



ORIGINAL ARTICLE

Parental confusion may result when primary health care professionals show heterogeneity in their knowledge, attitudes, and perceptions regarding infant nutrition, food allergy, and atopic dermatitis



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KEYWORDS

Atopic dermatitis;
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Abstract

Introduction and objectives: Whether the guidelines on infant nutrition, food allergy and atopic dermatitis confer real health benefits in practice at the population level has not been deeply studied. We aimed here to characterize the knowledge, attitudes, and perceptions regarding these issues among primary health care professionals. In addition, we surveyed available parent-reported information sources and the incidence of food-related symptoms, dietary restrictions, food allergy, and atopic dermatitis among one-year-old children in the general population.

Materials and methods: An online questionnaire was designed for public health nurses and general practitioners. In addition, parents of one-year-old children were recruited to a separate survey at the time of their regular check-up visit.

Results: Altogether, 80 professionals took part. The median overall knowledge score was 77% and significantly higher among the general practitioners than among the nurses ($p=0.004$). However, only 35% of all the professionals recognized either severe airway or cardiovascular symptoms as potential food allergy-related symptoms. Moisturizers and emollients were thought to be adequate treatment for atopic dermatitis by 56%. Among 248 one-year-old children, the incidence of food allergy was 4% and atopic dermatitis 13%. During this period, parents intentionally avoided giving at least one food to 23% of the children, yet more than 80% of these restrictions can be regarded as unnecessary.

Abbreviations: FA, food allergy; AD, atopic dermatitis; PHN, public health nurse; GP, general practitioner.

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Conclusion: The knowledge, attitudes and beliefs regarding infant feeding, food allergy, and atopic dermatitis varied significantly among the primary care professionals. This will likely result in heterogeneous guidance practices and confusion among the families at the population level.

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Introduction

The reported incidence of doctor-diagnosed food allergy (FA) is 1–6% among children in the U.S. and Europe.^{1,2} However, up to 30% of parents report their child as having this condition.³ Furthermore, as many as 50% of families intentionally exclude various foods from a child's diet.⁴ This discrepancy may reflect difficulties in interpreting the symptoms and a lack of adequate information provided by health care professionals.

Over the past several decades, infant feeding guidelines have changed more than once,⁵ and a plethora of ever-changing clinical care guidelines, expert opinion statements, booklets, and online material regarding FA and atopic dermatitis (AD) has been produced for both health care professionals and the public during the same period. This thicket of information has the potential to foment confusion and heterogeneous guidance practices.

Different countries have different occupational groups that provide frontline guidance to families. They include nutritionists, nurses, nurse practitioners, general practitioners, and pediatricians. In Finland, the public health nurses (PHNs) work independently, in collaboration with primary care physicians.⁶ PHNs provide the primary information to families regarding feeding practices, and are usually the first to be contacted in cases of food-related symptoms and eczema. They also decide whether there is a need to arrange an extra consultation or referral to a doctor. The primary goal of the present survey was to characterize knowledge, attitudes, and perceptions concerning infant feeding practices, FA, and AD among PHNs and general practitioners (GPs). In addition, we carried out a small survey on the parents' information sources and the incidence of food-related symptoms, dietary restrictions, FA, and AD among one-year-old children in the general population.

Methods

The design of the survey for health care professionals

A questionnaire was designed to characterize knowledge, attitudes and perceptions concerning infant feeding practices, FA and AD among primary care health nurses and general practitioners. The questions were created on the basis of the national Finnish guidelines.⁷ The questionnaire consisted of 94 items, of which 68 questions related to FA and AD (65 true/false items, two multiple-choice items and one item on the recognition of 18 various FA symptoms), and six to infant feeding recommendations (two true/false items and four multiple-choice items). See Supplementary

Table S1. The remaining 20 Likert scale questions assessed attitudes and perceptions. The survey also asked for work experience (years) and the sources of information regarding infant feeding, FA, and AD.

The questionnaire was first tested and evaluated by seven professionals (two experienced nurses, one senior allergist, and four pediatric trainees), and then modified according to their comments. The voluntary survey was carried out between December 16th, 2013 and February 28th, 2014. An information letter describing the study protocol and including a link to the online questionnaire (Webropol Ltd) was provided to all 91 PHNs and 60 GPs working in child health clinics in all primary health care centers in the city of Oulu. Fifty-eight (64%) PHNs and 22 (37%) doctors took part in the survey.

The design of the survey for the parents of one-year-old children

Parents with one-year-old children were recruited to a separate survey at the time of their regular check-up visit. The design of the questionnaire is shown in Supplementary Table S2. PHNs in all child health clinics in the city of Oulu delivered the questionnaire booklet to the parents (after obtaining informed consent) between August 15th, 2012 and August 31st, 2013. The parents were asked to fill out the questionnaire and mail it to the investigators in an attached prepaid envelope. Thirty-one percent of those asked (248 of 800) returned the questionnaire.

Statistical methods

Summary scores were created by calculating the percentage of knowledge items that each respondent answered correctly. Descriptive analyses included presentation of overall and subgroup scores, percentages of respondents who recognized each FA symptom item correctly, and scores according to respondent occupation (PHN and GP). Differences in the distribution of knowledge scores between the two occupational groups were evaluated using the Mann–Whitney *U* test. To describe the perceptions of the health care personnel, the response categories were collapsed to strongly disagree/disagree, neutral (neither agree nor disagree), and strongly agree/agree. The chi-square test was used to compare the frequencies between the category variables. The same statistical methods were used to analyze the data from the survey on one-year-old children. All the data were analyzed using SPSS Statistics Software for Windows Version 22 (IBM Corp., Armonk, New York, USA).

Results

Characteristics of the health care personnel

Altogether, 80 health care professionals took part in the survey, of whom 72.5% were PHNs and 27.5% GPs. The median length of working experience was 11 years (range 0–30 years). Only 13% of doctors, compared to 83% of PHNs, were acquainted with the National Nutrition Recommendation ($p < 0.001$). In contrast, 95% of doctors were acquainted with the Finnish Current Care Guideline on FA, and 95% with the Finnish Current Care Guideline on Atopic Eczema, compared to 47% ($p < 0.001$) and 29% ($p < 0.001$) of PHNs, respectively. Other current information sources (reported by 25 participants) on infant feeding and atopic diseases were The Handbook for Child Welfare Clinics (The Finnish version is at <https://www.thl.fi/en/web/lastenneuvolakasikirja>), various Internet sources, and various printed materials provided by The Finnish Allergy and Asthma Federation as well as by commercial companies.

