

PEDIATRIC ALLERGY AND
IMMUNOLOGY

Parental knowledge and use of epinephrine auto-injector for children with food allergy

Pouessel G, Deschildre A, Castelain C, Sardet A, Sagot-Bevenot S, de Sauve-Boeuf A, Thumerelle C, Santos C. Parental knowledge and use of epinephrine auto-injector for children with food allergy.
Pediatr Allergy Immunol 2006;17:221–226.

© 2006 The Authors

Journal compilation © 2006 Blackwell Munksgaard

Epinephrine should be prescribed for patients at risk of anaphylaxis. Our purpose was to determine the use of Anapen® prescribed for food-allergic children, to assess parental knowledge regarding Anapen, and to evaluate the arrangements for emergency kits and personalized care projects in everyday life. A prospective study was performed with a questionnaire sent to families with a food-allergic child previously prescribed Anapen. One hundred and fifty two families were contacted and finally 111 children included (median age 6.5 yrs). Main food allergens were peanuts ($n = 89$), egg ($n = 39$) and cow's milk ($n = 10$). The use of Anapen had been demonstrated to 90% of parents (by prescribing physician, 69%; pharmacist, 25%; general practitioner, 5%; nurse 1%), with a training device (76%) and/or written instructions (49%). When asked to list symptoms requiring injection, 48% of parents cited more than one response: breathing difficulties only (23%), or with angio-edema (41%), collapse or faintness (38%), anaphylactic shock (48%). Of 107 children attending school, 54% had a personalized care project, 72% an Anapen device, and 60% a complete emergency kit (epinephrine, inhaled β -agonist, corticosteroid, anti-H1 drug). β -Agonists were forgotten at school by 34 children (13 asthmatics). Anapen was used in one child for angio-edema and dyspnea after inadvertent ingestion of egg at home. In our population, epinephrine auto-injectors and emergency kits were insufficiently available at schools and in daily life. The use of auto-injectors was not adequately demonstrated. The prescription of epinephrine for food-allergic children at risk of anaphylaxis requires accurate diagnosis, educational programs, information, and follow up.

**G. Pouessel¹, A. Deschildre¹,
C. Castelain², A. Sardet³,
S. Sagot-Bevenot¹,
A. de Sauve-Boeuf⁴, C. Thumerelle¹
and C. Santos¹**

¹Unité de pneumologie-allergologie pédiatrique, Clinique de Pédiatrie, Hôpital Jeanne de Flandre, CHRU de Lille, France, ²Service de pédiatrie, Hôpital Saint Vincent, Lille, France, ³Service de pédiatrie, Hôpital Schaffner, Lens, France, ⁴Pharmacie centrale, CHRU de Lille, France

Key words: food allergy; epinephrine; child; personalized care project; emergency kit

A. Deschildre, Unité de pneumologie et allergologie pédiatriques, Hôpital Jeanne de Flandre, CHRU de Lille, 2 avenue Oscar Lambret, 59037 Lille cedex, France
Tel.: +33 320 445072
Fax: +33 320 444107
E-mail: adeschildre@chru-lille.fr

Accepted 11 January 2006

Food allergy affects 4%–8% of children, and reactions can be severe and potentially fatal (1, 2). In recent years, food allergy has been characterized by an increase in severe reactions, such as anaphylactic shock, laryngotracheal angio-edema, and severe acute asthma (2–5). Secondary prevention includes an elimination diet and the availability of an emergency kit containing at least injectable epinephrine and oral corticosteroids. The early administration of epinephrine for food-allergy reactions can be life-saving (6). However, epinephrine auto-injectors (EAI) are misused by patients and their families (7).

In France, various devices for the administration of epinephrine, including Anapen®

(Allerayde Ltd, Newark, UK), are available for patients at risk of severe allergic reactions to food. Anapen is the only EAI device available and is packaged as a pen. Compared to the United States, and Canada, prescription of epinephrine in Great Britain is restricted to anaphylactic shock and asthma. In France, children at risk of severe food-allergic reactions benefit from personalized care projects in schools.

