Allergies to Staple Foods and the Financial Burden on Households

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Pacific University

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Allergies to Staple Foods and the Financial Burden on Households

Abstract

Background: Allergies are defined as a rise in allergen-specific IgE plus symptoms. If only a rise in IgE is present then this indicates that the individual has become sensitized to the food, but this elevation does not mean there will be an allergic reaction when the food is consumed. This is often misunderstood when it comes to diagnosing food allergies, and these diagnoses can lead to unnecessary additional household changes and therefore costs. The purpose of this review is to evaluate the financial burden associated with the diagnosis of a food allergy to one or more staple foods (eg, hen's eggs, cow's milk, and/or wheat).

Methods: An exhaustive search of available medical literature was performed using MEDLINE-Ovid, CINAHL, and Web of science. The keywords used were costs and food allergies. All relevant articles were assessed using Grading of Recommendation, Assessment, Development, and Evaluation (GRADE).

Results: After reviewing the articles, a total of two articles were included in this systematic review. Both articles are observational studies using allergies to staple foods in adults, adolescents, and children. The Jansson et al study focusing on adults showed that there were increased total costs, indirect costs, and intangible costs, but direct costs did not have a significant difference between cases and controls. The Protudjet et al study concluded that although adolescents only had a significant cost difference when looking at total and intangible costs, households with children affected by allergies to staple foods experienced cost differences in all categories: total, direct, indirect, and intangible costs.

Conclusion: Households where there are allergies to one or more staple foods (eg, hen's eggs, cow's milk, and/or wheat) do experience a significant increase in household costs, approximately $5300 to over $11 000 per year. The associated financial burden with these food allergies should be discussed with patients and their families at the time of diagnosis. This gives the families an appropriate and well-rounded education regarding the diagnosis so they can better prepare for the future.

Keywords: costs, food allergies

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Allergies to Staple Foods and the Financial Burden on Households

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Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

[Redacted for privacy]
Abstract

Background: Allergies are defined as a rise in allergen-specific IgE plus symptoms. If only a rise in IgE is present then this indicates that the individual has become sensitized to the food, but this elevation does not mean there will be an allergic reaction when the food is consumed. This is often misunderstood when it comes to diagnosing food allergies, and these diagnoses can lead to unnecessary additional household changes and therefore costs. The purpose of this review is to evaluate the financial burden associated with the diagnosis of a food allergy to one or more staple foods (eg, hen’s eggs, cow’s milk, and/or wheat).

Methods: An exhaustive search of available medical literature was performed using MEDLINE-Ovid, CINAHL, and Web of science. The keywords used were costs and food allergies. All relevant articles were assessed using Grading of Recommendation, Assessment, Development, and Evaluation (GRADE).

Results: After reviewing the articles, a total of two articles were included in this systematic review. Both articles are observational studies using allergies to staple foods in adults, adolescents, and children. The Jansson et al study focusing on adults showed that there were increased total costs, indirect costs, and intangible costs, but direct costs did not have a significant difference between cases and controls. The Protudjet et al study concluded that although adolescents only had a significant cost difference when looking at total and intangible costs, households with children affected by allergies to staple foods experienced cost differences in all categories: total, direct, indirect, and intangible costs.

Conclusion: Households where there are allergies to one or more staple foods (eg, hen’s eggs, cow’s milk, and/or wheat) do experience a significant increase in household costs, approximately $5300 to over $11 000 per year. The associated financial burden with these food allergies should be discussed with patients and their families at the time of diagnosis. This gives the families an appropriate and well-rounded education regarding the diagnosis so they can better prepare for the future.

Keywords: costs, food allergies
Acknowledgements

[Redacted for privacy]
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List of Abbreviations

NIAID........................................National Institute of Allergy and Infectious Disease
AD........................................................Atopic Dermatitis
EQ-5D........................................EuroQol Health Questionnaire, 5 Dimensions
IgE......................................................Immunoglobulin E
Allergies to Staple Foods and the Financial Burden on Households

BACKGROUND

The National Institute of Allergy and Infectious Disease (NIAID) defines a food allergy as “an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food.”\(^1\) The NIAID developed guidelines for the diagnosis and management of food allergies in the US. These guidelines explain the important difference between allergic sensitization and an accurate allergy diagnosis. When an individual has a rise in an allergen-specific IgE, but does not have any clinical symptoms then it is not considered a food allergy, but rather an allergic sensitization.\(^1\) Therefore, that individual doesn’t have a true food allergy, and it should not be recommended to eliminate those foods from the individual’s diet.

