plan to repeat OFC in the future, as well as to begin eating a specific amount regularly at home (eg, a fraction of one serving, less than what had caused the reaction) (Figure 4). The odds of recommending the approach of ongoing ingestion of BM and BE rather than avoidance was higher for allergists practicing 10 or less years than more than 10 years (odds ratio [OR] = 3.33; $P = .028$) (Table III).

Safety considerations

Allergists typically provided instructions about what other types of food could be eaten or avoided after successful home introduction or negative BM and BE OFC. None answered that they did not provide recommendations. Most provided a handout (printed or electronic) (47 of 72; 58.3%), and just slightly fewer provided verbal recommendations (41 of 72; 56.9%), followed by individualized handwritten recommendations (18 of 72; 25%). Only two of 72 allergists (2.8%) referred to a registered dietitian for most or all patients.

Most allergists (61 of 72; 84.7%) indicated they continued to prescribe epinephrine autoinjectors to patients tolerating BM and BE, but six of 72 (8.3%) did not (Figure 5). Responses did not differ between milk and egg, or any demographic factor (data not shown).

DISCUSSION

This first survey of North American allergists offering BM and BE introduction in their practices revealed that 95% of respondents offered BM and BE OFCs, and more than half offered home introduction. Allergists used nearly identical approaches for milk and egg. Yet, there was heterogeneity in several key areas associated in some cases with the length of time in practice and region, and overall wide practice variability.

Rationale for introducing BM and BE

Most allergists in this survey discussed with their patients that eating BM or BE may accelerate outgrowing the milk or egg

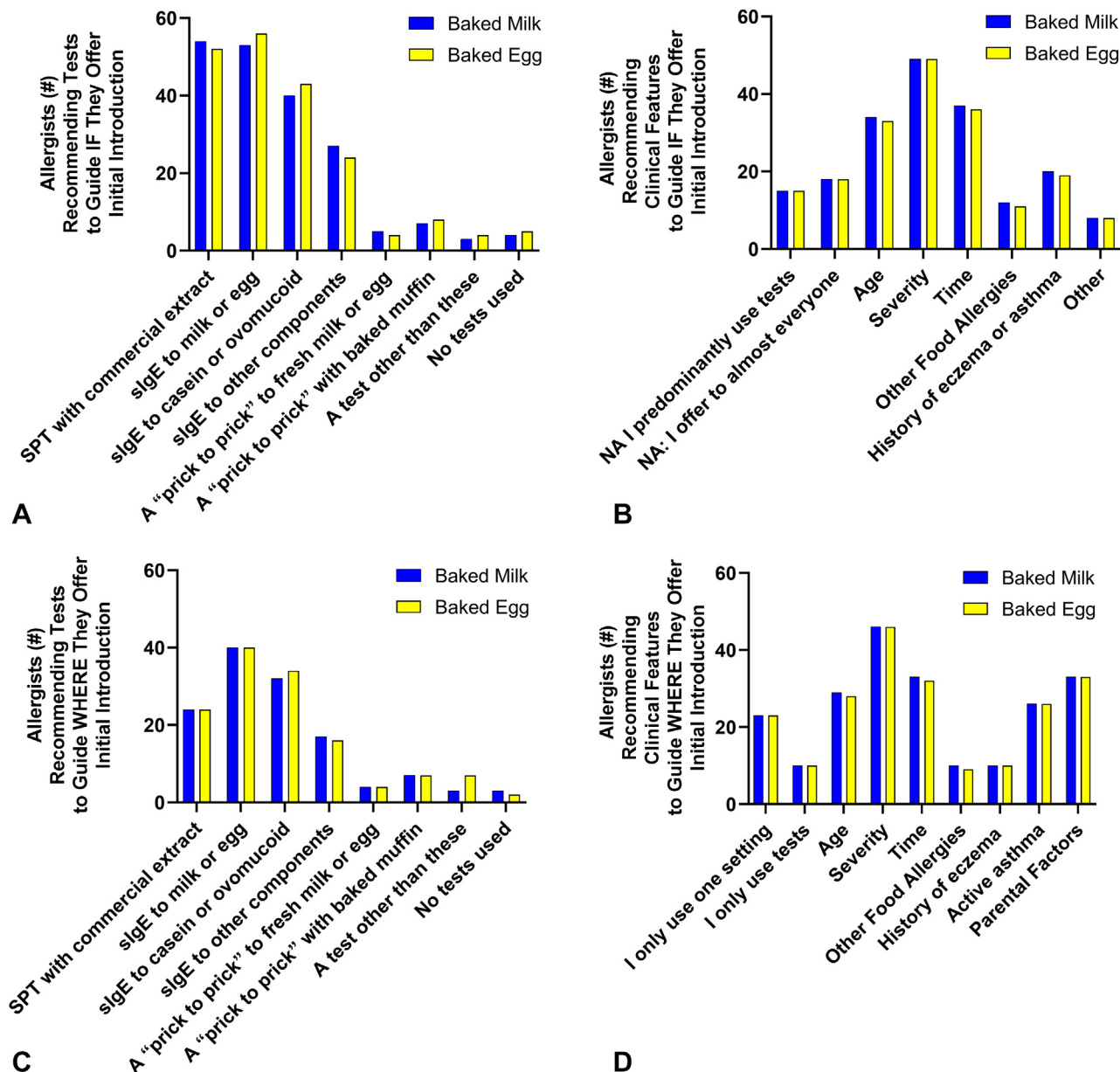


FIGURE 2. Tests and clinical features guiding the selection of patients and location (home or medically observed) for baked milk and baked egg introduction. (A) Tests and (B) clinical features used to guide whether baked milk and baked egg are introduced. (C) Tests and (D) clinical features used to guide the location where baked milk and baked egg are introduced.

allergy.³ Data supporting this benefit are inconclusive. In an open-label, randomized controlled trial (RCT), Esmailzadeh et al.⁶ showed 88.1% of milk-allergic/BM-tolerant children eating BM (37 of 42) and 66.7% of those in control group (28 of 42) had developed tolerance to unheated milk. For egg, a case-control study of young children (median age, 16 months) in Israel suggested that a structured graduated exposure protocol with heat-denatured egg led to a higher proportion of children developing tolerance to egg compared with strict egg avoidance (82% vs 54%; $P = .001$).²⁷ However, in an RCT for egg, Netting et al.²⁸ found that BE-tolerant children randomized to eating BE regularly did not outgrow the IgE-mediated egg allergy faster than did those randomized to egg-free baked goods.