The purpose of our study was to determine the use of the EAI Anapen prescribed for food-allergic children, to assess parental knowledge regarding Anapen®, and to evaluate the arrangements for emergency kits and personalized care projects in everyday life.

Methods

This was a prospective study involving families of food-allergic children who had previously been prescribed the Anapen device between June 2000 and March 2003. These children were cared for by pediatricians or allergists, referent for food allergy working in five children's hospitals [Lille (university hospital and hôpital Saint Vincent), Lens, Boulogne sur Mer, Dunkerque]] of the Nord Pas-de-Calais region (Northern France). Indications for the prescription of EAI were in accordance with the guidelines (8, 9). Prescriptions for self-injectable epinephrine were suggested for individuals who had experienced a systemic reaction to a trigger that might be encountered in the community, if the patient had also experienced a severe reaction (respiratory difficulty or hypotension) or if they were at high risk, as defined by any of the following: asthma, reactions to trace amount of allergen, at risk for repeated exposure with lack of access to emergency care, or comorbidity increasing the risk of a severe reaction.

We sent an anonymous questionnaire and a fact sheet concerning the objectives of the study to all families. Participants were limited to parents and children were not surveyed. Questionnaires were completed by one or both parents with only one survey for each child. Parents were instructed to return the completed questionnaire in the provided self-addressed stamped envelope. The questionnaire surveyed demographic data and included detailed questions concerning clinical manifestations of allergies, number of devices available, training given to parents on the use of Anapen (e.g., by a health care professional who trains parents, previous use of an EAI training device by the parents, verification of the correct use of the EAI on each medical follow up), establishment of personalized care project at school and difficulties encountered, the different drugs available at home or outside the home (particularly at school), instructions given by physicians in cases of allergic reaction, and informations provided by parents to other caregivers. This part of evaluation was based on multiple-choice and true-false queries. Family socio-economic status was also assessed by a multiple-choice question. The parents were asked to list the symptoms requiring epinephrine injection through an open-ended question.

A single reviewer abstracted all information anonymously from the questionnaires. Data concerning the diagnosis of food allergies, the clinical symptoms for which the children had been referred, and the duration of the prescription of the EAI were retrieved from medical

records by the same reviewer. This study was conducted independently of the relevant pharmaceutical company.

Data were analysed with Epi Info Version 5.0 (Centers for Disease Control and Prevention, Atlanta, GA, USA).

Results

One hundred and fifty-two families of food-allergic children who had previously been prescribed an EAI between June 2000 and March 2003 were enrolled in the study. Two surveys were returned with incompleted data and then were not included in the data analysis. The reply rate was finally 73% and 109 families concerning 111 children (69 boys and 42 girls) returned completed questionnaires: 36 children aged 1–5 yrs, 48 children aged 6–10 yrs, and 27 adolescents aged 11–18 yrs. The median age was 6.5 yrs (range, 17 months to 18.1 yrs). These children were cared for by 10 pediatricians (n = 71) and two allergists (n = 40). Four pediatricians had prescribed more than 10 EAIs; four pediatricians had prescribed only two EAIs each.

The allergic disorders are summarized in Table 1. One hundred and fifty-three food allergies were recorded, with 28 children having at least two food allergies. Food allergens implicated in severe allergic reactions are detailed in Table 1. All children had a clinical history

Table 1. Characteristics of 111 food-allergic children prescribed an epinephrine auto-injector for food allergy