Knowledge on infant feeding practices, FA, and atopic eczema

The summary scores of knowledge are presented in Table 1, and the results of the single-knowledge items appear in Supplementary Table S1. The median overall knowledge score was 77% and significantly higher among the GPs than among the PHNs ($p = 0.004$). The results of the recognition of 18 specific FA-related symptoms are shown in Fig. 1. Most strikingly, only 14% of the PHNs and 18% of the GPs recognized inspiratory stridor and expiratory obstruction/acute asthma attack as potential symptoms of FA. Correspondingly, only 33% of the PHNs, as against 73% of the doctors ($p = 0.002$), recognized sudden pallor/dysphoria and sudden drop in blood pressure/loss of consciousness as potential FA-related symptoms. Furthermore, conjunctival and nasal symptoms were very poorly recognized in both occupational groups.

Attitudes and perceptions on infant feeding practices, FA, and AD

Attitudes and perceptions are illustrated in Figs. 2 and 3. More than 80% of participants thought that food-related symptoms always or often cause significant anxiety and result in the introduction of an elimination diet. Eighty-four percent reported that potentially food-related symptoms or eczema in a child under one year of age had resulted in an extra call and 81% that they had resulted in a visit to health care. Most thought that they had the ability to instruct families on interpretation and treatment of food-related symptoms in a child, and more than 90% thought that they could tell parents how to treat AD in children in their first year of life, even though 56% falsely answered that moisturizers and emollients were adequate treatments for AD. However, 94% (100% of GPs and 92% of PHNs) knew that mild topical corticosteroids were approved for children under the age of one (see Supplementary Table S1).

Parents' information sources and reported feeding practices, dietary restrictions, and atopic diseases in one-year old children

The major results of our survey on one-year-old children ($n = 248$, of whom 119, or 48%, were boys) are presented in Table 2. The median length of exclusive breastfeeding was four months and overall breastfeeding 10 months. The median age of introduction of any solid food was five months, and, for the major potentially allergenic solid foods (egg, fish, oat, wheat, barley, rye, and peanut), the median age of introduction varied from six to 11 months. Furthermore, by the age of one year, 12 children (4.8%) had not yet been introduced to cow's milk, 31 (12.5%) to hen's egg, 10 (4.0%) to fish, three (1.2%) to oat, one (0.4%) to wheat, 40 (16.1%) to barley, 21 (8.5%) to rye, and as many as 189 (76.2%) to peanut.

Immediate food-related symptoms were reported in 11 children (4.4%) and one or more food substances had intentionally been avoided in nine of these (Table 2). Delayed food-related symptoms (any food) were reported in 102 children (41%), including all those 11 children with immediate symptoms. Forty-three (43%) of them had intentionally avoided one or more food substances (9% among those without symptoms, $p < 0.001$). The incidence of parent-reported, doctor-diagnosed FA (any food) by the age of one year was 4.0% (10 of 248).

There were 32 parent-reported, doctor-diagnosed cases of AD (13%) as shown in Table 2. In 12 of these (38%), one or more food substances were intentionally avoided during the first year of life (21% among those without doctor-diagnosed AD, $p = 0.035$), and 88% had used topical corticosteroids for treatment. Surprisingly, topical corticosteroids had also been used in 11.4% (20 of 176) of children with neither diagnosis of AD nor any skin symptoms. Fifteen of these (75%) had received information about allergies and AD from the public child health clinics, eight (40%) from the internet and seven (35%) from other sources.

Discussion

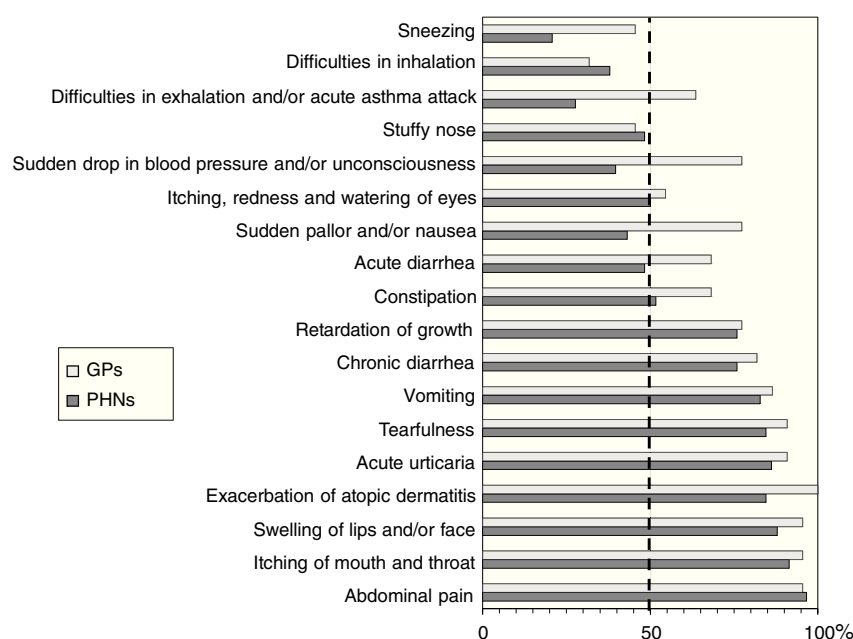
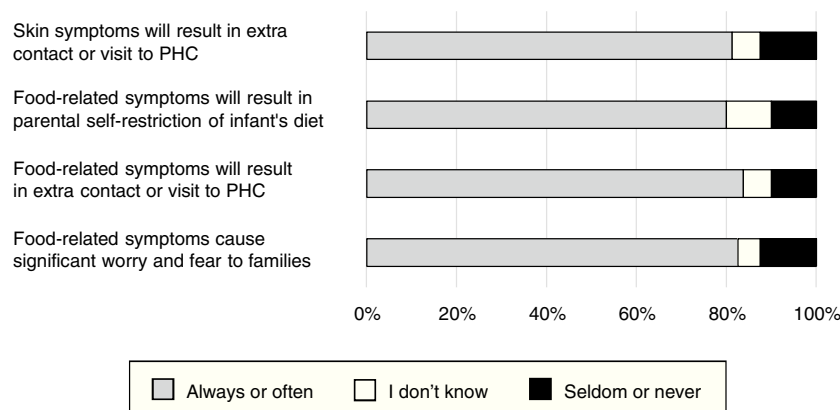
International and national guidelines offer health care professionals the best available information to ensure optimal growth and development of the baby and to ensure evidence-based diagnostics and treatment of FA and AD in children. Whether these guidelines confer real health benefits in practice at the population level has not been deeply studied. Our results show high individual and occupational variability in acquaintance with the guidelines. Furthermore, both health care professionals and families use additional sources of information that are not consistent with each other. These habits, together with the changing nature of the guidelines, seem to result in contradictory information and remarkable confusion among the families, as one mother in our survey told us (illustrated in Fig. 4).