Therefore, the highest level of evidence for BE did not show benefit.

One-third of survey respondents in this report discuss with their patients that introducing BM and BE. In the initial description of BM OFCs, Nowak-Węgrzyn et al.² described some children who experienced severe symptoms during BM OFC, which were more severe than reactions to unheated milk among BM-tolerant children. For egg allergy, tolerance to BE has not been clearly associated with a less severe phenotype.^{10,29}

Many respondents also recommend BM and BE because they allow patients to liberalize the diet, they have nutritional benefits, and they improve quality of life. These beliefs are widely accepted based on anecdotal or theoretical evidence. The data are

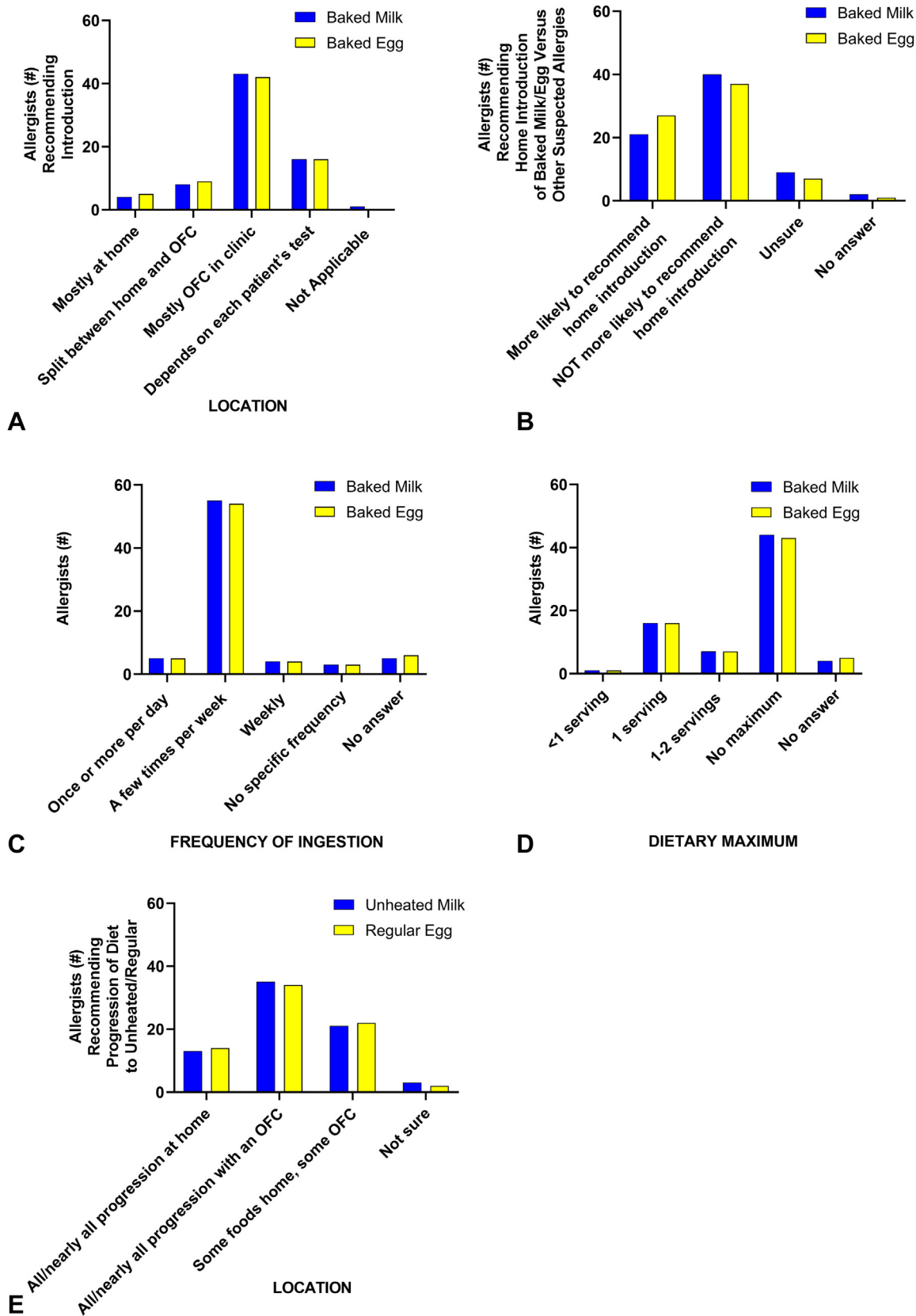


FIGURE 3. Location (home or medically observed) of baked milk and egg introduction and recommended frequency of ingestion once they are tolerated. (A) Location of initial introduction. (B) Location of initial introduction compared with recommendations for other food allergies. Once baked milk and egg are tolerated: (C) frequency of ingestion, (D) maximum allowed in diet, and (E) location of introduction of unheated milk or regular egg.