A food allergy is also defined as not only a rise in allergen-specific IgE, but also includes the clinical signs and symptoms of an allergy when exposed to the specific food.\(^2\) This has become a common misunderstanding and has led to misdiagnosis and elimination of foods unnecessarily. According to the NIAID, the gold standard for food allergy diagnosis is a double-blind placebo controlled food challenge. With that said, many forms of alternative tests are being used which has resulted in 50-90% of individuals with presumed food allergies to be incorrectly diagnosed.\(^1\) The other methods of allergy testing included in the guidelines by the NIAID include: skin prick test, intradermal tests, total serum IgE, and atopy patch testing all of which are not recommended to be used for routine allergy testing. The guidelines also included allergen-specific serum IgE which is a helpful tool in identifying foods that may provoke an IgE-
mediated allergic reaction, but it should not be used alone as it is not considered a diagnostic test.¹

The misdiagnosis of food allergies is common, and could be associated with the increased prevalence of allergies in general that has been seen in the past 10 years. The NIAID only recommends allergy testing if the patient has at least one of the following: (1) history of anaphylaxis or combination of cutaneous, ocular, respiratory, gastrointestinal, or cardiovascular symptoms occurring within minutes to hours of ingesting the food or (2) history of moderate to severe atopic dermatitis (AD).¹ One study³ published in 2014 looked at the misdiagnosis of allergies when using food allergen panel testing. This study³ included 284 patients who had a standard food-specific IgE test performed, but using the recommendations listed above only 90 of those patients actually warranted allergy testing. The study concluded that of the 45% of patients avoiding foods, based on test results and recommendations from their provider, 88.9% of these individuals were able to reintroduce at least one of the foods originally eliminated from their diet. But because many people are diagnosed with food allergies, their households then must live with the changes caused by food allergies.

This raises the question: what impact do food allergy diagnoses (correct and incorrect), both financially and from a quality of life standpoint, have on these households? The purpose of this systematic review is to assess the financial burden and how it affects quality of life in households with an adult, adolescent, or child who has been diagnosed with a food allergy to a staple food (eg, hen’s eggs, cow’s milk, and/or wheat). The following reviewed studies not only
focus on the increased associated costs, but also lost time and productivity and overall quality of life a household faces when dealing with food allergies.

**METHODS**

An exhaustive search of available medical literature was performed using MEDLINE-Ovid, CINAHL, and Web of science. The keywords used were costs and food allergies. All relevant articles were assessed using Grading of Recommendation, Assessment, Development, and Evaluation (GRADE).^4^

**RESULTS**

The initial search yielded 327 articles of which seven were screened for relevancy and inclusion criteria. After reviewing the articles, a total of two articles were included in this systematic review. Both articles are observational studies using allergies to staple foods (eg, hen’s eggs, cow’s milk, and/or wheat) in adults, adolescents, and children. (See Table I.) One study^5^ focuses on adults, and the other study^2^ focuses on the adolescent and children populations. Both studies were conducted by the same group of authors, and were conducted in Sweden.

The same group of authors completed both studies, therefore, both measured the same costs, and used the FA-ECOQ (Prevalence, Cost, and Basis of Food Allergy across Europe) to collect data regarding associated costs (please note the parent version was used for children and adolescent populations). The costs measured were total costs (sum of direct and indirect costs), direct (financial costs affecting both patients and families), indirect (loss of time and productivity), and intangible costs (health status, loss of well-being, etc.).^5^ The intangible costs
were measured using two validated questionnaires – EuroQol Health Questionnaire, 5 Dimensions (EQ-5D) and Self-Perceived Health Scale (please note that the parent version of the listed questionnaires were used for both the children and adolescent populations). \(^2,5\)

Jansson et al

This was an observational study\(^5\) that included 81 adults in the case group with a mean age of 40 and 85 adults in the control group with a mean age of 43. The individuals were recruited from an outpatient allergy clinic at Sahlgrenska University Hospital in Gothenburg, Sweden between 2010 and 2011. The inclusion criteria for this study was a convincing history of a food allergy to at least one of three staple foods (ie, hen’s eggs, cow’s milk, and/or wheat) which was diagnosed by a positive food challenge with well-characterized symptoms, or IgE levels associated with a 95% probability of a food allergy with a convincing history of allergy to that same staple food. An individual was excluded from the study if the individual had an unclear food allergy diagnosis, non-Swedish speaking, and/or a household member(s) with celiac disease, diabetes, and/or a malignancy. The cases and controls were age-matched by decades and ensured that the number of males and females in each decade were equivalent.\(^5\)