Characteristics of patients	Number of patients (% of 111 children)	Main food allergen
Personal history of:		
Asthma	65 (59%)	Peanut (n = 42)
Associated with: anaphylactic shock	10 (9%)	Peanut (n = 7)
Atopic dermatitis	43 (39%)	Egg (n = 23)
Urticaria/angio-edema	59 (53%)	Peanut (n = 22)
Anaphylactic shock	15 (14%)	Peanut (n = 11)
Associated with: atopic dermatitis	9 (8%)	Peanut (n = 6)
Urticaria/angio-edema	9 (8%)	Peanut (n = 7)
Food allergens (some children had several food allergies):	n = 153	
Peanut	89 (80%)	
Egg	39 (35%)	
Cow's milk	10 (9%)	
Nuts (pistachio, cashew, hazel, pecan)	10 (9%)	
Corn	2 (2%)	
Mustard	2 (2%)	
Fish	1 (1%)	

suggestive of IgE-dependent sensitization, established by prick-tests (native food and/or allergens) and/or by the CAP System RAST, with levels of specific IgE antibodies higher than the 95% predictive positive value for some foods (10). Food allergy was confirmed by labial tests in 37 children (peanut, $n = 17$; egg, $n = 6$; nuts, $n = 10$; corn, $n = 2$; mustard, $n = 2$) and by open oral challenge tests in 60 children (peanut, $n = 28$; egg, $n = 26$; cow's milk, $n = 6$).

Prescription and use of Anapen outside the home

All the children had been prescribed the same type of ready-to-use EAI (Anapen). Seven children (6%) had been prescribed only one epinephrine device; all the others had been prescribed two devices. Of the 111 children, 51 (46%) had been prescribed another type of EAI (Epi-Pen®, Anakit®) before Anapen. The median age at which Anapen had been prescribed was 2 yrs (range, 2 months to 14 yrs). The duration of the prescription was over 6 months for all children.

An EAI was available at school for 77 (72%) of 107 schoolchildren: preschool, $n = 42$, (82%); school, $n = 23$ (72%); secondary school, $n = 12$ (55%). We did not assess all allergic reactions that had occurred since the prescription of Anapen. However, only one child, a girl with facial angio-edema and dyspnea after inadvertent ingestion of egg at home had been injected Anapen with a good outcome.

Parents' knowledge about Anapen

The use of Anapen had been demonstrated to 97 of 109 (90%) families (at least one parent in the family) by the physician prescribing the EAI ($n = 67$, 69%), by a pharmacist ($n = 24$, 25%), by a general practitioner ($n = 5$, 5%), or by a

nurse ($n = 1$, 1%). The use of Anapen was demonstrated with a trainer to 84 of 111 (76%) patients, and with written instructions to 54 (49%) patients. The demonstration was repeated at each medical follow-up visit for only 19% of families. Twelve (10%) parents reported that the use of Anapen had never been demonstrated to them. However, 96 (88%) parents stated that they knew how to use Anapen in cases of emergency. We also assessed quality of education and instructions given to parents by physicians compared to allergists and by physicians prescribing more than 10 devices ($n = 4$) compared to those prescribing less than 10 devices ($n = 8$). There were no difference between these groups for the following items: emergency kit available at school and at home, written emergency plan available, demonstration of epinephrine device done by the physician himself (Table 2).

When parents were asked to describe the symptoms requiring epinephrine injection, only 48% of the 109 parents were able to cite more than one usual symptom (Table 3). The assessment of parental knowledge regarding the use and availability of EAIs is summarized in Table 3. There were no difference among familial socio-economic status for parental knowledge regarding the use and availability of EAI, availability of emergency kit at school or at home. β -agonist had not been systematically prescribed in the emergency kit available at school, even among asthmatic children: 34 (32%) of 107 school children, 13 of whom were asthmatic, had no β -agonist at school.

Arrangement with emergency kit and personalized care project outside the home

One hundred and seven children (96%) attended school (preschool, $n = 42$; school, $n = 23$;

Table 2. Instructions given by 12 physicians (10 pediatricians and 2 allergists) for 111 children with food allergy

N	Pediatrician (P) or allergist (A)	Food-allergic children cared for (n)	No demonstration of EIA	Emergency kit available at school	Emergency kit available at home	Written emergency treatment plan
1	A	35	9%	60%	66%	80%
2	A	5	0	80%	80%	80%
3	P	21	14%	47%	90%	86%
4	P	15	20%	73%	93%	80%
5	P	11	18%	55%	91%	73%
6	P	8	13%	38%	100%	100%
7	P	5	20%	60%	100%	60%
8	P	3	33%	67%	100%	100%
9	P	2	0	50%	100%	100%
10	P	2	0	100%	100%	100%
11	P	2	0	100%	100%	100%
12	P	2	0	100%	100%	100%

EIA, epinephrine auto-injector.