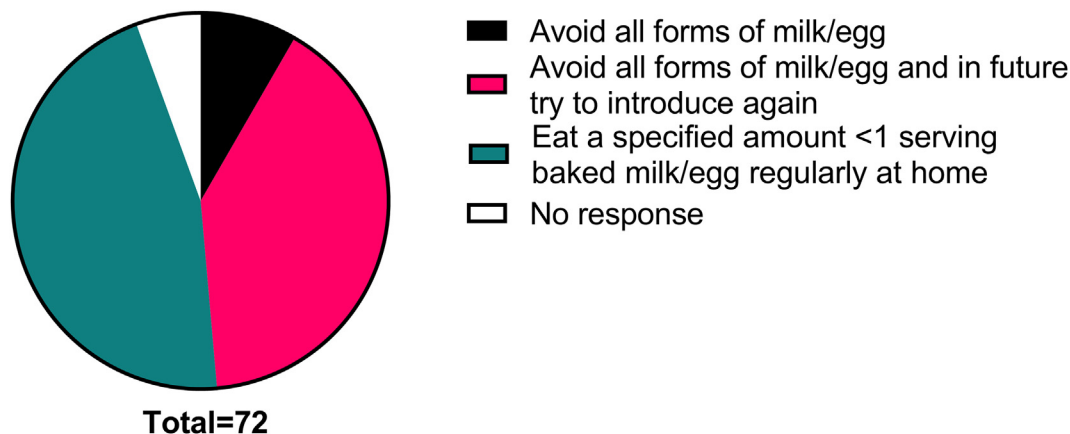


FIGURE 4. Allergist's recommendation for patient experiencing a mild allergic reaction after ingesting a whole baked milk or egg muffin.

even more limited regarding the role of BM and BE in non-IgE mediated conditions such as food protein-induced enterocolitis syndrome and eosinophilic esophagitis.¹³ A minority of allergists responding to this survey, about 20%, offered BM and BE to patients with non-IgE mediated conditions involving milk or egg avoidance.

Predicting who will tolerate BM and BE

The survey reflects that patient history and multiple tests are used in making decisions to predict BM and BE reactivity (Figure 2). The use of multiple factors is likely due to the recognized imprecision of SPT, laboratory tests, and clinical history.^{4,11,30-34} A limitation of these questions is that we did not ask respondents to provide cutoff levels or rank the tests and clinical factors. This might have provided a more detailed picture of how decisions are made by allergists, but the added time and complexity risked a high dropout rate or invalid answer choices.

Safety

Most allergists stated that they offered a mixed approach to initial BM and BE introduction: home introduction for some patients and medically supervised OFCs for others. Only 20% offered either location alone. When recommending home introduction, most use the approach of incremental full-dose ingestion over hours to days. Fewer advise patients to start eating a small amount of BM or BE for some time, and then slowly increase to a full serving (eg, over weeks or months) before advancing to a more allergenic form, as with a ladder (ie, a structured graduated exposure approach).

The survey was conducted during the COVID-19 pandemic, which has led to some changes in the practice of allergy, including limiting the number of OFCs offered or suspending them for periods of time in some practices.^{35,36} This may have led to more home introductions, although respondents were instructed to answer as they would have before the pandemic.

Some allergists described a perception of less risk compared with other foods: 21 of 72 respondents (29.2%) were more likely to offer home introduction for BM, and 27 of 72 (37.5%) for BE. There was also a small population (8.7%) who did not recommend the continued carriage of epinephrine autoinjectors after incorporating BM and BE.

Baked milk and BE as oral immunotherapy

More than half of respondents would advise the complete avoidance of all forms of milk and egg including BM and BE if a baked OFC resulted in a mild reaction after cumulatively eating a full serving. The remaining allergists would offer the patient an option similar to oral immunotherapy (OIT) using BM and BE. The child would start eating an amount of muffin daily below that which caused the reaction.

The original descriptions of the baked diets used the OFC outcome to assign children dichotomously as reactive to the baked form or tolerant of it, with advancement to less baked forms also by OFC among tolerant individuals.^{2,3} Since those early descriptions, multiple groups have explored using BM and BE as an OIT, with varying results. For milk, Goldberg et al.³⁷ reported that only three of 14 BM-allergic children (21%) could progress the diet to unheated milk with BM OIT, and many patients experienced reactions at previously tolerated doses. Dantzer et al.³⁸ conducted an RCT of BM-reactive children, and more than 70% of children randomized to ingesting BM achieved BM maintenance dosing over 12 months, although three of 15 (20%) had reactions treated with epinephrine. The newly released Diagnosis and Rationale for Action against Cow's Milk Allergy guidelines¹ recommended against BM OIT, but also state with low certainty that "persons with IgE-mediated [cow's milk allergy] who do tolerate certain amounts of baked cow's milk can continue consuming it and advance with the amounts tolerated under physician supervision." It is critically important to recognize that BM-allergic individuals may experience severe reactions to BM, and BM introduction must be approached with caution.¹⁶⁻¹⁸

For egg, in a small open-label study of BE-allergic children,⁷ 13 BE-reactive children (median age, 4.3 years) ate BE regularly in progressively larger doses. After 1 year of dose escalation, seven could ingest 3.8 g BE without a reaction. After another year of daily BE ingestion, six were challenged to 6 g lightly cooked egg and five passed. This study therefore showed evidence of BE hastening tolerance to lightly cooked egg. Compared with OIT using pasteurized raw egg white powder, BE ingestion was less effective at inducing sustained unresponsiveness.¹⁰ Kim et al.¹⁰ randomized 50 egg-allergic, BE-tolerant children to eating BE daily or egg OIT. Sustained unresponsiveness was achieved in 11.1% in the BE group (three of 27), compared with 43.5% of participants receiving egg OIT (10 of 23; $P = .009$), despite similar decreases in

TABLE III. Univariate logistic regression of demographic predictors of allergist recommendations