The results showed that there was a significant cost difference between cases and controls for total costs, indirect costs, and intangible costs. The total household costs (direct plus indirect) differed by €8164 (US $11 721 for 2011 exchange rate as described by www.exchangerates.org.uk). The total indirect costs differed by €6424 (US $9223 for 2011 exchange rate as described by www.exchangerates.org.uk). The intangible costs showed that cases had both lower self-perceived health status and overall health status. The severity of the
allergy (such as anaphylaxis) did impact total costs, but the number of staple foods the individual was allergic to did not have an impact. There was not a significant cost difference when looking at direct costs. It was suggested that this insignificant difference could be due to the redistribution of discretionary spending to the additional allergy-related costs. See Table II.

The authors concluded that health care professionals should be aware of these additional costs when discussing new food allergy diagnoses with patients. This is something that is rarely discussed, but with this new research it can now be included when educating the patient. They also mentioned that the cost difference provided in this article could be an underestimation in countries where a public health system doesn’t exist as health related expenses in those countries may be significantly higher.

Protudjer et al

This was an observational study that looked at the costs associated with food allergies for both children and adolescents. An individual was considered a child if within the ages of 0-12 years old and an adolescent if within the ages of 13-17 years old. The individuals were recruited from the outpatient allergy clinic at Sachs’ Children and Youth Hospital in Stockholm, Sweden between 2010 and 2012. This study included 84 children with a mean age of 6 years old and 60 adolescents with a mean age of 14 years old in the case group. It included 94 children with a mean age of 7 years old and 56 adolescents with a mean age of 15 years old in the control group. The groups were age-matched in 2-year intervals. The inclusion criteria was a convincing history of allergy to at least one staple food (i.e., hen’s eggs, cow’s milk, and/or wheat) with either a positive food challenge plus symptoms or food-specific IgE antibody levels.
with a 95% probability for a food allergy in a double-blind placebo controlled food challenge plus a convincing history of allergy to that same food. The child or adolescent was excluded from the study if their food allergy was unclear, if they had celiac disease, diabetes, a malignancy, or did not understand Swedish.  

The results showed that there was a significant difference in total costs for both children and adolescents. The total costs differed by €3691 (US $5299 for 2011 exchange rate as described by www.exchangerates.org.uk) for children, and €4792 (US $6880 for 2011 exchange rate as described by www.exchangerates.org.uk) for adolescents. Total costs were not affected by the severity of allergy (such as anaphylaxis) or number of staple foods the patient was allergic to. Although direct and indirect costs did not differ significantly in adolescents, there was a significant difference in children. Not only were both direct and indirect costs affected by severity of allergy (such as anaphylaxis) causing costs to increase to €13016 (US $18 688 for 2011 exchange rate as described by www.exchangerates.org.uk) and €11 915 (US $17 107 for 2011 exchange rate as described by www.exchangerates.org.uk) respectively, but there was also a difference of €2085 (US $2994 for 2011 exchange rate as described by www.exchangerates.org.uk) in direct costs and €1876 (US $2693 for 2011 exchange rate as described by www.exchangerates.org.uk) in indirect costs between cases and controls. The intangible costs were affected in both children and adolescents. The study showed that parents of children and adolescents expressed both a lower self-perceived health status and overall health status than that of the control group. It was suggested that the lack of difference in direct and indirect costs in adolescents could be due to household with adolescents having adjusted to the food allergy and become more confident in managing it.  

See Table III and IV.
The authors concluded that providers need to be aware of the relationship between the increased financial burden and allergy severity when educating their patients in addition to overall increased costs associated with allergies to staple foods. The study mentioned the following 4 reasons why direct costs weren’t significantly affected for adolescents: (1) families have adjusted and don’t utilize healthcare system as often; (2) challenges or delays in transitioning from pediatric to adult care; (3) accessing healthcare information via the internet without parents knowing; and (4) redistribution of discretionary spending to food allergy-related costs as found with the adult population. Also, since many adolescents tend to turn to the internet to find answers the authors stressed the importance of ensuring that they are using reliable sources. Lastly, the authors speculated that these costs might be an underestimation due to Sweden having not only a public healthcare system, but also all children and adolescents are eligible to receive free school lunches.²

