

Risk Reduction in Peanut Immunotherapy



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KEYWORDS

• Peanut • Peanut immunotherapy • Food allergy • Risk assessment • Risk reduction
• Relative risk reduction • Quantitative risk assessment • Quantitative risk reduction

KEY POINTS

- Immunotherapy for peanut allergy is a potential treatment option being developed with the potential to reduce the risk of accidental reactions to peanut in the community.
- This article covers the epidemiology of unexpected allergic reactions to peanut, and outlines definitions of risk and risk reduction with quantitative risk assessment examples.
- Models for estimating accidental reaction risks to peanut show significant potential relative risk reductions for the peanut-allergic population and the peanut-allergic individual being treated with immunotherapy.
- However, longer-term clinical trials or commercial data will strengthen the knowledge surrounding risk and potential options for risk reduction in patients with peanut allergy.
- It is important to clearly define the specified period of time and population when risk is being assessed to enable better communication and understanding.

INTRODUCTION

Peanut allergy is a global disease and can be life threatening.^{1–3} Patients must practice strict avoidance of peanut and be prepared to use rescue medication on development of symptoms caused by unintentional peanut ingestion.¹ However, because of widespread use in packaged foods, restaurants, and catered meals, complete avoidance of peanut is difficult. As such, unexpected allergic reactions to peanut are frequent and symptoms are unpredictable.^{2,4–8} Peanut-allergic individuals and their caregivers experience tremendous anxiety and stress, and report poor quality of life; thus, an important goal for patients undergoing immunotherapy is to be able to live, eat, and socially interact more freely.^{9–11}

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At present there are no US Food and Drug Administration–approved therapies for treatment of peanut allergy and no treatments under development have shown the ability to cure a food allergy. However, the drugs in development have been focused on increasing the eliciting dose (ED) or reaction threshold (ie, the amount of protein ingested at which an allergic reaction is initiated) to provide protection against accidental exposure reactions.¹² Recent studies have created models to quantitatively estimate the clinical benefits of increasing a hypothetical individual's threshold through immunotherapy (nonspecific to immunotherapy method) in modeling predicted relative risk reduction (RRR) in American and European consumers.^{13,14} More recently, RRRs for a phase 3 clinical trial population were modeled based on the increase in ED during a food challenge after 12 months of treatment with epicutaneous immunotherapy (EPIT).¹⁵

This article covers the epidemiology of unexpected allergic reactions to peanut and outlines definitions of risk and risk reduction with relevant examples. In addition, prior efforts to model potential risk reduction for peanut-allergic individuals or peanut-allergic populations undergoing immunotherapy are discussed.

EPIDEMIOLOGY

Frequency and Causes of Allergic Reactions

Previously, it has been reported that between 3% and 55% of peanut-allergic individuals experienced at least 1 unexpected allergic reaction during a 1-year period.^{4–7,16–21} When the place of reaction was identifiable, most adverse events occurred at home, or at a relative's/friend's home, in restaurants, at a party, or at school or day care.^{6,16–18,22} Reactions are commonly attributed to packaged foods, meals outside the home (ie, restaurants, school, friends' or relatives' homes), fresh products, products or meals in a foreign country, and meals at home.^{4,23} Accidental reactions have been caused by forgetfulness, reduced supervision, not checking a product, label reading errors, cross contamination, errors in meal preparation, and manufacturer labeling errors.^{4,5,21,24} When discussing unexpected reactions to packaged foods, it is acknowledged by allergic consumers that the total avoidance of food products bearing precautionary allergen labeling (PAL) is impossible. In addition, the application of PAL is voluntary and specifics for application not officially regulated within any allergen labeling framework.^{25,26} As such, decisions leading to the application of PAL (or its absence) and which form of PAL (ie, may contain..., produced in the same facility as..., made on the same equipment as...) can differ, even in situations with comparable risks for unintended allergen presence.^{26,27} Because of its voluntary nature and nonuniform application, PAL is often misunderstood, which leads to increased consumption of PAL containing products and increased risk taking because of more potential allergen exposures.^{4,21,24,28–31} Thus it is not surprising to find packaged foods reported as a common cause for accidental allergic reactions, especially when surveys of packaged food products with PAL for peanut found roughly 10% of products contained peanut concentrations from 0.175 to 6500 ppm (mg/kg) peanut protein.^{13,30,32–42} An Australian survey further showed the disconnect between PAL and consumer adherence to labeling. The foods suspected to trigger anaphylactic reactions in 38% of the study population contained PAL.²¹ Peanut was also the most commonly suspected food to cause anaphylaxis in the Australian survey.²¹