Recommendation	Odds ratio	95% CI	P
Offer high (>75%) proportion of children with milk allergy baked milk introduction in any location (home or medically observed)			
Time in practice (reference <10 y)			
>10 y	0.16	0.051-0.47	.001
Specialty (reference pediatrics)			
Internal medicine	0.93	0.30-2.86	.904
Medicine/pediatrics	2.67	0.45-15.96	.283
Age distribution of patients (reference all children)			
More children than adults	0.5	0.11-2.27	.370
About equal mix of children and adults	0.31	0.07-1.26	.101
More adults than children	0.22	0.04-1.19	.080
Region (reference US Northeast)			
US Midwest	7.47	1.39-40.24	.019
US South	2.33	0.60-9.03	.222
US West	2.80	0.67-11.67	.157
Canada	8.0	1.17-54.72	.034
Practice setting (reference solo group)			
Private solo practice	2.14	0.50-9.27	.308
Academic practice	5.25	1.09-25.21	.038
Hospital practice (nonacademic)	1	N/A	
Other	1	N/A	
Offer high (>75%) proportion of children with egg allergy baked egg introduction in any location (home or medically observed)			
Time in practice (reference <10 y)			
>10 y	0.11	0.03-0.38	<.001
Specialty (reference pediatrics)			
Internal medicine	1.27	0.42-3.84	.670
Medicine/pediatrics	2.26	0.38-13.51	.371
Age distribution of patients (reference all children)			
More children than adults	0.63	0.14-2.89	.544
About equal mix of children and adults	0.41	0.10-1.66	.209
More adults than children	0.31	0.06-1.61	.164
Region (reference US Northeast)			
US Midwest	7.47	1.39-40.24	.019
US South	2.33	0.60-9.03	.222
US West	4.80	1.14-20.27	.033
US Canada	1	N/A	N/A
Practice setting (reference solo group)			
Private group practice	1.79	0.46-7.02	.404
Academic practice	3.5	0.80-15.40	.097
Hospital practice (nonacademic)	1	NA	
Other	1	NA	
Eat baked milk or egg regularly (vs avoid) if patient has mild allergic reaction (eg, few hives, itching, or one episode of vomiting) after ingesting whole baked milk or egg muffin			
Time in practice (reference <10 y)			
>10 y	0.30	0.10-0.88	.028
Specialty (reference pediatrics)			
Internal medicine	1.41	0.44-4.54	.560
Medicine/pediatrics	2.48	0.41-14.86	.321
Age distribution of patients (reference all children)			
More children than adults	1.12	0.25-4.97	.879
About equal mix of children and adults	0.42	0.10-1.68	.221
More adults than children	0.60	0.11-3.10	.538
Region (reference US Northeast)			
US Midwest	1.26	0.25-6.36	.782

(continued)

TABLE III. (Continued)

Recommendation	Odds ratio	95% CI	P
US South	3.4	0.88-13.19	.076
West	1.05	0.26-4.26	.948
Canada	1.18	0.20-6.93	.856
Practice setting (reference solo group)			
Private group practice	1.32	0.35-5.01	.686
Academic practice	1.54	0.37-6.45	.555
Hospital practice (nonacademic)	1	N/A	
Other	1	N/A	

N/A, not applicable.

Bolded values are statistically significant at $P \leq .05$.

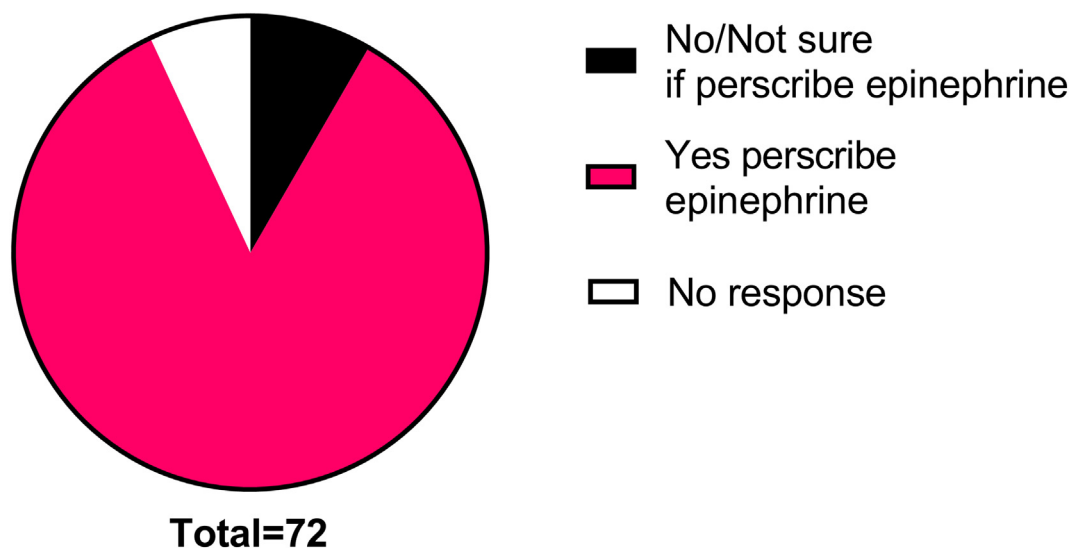


FIGURE 5. Epinephrine prescribed after tolerating baked milk or egg.

SPT and sIgE to egg white. Surprisingly, more children withdrew from the BE group than from OIT (29.6% vs 13%), although there were no significant difference in side effects.

Instructions provided to patients

Handouts. Respondents demonstrated an interest in using recipes and instructions. Most used a published recipe for BM and BE, and none recommended store-bought products. Most allergists also gave a handout with instructions about incorporating BM and BE into the diet at home after a negative OFC. Both of these practices should become the standard of care adopted by all those offering BM and BE OFCs to minimize the risk for reaction if recommendations about safe products are unclear, and for future reference at home. Handouts addressing BM are available.¹³ It was recently shown that families desire ongoing communication about baked diets.³⁹

Differences among providers

A recent survey of OFC practices for all foods identified that an allergist was more likely to perform more challenges in the practice the closer the allergist was to having completed an allergy fellowship.¹² In the current survey, time in practice (10 years or less vs more than 10 years) similarly had an effect on allergists offering patients BM and BE (OR = 0.16; $P = .001$). Other factors that influenced whether allergists offered BM and BE

were the region of practice. Significant differences were observed between the Northeast United States (reference) and the Midwest, and compared with Canada (ORs = 7.47 and 8, respectively) (the Southern and Western regions of the United States were not statistically different from the Northeast). Finally, offering BM and BE was also more common among those in academic practice compared with private solo practice (OR = 5.25; $P = .038$). It is notable that 68.1% of respondents of this survey had primary training in pediatrics versus 51% in pediatrics in the 2009/10 AAAAI workforce report.⁴⁰ We hypothesized that pediatric training would be associated with offering BM and BE to more patients, but we saw no differences.