**DISCUSSION**

Again food allergies are defined as the presence of both allergen-specific IgE and symptoms. If the patient is not experiencing any symptoms, but when tested there is a rise in that allergen-specific IgE then it shows the individual has become sensitized to that food. With this finding, there is no need to remove that food from the individual’s diet. Doing so would only result in increased households costs that currently aren’t necessary based on the allergen-specific IgE test. The general public often sees food allergies as not causing much of a burden on families since symptoms are rarely present. Therefore, the financial burden and other household
changes associated with food allergies are not often discussed with patients. The patients and families are given recommendations of foods that should be avoided, but the element of cost is often left out. The expansion of patient education to include associated costs should not be the stopping point of this important informational time with the patient’s provider. The provider should utilize this time to also provide handouts with suggested recipes, good food alternatives to replace the foods that need to be eliminated, reliable online resources for both the parents and patients, and maybe even a referral to a nutritionist to help with modifications to the daily diet without losing important nutrients. It is also important for the provider to explain the difference between being sensitized to a food versus having an allergy to a food. It is often a misunderstanding leading to patients or patients’ parents eliminating foods unnecessarily even without a recommendation from the provider.

It is not only time consuming to come up with alternatives to ensure that individual is getting the appropriate nutrition, but also the foods that need to be purchased are often more expensive. In America today, many families have become dependent on ready-made dinners or eating out as it fits the busy lifestyle and is less expensive, but when a household has a member with a food allergy that no longer is as convenient especially when the allergy is to a staple food as those addressed in the above studies.

There are very few studies of this kind, and based on the research used for this systematic review, most are using populations outside of the United States. The two studies\textsuperscript{2,5} reviewed were rated very low. First they were both one of only a few studies of this kind and second these studies have small sample sizes and were conducted in Sweden. (See Table I).
Even with the limitations, these two studies\textsuperscript{2,5} are a great start at exposing the financial burden and decrease in quality of life (ie, the intangible costs) related to food allergies. This information can and should be used by providers when discussing the impact a food allergy can have on an individual and that individual’s household. When the patient is presented with all the information associated with a new diagnosis then the patient is able to better prepare not only for the lifestyle changes, but also the increased costs.

The authors of both the Jansson et al\textsuperscript{5} and Protudjer et al\textsuperscript{2} studies mentioned the main limitation was the public healthcare system in Sweden which could lead to an underestimation of related costs. Also, Protudjer et al\textsuperscript{2} study referred to the availability of free school lunches for all adolescents and children that could also cause an underestimation of costs for countries where this benefit is not available. With that said, these associated higher costs because of food allergies are still relevant in countries that don’t have either of the benefits listed above, but it is recommended that more studies of this kind be done in the United States to more accurately determine the financial burden to American households. Lastly, it is also recommended that food allergies to non-staple foods be evaluated to determine if a household experiences as significant of a financial burden as those with allergies to staple foods.

Researchers should continue to evaluate adults, adolescents, and children as separate populations and include larger sample sizes. There were many differences between adolescents and children in the studies reviewed here so it is important to continue to distinguish the two groups. These new studies should also look at the associated costs with non-staple food allergies to aim at being more inclusive of all potential food allergies and the potential effects.
on a household. Lastly, additional studies looking at the misdiagnosis of food allergies and if that can be connected to the increased prevalence today to help provide an explanation on why there has been such an increase in food allergies over the past decade.

**CONCLUSION**

There is an increased financial burden imposed on households where there is a food allergy to at least one staple food. Although the evidence is very low for the two observational studies, it should still be used to educate patients. By providing patients with a more well-rounded education, it allows the patients to have more control over their quality of life. The food allergies will not define them. If providers take the time to educate their patients it may help reduce not only household costs, but also the increased prevalence of allergy diagnoses that has caused so much change especially within the school system. It will also give households a better opportunity to plan for any additional costs before it overwhelms them.

Most importantly, providers should be properly testing for and diagnosing food allergies as their prevalence continues to rise. There are so many individuals with allergies today that it has extended past just affecting the household and is now changing schools and public places. By combining appropriate testing and education regarding costs, lifestyle changes, and an explanation of what the test results mean, it can prevent unnecessary additional costs due to misdiagnoses, prevent the unnecessary elimination of foods, and better prepare households for the adjustment that accompanies a food allergy diagnosis.
References


Table I. Characteristics of Reviewed Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Downgrade Criteria</th>
<th>Upgrade Criteria</th>
<th>Quality</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>Limitations</td>
<td>Indirectness</td>
<td>Inconsistency</td>
</tr>
<tr>
<td>Jansson et al</td>
<td>Observational</td>
<td>Not serious</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td>Protudjer et al</td>
<td>Observational</td>
<td>Not serious</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
</tbody>
</table>