Not all allergic individuals check product labels; some ignore them, and others do not inform their waitstaff of their allergy when eating out.⁴ Skipping the reading of a label or informing waitstaff were done regardless of whether there was a history of severe reactions.^{4,24} However, even in cases of strict avoidance or informing restaurant

staff, accidental or unexpected allergic reactions still occur.⁴ In these cases in which informing waitstaff did not prevent a reaction, a mistaken ingredient, shared cooking equipment or utensils, or several other factors could have played a role in an unexpected reaction. Although mistaken ingredients can lead to high exposures of peanut protein, transfers from shared, uncleaned kitchen equipment have also been shown to reach levels of peanut protein known to cause reactions in a significant portion of the peanut-allergic population.⁴³ However, these exposures and subsequent reactions could be deemed accidental. In contrast, there were also a surprising number of reactions reportedly caused by purposeful exposure to the allergen, which again highlights the need for better, continued education of allergic individuals and their caregivers.^{5,6,44}

Frequency of Severe Allergic Reactions to Peanut

The true proportion of food-allergic reactions that are severe is difficult to estimate because of differences in data collection methods, different definitions of severity, and study heterogeneity.⁴⁵ As such, there is a wide variance in estimates, from 0.4% to 40% of food-allergic reactions that result in a severe reaction,⁴⁶ with fatal anaphylaxis being a rare but unpredictable event.⁴⁵ More recent data confirm these previously reported values, with a prospective study in Dutch adults that found 28% of unexpected allergic reactions to food were severe⁴ and a parent-reported study in the United States that found 42% of children with food allergies were considered to have a history of severe reaction and 19% of food-allergic children had at least 1 food-related emergency department visit in the past year.² In Australia, the Victoria State Government anaphylaxis notification system reported 1200 anaphylaxis notifications over the 6-month period of November 2018 through April 2019, with an average of 46 total anaphylaxis episodes per week of which 28 per week were attributed to food.²³ There was a fairly equal proportion of reported anaphylaxis episodes to packaged foods (18%), unpacked foods from food premises (22%), and other foods (21%).²³

Similar severity results were found when focusing on peanut alone, with wide variations in definitions of severity and anaphylaxis leading to a range of 11% to 52% of accidental exposure reactions being deemed severe.^{5,6,16,17,19,20,44} If an allergic reaction was deemed severe, medical attention was sought 14% to 75% of the time.^{4,6,16,17,22} Parents in the United States reported that 59.2% of children with peanut allergy were considered to have a history of severe allergy to peanut and that 22.9% of the peanut-allergic children had at least 1 food-related emergency department visit in the past year.²

Prediction of a Severe Reaction

The history of prior reactions is not a predictor for the severity of future reactions. Compared with previous reactions, 10% to 32% of subsequent reactions were more severe, 40% to 64% were similar in severity, and 8% to 29% were less severe.^{6,16–19,47} In addition to not being able to predict the severity of reaction, recent reviews have deemed that severity and sensitivity (individual threshold) should be treated as separate factors because of the inability to predict severity from known prior data.^{47,48} Severe reactions can occur to low or high doses of allergen and the ED of an allergic reaction cannot predict the symptom severity. The notion of separating severity and sensitivity was supported by Pettersson and colleagues,⁸ who could explain only 23.5% of total variance when predicting severity during double-blind, placebo-controlled food challenge (DBPCFC) in a large dataset, and the ED at food challenge only contributed 4.4% to the model for severity prediction.