We recognize limitations of this survey, including its brevity, that it was administered at the height of the COVID-19 pandemic, and the 10% response rate (typical for an AAAAI survey) limits the ability to derive definitive results about subgroups.

Responding allergists have a similar approach to introducing BE and BM as well as OFCs. Some demographic features are significantly associated with the odds of introducing BM and BE, especially time in practice and region of practice. Tests and clinical features are used variably to guide decisions regarding BM and BE. A subset of allergists advise that BM and BE are appropriate for home introduction and offer home introduction for BM and BE more often than other foods, and a small subset advise that availability of an epinephrine autoinjector is no longer needed when tolerating BM

and BE. The use of BM and BE as food for OIT for a mild reaction at the top dose of a baked OFC was endorsed by almost half of respondents who had less time in practice; this was the most significant factor in offering this approach. Published recipes were used and written information was widely provided to patients by most allergists. The wide practice variabilities reveal a need for more structured guidance about OFCs, ladders, in-office versus home procedures and patient education. There is a need for more data regarding the safety and effectiveness of varying forms of milk and egg in IgE and non-IgE allergy, BM/BE OIT, markers of tolerance, and quality of life assessments to aid in patient-centered decision-making.

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REFERENCES

- Brozek JL, Firmino RT, Bognanni A, Arasi S, Ansotegui I, Assa'ad AH, et al. World Allergy Organization (WAO) Diagnosis and Rationale for Action against Cow's Milk Allergy (DRACMA) Guideline update - XIV - Recommendations on CMA immunotherapy. *World Allergy Organ J* 2022;15:100646.
- Nowak-Węgrzyn A, Bloom KA, Sicherer SH, Shreffler WG, Noone S, Wanich N, et al. Tolerance to extensively heated milk in children with cow's milk allergy. *J Allergy Clin Immunol* 2008;122:342-347.e2.
- Leonard SA, Sampson HA, Sicherer SH, Noone S, Moshier EL, Godbold J, et al. Dietary baked egg accelerates resolution of egg allergy in children. *J Allergy Clin Immunol* 2012;130:473-480.e1.
- Upton J, Nowak-Węgrzyn A. The impact of baked egg and baked milk diets on IgE- and non-IgE-mediated allergy. *Clin Rev Allergy Immunol* 2018;55:118-38.
- Leonard SA, Nowak-Węgrzyn AH. Baked milk and egg diets for milk and egg allergy management. *Immunol Allergy Clin North Am* 2016;36:147-59.
- Esmailzadeh H, Alyasin S, Haghghat M, Nabavizadeh H, Esmailzadeh E, Mosavat F. The effect of baked milk on accelerating unheated cow's milk tolerance: a control randomized clinical trial. *Pediatr Allergy Immunol* 2018;29:747-53.
- Bird JA, Clark A, Dougherty I, Brown LS, Arneson A, Crain M, et al. Baked egg oral immunotherapy desensitizes baked egg allergic children to lightly cooked egg. *J Allergy Clin Immunol Pract* 2019;7:667-669.e4.
- Leonard SA. Baked egg and milk exposure as immunotherapy in food allergy. *Curr Allergy Asthma Rep* 2016;16:32.
- Leonard SA. Debates in allergy medicine: baked milk and egg ingestion accelerates resolution of milk and egg allergy. *World Allergy Organ J* 2016;9:1.
- Kim EH, Perry TT, Wood RA, Leung DYM, Berin MC, Burks AW, et al. Induction of sustained unresponsiveness after egg oral immunotherapy compared to baked egg therapy in children with egg allergy. *J Allergy Clin Immunol* 2020;146:851-862.e10.
- Dantzer JA, Dunlop JH, Wood RA. Standard testing fails to identify patients who tolerate baked milk. *J Allergy Clin Immunol* 2020;146:1434-1437.e2.
- Greife J, Oppenheimer J, Bird JA, Fleischer DM, Pongracic JA, Greenhawt M, et al. AAAAI Work Group Report: trends in oral food challenge practices among allergists in the United States. *J Allergy Clin Immunol Pract* 2020;8:3348-55.
- Bird JA, Leonard S, Groetch M, Assa'ad A, Cianferoni A, Clark A, et al. Conducting an oral food challenge: an update to the 2009 Adverse Reactions to Foods Committee Work Group Report. *J Allergy Clin Immunol Pract* 2020;8:75-90.e17.
- Yonkof JR, Mikhail IJ, Prince BT, Stukus D. Delayed and severe reactions to baked egg and baked milk challenges. *J Allergy Clin Immunol Pract* 2021;9:283-289.e2.
- Lieberman JA, Huang FR, Sampson HA, Nowak-Węgrzyn A. Outcomes of 100 consecutive open, baked-egg oral food challenges in the allergy office. *J Allergy Clin Immunol* 2012;129:1682-1684.e2.
- Smith G. Alabama boy, 3, dies of severe reaction during baked milk challenge test. *Allergic Living*. Accessed February 3, 2023. <https://www.allergicliving.com/2017/08/02/alabama-boy-3-dies-of-severe-reaction-during-baked-milk-challenge-test/>
- Canadian Society of Allergy and Clinical Immunology. CSACI/BSACI Statement on OIT. Accessed February 3, 2023. https://www.csaci.ca/wp-content/uploads/2022/01/CSACI_-BSACI-Statement-on-OIT.pdf
- Mondello W. Girl with milk allergy dies of severe reaction related to desensitization. *Allergic Living*. Accessed February 3, 2023. <https://www.allergicliving.com/2021/12/20/girl-with-milk-allergy-dies-of-severe-reaction-related-to-desensitization/>
- Dupont C. How to reintroduce cow's milk? *Pediatr Allergy Immunol* 2013;24:627-32.
- Nowak-Węgrzyn A, Groetch M. Let them eat cake. *Ann Allergy Asthma Immunol* 2012;109:287-8.
- Venter C, Meyer R, Ebisawa M, Athanasopoulou P, Mack DP. Food allergen ladders: a need for standardization. *Pediatr Allergy Immunol* 2022;33:e13714.
