

Review

Providing cost-effective care for food allergy



Marcus Shaker, MD, MS^{*,†}; Matthew Greenhawt, MD, MBA, MSc[‡]

^{*} Dartmouth-Hitchcock Medical Center, Section of Allergy and Immunology, Lebanon, New Hampshire

[†] Dartmouth Geisel School of Medicine, Hanover, New Hampshire

[‡] Children's Hospital Colorado, University of Colorado School of Medicine, Section of Allergy and Immunology, Food Challenge and Research Unit, Aurora, Colorado

Key Messages

- Cost-effectiveness analysis can help identify important variables in decision making when caring for children with food allergies.
- Families should be informed of risks, benefits, alternatives, and tradeoffs of screening before evaluation of allergen sensitization.
- Incorporating patient and family preferences into models of care is important to provide individualized management tailored to the needs of each family.
- Adoption of value-based pricing and school resourcing of epinephrine autoinjectors can lead to cost savings and improved epinephrine access.
- Oral and epicutaneous immunotherapy can be cost-effective and may be cost-saving at high rates of sustained unresponsiveness.

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ABSTRACT

Objective: To review the cost-effectiveness of food allergy management strategies.

Data Sources and Study Selections: A narrative review and synthesis of literature identified using a PubMed search of relevant articles describing cost-effectiveness evaluations of food allergy management.

Results: Screening at-risk infants for peanut allergy carries risk of overdiagnosis and is not cost-effective. Evidence suggests that cost-effective care could be better optimized by minimizing delay in oral food challenges for eligible patients, clarifying the role of precautionary allergen labeling, incorporating patient-preference sensitive care in activation of emergency medical services for resolved allergic reactions, and considering value-based pricing and school-supply models for epinephrine. Finally, the annual value-based cost (willingness to pay [WTP] \$100,000/quality-adjusted life years [QALY]) of peanut immunotherapy has been estimated to be between \$1568 and \$6568 for epicutaneous immunotherapy (EPIT) and between \$1235 and \$5235 for probiotic with peanut oil immunotherapy (POIT), with each therapy showing more favorable cost-effectiveness with greater improvements in health utility, particularly if sustained unresponsiveness can be achieved.

Conclusion: Many aspects of food allergy management are not cost-effective, and recent evaluations suggest a greater role for incorporating patient and family preferences into guideline-based and traditionally reflexive management decisions. Caregiver understanding of food allergy screening tradeoffs is critical, given that screening children before allergen exposure has significant costs and results in overdiagnosis, especially

Reprints: Marcus Shaker, MD, MS, Associate Professor of Pediatrics; Associate Professor of Community and Family Medicine, Dartmouth-Hitchcock Medical Center, Section of Allergy and Immunology, Dartmouth Geisel School of Medicine, 1 Medical Center Dr., Lebanon, NH 03756; E-mail: marcus.s.shaker@hitchcock.org.

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Prevention; has served as a consultant for the Canadian Transportation Agency, Thermo Fisher, Intrimmune, and Aimmune Therapeutics; is a member of physician/medical advisory boards for Aimmune Therapeutics, DBV Technologies, Nutricia, Kaleo Pharmaceutical, Nestle, and Monsanto; is a member of the scientific advisory council for the National Peanut Board; has received honorarium for lectures from Thermo Fisher, Before Brands, multiple state allergy societies, the ACAAI, the EAACI; is an associate editor for the *Annals of Allergy, Asthma, and Immunology*; and is a member of the Joint Taskforce on Allergy Practice Parameters.

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when oral food challenges are omitted from diagnostic algorithms. Cost-effectiveness analysis can help to identify important decision levers in patient management across a wide range of topics. Further research is needed to better understand health state utilities of specific patient populations.

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Introduction

Food allergy affects approximately 9% of children¹ and has far-reaching though variable impacts on anxiety, quality of life (QoL), and psychosocial development.^{2–7} Managing food allergy attempts to provide children and families with strategies that maximize allergen avoidance, minimize the risk of anaphylaxis, and enhance the quality of daily life with food allergy.^{8,9} However, striking this balance is sometimes difficult, and we must weigh tradeoffs between prevention of reactions, potentially escalating sequelae of future reactions, and the potential for overdiagnosis.^{10,11} All health care systems have finite resources to provide care, which necessitates responsible stewardship of limited health care resources to ensure that costs are justified by superior health outcomes relative to other potential options.^{12–14} This is the basic principle of cost-effective practice—providing care that produces the best health outcomes for the lowest expenditures.^{15,16}

Many third-party payers and governments already use cost-effectiveness analysis (CEA) to determine reimbursement.¹⁷ Although in one sense cost is just another outcome of competing health care delivery strategies—like QoL, morbidity, and

mortality—finite resources require balanced allocation.¹⁸ Figure 1 depicts how cost relates to effectiveness. However, CEA allows clinicians to understand critical levers that may shift the value of the care we provide.¹⁶ Such levers in these analyses create scenarios to understand where care is cost-effective, as well as where health and economic benefits are not favored.^{19,20} Although this area is relatively new in food allergy, multiple publications have demonstrated examples of how food allergy care can be more cost-effective.^{21–36}