Single-dose studies for peanut,⁴⁹ and milk, egg, or hazelnut,⁵⁰ provide a good demonstration that very low (milligrams) doses result mostly in mild to moderate symptoms, but a severe reaction has been observed, again indicating that ED alone does not determine severity. In addition, Taylor and colleagues⁵¹ found no difference in DBPCFC dose distributions for individuals with a history of severe reactions or with a history of nonsevere reactions before food challenge, strengthening the argument that severity and sensitivity should be treated as separate factors. There is also a theme of undertreatment regarding severe or anaphylactic reactions. Multiple studies have confirmed that most severe reactions are insufficiently treated according to current guidelines, with low epinephrine usage rates and severe reactors not seeking medical help.^{4-6,16,17,20,22,52-55} These results confirm that there are many unknown factors that contribute to the severity of an allergic reaction at DBPCFC and in everyday life. However, although the severity of an individual reaction is unpredictable, it is expected that, if the number of allergic reactions were reduced, then the number of severe reactions would at least be proportionally reduced. In light of the unpredictable severity and undertreatment of reactions being common, the desire for a buffer or margin of safety against reactions to accidental peanut exposures as expressed by caregivers of allergic children is well understood.¹¹

RISK AND RISK REDUCTION

In epidemiology, absolute risk (AR) is defined as the probability of an adverse event in a defined population over a specified period of time.⁵⁶ When discussing the AR of an allergic reaction, the specified period of time is an important consideration and must be clearly communicated and understood to enable further risk assessment and discussions. Periods of time that were previously used in food allergy risk assessments for unexpected allergic reactions to an accidental exposure include risk per eating occasion, per week, per month, and per year.^{13-15,33,38,57,58} In addition, risks of unexpected allergic reactions have also been expressed in different populations, which can seemingly be a great influence toward the reported risk assessment results, even though most results are readily translatable into other populations. Previous risk assessments have expressed risk in one of the following populations:

- Population A: the overall population (includes allergic and nonallergic individuals, includes consumers and nonconsumers, includes products with or without unintended allergen presence)
- Population B: the allergic population (all individuals considered allergic, includes consumers and nonconsumers, includes products with or without unintended allergen presence)
- Population C: the allergic consumer population (all individuals considered allergic and all who consume the product in question, includes products with or without unintended allergen presence)
- Population D: the allergic consumer population of products containing unintended allergen presence (all individuals considered to be allergic, all are consumers of the product, and all products contain an unintended allergen presence)

With so many different combinations, it is easy to dismiss risk results when time periods and populations are not understood or provided without clear definitions. For example, a risk of 1 in 100 million (0.000001%) *per eating occasion* of a packaged food category *in the overall population* (population A) can still predict multiple reactions per day in a population as large as the United States (estimated population of

330 million people). In contrast, a risk of 1 in 100 (1%) *per eating occasion* in the *allergic consumers of a product containing unintended allergen presence* (population D) might seem large but is not likely to predict reactions if the frequency of unintended allergen presence is extremely low and only 5 products contain allergen residue out of millions of packages produced per year. In this scenario, the prevalence of allergy, the frequency of consumption, and the frequency of unintended allergen presence would still need to be accounted for before a comparison could be made in the overall population. In the second scenario, the odds of a contaminated product being consumed by the most sensitive allergic individual and triggering a reaction are low, and much lower than 1 in 100 million.

It is with this understanding of small percentages that examples from 2 studies were selected to show different specified periods of time for the risk assessments and different populations for the expression of risk results. In a study by the French Agency for Food, Environmental and Occupational Health Safety (ANSES), simulations for the peanut-allergic pediatric age group predicted risks of 0.2% to 2.0% *per eating occasion* in the *allergic consumer population* (population C) for 6 different packaged food categories.³⁸ To highlight the difference by removing frequency of unintended allergen presence in the risk assessment, these same risks were also expressed as 0.9% to 6.6% *per eating occasion* in *allergic consumers of a product containing unintended allergen presence* (population D).³⁸ The results for children were also modeled on a weekly basis, and, when the full pediatric consumption pattern was included, it could be predicted that up to 3.7% of the *allergic population* (population B) would be predicted to experience at least 1 allergic reaction *per week* when consuming these 6 packaged foods.³⁸ Similar to the ANSES results, a recent study using threshold data from children in a phase 3 immunotherapy trial population estimated risks of 1% to 4% *per eating occasion* in *allergic consumers of a product containing unintended allergen presence* (population D) for 4 commonly eaten packaged food categories.¹⁵ When expressed on a yearly basis, including frequency of consumption and frequency of contamination, it was predicted that up to between 11% and 30% of the *allergic population* (population B) would experience an unexpected allergic reaction *per year* to one of the 4 packaged foods,¹⁵ comparable with estimates in prior reported literature.^{2,4-7,16-21} These examples are given as a reminder that not all risks are reported in similar fashion and it is important to understand how results would change if expressed in different populations or in different time frames.