There are very few published studies from any country into the knowledge and perceptions on childhood food allergies in primary care settings. All of these have reported passable or poor areas of knowledge. In the U.S. study, 61% of 407 primary care physicians answered FA-related knowledge-based items correctly.⁸ The authors concluded

Table 1 Knowledge on infant feeding practices, food allergy and atopic dermatitis among primary care health professionals working in child health clinics.

	All participants (n = 80)	PHNs (n = 58)	Doctors (n = 22)	p-Value
<i>Overall knowledge (73 items)</i>	77 (69–80)	74 (66–80)	80 (76–85)	<i>0.004</i>
<i>Knowledge on food allergy and atopic dermatitis (67 items)</i>	76 (67–81)	73 (65–78)	81 (79–85)	<i><0.001</i>
Epidemiology, risk factors and natural history (12 items)	81 (70–88)	81 (73–88)	81 (69–88)	0.991
Symptoms (17 items)	77 (69–85)	77 (69–85)	85 (83–92)	<i>0.001</i>
Diagnosis (18 items)	67 (50–72)	61 (44–67)	72 (67–85)	<i><0.001</i>
Treatment (20 items)	80 (75–85)	80 (70–85)	83 (79–90)	<i>0.015</i>
<i>Knowledge on infant feeding practices (6 items)</i>	83 (67–100)	100 (83–100)	75 (63–83)	<i>0.001</i>

Data represent median (interquartile range) percentage of correctly answered questions in each question category. Statistical comparison (Mann–Whitney *U* test) was done between the two occupational groups. *p*-Value of 0.05 or less represent statistically significant difference and are shown in italics. PHNs, public health nurses.

**Figure 1** The recognition of 18 specific food allergy related symptoms among primary health care professionals. The percentage represents professionals who correctly recognized that the symptom could potentially be caused by food allergy. The dashed line is set at 50% to demonstrate very poor knowledge of several key symptoms, as even flipping a coin (guessing) will give a chance of 50%. PHN = public health nurse.**Figure 2** The perceptions of 80 primary health care professionals on the frequency of burden to the families and to the primary health care system caused by food-related symptoms and eczema.

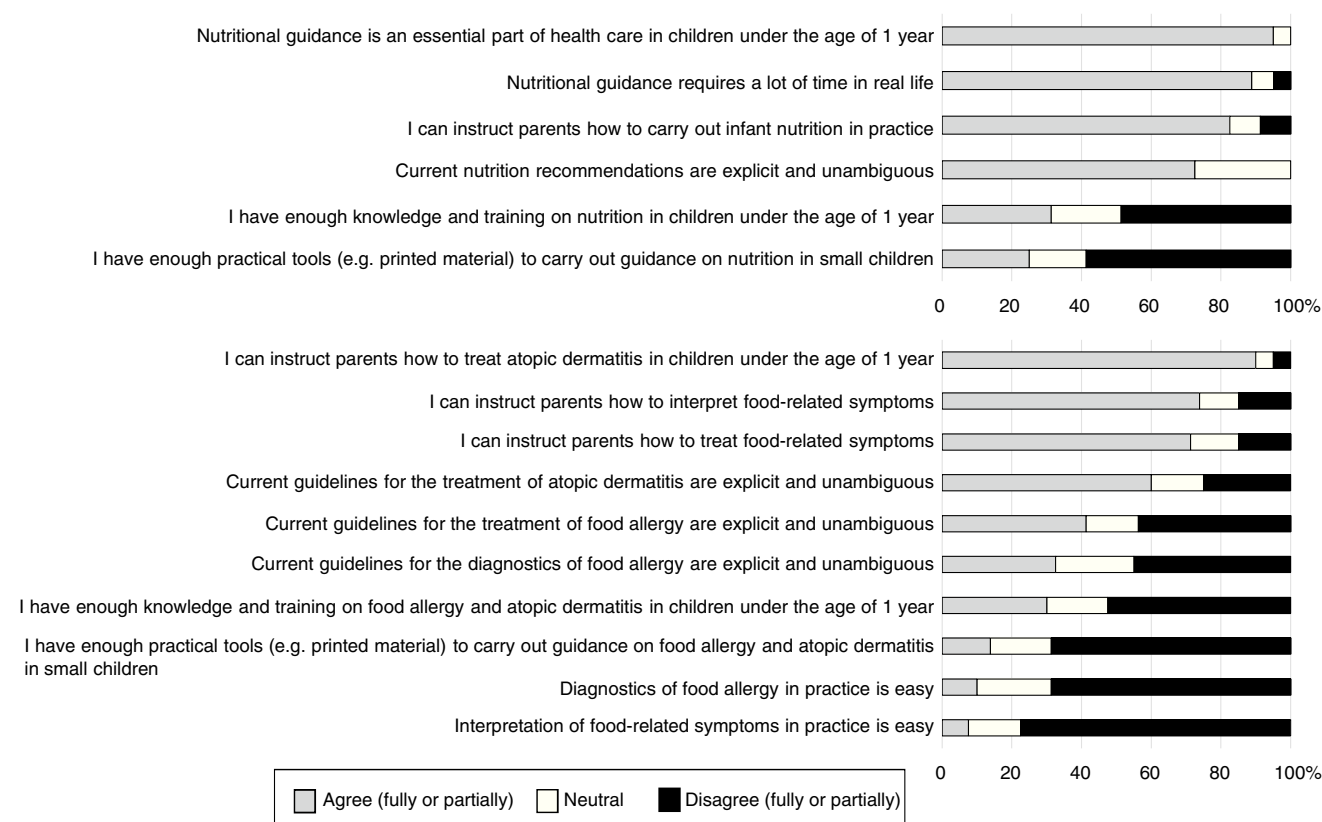


Figure 3 Attitudes and opinions of 80 primary health care professionals concerning guidelines and practices on infant nutrition, atopic dermatitis, and food allergy.