- Athanasopoulou P, Deligianni E, Dean T, Dewey A, Venter C. Use of baked milk challenges and milk ladders in clinical practice: a worldwide survey of healthcare professionals. *Clin Exp Allergy* 2017;47:430-4.
- Vandenplas Y, Brough HA, Fiocchi A, Miqdady M, Munasir Z, Salvatore S, et al. Current guidelines and future strategies for the management of cow's milk allergy. *J Asthma Allergy* 2021;14:1243-56.
- Thomas L, Belcher J, Phillips R, Preece K, Bhatia R. Use of an egg ladder for home egg introduction in children with IgE-mediated egg allergy. *Pediatr Allergy Immunol* 2021;32:1572-4.
- Chomyn A, Chan ES, Yeung J, Vander Leek TK, Williams BA, Soller L, et al. Canadian food ladders for dietary advancement in children with IgE-mediated allergy to milk and/or egg. *Allergy Asthma Clin Immunol* 2021;17:83.
- Luyt D, Ball H, Makwana N, Green MR, Bravin K, Nasser SM, et al. BSACI guideline for the diagnosis and management of cow's milk allergy. *Clin Exp Allergy* 2014;44:642-72.
- Gotesdyner L, Zeldin Y, Machnes Maayan D, Efron A, Stauber T, Maoz Segal R, et al. A structured graduated protocol with heat denatured eggs in the treatment of egg allergy. *Pediatr Allergy Immunol* 2019;30:824-32.
- Netting M, Gold M, Quinn P, El-Merhibi A, Penttila I, Makrides M. Randomised controlled trial of a baked egg intervention in young children allergic to raw egg but not baked egg. *World Allergy Organ J* 2017;10:22.
- Lemon-Mule H, Sampson HA, Sicherer SH, Shreffler WG, Noone S, Nowak-Węgrzyn A. Immunologic changes in children with egg allergy ingesting extensively heated egg. *J Allergy Clin Immunol* 2008;122:977-983.e1.
- Vilar LK, Araujo FA, Santos TP, Menezes TT, Cheik MF, Segundo GRS. Baked tolerance in cow's milk allergy: quite frequent, hard to predict. *Int Arch Allergy Immunol* 2021;182:319-23.
- Vilar LK, Rolins Neto PR, Abdo MA, Cheik MFA, Afonso C, Segundo GRS. Baked egg tolerance: is it possible to predict? *J Pediatr (Rio J)* 2020;96:725-31.
- Machinena A, Riggioni C, Dominguez O, Gereda D, Jimenez-Feijoo R, Folque M, et al. Are there any biomarkers that can predict tolerance to baked egg in egg allergic children younger than 6 years? *Pediatr Allergy Immunol* 2020;31:427-30.
- De Boer R, Cartledge N, Lazenby S, Tobias A, Chan S, Fox AT, et al. Specific IgE as the best predictor of the outcome of challenges to baked milk and baked egg. *J Allergy Clin Immunol Pract* 2020;8:1459-1461.e5.
- Sackesen C, Suarez-Farinas M, Silva R, Lin J, Schmidt S, Getts R, et al. A new Luminex-based peptide assay to identify reactivity to baked, fermented, and whole milk. *Allergy* 2019;74:327-36.
- Shaker MS, Oppenheimer J, Grayson M, Stukus D, Hartog N, Hsieh EWY, et al. COVID-19: pandemic contingency planning for the allergy and immunology clinic. *J Allergy Clin Immunol Pract* 2020;8:1477-1488.e5.
- Searing DA, Dutmer CM, Fleischer DM, Shaker MS, Oppenheimer J, Grayson MH, et al. A phased approach to resuming suspended allergy/immunology clinical services. *J Allergy Clin Immunol Pract* 2020;8:2125-34.
- Goldberg MR, Nachshon L, Appel MY, Elizur A, Levy MB, Eisenberg E, et al. Efficacy of baked milk oral immunotherapy in baked milk-reactive allergic patients. *J Allergy Clin Immunol* 2015;136:1601-6.
- Dantzer J, Dunlop J, Psoter KJ, Keet C, Wood R. Efficacy and safety of baked milk oral immunotherapy in children with severe milk allergy: a randomized, double-blind, placebo-controlled phase 2 trial. *J Allergy Clin Immunol* 2022;149:1383-1391.e17.
- Hicks AG, Pickett K, Casale TB, Cassimos D, Elverson W, Gerds J, et al. Educational resources received by families after successful baked egg/baked milk oral food challenge: an international survey. *J Allergy Clin Immunol Pract* 2022;10:3328-33232.e2.
- Center for Public Health Workforce Studies. American Academy of Allergy Asthma and Immunology Report on the Allergy and Immunology Physician Workforce. 1999-2009/10. Accessed February 3, 2023. <https://www.aaaai.org/Aaaai/media/MediaLibrary/PDF%20Documents/Practice%20and%20Parameters/2012-AI-Physician-Workforce-Report.pdf>

ONLINE REPOSITORY

TABLE E1. American Academy of Allergy, Asthma & Immunology Adverse Reactions to Foods Committee Baked Milk and Baked Egg Work Group Survey

Survey production notes (not included in live SurveyMonkey version)
• Skip logic instructions are noted at the end of the answer choices, where applicable, in italics.
• Questions with *Matrix* listed before the answer choices consisted of two response columns (e.g., 1 for milk and 1 for egg) in SurveyMonkey.
• The other or none answer choices included an optional free text box in SurveyMonkey only if the answer choice states Please list.
• The following instructions were included on the first page of the online survey.
Survey instructions
• Throughout the survey, milk exclusively refers to cow's milk, and egg to hen's egg.
• Baked milk/egg is short for cow's milk and/or hen's egg in baked goods (eg, a muffin, but not a quiche or casserole).
• Oral food challenge (OFC) always refers to an observed, medically supervised challenge, typically involving at least two different doses. Challenges or observed introductions in other settings (primary care clinic without allergist, emergency room parking lot, home, etc) are never considered OFCs for the purposes of this survey.
• All questions refer to IgE-mediated food allergy and do not include other causes (such as non-IgE mediated or an intolerance), except when asked specifically about non-IgE mediated conditions.
• Answer questions to the best of your ability, as you would have before any changes in your practice owing to the COVID-19 pandemic.