Risk Reduction

When discussing the potential results, benefits, and risks related to immunotherapy for peanut allergy, it is important to understand the potential risk reduction or risk increase achieved by the immunotherapy treatment. As previously defined, the AR is the probability of an adverse event in a defined population over a specified period of time.⁵⁶ If the AR for the treatment group ($AR_{\text{Treatment}}$) is less than the AR for the control group (AR_{Control}), then the risk difference is defined as the AR reduction (ARR) and calculated as shown in [Table 1](#).⁵⁶ Further calculations for presenting results of randomized clinical trials can include the relative risk (RR), RRR, and the number needed to treat (NNT) (see [Table 1](#)). The NNT is the average number of persons who need to undergo treatment in order for 1 adverse event to be prevented compared with the control group.⁵⁶ The RR is the risk ratio of the $AR_{\text{Treatment}}$ and AR_{Control} and is commonly used to present clinical trial results. $RR = 1$ indicates that treatment did not affect the probability of an adverse event, whereas $RR < 1$ indicates that the probability of an adverse event is decreased by the treatment and $RR > 1$ indicates that the probability of an adverse event is increased because of treatment. The RRR, or efficacy of the treatment, is

Table 1 Absolute risk and risk reduction definitions, with equations for calculation		
Term	Definition	Equation
AR	The probability of an adverse event in a defined population over a specified period of time	—
ARR	The $AR_{Control}$ minus the $AR_{Treatment}$	$AR_{Control} - AR_{Treatment}$
RR	Risk ratio or RR is the ratio of the probability of an $AR_{Treatment}$ in relation to the probability of $AR_{Control}$	$\frac{AR_{Treatment}}{AR_{Control}}$
RRR	The RRR or efficacy is the relative decrease in the risk of an adverse event in the treatment group compared with a control group	$\frac{AR_{Control} - AR_{Treatment}}{AR_{Control}}$
NNT	The number of persons needed to be treated, on average, to prevent 1 event	$\frac{1}{AR_{Control} - AR_{Treatment}}$

Abbreviations: NNT, number needed to treat; RR, relative risk.
Data from Porta M, editor. *A Dictionary of Epidemiology*, 6th edition. New York: Oxford University Press; 2014.

the relative decrease in the $AR_{Treatment}$ compared with the $AR_{Control}$ and can be easily understood by nonexperts, and is most helpful when used in conjunction with the AR. A fictitious dataset was created as an example (Table 2), in which 50% of the peanut-allergic control population was predicted to experience an allergic reaction over the course of 1 year ($AR_{Control} = 50\%$), whereas only 10% of the treatment population was predicted to experience an allergic reaction after 1 year of treatment ($AR_{Treatment} = 10\%$). These ARs would correspond with a predicted ARR of 40%, an RR of 20%, an RRR of 80%, and an NNT of 2.5 (see Table 2).

Table 2 Example scenario of risk reduction calculations	
$AR_{Control}$	$AR_{Treatment}$
0.5 (or 50%)	0.1 or 10%
ARR	0.4 or 40%
RR	0.2 or 20%
RRR	0.8 or 80%
NNT	2.5

The data in this table are not based on clinical data and are only used as examples.

Risk Increase

In cases in which a treatment option does not reduce the probability of an adverse event but increases the probability of an adverse event, resulting in an $AR_{Treatment}$ that is greater than the $AR_{Control}$, then the risk difference is defined as the AR increase (ARI) and calculated as shown in Table 3.⁵⁶ In addition, in cases in which the $AR_{Treatment}$ is greater than $AR_{Control}$, the RR increase (RRI) and the number needed to harm (NNH) can also be calculated (see Table 3). In Table 4, a risk increase example was created in which the sample treatment population had a higher risk after 1 year of treatment ($AR_{Treatment} = 60\%$) than the control group ($AR_{Control} = 50\%$). These ARs would correspond with a predicted ARI of 10%, an RR of 120%, an RRI of 20%, and an NNH of 10 (see Table 4).