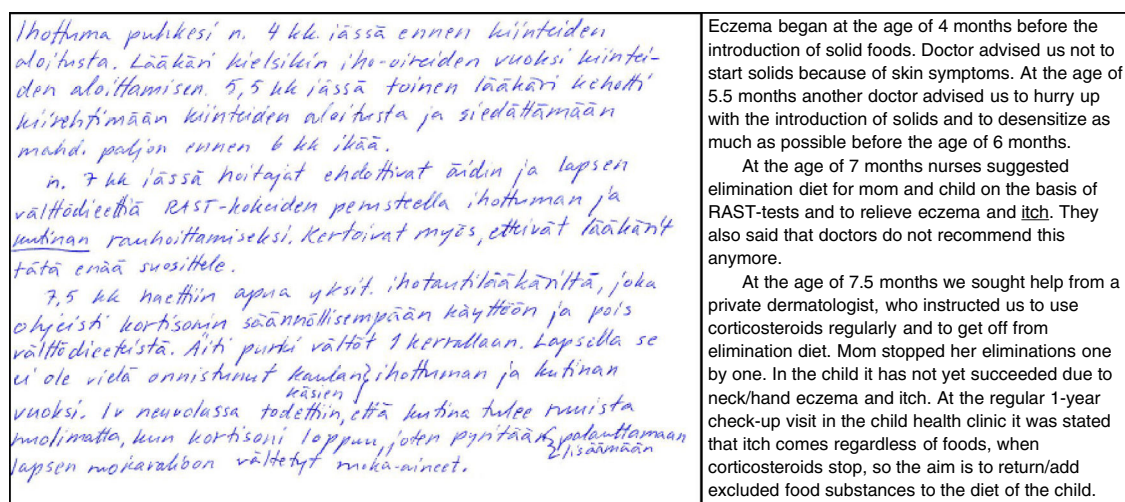


Figure 4 A parent's real-life description of parental confusion caused by discrepancies among health professionals' provision of instructions regarding infant feeding, food allergy and atopic dermatitis in a child. L: a photo of the original Finnish handwritten free comment in the questionnaire booklet; R: free translation of the text into English.

that the overall knowledge was fair but that significant knowledge gaps existed and needed to be addressed. In a Turkish study, knowledge of FA and anaphylaxis among primary care physicians was found to be unsatisfactory, as the average percentage of correct answers was only 47% among the 297 participants.⁹ An Australian survey that included GPs reported significant gaps and variability in knowl-

edge of the diagnosis and management of FA, potentially resulting in clinical practices inconsistent with international guidelines.¹⁰ A Brazilian study of 300 physicians and 220 nutritionists revealed many gaps in their knowledge of primary FA prevention.¹¹ Our present study is the first to focus on knowledge and perceptions among primary care professionals while taking three factors together—infant nutrition,

Table 2 A survey-based characteristics of parent's sources of information, infant nutrition practices, and the incidence of potential food related symptoms and atopic diseases among the 248 children by the age of 1 year.**Parent's sources of information regarding infant feeding, FA and atopic dermatitis, n (%)***Infant feeding practices*

Health professionals in Child Health Clinics	247 (99.6)
Internet	124 (50)
Other sources (e.g. magazines, relatives, friends, etc.)	148 (60)
No information received	0 (0)

Food allergy and atopic dermatitis

Health professionals in Child Health Clinics	157 (63)
Internet	71 (29)
Other sources (e.g. magazines, relatives, friends etc.)	71 (29)
No information received	0 (0)

Nutrition during the first year of life

<i>Exclusive breastfeeding, months (median, IQR) (n = 197)</i>	4 (1–5)
<i>Total length of breastfeeding, months (median, IQR) (n = 245)</i>	10 (6–13)
<i>Age when the first essential solid food was introduced, months (median, IQR)</i>	5 (5–6)
<i>Age when a specific food was introduced, months (median, IQR)</i>	
Cow's milk (including infant formulas) (n = 236)	6 (1–10)
Hen's egg (n = 2217)	8 (6–10)
Fish (n = 2238)	6 (6–8)
Oat (n = 2245)	6 (5–6)
Wheat (n = 2237)	6 (5–8)
Barley (n = 2208)	6 (6–8)
Rye (n = 2227)	6.5 (6–8)
Peanut (n = 259)	11 (8–12)

Parent-reported symptoms, n (%)

<i>Urticaria</i>	8 (3.2)
<i>Persistent or relapsing eczema described as being atopic</i>	35 (14)
<i>Dry skin</i>	31 (13)
<i>Mucosal symptoms (oral, nasal or conjunctival)</i>	6 (2.4)
<i>Airway obstruction</i>	3 (1.2)
<i>Persistent diarrhea</i>	10 (4.0)
<i>Other gastrointestinal symptoms</i>	51 (21)
<i>Exceptional or excess tearfulness</i>	50 (20)
<i>Any immediate symptom potentially related to food ingestion</i>	11 (4.4)
<i>Any delayed symptom potentially related to food ingestion</i>	102 (41)

Parent-reported, doctor-diagnosed diseases, n (%)

<i>Any food allergy</i>	10 (4.0)
Milk	8 (3.2)
Hen's egg	5 (2.0)
Fish	1 (0.4)
Cereal (wheat)	2 (0.8)
Peanut	0 (0)
Other	0 (0)
<i>Atopic dermatitis</i>	32 (13)

AD and FA. The overall knowledge of 77% is somewhat better than reported in other studies, but is still unsatisfactory in several areas.

The study's most serious finding is that frontline health care professionals are poor at recognizing many significant symptoms of FA. Most importantly, only 14% of the PHNs and 18% of the GPs knew that severe airway symptoms can be caused by an allergic reaction to food. Correspondingly, only 33% of the PHNs, compared to 73% of the GPs, recognized severe cardiovascular symptoms as potentially FA-related.

These gaps of knowledge are alarming, as they indicate that frontline professionals cannot teach parents to recognize the symptoms themselves. This may delay the treatment of acute allergic reactions.

Another remarkable observation is a clear discrepancy between professionals' knowledge and the perceptions of their own skills regarding FA and AD in small children. A very large proportion thought that they knew how to instruct families in the diagnosis, interpretation, and treatment of food-related symptoms in a child, even though we

observed clear knowledge gaps in these areas. Furthermore, the results of the survey into AD treatment knowledge are contradictory, as they show that roughly 90% of participants reported their ability to instruct families in the treatment of AD in children under the age of one, even though 56% answered that moisturizers and emollients were adequate treatments for the condition. On the other hand, the majority agreed on the difficulty of diagnosing and interpreting food-related symptoms, and believed that they did not have enough training and practical tools to instruct families in the treatment of AD and food allergies.