This review focuses on several topics with significant policy implications. These include a) screening at-risk children before early allergenic solid food introduction^{37–40}; b) epinephrine autoinjector device price, school stocking policy, preemptive epinephrine use policy, and the necessity to automatically activate emergency medical services (EMS) after community epinephrine use^{22,24,26,29,30}; and c) whether food allergy immunotherapy treatment strategies will be cost-effective, and where preference-sensitive care and shared decision making may influence such considerations.^{28,31,41,42} This review details several case studies of how CEA assists medical decision making, and explores whether currently practiced or recommended management strategies are cost-effective.¹⁶

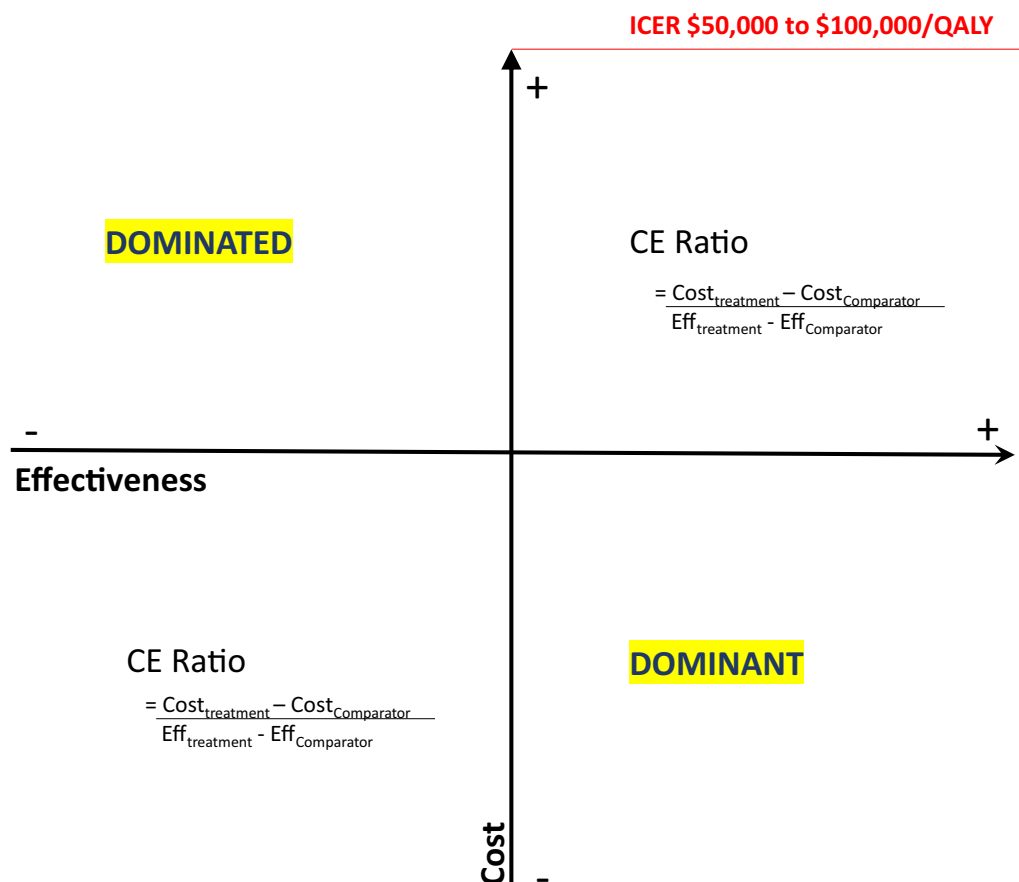


Figure 1. Cost vs effectiveness. Medical strategies that are cost-saving and improve outcomes present a dominant scenario, while those that necessitate health care spending for worse outcomes are dominated. The Incremental Cost-Effectiveness Ratio (ICER) represents the difference in costs and outcomes between competing strategies, with an ICER of \$50,000 - \$100,000 considered a ceiling for cost-effective care.

Case 1: Screening for Food Sensitization before Early Allergen Introduction

Clinical Situation

The mother of a 5-month-old high-risk infant for early peanut introduction wants to know why her 5-month-old niece in Australia, with the same risk factors, does not have to undergo screening testing for peanut before early introduction.