Table 3. Knowledge of parents regarding the use of the EAI Anapen prescribed for 111 food-allergic children

	Number (% of 111 children)
Indications for use of the EAI:	
Face swelling with cough or breathing difficulties	45 (41%)
Breathing difficulties or asthma	25 (23%)
Collapse or feeling of faintness	42 (38%)
Anaphylactic shock	53 (48%)
Storage of the EAI:	
At room temperature	95 (86%)
In the refrigerator	6 (5%)
EAI availability:	
At school	77 (72%)
During familial trips	95 (86%)
During school trips	59 (53%)
During leisure activities	61 (55%)
In restaurants	73 (66%)
Emergency kit (corticosteroids, anti-H1 drug, EAI) availability:	
At school	67 (60%)
At home	94 (85%)

EAI, epinephrine auto-injector.

secondary school, $n = 22$). The conditions under which meals were taken were diverse (seven families did not answer this question): exclusively at home ($n = 58$, 52%); at home or at school ($n = 38$, 34%) with a meal prepared by the parents ($n = 27$, 24%) or with school lunches ($n = 11$, 10%); at home or with other caregivers ($n = 8$, 7%). Ten (9%) families reported that they had encountered some difficulties at school because of food allergies, which required them to move to another school.

Written medical instructions on what to do in case of an allergic reaction had been given by the physician to 92 (83%) families. Only 64 (54%) of the children who attended school had a personalized care project. When children had personalized care projects, they had been discussed with the general practitioner ($n = 63$, 57%) and/or with the school physician ($n = 60$, 54%). Thirteen (11%) children had an EAI available at school with no personalized care project. Children who had their lunch at school had no personalized care project more often than children who had their lunches at home ($p = 0.71$). A personalized care project had been refused by the school for four (4%) of these 107 schoolchildren, for the following reasons: the school physician declined to validate the personalized care project ($n = 2$), and the head teacher refused to create the document in preschool ($n = 2$). The reasons for not establishing personalized care project for the other children were not evaluated in our study. Personalized care project were more often used for asthmatic children than for non-

asthmatic children ($p = 0.03$). Personalized care project use was not significantly associated with the following parameters: history of anaphylaxis ($p = 0.84$), food allergy confirmed by oral challenge test ($p = 0.32$) or by labial challenge test ($p = 0.08$). Most families (98%) were used to give the emergency treatment plan to caregivers.

Discussion

In this study, we have demonstrated clear deficiencies in the use of EAIs after prescription and in parents' knowledge of its appropriate use in food-allergic children at risk of life-threatening reactions. At school, personalized care project were not established for all food-allergic children, even when EAIs were available at school.

This study does not address the actual controversy concerning the putative over-prescription of EAIs, the inadequate indications for its prescription, and the consequent risk of the inappropriate use of epinephrine. Moreover, we did not focus on the diagnosis of food allergies. A double-blind oral challenge test is accepted as the gold standard for the diagnosis of food allergy. In our population, high levels of specific IgE antibodies, identified in previously published studies, permitted diagnosis without oral challenge tests for 61% of food allergens (10).

Anapen is an easy-to-use, sterile, pre-measured single-dose auto-injector of epinephrine. Until July 2004, Anapen had only been dispensed in France by hospital pharmacists. The total volume in each auto-injector is 1 ml, of which 0.3 ml is injected intramuscularly when the device is used correctly. Anapen is available in two forms: Anapen 0.05% (0.15 mg/0.3 ml) for children weighing less than 20 kg, and Anapen 0.1% (0.3 mg/0.3 ml) for those weighing more than 20 kg. The information provided about Anapen in the package inserts distributed with the device states: 'Store in a dark place at room temperature ($< 30^{\circ}\text{C}$). Do not refrigerate. Check expiry date.'