Nearly all the frontline public health care professionals in our study recognized guidance on nutrition as an essential, although time-consuming, part of infant health care. Eighty percent of the participants had also seen that food-related symptoms cause significant anxiety and always (or at least often) result in an elimination diet. A similar proportion reported that potentially food-related symptoms or eczema in a child under the age of one year resulted in an extra call or a visit to health care. Therefore, it is likely that matters related to infant nutrition, FA, and AD cause a significant burden to families with small children and to the health care system.

Although our survey for the parents of 1-year-old children was fairly small ($n = 248$), it offers three important and timely observations at the population level: Firstly, all but three babies had received breast milk and 65% of them were exclusively breastfed until at least the age of four months and 17% until the age of six months (data not shown). Secondly, at least one food substance was intentionally avoided in a quarter of the children (57/248) during the first year of life. Four percent of all the babies had experienced immediate symptoms potentially related to food ingestion (any food) and close to 40% had experienced delayed symptoms during their first year of life, resulting in avoidance of one or more food substances in about 40% of these children. Furthermore, the incidence of parent-reported, doctor-diagnosed FA was 4% by the age of one year (only half of these had experienced immediate symptoms). Therefore, more than 80% of the avoidance diets (including 13 subjects without symptoms and 34 subjects without doctor-verified FA diagnoses) are unnecessary, according to current national and international clinical care guidelines. These children make up as much as 20% of the subjects in the present study. Thirdly, parent-reported, doctor-diagnosed AD was present in 13% by the age of one year, and most had been treated with topical corticosteroids. However, these treatments were also used in 10% of children with no skin symptoms, a remarkable divergence from current care guidelines. Taken together, these results might reflect the lack of practical tools in frontline health care or poor acquaintance with and knowledge of the current care guidelines.

The availability of the health care system's primary care services is homogeneous throughout Finland, in both rural and urban areas. Therefore, it is very likely that the current results can be extrapolated to apply to the whole country. On the other hand, as only 64% of the PHNs, 37% of the GPs and 31% of the families returned the questionnaires, we cannot be certain that the respondents are fully representative of the population. Their self-selection as participants may indicate a higher confidence of knowledge or a higher level of education and so may be somewhat biased.

In conclusion, professionals working in primary health care have a crucial role in providing information to families regarding infant feeding practices, food-related symptoms, FA, and AD. However, our present results suggest that the observed significant variation in knowledge, attitudes and beliefs may result in heterogeneous guidance practices, person-to-person variation, and confusion among both professionals and families. We also found several alarming gaps and heterogeneity in many areas of knowledge; these may jeopardize the treatment of FA and AD. In addition to further postgraduate training,^{12–14} simple and unambiguous practical tools, designed for primary care, are urgently needed in order to translate current guidelines into the practical health benefits at the population level.

Conflict of interest

No conflicts of interest.

Acknowledgements

We thank all the primary care health professionals and the parents of the children attending this survey. This work was supported by the research grants from the Alma and K.A. Snellman Foundation, the Finnish Medical Association, the Allergy Research Foundation and the Finnish Pediatric Research Foundation.

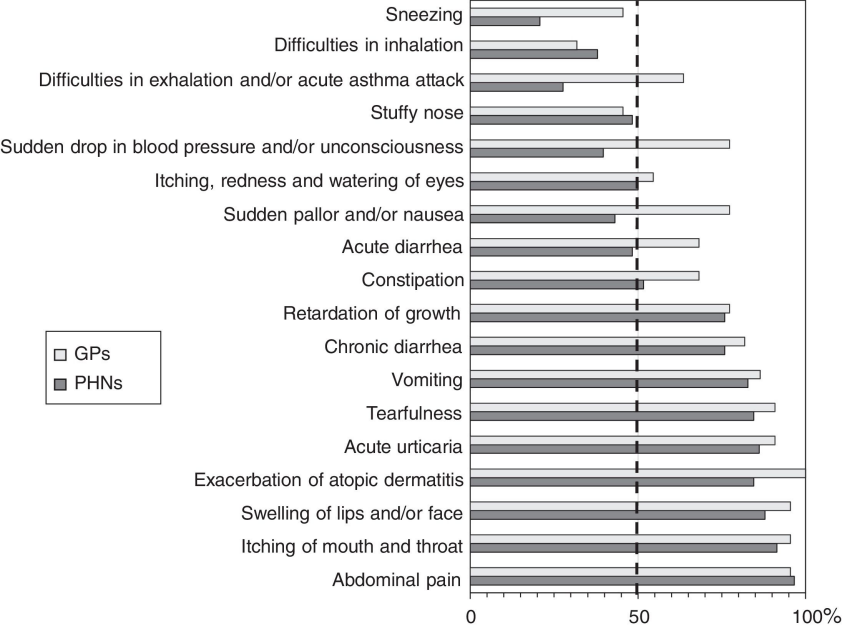
Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.aller.2017.09.017>.

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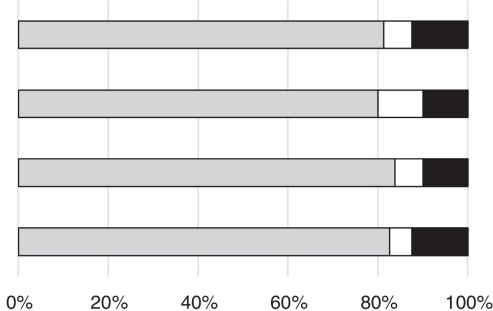