Rationale and Cost-effectiveness Analysis

An expert panel sponsored by the National Institute of Allergy and Infectious Disease released addendum guidelines in January 2017 for the prevention of peanut allergy in the United States and Canada.³⁸ This report closely mirrored the strategy and findings of the Learning Early About Peanut (LEAP) study and pertains only to peanut. The expert panel decided to include screening (similar to that used in the LEAP study) in the guideline for high-risk children meeting criteria for addendum 1 (eTable 1), where it strongly recommended screening infants using specific immunoglobulin E (sIgE) or skin prick test (SPT) before peanut introduction, with a cutoff of 8 mm to not offer introduction. In addenda 2 and 3, children with mild to moderate eczema or no eczema are not recommended to receive any use of screening tests before offering peanut protein. However, in similar guidelines from outside the United States, screening was not recommended in the United Kingdom or Australia/New Zealand, and therefore international variation exists regarding early allergenic food introduction^{39,40} (Fig 2). Australia and New Zealand not only recommend introduction of peanut-containing products in the first year of life (along with cooked egg, dairy, and wheat products), but stipulate that this be done without any pre-assessment/screening.³⁹ A simulation in the Australian Health Nuts population noted that if all infants meeting the addendum 1 criteria for high risk underwent screening, upwards of 22% of new-onset peanut allergy would have been missed.^{35,36} The UK approach is similar to the Australian/New Zealand approach (limited to peanut and cooked egg), but states

that “families of infants with a history of early-onset eczema or suspected food allergy may wish to seek medical advice before introducing these foods,” without making specific recommendation that this actually be done.⁴⁰

To better define an optimal health economic strategy among the differing international policies, Shaker et al²³ conducted a simulation of the US infant population ($n = 4,009,514$), comparing the screening (National Institute of Allergy and Infectious Diseases [NIAID] approach) vs a no-screening approach (UK/Australia/New Zealand strategy) and a delayed introduction approach over a 20-year time horizon, using Markov modeling.²³ Strategies compared included SPT, sIgE testing, early introduction without testing, and delayed introduction. Quite definitively, the no-screen approach dominated (eg, produced the greatest health benefits at the lowest cost among the choices) SPT or sIgE screening and delayed introduction, producing cost-savings and greater quality-adjusted life years (QALYs). Compared with not screening, screening SPT cost \$654,115,322 from a US societal perspective and added 3,208 peanut allergy diagnoses. Although screening resulted in fewer allergic reactions per patient (0.35 vs 0.4 without screening, attributable to preventing an index reaction in children with >8 mm SPT), episodes of severe reactions were similar.

Similar analyses were conducted by Shaker et al²⁵ to compare screening strategies before cooked egg introduction in infants with severe eczema (similar to LEAP/NIAID criteria)²⁵ and to explore the value of screening younger siblings of a peanut-allergic child before peanut introduction (a common practice).²⁷ The approach to these models differed slightly, because no existing strategies were available to compare, which allowed exploration of critical levers under which the practice could be cost-effective. For cooked egg introduction using a 20-year horizon comparing egg SPT, egg sIgE, and a no-screen approach, the no-screening approach demonstrated massive cost-savings and produced fewer cases of egg allergy and fewer allergic reactions. As the simulation concluded, without screening, 2.5% of infants were egg allergic vs 9.5%, 12%, and 21.4% of those undergoing egg SPT, delayed introduction, and egg sIgE screening. Incremental societal costs from SPT and sIgE

US/Canada	United Kingdom	Australia and New Zealand
- Addendum 1: infants with severe eczema, egg allergy or both should have introduction of age-appropriate peanut-containing food as early as 4 to 6 months of age to reduce the risk of peanut allergy. - Addendum 2: infants with mild to moderate eczema should have introduction of age-appropriate peanut-containing food around 6 months of age, in accordance with family preferences and cultural practices, to reduce the risk of peanut allergy. - Addendum 3: infants without eczema or any food allergy have age-appropriate peanut-containing foods freely introduced in the diet, together with other solid foods, and in accordance with family preferences and cultural practices.	- Exclusive breastfeeding for around the first six months of life. - Foods containing peanut and hen's egg need not be differentiated from other complementary foods and should be introduced in an age-appropriate form from around six months of age, alongside continued breastfeeding, at a time and in a manner to suit both the family and individual child. - The deliberate exclusion of peanut or hen's egg beyond six to twelve months of age may increase the risk of allergy - Once introduced, and where tolerated, these foods should be part of the infant's usual diet, to suit both the individual child and family. - Families of infants with a history of early-onset eczema or suspected food allergy may wish to seek medical advice before introducing these foods.	- When your infant is ready, at around 6 months, but not before 4 months, start to introduce a variety of solid foods, starting with iron-rich foods, while continuing breast-feeding. - All infants should be given allergenic solid foods including peanut butter, cooked egg, dairy, and wheat products in the first year of life. This includes infants at high risk of allergy. - Hydrolyzed (partially or extensively) infant formula is not recommended for the prevention of allergic disease. - No specific screening, testing, evaluation recommendations prior to introduction

Figure 2. Comparison of international early food introduction strategies.