Table 3
Risk increase definitions with equations for calculation

Term	Definition	Equation
AR	The probability of an adverse event in a defined population over a specified period of time	—
ARI	The $AR_{\text{Treatment}}$ minus the AR_{Control}	$AR_{\text{Treatment}} - AR_{\text{Control}}$
RR	Risk ratio or RR is the ratio of the probability of an adverse event in a treatment group in relation to the probability of an adverse event in a control group	$\frac{AR_{\text{Treatment}}}{AR_{\text{Control}}}$
RRI	The RRI is the relative increase in the risk of an adverse event in the treatment group compared with a control group	$\frac{AR_{\text{Treatment}} - AR_{\text{Control}}}{AR_{\text{Control}}}$
NNH	The number of persons needed to be treated, on average, to produce 1 more adverse event	$\frac{1}{AR_{\text{Treatment}} - AR_{\text{Control}}}$

Abbreviations: NNH, number needed to harm; RRI, relative risk increase.

Data from Porta M, editor. *A Dictionary of Epidemiology*, sixth edition. New York: Oxford University Press; 2014.

Table 4
Example scenario of risk increase calculations

AR_{Control}	$AR_{\text{Treatment}}$
0.5 (or 50%)	0.6 or 60%
ARI	0.1 or 10%
RR	1.2 or 120%
RRI	0.2 or 20%
NNH	10

The data in this table are not based on clinical data and only used as examples.

Quantitative Risk Assessment Modeling

Recently, the measure of treatment efficacy through oral food challenges in a clinic has come under question, and there was a desire for other measures focused on risk and frequency of reactions for characterizing treatment efficacy.⁵⁹ Measurable clinical results and validation through real-world outcomes are expected in other forms of allergen immunotherapy (ie, respiratory allergens), but there is no specified or harmonized methodology for this process.⁶⁰ Quantitative risk assessment modeling in food allergy provides a tool for modeling real-world exposures, frequencies of allergic reactions, and the potential impact of immunotherapy treatments.

Quantitative risk assessments are typically conducted using Monte Carlo simulations, a long-established statistical methodology used in food safety and broadly accepted across other scientific disciplines.^{61–63} In short, quantitative risk assessments simulate possible exposure amounts and compare them with either a hypothetical food-allergic individual^{13,14} or to a food-allergic population^{33,35,38,42,57,58,64–68} in an effort to assess the risk and frequency of predicted allergic reactions in certain scenarios.

Population-based quantitative risk assessments were conducted using Monte Carlo simulations with 3 primary inputs for the risk assessment:

- Allergen thresholds
- The concentration of peanut protein in the product
- The amount of food consumed per eating occasion of the product

Risk assessments are then conducted by simulating a large number of eating occasions to obtain a predicted AR per eating occasion. Depending on the risk assessment, the allergen thresholds can be defined to focus on a single individual to assess individual risk, or the allergen thresholds are selected from the allergic population dose-response curves for population assessments. Additional secondary inputs necessary for specific population assessments may include prevalence of (peanut) allergy, frequency of consumption, frequency of unintended allergen presence, shopping habits (label avoidance), and so forth to express risk in a different population or a different specified period of time. Once the ARs have been modeled and predicted, the RRRs can be calculated.

Quantitative population risk assessment and relative risk reduction

A model estimating the quantitative risk assessment and RRR associated with 12 months of EPIT for peanut allergy with a patch containing 250 μg of peanut protein was recently published.¹⁵ Study population dose-response curves were fitted to baseline and 12-month DBPCFC data from a recently described EPIT phase 3 clinical trial population⁶⁹ using interval-censoring survival analysis (ICSA). ICSA was chosen because it uses the interval between the previously tolerated dose and discrete ED during DBPCFC. Because the exact dose that causes the individual reaction is not known, but is in the interval between the ED and previous dose, ICSA has been used in other studies as the appropriate, conservative method for fitting food allergen dose distributions.^{70–73} Risk assessments were conducted by simulating a total of 5 million eating occasions of a contaminated packaged food product and then calculating ARs and RRRs for each study population. As detailed earlier, ARs were estimated to be 1% to 4% *per eating occasion* in *allergic consumers of a product containing unintended allergen presence* (population D) for 4 commonly eaten packaged food categories; when expressed on a yearly basis, it was predicted that between 11% and 30% of *the allergic population* (population B) would experience an unexpected allergic reaction *per year* to one of the 4 packaged foods.¹⁵ After 12 months of EPIT with a patch containing 250 μg of peanut protein, RRRs for an allergic reaction when consuming the packaged foods were estimated from 73% to 78% (RRR). The placebo group did not change at the 12-month time point.¹⁵