Skin symptoms will result in extra contact or visit to PHC

Food-related symptoms will result in parental self-restriction of infant's diet

Food-related symptoms will result in extra contact or visit to PHC

Food-related symptoms cause significant worry and fear to families



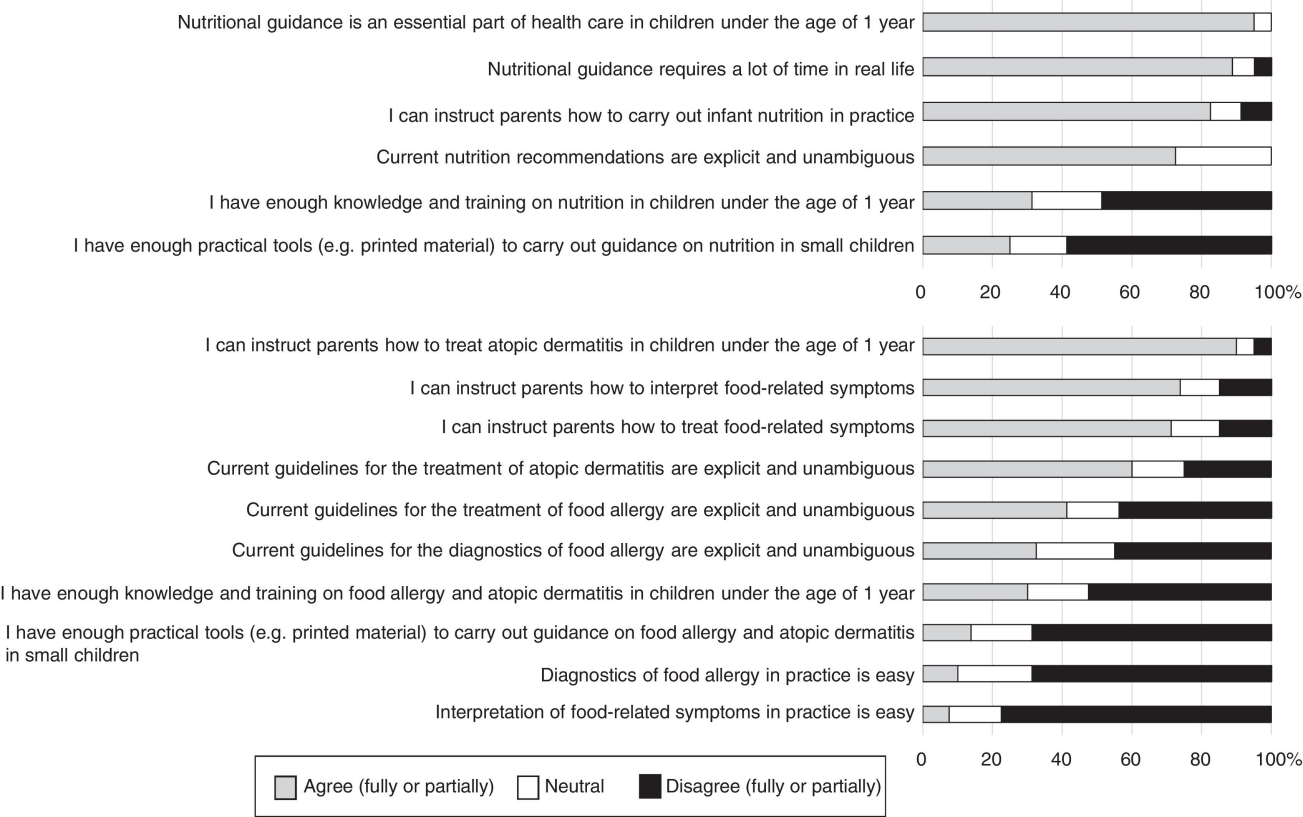
Always or often



I don't know



Seldom or never



Ihottuma putkesi n. 4 kk. iässä ennen kiinteiden aloitusta. Lääkäri kielsikin iho-oireiden vuoksi kiinteiden aloittamisen. 5,5 kk iässä toinen lääkäri kehotti kiirehtimään kiinteiden aloitusta ja siedättämään mahd. paljon ennen 6 kk ikää.

in. 7 kk iässä hoitajat ehdottivat äidin ja lapsen välitöiden RAST-kokeiden perusteella ihohtuman ja umman rauhoittamiseksi. Kertoivat myös, etteivät lääkärit tätä enää suosittele.

7,5 kk haettiin apua yksit. ihotautilääkäriltä, joka ohjeisti kortisonin säännöllisempään käyttöön ja pois välttödieteistä. Äiti purki vältöt 1 kerrallaan. Lapsella se ei ole vielä onnistunut kaulan*käsien*ihoituksen ja kutinan vuoksi. Iv neuvolassa todettiin, että kutina tulee ruuista ^{ruoasta}polimatta, kun kortisoni loppuu, joten pyritään palauttamaan lapsen ruokavalioon vältetyt ruoka-aineet.

Eczema began at the age of 4 months before the introduction of solid foods. Doctor advised us not to start solids because of skin symptoms. At the age of 5.5 months another doctor advised us to hurry up with the introduction of solids and to desensitize as much as possible before the age of 6 months.

At the age of 7 months nurses suggested elimination diet for mom and child on the basis of RAST-tests and to relieve eczema and itch. They also said that doctors do not recommend this anymore.

At the age of 7.5 months we sought help from a private dermatologist, who instructed us to use corticosteroids regularly and to get off from elimination diet. Mom stopped her eliminations one by one. In the child it has not yet succeeded due to neck/hand eczema and itch. At the regular 1-year check-up visit in the child health clinic it was stated that itch comes regardless of foods, when corticosteroids stop, so the aim is to return/add excluded food substances to the diet of the child.

	All participants (n = 80)	PHNs (n = 58)	Doctors (n = 22)	p-Value
<i>Overall knowledge (73 items)</i>	77 (69–80)	74 (66–80)	80 (76–85)	0.004
<i>Knowledge on food allergy and atopic dermatitis (67 items)</i>	76 (67–81)	73 (65–78)	81 (79–85)	<0.001
Epidemiology, risk factors and natural history (12 items)	81 (70–88)	81 (73–88)	81 (69–88)	0.991
Symptoms (17 items)	77 (69–85)	77 (69–85)	85 (83–92)	0.001
Diagnosis (18 items)	67 (50–72)	61 (44–67)	72 (67–85)	<0.001
Treatment (20 items)	80 (75–85)	80 (70–85)	83 (79–90)	0.015
<i>Knowledge on infant feeding practices (6 items)</i>	83 (67–100)	100 (83–100)	75 (63–83)	0.001

Parent's sources of information regarding infant feeding, FA and atopic dermatitis, n(%)*Infant feeding practices*

Health professionals in Child Health Clinics	247 (99.6)
Internet	124 (50)
Other sources (e.g. magazines, relatives, friends, etc.)	148 (60)
No information received	0 (0)

Food allergy and atopic dermatitis

Health professionals in Child Health Clinics	157 (63)
Internet	71 (29)
Other sources (e.g. magazines, relatives, friends etc.)	71 (29)
No information received	0 (0)