Table 1
Cost-effectiveness of allergy screening prior to infant food introduction

Infants at risk	Cost per patient at risk	QALY per patient at risk	Allergic reactions per patient at risk
For peanut allergy (personal history of early-onset eczema or egg allergy)			
No screening, early introduction	\$6557	19.63	0.4
Skin test screening before early introduction	\$7576	19.62	0.35
Specific IgE screening before early introduction	\$7977	19.6	0.38
Delayed introduction	\$11,708	19.46	0.72
For peanut allergy (sibling history of peanut allergy)			
No screening before introduction	\$3278	19.72	0.2
Skin test screening with challenge before introduction	\$3984	19.72	0.2
For egg allergy (early-onset eczema)			
No screening, early cooked introduction	\$2235	19.78	0.03
Skin test screening before early cooked introduction	\$9100	19.59	0.12
Specific IgE screening before early cooked introduction	\$18,957	19.28	0.26
Delayed cooked introduction	\$10,615	19.53	0.13

screening exceeded \$2B and \$4B over the model, respectively. As an example of a critical lever shifting a strategy recommendation, this showed that only when the risk of an initial reaction with egg ingestion exceeded 22% would screening SPT be a cost-effective strategy.²⁵ In a model of sibling screening strategies before peanut introduction (which excluded infants meeting addendum 1 NIAID guideline criteria),²⁷ the incremental cost-effectiveness ratio (ICER, the difference in the ratio of the costs and benefits of 1 strategy relative to another) for the SPT strategy was \$211,411 per QALY (a measure of a year of ideal health status). With cost-effective care defined as less than \$100,000/QALY,^{16,19,43} screening siblings of children with peanut allergy was only cost effective if the US prevalence of sibling peanut allergy exceeded 11% (nearly 5 times the current peanut allergy prevalence) and families placed a high value on index reactions occurring in an allergy clinic vs at home (described as a health disutility toll, making it worse to have a reaction in one venue relative to another venue).²⁷ Table 1

summarizes per-patient costs and allergic reactions of screening strategies.

Case 2: Is Strict Avoidance of Foods That “May Contain” Allergen Really the Optimal Strategy?

Clinical Scenario

Parents of a 4-year-old peanut-allergic girl are interested in a more optimal way to determine risk from precautionary labeling.

Rationale and Cost-effectiveness Analysis

The bedrock of food allergy management relies on strict allergen avoidance, which includes foods with declaratory food allergen labeling legally required by the Food Allergen Labelling and Consumer Protection Act in the United States.⁴⁴ However, this is commonly also expanded to products containing voluntary

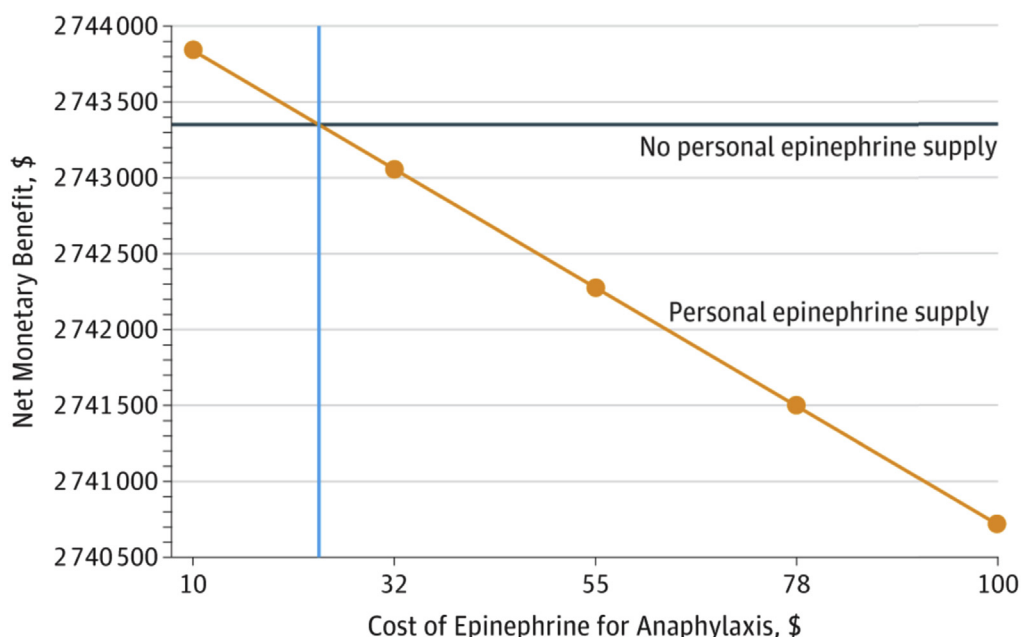


Figure 3. Sensitivity analysis of personal epinephrine cost-effectiveness at a willingness-to-pay threshold of \$100,000 per quality-adjusted life-year demonstrates a ceiling value-based cost of \$24 for an annual personal epinephrine prescription in the base-case analysis.