Grouhi et al. reported that only 25% of 122 physicians were able to demonstrate the different steps of epinephrine injection (11). This was also reported by Sicherer et al. (12), but was not evaluated in our study. Moreover, most physicians (81%) did not have a placebo auto-injector training device and performed poorly in training patients, if they trained them at all (11). In our study, the use of Anapen was demonstrated with a training device in 76% of cases and was repeated on each medical follow-up visit in 19% of cases. The fact that 10% of 109 families had never seen a demonstration of Anapen injection is worrying, but is consistent with the

results of previous studies (13). The infrequent medical demonstration of the EAI to parents has often been reported: 8%–25% by physicians and allergists (14), 49% by pediatricians (12). In our study, half of the physicians habitually provided written instructions for the use of the device. Sicherer et al. reported that only 24% of physicians did likewise and that the use of EAIs was most often verbally explained (12).

Parents did not really know the emergency circumstances that required epinephrine injection: only 48% of 109 parents were able to list more than one relevant symptom. However, the way this question was asked (open ended question) may have caused a bias in the responses. It may be an erroneous over-emphasis of this deficiency in knowing when to use EAI.

In this study, we did not assess patients' knowledge of the use of Anapen. It has been reported that patients may not operate the EAI properly (12–14), as is also true of metered-dose inhalers for asthma (15, 16). Although parents readily informed other caregivers that their child was at risk of severe allergic reactions, all measures were not always in place to ensure access to epinephrine and inhaled β -agonists, particularly at school but even during familial activities (restaurants and sport). This trend has also been reported in other studies (7, 12). Among Sicherer et al., 29% of families failed to carry an EAI with them outside the home (12).

The French authorities recommend the creation of personalized care project at school for food-allergic children at risk of severe reactions (17). These documents specify the hazardous food and provide information concerning the symptoms of allergic emergencies and a protocol for personalized care with details for the use of the EAI, oral corticosteroids, β -agonists, and anti H1 drugs. The protocol is set up by the pediatrician or allergist making the initial diagnosis. Then, a request for implementation of the personalized care project is made by the family to the public health physician in charge of the school. The personalized care project is implemented by the school officials and countersigned by the physician and parents. In our study, only half the children had an EAI at school together with a personalized care project. The complexity of the procedure and the investment in time and manpower might be the main reasons that a personalized care project is not established.

In our study, β -agonists were not often prescribed in emergency kits, even among asthmatic children. Asthmatic symptoms in fatal food-allergic reactions has been reported (5, 18). Asthma is a cause of death due to food-induced

anaphylaxis (5). Difficulty in breathing was noted in 86% of fatal reactions in food-induced anaphylaxis (18). Food allergy is a significant risk factor for life-threatening asthma (19). Furthermore, epinephrine alone is not sufficient treatment for serious acute asthma (18). The addition of inhaled β -agonists in the emergency kit is advisable for children with food allergies, even those without a previous history of asthma (20). This therapy has fewer adverse effects and is more acceptable to non-medical caregivers.

Epinephrine was injected with Anapen on only one occasion in our study, which was surprisingly infrequent because unexpected exposure to allergens is inevitable. Epinephrine is administered for only a minority of anaphylactic reactions, even when injectable epinephrine is available and in date (7). Epinephrine was administered in only 17 of the 95 episodes of anaphylaxis occurring in the 76 children assessed in a previous study (21). The reasons for the infrequent use of epinephrine require further study. However, our study suggests that parents were poorly informed of the correct indications for epinephrine injection.

In our study, nearly all children were cared for at specialized centres, which may have influenced the management of their food allergies. This may constitute a bias in our study, and may explain the rather good management of food allergies observed compared with those described in previous studies. Blyth and Sundrum reported that training in the use of EAIs and written advice provided ranged from 67% to 86% in tertiary allergy clinics and from 0% to 33% among general practitioners (22). Furthermore, the characteristics of the families who agreed to take part in this study are likely to be different from those who did not. It may be that non-respondents were less motivated and even less well informed than respondents.