Nutrition during the first year of life

<i>Exclusive breastfeeding, months (median, IQR) (n = 197)</i>	4 (1–5)
<i>Total length of breastfeeding, months (median, IQR) (n = 245)</i>	10 (6–13)
<i>Age when the first essential solid food was introduced, months (median, IQR)</i>	5 (5–6)
<i>Age when a specific food was introduced, months (median, IQR)</i>	
Cow's milk (including infant formulas) (n = 236)	6 (1–10)
Hen's egg (n = 2217)	8 (6–10)
Fish (n = 2238)	6 (6–8)
Oat (n = 2245)	6 (5–6)
Wheat (n = 2237)	6 (5–8)
Barley (n = 2208)	6 (6–8)
Rye (n = 2227)	6.5 (6–8)
Peanut (n = 259)	11 (8–12)

Parent-reported symptoms, n(%)

<i>Urticaria</i>	8 (3.2)
<i>Persistent or relapsing eczema described as being atopic</i>	35 (14)
<i>Dry skin</i>	31 (13)
<i>Mucosal symptoms (oral, nasal or conjunctival)</i>	6 (2.4)
<i>Airway obstruction</i>	3 (1.2)
<i>Persistent diarrhea</i>	10 (4.0)
<i>Other gastrointestinal symptoms</i>	51 (21)
<i>Exceptional or excess tearfulness</i>	50 (20)
<i>Any immediate symptom potentially related to food ingestion</i>	11 (4.4)
<i>Any delayed symptom potentially related to food ingestion</i>	102 (41)

Parent-reported, doctor-diagnosed diseases, n (%)

<i>Any food allergy</i>	10 (4.0)
Milk	8 (3.2)
Hen's egg	5 (2.0)
Fish	1 (0.4)
Cereal (wheat)	2 (0.8)
Peanut	0 (0)
Other	0 (0)
<i>Atopic dermatitis</i>	32 (13)

Table S1. The description and the results of the single knowledge items related to infant nutrition, food allergy, and atopic dermatitis among primary health care professionals. The type of question is shown in parenthesis and correct answer indicated with bold font. Data represent the percentage of correct answers among the participants. (PHNs, public health nurses; T/F, True/False; OFC, oral food challenge).

Epidemiology, risk factors and natural history	All (n=80)	PHNs (n=58)	Doctors (n=22)
Which proportion of parents think that their 0-3 year old child has food allergy? (multiple choice; 30%)	45	47	41
What is the prevalence of proven food allergies among 0-3 year old children? (multiple choice; 5-10%)	45	41	55
Food allergy resolves usually spontaneously before school-age (T/F)	96	97	96
If mother avoids certain foods (i.e. milk and egg) during pregnancy, the child is less likely to get food allergy or atopic eczema (T/F)	99	98	100
If mother avoids certain foods (i.e. milk and egg) during lactation, the child is less likely to get food allergy or atopic eczema (T/F)	99	100	96
Exclusive breastfeeding does not prevent or reduce the child's probability to get food allergy or atopic eczema (T/F)	36	36	36
Late introduction of solid foods (after the age of 6 months) does not prevent or reduce the child's probability to get food allergy or atopic eczema (T/F)	80	85	68
Children in allergy risk families (parents or siblings have physician-diagnosed allergic disease) should avoid so called generally allergenic foods to reduce risk to get food allergy and atopic eczema (T/F)	94	95	91
Food allergy does not cause atopic eczema but can be one of factors worsening the eczema (T/F)	98	97	100
Atopic eczema is rare among children without food allergy (T/F)	95	93	100
Food allergy is more common among children with atopic eczema (T/F)	78	76	82
Symptoms			
The symptoms of food allergy appear always immediately after ingestion of allergy-causing food (T/F)	81	76	96
<i>Which of the following symptoms can result from food allergy: (T/F; all of the symptoms are true)</i>			
Vomiting	84	83	86
Acute diarrhea	54	48	68
Chronic diarrhea	78	76	82
Constipation	56	52	68
Abdominal pain	96	97	96
Tearfulness	86	85	91
Difficulties in inhalation	36	38	32
Difficulties in exhalation and/or acute asthma attack	38	28	64
Acute urticarial	88	86	91
Exacerbation of atopic dermatitis	89	85	100
Retardation of growth	76	76	77
Sudden drop in blood pressure and/or unconsciousness	50	40	77
Sudden pallor and/or nausea	53	43	77
Swelling of lips and/or face	90	88	96

Stuffy nose	48	48	46
Sneezing	28	21	46
Itching of mouth and throat	93	91	96
Itching, redness and watering of eyes	51	50	55
Symptoms of food allergy are always similar despite child's age (T/F)	96	95	100
The reason of infant's tearfulness is usually food allergy (T/F)	100	100	100
The symptoms of food allergy appear the first time usually when the food in question has been in use for several weeks (T/F)	70	66	82
The symptoms of food allergy may continue for several weeks although that food is eliminated from diet (T/F)	51	52	50
Atopic eczema of an infant usually results from food allergy (T/F)	89	90	86
Food allergy is a common worsening factor of infant's severe or moderate atopic eczema (T/F)	80	74	96
Atopic eczema manifests often before the age of 1 year (T/F)	74	79	59
Food allergy is usually the cause of atopic eczema which manifests before the age of 6 months (T/F)	76	79	68
Atopic eczema in a child over one year of age is not usually a sign of food allergy (T/F)	74	69	86
Urticaria is always a sign of severe allergic reaction (T/F)	84	79	96
Mucosal swelling of mouth or lips is always a sign of severe allergic reaction (T/F)	11	7	18
Change or alteration in the odour, colour and consistency of stool is usually a sign of food allergy (T/F)	83	78	96
The rumination and reflux are usually signs of food allergy (T/F)	93	93	91
Abdominal and bowel symptoms caused by a new food are not usually a sign of food allergy (T/F)	66	62	77
Food allergy is a common reason of infantile colic (T/F)	99	98	100
If a child has had an anaphylaxis, the causative substance should always to be found out (T/F)	100	100	100
Anaphylaxis caused by food allergy is rare among children under the age of 1 year (T/F)	84	81	91