Table 2

Cost-effectiveness comparison of school epinephrine strategies

Strategy	Cost	Effectiveness (QALY)	ICER
Undesignated school epinephrine supplemental supply	\$108,160 (95% CI, \$107,725–\$108,595)	26.869 (95% CI, 26.841–26.897)	\$268,811/QALY ^a
Undesignated school epinephrine universal supply	\$100,397 (95% CI, \$99,979–\$100,815)	Dominant	
No undesignated school epinephrine supply	\$107,816 (95% CI, \$107,382–\$108,250)	26.867 (95% CI, 26.839–26.896)	

CI, confidence interval; ICER, incremental cost-effectiveness ratio; QALY, quality of life adjusted years.

^aIncremental cost-effectiveness ratio, supplemental model vs no undesignated school epinephrine.

precautionary allergen labeling (PAL) of foods that “may contain,” “might contain,” are “made in a shared facility,” or “made on shared equipment,” where the potential risk associated with these labels is highly variable because of lack of standardization of what these precautions may mean. Still, many allergists and parents believe that the uncertainty of PAL presents too much of a risk to take. Indeed, in some surveys certain categories of foods carry such advisory labeling in upwards of 50% of products, but often contain only minuscule amounts of allergen, on the level of parts per million (1 part per million = 1 mg protein per kg product weight, or the volume of a 1-L soda bottle in a 50-m Olympic pool).⁴⁵ Avoidance of such products may be unnecessary, given advances in the understanding of allergy thresholds, with 3 studies defining an eliciting dose (ED) that only 5% of the peanut-allergic population would react to (ED5) at between 1.5 to 2 mg peanut protein. Hourihane et al⁴⁶ recently objectively reconfirmed this in a blinded “one-shot” challenge to a cookie containing 1.5 mg peanut protein, but furthermore showed that tolerance of this ED5 was associated with a large QoL improvement.⁴⁶ Shaker and Greenhawt²¹ used a Markov model to show that, compared with having patients undergo a “one-shot” challenge to the ED5 in the office, strict PAL avoidance was not cost-effective (>\$100,000/QALY) if the low-dose challenge was able to predict PAL tolerance.²¹ Additional work is needed to

improve utility of PAL and better define predictive value of eliciting dose thresholds in PAL foods.

Case 3: Is There Value in Receiving Emergency Care after Epinephrine Use in Anaphylaxis?

Clinical Scenario

A parent wants to know whether they “have” to call 911 after they use their epinephrine auto-injector to treat their child, as their anaphylaxis management plan states.

Rationale and Cost-effectiveness Analysis

Epinephrine is a safe, effective first-aid management for anaphylaxis.^{47–50} Food and Drug Administration reports of adverse events have increased in recent years, but severe adverse events are infrequent, and inadvertent digital injection continues to be a risk mitigated by ongoing training and education.²⁴ Although epinephrine market prices have skyrocketed in recent years,⁵¹ a recent survey evaluating willingness to share epinephrine autoinjectors revealed that most families spend less than \$200 for their devices each year.⁵² Still, wide variation exists in out-of-pocket costs, and in an era of high-deductible insurance plans, epinephrine costs can be a