SECTION 1: DEMOGRAPHIC AND PRACTICE INFORMATION

- How long have you been practicing allergy/immunology?
 - <5 y
 - 6-10 y
 - 11-20 y
 - 21-30 y
 - >30 years
 - Not applicable/never practiced or no longer practicing

Skip logic: if f, survey ends
- Select the degree or certification relevant to your medical practice:
 - Doctor of Medicine/Doctor of Osteopathic Medicine or international equivalent
 - Physician Assistant
 - Nurse Practitioner and related degree (e.g., Doctor of Nursing Practice, Family Nurse Practitioner, etc)
 - Registered Nurse, Licensed Vocational Nurse, or Licensed Practical Nurse
 - Other, please list
- In what specialty was your primary training before allergy/immunology:
 - Pediatrics
 - Internal medicine
 - Family medicine
 - Medicine/pediatrics
 - Other, please specify

- What is the approximate proportion of child/pediatric vs adult patients in your practice?
 - All children
 - More children than adults
 - About an equal mix between adults and children
 - More adults than children
 - All adults
- In what region is your practice located?
 - Northeast (Conn, Mass, Maine, NH, NJ, NY, Pa, RI, Vt)
 - Midwest (Iowa, Ind, Ill, Kan, Mich, Minn, Miss, ND, Neb, Ohio, SD, Wis)
 - South (Ala, Ark, DC, Del, Fla, Ga, Ky, La, Md, Mo, NC, Okla, PR, SC, Tenn, Texas, Va, WV)
 - West (Alaska, Ariz, Calif, Colo, Hawaii, Idaho, Mont, NM, Nev, Utah, Ore, Wash, Wyo)
 - Canada
 - Other, please list
- How would you describe your practice setting?
 - Private solo practice
 - Private group practice
 - Academic practice
 - Hospital practice (nonacademic)
 - Active military practice
 - Veterans hospital
 - Other
- In your practice (before the pandemic), did you perform oral food challenges (OFCs), either personally or in collaboration with partners or advanced practice providers?
 - Yes
 - No
 - No, but I referred to another allergist to perform
 - Not sure
- For what proportion of children with a milk allergy do you ever recommend baked milk introduction in any setting?
 - None
 - 1% to 25%
 - 26% to 75%
 - >75%
- For what proportion of children with an egg allergy do you ever recommend baked egg introduction in any setting?
 - None
 - 1% to 25%
 - 26% to 75%
 - >75%

Skip logic: If 8 and 9 = A, survey ends

SECTION 2: BAKED MILK/EGG INTRODUCTION

- Which of the following do you discuss with patients as reasons to consider baked milk or egg introduction? Select all that apply.
 - To liberalize the diet
 - Nutritional benefits
 - Improve quality of life
 - Eating baked milk/egg may accelerate outgrowing the milk/egg allergy
 - To help determine the milk/egg allergy phenotype, which can predict severity and persistence
 - None
 - Other
 - Not sure

11. In what setting do you typically recommend that the initial introduction of baked milk/egg take place for a patient with milk/egg allergy? Select the one best answer for each food.

Matrix

- a. Mostly at home
 - b. About evenly split between home and OFC in clinic
 - c. Mostly OFC in clinic
 - d. Location depends on each patient's testing
 - e. Not sure
 - f. N/A
12. If recommending initial introduction at home to a patient, which is your typical approach?
- a. N/A; I never or almost never recommend home introduction
 - b. Advise eating an age-appropriate serving size as a single dose
 - c. Advise eating an age-appropriate serving size in incremental doses (eg, over hours or a few days)
 - d. Start eating a small amount of milk/egg in baked goods for a period of time and then slowly increase to a full serving (eg, over weeks or months)
 - e. Other, please list
13. When deciding whether you will offer baked milk introduction to a patient in any setting, which of the following tests do you use, with or without a cutoff value, to determine which patients will be offered baked milk introduction? Select all that apply.
- a. N/A; no tests used
 - b. Skin prick test (SPT) to milk using a commercial extract
 - c. Serum specific IgE (sIgE) to milk
 - d. sIgE to casein
 - e. sIgE to other milk components
 - f. A prick-to-prick or fresh food SPT to fresh milk
 - g. A prick-to-prick or fresh food SPT using the baked milk muffin
 - h. A test other than these (please list that test)
14. When deciding whether you will offer baked egg introduction to a patient in any setting, which of the following tests do you use, with or without a cutoff value, to determine which patients will be offered baked egg introduction? Select all that apply.
- a. N/A; no tests used
 - b. SPT to egg using a commercial extract
 - c. sIgE to egg
 - d. sIgE to ovomucoid
 - e. sIgE to other egg components
 - f. A prick-to-prick or fresh food SPT to egg
 - g. A prick-to-prick or fresh food SPT using the baked egg muffin
 - h. A test other than these (please list that test)
15. In addition to, or instead of, test-based cutoffs to determine whether someone is offered baked milk/egg introduction, please select all of the following factors that you consider for offering introduction of each baked food (select all that apply in each column):

Matrix

- a. N/A; I predominantly use tests

- b. I do not use any specific factor because I offer baked milk/egg to almost every patient
- c. Age
- d. Severity of initial reaction
- e. Time since initial reaction
- f. Other food allergies
- g. History of eczema or asthma
- h. Other (please list)