Diagnostics

The diagnosis of food allergy can be set based on a positive result in a skin prick test (T/F)	51	45	68
Reaction of over 5 mm in a skin prick test means almost always certain allergy (T/F)	49	47	55
Likelihood of a severe immediate allergic reaction is very low if skin prick test or food-specific IgE is negative (T/F)	73	67	86
The diagnosis of food allergy can be set based on a positive food-specific-IgE result (T/F)	61	50	91
If the level of food-specific-IgE in the blood sample is over 30 kU/L, it means almost always certain allergy (T/F)	53	47	68
Skin prick test cannot be used in a child less than 1 year of age (T/F)	35	31	46
Skin prick test or serum IgE assays are not generally needed to set the allergy diagnosis in an infant (T/F)	69	66	77
Allergy tests can be used in the screening for manifest food allergies (T/F)	31	22	55
Skin prick test and serum IgE assay measure the same thing, thus those should not to be used simultaneously (T/F)	19	14	32
Interpretation of an allergy test result depends on the allergen (T/F)	71	64	91
Each food allergy should be confirmed using OFC (oral food challenge test) (T/F)	59	52	77
The diagnosis of food allergy can only be set based on OFC (T/F)	76	72	86
OFC can be instructed to be carried out at home if symptoms are not severe (T/F)	96	95	100
The use of symptom-diary has to be always included in the OFC (T/F)	95	93	100
If the symptoms disappear during avoidance, it suffices for the diagnosis of food allergy and challenge is no more needed (T/F)	63	57	77
A child should be referred to secondary/tertiary health care if he/she is suspected to have allergy to milk, egg or grain (T/F)	36	29	55

OFC test is interpreted to be negative if symptoms don't appear in seven days (T/F)	73	71	77
The food causing the symptoms in infancy should be re-challenged at intervals of 6-12 months (T/F)	86	83	100

Treatment

If a child is diagnosed with food allergy, avoiding also other common allergenic foods is of benefit (T/F)	93	92	96
If breastfeeding mother avoids common allergens in her diet (i.e. egg, milk), atopic dermatitis in the child will recover faster (T/F)	76	69	96
Avoidance diet speeds up the final resolution of atopic dermatitis (T/F)	64	62	68
Avoidance diet speeds up the final resolution of food allergy (T/F)	85	83	91
If a child is diagnosed with food allergy, but the symptoms are mild, that food needs usually not to be completely excluded from diet (T/F)	96	95	100
The only treatment for food allergy is avoidance diet (T/F)	74	76	68
Food allergy in most children gets worse and recovers slower if the symptom-causing food is given to the child (T/F)	85	81	96
The food eliciting severe symptoms should not be given to a food allergic child at home (T/F)	86	81	100
A child with milk allergy can usually drink lactose-free milk (T/F)	93	93	91
Some of the milk allergic children tolerate milk in well-baked form (i.e. in pastries) (T/F)	60	57	68
Antihistamine reduces significantly itching related to atopic dermatitis (T/F)	21	16	36
Antihistamine usually relieves urticaria and mucosal symptoms (T/F)	94	93	96
Emergency medicine for anaphylactic reaction is always adrenaline (T/F)	88	86	91
Antihistamine and oral or intravenous cortisone are usually sufficient first-line treatments for an anaphylactic reaction (T/F)	71	67	82
Topical corticosteroids should not be used as a treatment for infant's atopic dermatitis (T/F)	94	92	100
Basic emollients and moisturizers are usually sufficient treatment for atopic dermatitis (T/F)	44	43	46
Egg allergic children can generally be vaccinated with MPR vaccine(T/F)	86	85	91
Egg allergic children without generalized allergic reaction can usually be vaccinated with influenza vaccine (T/F)	94	95	91
A child should be referred to nutritionist if he/she is diagnosed with wheat allergy (T/F)	48	38	73
Treatment and follow-up of all food allergic children belongs to secondary/tertiary health care (T/F)	90	88	96

Infant nutrition

Breast milk usually suffices to ensure the normal growth and development of a child until the age of 1 year (T/F)	86	91	73
How long is exclusive breastfeeding recommended according to Finnish Nutrition Recommendation? (multiple-choice; 4-6 months)	81	85	73
How long is total breastfeeding recommended according to Finnish Nutrition Recommendation? (multiple-choice; 12 months)	91	95	82
Common milk formulas are cow's milk based (T/F)	93	91	96
At which age are fermented milk and common milk products recommended to be introduced to the diet (multiple-choice; 10 months)	75	88	41
At which age are solid foods recommended to be introduced to the diet (multiple-choice; 4-6 months)	74	78	64

Table S2. The description of the questions used in a printed survey questionnaire for the parents of 1-year-old children.

Basic information

Child's name
Sex
Birth date
Date
Public health clinic, Postal code
Birth weight and height
Child's weight and height now

Have you received information and instructions concerning introducing solid foods to child's diet?

From Public Health Center
From the Internet If yes, from which sites?
From another source What source?

Have you received information and instruction about allergies and rash of child?

From Public Health Center
From the Internet If yes, from which sites?
From another source What source?

How long was your child exclusively breastfed?

Partially breastfed?

Have the following foods been introduced to the diet of your child? If so, when (child's age as months)

Cow's milk (including formulas)	Hen's egg
Wheat	Oats
Barley	Rye
Nut	Fish

Did food cause symptoms?

Which food caused the symptoms? What kind of symptoms and how long they lasted?

Has some food been avoided in the diet of your child?

If yes, describe the reason?

Has your child any of the following conditions diagnosed by a physician

Atopic dermatitis	not diagnosed, no more, yes, periodically; yes, continuous
Allergic rhinitis (i.e. animals)	not diagnosed, yes
Allergy to cow's milk	not diagnosed; no more; yes
Allergy to wheat of other cereal	not diagnosed; no more; yes
Allergy to any other food	not diagnosed; no more; yes
Describe which foods	
Other allergy, which?	

Has your child been diagnosed with any other chronic diseases?

If yes, describe which and when have these been diagnosed?

Does your child use any medication regularly?

If yes, describe?

Has your child had following symptoms? Describe the characteristics and duration

Urticaria
Long-lasting rash
Other skin symptom
Mucosal symptoms in eyes, nose or mouth (itching, sting, redness, swelling, watering)
Long-lasting diarrhea
Other gastrointestinal symptoms
Tearfulness
Dyspnea

How many common colds or other respiratory infections has your child experienced?

How many otitis media with antibiotics has your child ailed?

Has your child had other illnesses treated with antibiotics?

Has your child been examined in a hospital?

If yes, why?

Has your child ever been tested for allergy? Which tests?

Has your child ever used following medications?

Antihistamine
Adrenaline autoinjector
Topical corticosteroids
Moisturizers or emollients

Have other family members been diagnosed with following diseases? (who: mother, father, siblings, none)

Asthma
Pollen or animal allergy
Food allergy
Atopic dermatitis