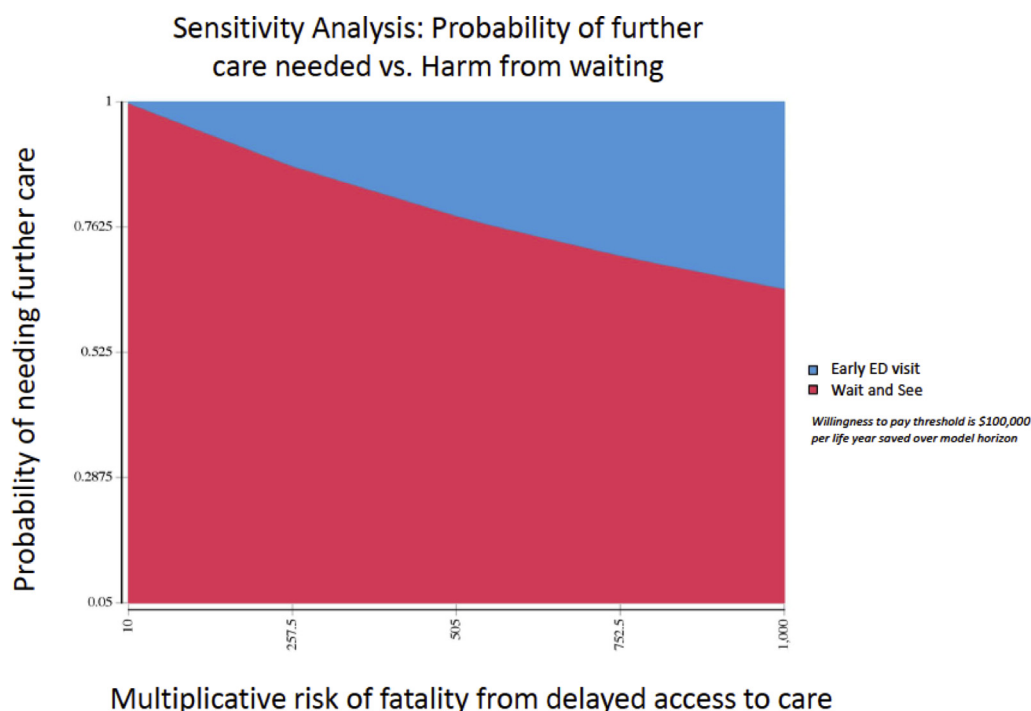


Figure 4. Cost-effectiveness of immediate EMS activation after epinephrine use. The most cost-effective strategy is highlighted across probabilities that additional care will ultimately be required and fatality risks associated with delayed medical observation.

Table 3
Cost-effectiveness of peanut immunotherapies

Therapy	Cost (\$, mean, SD)	Effectiveness (QALY, mean, SD)	Net monetary benefit (\$, mean, SD)	All anaphylaxis (mean, SD)	Therapy associated anaphylaxis (mean, SD)	Food allergy fatality (mean, SD)	Size	Incremental cost	Incremental effectiveness	ICER
No Immunotherapy	\$124,568 (\$10,261)	26,792 (2.318)	\$2,554,666 (\$221,717)	0.72 (0.85)	0.00 (0)	0.0001 (0.01)	10,000	—	—	—
EPT	\$154,662 (\$46,716)	26,932 (2.241)	\$2,538,501 (\$212,765)	1.33 (1.55)	0.62 (1.3)	0.0002 (0.0141)	10,000	\$30,094	0.139	\$216,061
OIT	\$163,524 (\$56,800)	26,945 (2.32)	\$2,530,961 (\$220,589)	3.83 (5.02)	3.10 (4.94)	0.0002 (0.0141)	10,000	\$38,956	0.153	\$255,431

CI, confidence interval; EPT, epicutaneous immunotherapy; ICER, incremental cost-effectiveness ratio; OIT, oral immunotherapy; QALY, quality of life adjusted years.

significant burden for some families. The question remains of whether the device itself is actually cost-effective. A recent analysis exploring the value-based price ceiling for autoinjectors noted that at present market costs, epinephrine devices are not cost-effective against an outcome of reducing fatality from anaphylaxis. Shaker and Greenhawt²⁶ demonstrated a value-based device cost of \$24 per twinpack, a cost-effective ceiling price presuming the device reduced the annual risk of food allergy fatality by 10-fold. At current retail prices (~\$700), autoinjectors were not cost-effective even at a 100-fold fatality risk reduction (even assuming 100% carried and used epinephrine in a reaction)²⁶ (Fig 3).

Recent autoinjector shortages have presented a further challenge of reduced access to critical medication in food allergy management.⁵³ Forty-nine of 50 states allow stock epinephrine in schools, generally implemented as stocking 2 twinpacks in addition to requiring all allergic students to also supply their own 2 twinpacks, but until recently no exploration of whether this policy is cost-effective had occurred. In a related analysis exploring stock epinephrine policy, Shaker and Greenhawt compared the cost-effectiveness of alternative paradigms of supplying school epinephrine (only keeping 2 stock twinpacks at each school and not requiring allergic students to supply their own individual units in addition to these stock units, vs stock units plus all allergic students supplying personal units), showing that the annual value-based cost for a twinpack in the school setting is significantly higher (\$169), given the device in the school setting can be shared across more lives than at the individual level. More importantly, this demonstrated that a stock-only policy without requiring students to provide their own additional supplemental twinpacks could result in significant cost-savings and improvements in supply-chain availability^{29,54} (Table 2).

Beyond pricing and access policy, questions surrounding the cost-effectiveness of epinephrine use also exist, specifically regarding outcomes related to the timing of when epinephrine is used. Although early epinephrine use is recommended in anaphylaxis, some controversy exists regarding recommendations for preemptive use of epinephrine after ingestion but before symptom development (especially in those with a previous “severe” reaction), an instruction found on a commonly used food allergy action plan that is without evidence of efficacy.⁵⁵ Preemptive use risks the paradox of severe symptoms occurring after a digestion-related delay, when preemptively used epinephrine may no longer be in the individual’s system given a short half-life, and 1 less dose is now available to the individual.⁵⁶ However, the context of epinephrine use matters—use in anaphylaxis improves QoL, but use outside of anaphylaxis impairs QoL.⁵⁷ Recent study has shown that preemptive use has poor cost-effectiveness in a Markov model simulation. Assuming a 10-fold fatality risk increase for not immediately injecting epinephrine on allergen ingestion (but before symptoms occur, per some allergy action plan instructions), preemptive epinephrine use was not cost-effective (\$11,681,501 per QALY). In the best-case scenario in this analysis, even assuming that preemptive epinephrine reduced the risk of fatality by 1000-fold, the strategy was still above the cost-effectiveness threshold (\$107,971/QALY).²¹