Quantitative individual risk assessment and relative risk reduction

Two previous models with similar methodologies have been published to estimate the RRR for peanut-allergic individuals who increase their ED after immunotherapy.^{13,14} These models were not tied to a specific immunotherapy method and were focused only on risk reductions when consuming packaged foods achieved through an increase in ED. Scenarios in this model investigated the RRR of a hypothetical individual with a preimmunotherapy ED of 1, 3, 10, 30, or 100 mg of peanut protein who was able to achieve a postimmunotherapy ED of 300 or 1000 mg of peanut protein. The studies estimated a greater than 95% RRR for the risk of accidental allergic reactions caused by peanut in packaged foods for the peanut-allergic individual who achieved an ED of 300 mg of peanut protein (if initial ED ≤ 100 mg) or 1000 mg (if initial ED ≤ 300 mg) after immunotherapy.^{13,14}

CURRENT CONTROVERSIES

Although understanding the potential benefits and risk reductions achievable through different immunotherapy options is important, the potential benefits of treatment must be weighed against the potential risks of treatment to provide a full perspective. Recent health and economic benefit analysis from Shaker and Greenhawt⁷⁴ and the

Institute for Clinical and Economic Review (ICER) regarding oral immunotherapy or EPIT for peanut allergy,¹⁰ as well as a systematic review and meta-analysis of efficacy and safety for oral immunotherapy for peanut allergy,⁵⁹ has raised questions regarding the potential immunotherapies in development. The peanut allergen immunotherapy, clarifying the evidence (PACE) meta-analysis of oral immunotherapy trial data found that oral immunotherapy increased the risk of anaphylaxis compared with no oral immunotherapy.⁵⁹ The PACE review also found that peanut oral immunotherapy, including the AR101 treatment⁷⁵ described earlier, induced desensitization but considerably increased the number of allergic and anaphylactic reactions compared with avoidance or placebo because of reactions to treatment.⁵⁹ It was concluded that safer peanut allergy treatment approaches than current oral immunotherapy options are needed.⁵⁹ In addition, the health and economic benefit analysis by Shaker and Greenhawt⁷⁴ found that the cost-effectiveness of oral immunotherapy with AR101 or EPIT with a patch containing 250 µg of peanut protein for treatment of peanut allergy is influenced by each therapy's "probability of sustained unresponsiveness, improvement in quality-of-life, reduction in anaphylaxis risk, and cost to the patient."⁷⁴ The ICER report states that evidence for both potential therapies was inadequate to show a superior net health benefit of either compared with strict peanut avoidance; that neither trial showed a quality-of-life improvement compared with placebo; and, contrary to the prior RRR models, that neither trial showed a reduction in accidental reactions to when exposed to peanut.¹⁰ In addition, it was voted that there were insufficient data to show a net health benefit of AR101 compared with noncommercialized peanut oral immunotherapy. Three themes arose from this concern: the seeming need for indefinite treatment without longer-term safety or efficacy data, the need to continue vigilant avoidance diets while on therapy, and the known increase in the risk of allergic reactions and epinephrine use during treatment in the 1-year clinical trials.¹⁰ However, both analyses concluded that AR101 and EPIT with a patch containing 250 µg of peanut protein were long-term cost-effective under certain assumptions and pricing scenarios, but longer clinical trials and commercial data are still needed to investigate long-term sustained unresponsiveness and other important patient-related outcomes.^{10,74} In addition, all public comments to the ICER review were positive toward the potential of immunotherapy and most argued that the review was premature in light of additional data that will soon become available.¹⁰

FUTURE CONSIDERATIONS/SUMMARY

It is well known that complete avoidance of peanut is difficult and accidental reactions occur, with possibly severe symptoms. Immunotherapy for peanut allergy is a potential treatment option being developed with the potential to reduce the risk of reactions to accidental exposure to peanut in the community. Models for estimating risks for reactions to accidental exposure to peanut in packaged foods show significant potential RRRs for the peanut-allergic population and peanut-allergic individuals. However, it is important to clearly define the specified period of time and population when the risk is being assessed to enable clear communication and understanding. In addition, future areas of research still exist, especially in the area of longer-term clinical trials or commercial data, which will strengthen the knowledge surrounding risk and potential options for risk reduction in people with peanut allergy.

DISCLOSURE

Dr B.C. Remington is the Managing Director of the Remington Consulting Group B.V. and is an Adjunct Assistant Professor of Food Science & Technology at the University

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