<sup>a</sup> Small sample size  
<sup>b</sup> Few studies published on this topic

Table II. Summary of Findings, Jansson et al

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Design</th>
<th>Group</th>
<th>Number of Patients</th>
<th>Age in years – median (range)</th>
<th>Total Annual Costs</th>
<th>Mean Annual Direct Costs</th>
<th>Mean Annual Indirect Costs</th>
<th>Mean Annual Intangible Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jansson et al&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Observational</td>
<td>Cases</td>
<td>81</td>
<td>40 (19-78)</td>
<td>23,856 Euros</td>
<td>11,034 Euros</td>
<td>12,822 Euros</td>
<td>EQ-5D&lt;sup&gt;a&lt;/sup&gt; = 0.797 Self-perceived&lt;sup&gt;b&lt;/sup&gt; = 2.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controls</td>
<td>85</td>
<td>43 (19-80)</td>
<td>15,692 Euros</td>
<td>9,294 Euros</td>
<td>6,398 Euros</td>
<td>EQ-5D = 0.951 Self-Perceived = 1.88</td>
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<tr>
<td>P-Value&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>&lt; 0.05</td>
<td>0.23</td>
<td>&lt; 0.05</td>
<td>EQ-5D &lt; 0.05 Self-Perceived &lt; 0.05</td>
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<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Lower score is equivalent to lower overall health status  
<sup>b</sup> Higher score is equivalent to lower self-perceived health status  
<sup>c</sup> Bolded P-values are statistically significant

Table III. Summary of Findings, Protudjer et al, Children

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Design</th>
<th>Group - Children</th>
<th>Number of Patients</th>
<th>Age in years – median (range)</th>
<th>Total Annual Costs</th>
<th>Annual Direct Costs</th>
<th>Annual Indirect Costs</th>
<th>Annual Intangible Costs</th>
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<tr>
<td>Protudjer et al&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Observational</td>
<td>Cases</td>
<td>84</td>
<td>6 (0-12)</td>
<td>20,819 Euros</td>
<td>11,609 Euros</td>
<td>9,210 Euros</td>
<td>EQ-5D&lt;sup&gt;a&lt;/sup&gt; = 0.84 Self-perceived&lt;sup&gt;b&lt;/sup&gt; = 2.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controls</td>
<td>94</td>
<td>7 (0-12)</td>
<td>16,858 Euros</td>
<td>9,524 Euros</td>
<td>7,334 Euros</td>
<td>EQ-5D = 0.94 Self-Perceived = 1.42</td>
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<tr>
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<td>&lt; 0.05</td>
<td>0.011</td>
<td>0.001</td>
<td>EQ-5D &lt; 0.001 Self-Perceived &lt; 0.001</td>
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<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Lower score is equivalent to lower overall health status  
<sup>b</sup> Higher score is equivalent to lower self-perceived health status  
<sup>c</sup> Bolded P-values are statistically significant
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Design</th>
<th>Group - Adolescents</th>
<th>Number of Patients</th>
<th>Age in years – median (range)</th>
<th>Total Annual Costs</th>
<th>Annual Direct Costs</th>
<th>Annual Indirect Costs</th>
<th>Annual Intangible Costs</th>
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<tbody>
<tr>
<td>Protudjer et al²</td>
<td>Observational</td>
<td>Cases</td>
<td>60</td>
<td>14 (13-17)</td>
<td>23,468 Euros</td>
<td>14,021 Euros</td>
<td>9,447 Euros</td>
<td>EQ-5D^a – 0.91 Self-Perceived^b – 2.26</td>
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<tr>
<td></td>
<td></td>
<td>Controls</td>
<td>56</td>
<td>15 (13-17)</td>
<td>18,676 Euros</td>
<td>11,129 Euros</td>
<td>7,547 Euros</td>
<td>EQ-5D – 1.00 Self-Perceived – 1.41</td>
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<td></td>
<td></td>
<td></td>
<td>&lt; 0.05</td>
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<tr>
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<td></td>
<td>P-Value^c</td>
<td></td>
<td></td>
<td>0.148</td>
<td>0.105</td>
<td></td>
<td>EQ-5D – &lt; 0.001 Self-Perceived – &lt; 0.001</td>
</tr>
</tbody>
</table>

^a Lower score is equivalent to lower overall health status

^b Higher score is equivalent to lower self-perceived health status

^c Bolded P-values are statistically significant