Therefore, given evidence that neither high-price auto-injector devices nor preemptively using them is cost-effective, the next question relates to the cost-effectiveness of automatic EMS activation after epinephrine use. Ample data exist suggesting that many patients at risk for anaphylaxis do not even have their epinephrine available when needed, and if it is available, they fail to use it.^{58–60} This is particularly worrisome. One possible explanation for this finding is that families substitute EMS activation for epinephrine activation and fail to use the device themselves as opposed to having the responding EMS unit provide this.²³

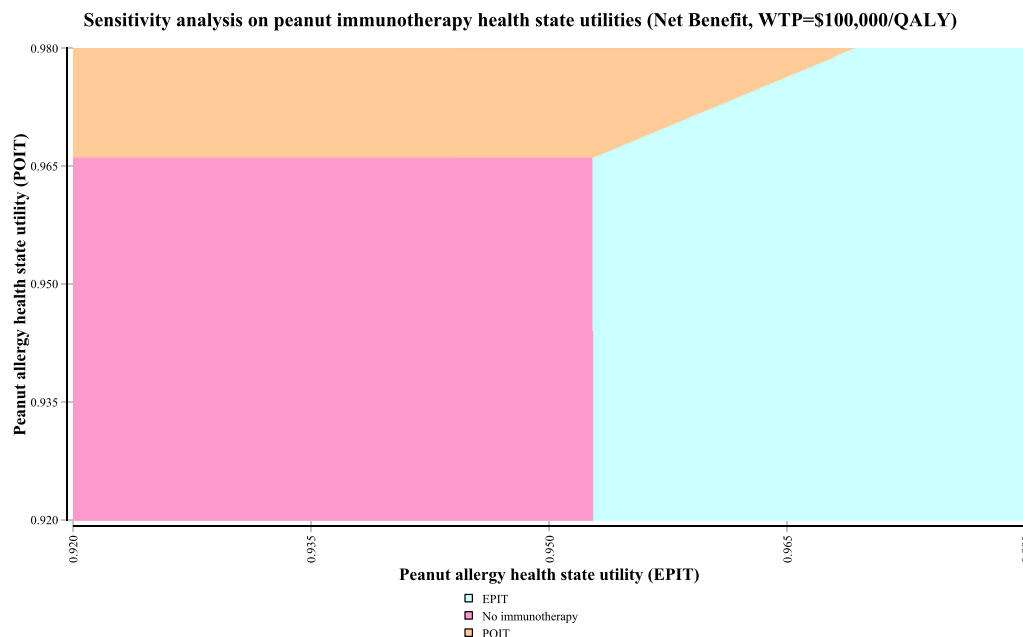


Figure 5. Sensitivity analysis of peanut immunotherapy health state utilities, showing preferred strategies with greatest net monetary benefit (NMB) within color-coded regions, at a willingness to pay (WTP) of \$100,000/QALY.

Conversely, some patients may delay epinephrine use to avoid the necessity of ambulance transport and emergency evaluation with their associated costs, given home anaphylaxis management plans dictate universal activation of emergency management after epinephrine use.⁶¹ Given these contexts, when someone uses epinephrine after a reaction, what value does immediate EMS activation have, even if the reaction resolves? In an economic evaluation of reflexive EMS activation vs calling 911 only if symptoms did not immediately improve and resolve promptly without recurrence after treatment of a peanut-allergic reaction with epinephrine (eg, a “wait and see” approach), reflex EMS activation irrespective of symptom improvement was not a cost-effective strategy (\$142,943,447 per QALY)²² (Fig 4). The high cost of reflexive EMS activation suggests a large potential role for patient-preference sensitive care in anaphylaxis management, and injection of common sense. It would make both economic and common sense that if a child reacts, receives epinephrine at home, and the symptoms promptly resolve without recurrence, parents should be offered tailored management in this situation to not take their child to the nearest ED, provided close, reliable, and responsible observation can be assured, and that EMS is available if needed. This does not preclude EMS access for parents having a strong preference for what is more than likely going to be superfluous and expensive ED observation, but it does strongly support an argument that anaphylaxis plans should revise the “immediately call 911” instructions, or at the very least, better specify situations in which this may be of higher benefit. However, these data certainly do highlight the continued recommendation that EMS activation should not substitute for early epinephrine use in the treatment of community anaphylaxis.

Case 4: What Is the Value of Food Allergy Immunotherapy vs Allergen Avoidance?

Clinical Scenario

A medical student asks if new food allergy immunotherapies prevent more reactions than they cause, and if so at what expense?