16. When deciding where a patient will do baked milk introduction, either at home or an OFC in the clinic, which tests do you consider? Select all that apply.
- a. N/A; I do not use tests to determine the location or I only offer introduction in one setting, so I do not have to decide where
 - b. SPT to milk
 - c. sIgE to milk
 - d. sIgE to casein
 - e. sIgE to other milk components
 - f. Prick-to-prick or fresh food SPT to fresh milk
 - g. Prick-to-prick or fresh food SPT using the baked milk muffin
 - h. A test other than these (please list)
17. When deciding where a patient will do baked egg introduction, either at home or an OFC in the clinic, which tests do you consider? Select all that apply.
- a. N/A; I do not use tests to determine location, or I only offer introduction in one setting, so I do not have to decide where
 - b. SPT to egg
 - c. sIgE to egg
 - d. sIgE to ovomucoid
 - e. sIgE to other egg components
 - f. Prick-to-prick or fresh food SPT to egg
 - g. Prick-to-prick or fresh food SPT using the baked egg muffin
 - h. A test other than these (please list)
18. In addition to, or instead of, test-based cutoffs to determine where a patient will do a baked milk/egg introduction, either at home or an OFC in the clinic, please select all of the following factors that you consider for offering introduction of each baked food (select all that apply in each column):

Matrix

- a. I only use one setting
 - b. I only use diagnostic test results
 - c. Age
 - d. Severity of initial reaction
 - e. Time since initial reaction
 - f. Other food allergies
 - g. History of eczema
 - h. History of or active asthma
 - i. Parental preference or comfort and home environment
 - j. None of these (please list)
19. In general, I am more likely to recommend home introduction for baked milk/egg than other foods for patients with a likely or suspected food allergy:

Matrix

- a. Yes

- b. No
- c. Unsure

SECTION 3: BAKED MILK/EGG OFC PRACTICES

20. How many OFCs to baked milk/egg did you perform and/or order for your patients in a typical month before the COVID-19 pandemic?
- a. None
 - b. 1-5
 - c. 6-10
 - d. 11-15
 - e. >15

Skip logic: if A, skip to Section IV

21. To which of the following food(s) do you offer baked OFCs? Select all that apply.
- a. Baked egg using a muffin or waffle
 - b. Baked milk using a muffin or waffle
 - c. Baked cheese using pizza
 - d. Rice pudding
 - e. Not sure
 - f. Other (please list)
22. Before baked milk/egg OFCs, do you give patients and caregivers a particular recipe or specific instructions about what to bring to the OFC?
- a. A recipe published in the allergy literature (eg, the Mt Sinai recipe in the OFC Work Group Report)
 - b. A locally developed recipe from another source
 - c. Specific instructions on what commercial product to use
 - d. General instructions for how to make it (eg, amount of milk/egg, baking time and temperature), but not a specific recipe
 - e. No specific recipe or instructions
 - f. Not sure

SECTION 4: MILK/EGG PROGRESSION

23. Once tolerating baked milk/egg, in what location do you typically recommend that a patient advance to the next stage or step (eg, from baked milk muffin to pizza to a glass of milk, or from baked egg muffin to egg noodles to a scrambled egg)?

Matrix

- a. All or nearly all progression at home
 - b. All or nearly all progression with an OFC in clinic
 - c. Progression to some foods is typically done at home, whereas others are in the clinic with OFC
 - d. N/A, or not sure
24. Based on what factors, if any, do you decide when to offer a glass of milk or scrambled egg to a patient who is tolerating baked milk/egg? Select all that apply.

Matrix

- a. Patient age
- b. Duration of tolerance to the currently tolerated form (eg, muffins)
- c. Severity of previous allergic reactions
- d. Initial test results (eg, SPT, sIgE)

- e. Testing repeated since starting current stage/step
 - f. N/A, or not sure
 - g. Other specific factor not included here (please list)
25. Do you offer baked milk/egg introduction or OFC to all or most children with each condition alone (ie, excluding children with more than one condition)? Select all that apply.

Matrix

- a. IgE-mediated food allergy
- b. Eosinophilic esophagitis
- c. Food protein-induced enterocolitis syndrome
- d. Other non-IgE mediated conditions (eg, milk-induced proctocolitis)

SECTION 5: BAKED MILK/EGG PATIENT RECOMMENDATIONS

26. Once patients are tolerating a full muffin containing baked milk/egg, how often do you tell them to eat it?

Matrix

- a. Monthly
 - b. Weekly
 - c. A few times per week
 - d. Once or at least once per day
 - e. No specific frequency
 - f. N/A, or not sure
27. Once patients are tolerating an age-appropriate serving of baked milk/egg, what do you tell most of them is the maximum amount that they can tolerate in a meal or snack?

Matrix

- a. Less than one serving
 - b. One serving
 - c. One to two servings
 - d. No maximum
 - e. N/A, or not sure
28. A patient has a mild allergic reaction (eg, a few hives, itching, or one episode of vomiting) after ingesting a whole baked milk/egg muffin. What would you tell this patient?
- a. Avoid all forms of milk/egg
 - b. Avoid all forms of milk/egg, and plan to offer a trial to introduce baked milk/egg again in the future
 - c. Eat baked milk/egg regularly at home with a specific amount that is less than one serving (eg, at or below the last tolerated dose)
 - d. Not sure
 - e. None of these match (please explain)
29. In what way do you typically provide instructions about what other types of food can be eaten or need to be avoided after successful home introduction or passing an OFC to baked milk/egg? Select all that apply.
- a. Verbal recommendations provided
 - b. A handout (printed or electronic) is given to each patient
 - c. Referral to a registered dietitian for most or all patients
 - d. Individualized handwritten recommendations provided
 - e. No recommendation provided

- f. Not sure
 - g. Other (please list)
30. Do you recommend that patients continue to carry epinephrine autoinjectors if they do not have any other food allergies, after tolerating baked milk/egg?

- a. Yes
- b. No
- c. Not sure
- d. N/A; I do not prescribe medications

End of survey—thank you for your participation!

Matrix