Rationale and Cost-effectiveness Analysis

New therapies have to clear a high bar in terms of proving their use is justified vs. already available alternatives. Food allergy treatments are somewhat unique—no practical alternatives exist beyond avoidance, which makes such comparison difficult to some degree. Food and Drug Administration approval for one or more commercially available food allergy therapies is expected soon, and a growing off-label market already exists. A preliminary evaluation of an experimental, noncommercial peanut oral immunotherapy with probiotic (PPOIT) demonstrated that this therapy was cost-effective using readily available peanut flour and probiotic purchased at a store without prescription (\$2142/QALY), at an estimated cost of approximately \$20/year.³¹ The PPOIT analysis noted multiple important points (potential tradeoffs), such as the issue that the therapy causes more episodes of anaphylaxis than it would prevent unless the annual rate of therapy-associated anaphylaxis fell below 6%, or the probability of sustained unresponsiveness exceeded 68% after 4 years, which denotes a finite lifespan for PPOIT use.³¹ Little work exists on understanding what caregivers may prefer as tradeoffs in therapy (such as acceptable risks or benefits), nor are there processes in place to help with values clarification surrounding this.^{5,6,62,63}

Although evaluation of commercial POIT and epicutaneous immunotherapy (EPIT) is limited by both product approval and a known market price (and 3rd-party reimbursement), some initial estimates of cost-effectiveness can be calculated for these products. Using a previously published ceiling for caregiver-reported willingness to pay (WTP)⁶⁴ for a food allergy treatment of \$3839 (adjusted to 2018 dollars), from a societal perspective neither EPIT nor POIT are cost-effective compared with avoidance in the base-case (ICER for EPIT \$216,061 and for POIT \$255,431), but would be cost-effective at a value-based ceiling cost of \$1568 and \$1235 per year, respectively (Table 3).³⁷ Apart from price, this analysis shows that both therapies could become cost-effective in the base-case, depending on 2 other major levers: the degree of caregiver/patient improvement in health state utility (Fig 5) and the rates at which these therapies produce sustained unresponsiveness (SU) and can be discontinued.³⁷ With health state utility sensitivity

analyses, the annual ceiling value-based costs reached \$6568 for EPIT and \$5235 for POIT.³⁷ If the rate of SU achieved increased (starting at 19% for EPIT and 30% for POIT), both therapies became cost-effective, and at a 75% rate of SU both dominated a no-immunotherapy approach.³⁷ Although neither treatment is approved for use in spring 2019, it is expected that commercial availability of 1 or more peanut immunotherapy products will become a reality soon. Further studies are needed to determine whether commercial immunotherapy products will induce durable SU, allowing discontinuation of immunotherapy in place of ad libitum peanut consumption.

Conclusion

The practice of medicine is limited by finite financial and workforce resources, and therapies must have clearly justified value in terms of both health and economic outcomes. In 1580, the French essayist Michel de Montaigne introduced the metaphor “le jeu ne vaut pas la chandelle.”⁶⁵ The phrase, which translates “the game is not worth the candle,” has parallels in a modern health care environment. We must continuously evaluate whether our shared investment in health care interventions for food allergy are justified by outcomes. Cost-effectiveness analysis is one way to begin to answer this question.

No health-economic model is perfect, and all have limitations and differential assumptions that one can make. In food allergy, models are limited by how health state utilities are derived and generalized. Health state utilities used to derive QALY have been poorly studied, in particular for populations most representative of the disease, and further research in food-specific health state utilities is needed. Moreover, when faced with low-benefit/high-cost care propositions, the role for understanding patient-preference sensitive decision making, and how this may change over the course of specific diseases, must be clarified. In some circumstances, in some population segments such care has higher relative value. This only complicates the quest for the “best” practice, which, like anything in medicine, depends on the patient on the other end of the stethoscope.

In 2019, the practicing allergist is part of a complex health care system in a dynamic world. Understanding the broader ramifications of our clinical decision making and appreciating how risks, benefits, and costs become manifest over short- and long-term horizons is key. Providing optimal care incorporates patient preferences at every stage, and these preferences may shift discrete individual values and cost-effectiveness of some interventions. As we consider a cost-effective approach to health care, the quality of evidence and tradeoffs between strategies will emerge to provide care tailored to fit each patient and family.

Supplementary Data

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.jana.2019.05.015>.

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Supplementary Data

eTable 1

Summary of National Institute of Allergy and Infectious Disease 2017 addendum guidelines for the prevention of peanut allergy

Addendum guideline	Infant criteria	Recommendations	Earliest recommended age of peanut introduction
1	Severe eczema, egg allergy, or both	Strongly consider evaluation by sIgE or SPT, and if necessary an oral food challenge. Based on test results, introduce peanut-containing foods.	4-6 months
2	Mild to moderate eczema	Introduce peanut-containing foods	Around 6 months
3	No eczema or any food allergy	Introduce peanut-containing foods	Timing of introduction is age appropriate and in accordance with family preferences and cultural practices