Based on the results of this study, several recommendations can be made concerning the prescription of EAIs. Indications for prescribing EAIs should always be in accordance with the recommendations of ad hoc committees, so that EAIs are not under- or over-prescribed (8, 9, 17). This study stresses the need for better education of parents and physicians concerning the use of EAIs, the need for emergency kits available at home and at school, and the need for verbal and written instructions about when and how to use these emergency kits. The inclusion of an inhaled β -agonist in an emergency kit that also contains an EAI, oral corticosteroid, and anti-H1 drug should be considered, particularly for asthmatic children. Parents should have the opportunity to

practice with an EAI training device and inhaled β -agonist, and to review the technique frequently. Verbal and written instructions regarding the indications for using these medications should be reviewed. Schools, caregivers, and school physicians should receive the same training. The inclusion of information concerning these devices in courses for physicians should be encouraged. Personalized care project are required for children treated with EAI at school, and should entail the collaboration of school physicians, teaching staff, and the physicians making the initial diagnoses. Personalized care project at school should be encouraged for all food-allergic children at risk of severe reactions. Further studies are warranted to evaluate the usefulness of guidelines and of personalized care project at school in the prevention of severe food-allergic reactions.

In conclusion, this study has shown some problems encountered with epinephrine in food allergic children. More studies to create consensual and comprehensive evidence based recommendations for first and self-management of anaphylaxis in the community are needed. Physicians should instruct patients, and regularly re-evaluate the risk and the knowledge of the patient regarding the management of food allergy. The prescription of EAI should always be done in the context of emergency plan, along with education, instruction to avoid the food at risk and other preventive measures.

Acknowledgments

We thank the families and physicians who kindly participated in this study: L Delbecque, MD; M Chenaud, MD; C Lamblin, MD.

References

1. RANCE F, GRANDMOTTET X, GRANDJEAN H. Prevalence and main characteristics of schoolchildren diagnosed with food allergies in France. *Clin Exp Allergy* 2005; 35: 167–72.
2. MONERET-VAUTRIN DA, MORISSET M, FLABBE J, BEAUDOUIN E, KANNY G. Epidemiology of life-threatening and lethal anaphylaxis: a review. *Allergy* 2005; 60: 443–51.
3. BOCK SA, MUNOZ-FURLONG A, SAMPSON HA. Fatalities dues to anaphylactic reactions to foods. *J Allergy Clin Immunol* 2001; 107: 191–3.
4. WÜLTHRICH B. Lethal or life-threatening allergic reactions to food. *Invest Allergol Clin Immunol* 2000; 32: 237–41.
5. SAMPSON HA, MENDELSON L, ROSEN JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. *N Engl J Med* 1992; 327: 380–4.
6. LIEBERMAN P, KEMP SF, OPPENHEIMER J, et al. The diagnosis and management of anaphylaxis: an updated practice parameter. *J Allergy Clin Immunol* 2005; 115: S483–523.
7. GOLD MS, SAINSBURY R. First aid anaphylaxis management in children who were prescribed an epinephrine autoinjector device (EpiPen). *J Allergy Clin Immunol* 2000; 106: 171–6.
8. McLEAN-TOOKE APC, BETHUNE CA, FAY AC, SPICKETT GP. Adrenaline in the treatment of anaphylaxis: what is the evidence? *BMJ* 2003; 327: 1332–5.
9. RANCÉ F. La prescription d'adrénaline dans les allergies alimentaires de l'enfant: doit-elle être systématique? *Rev Fr Allergol Immunol Clin* 2001; 41: 644–50.
10. SAMPSON HA. Update on food allergy. *J Allergy Clin Immunol* 2004; 113: 805–19.
11. GROUHI M, ALSHEHRI M, HUMMEL D, ROIFMAN CM. Anaphylaxis and epinephrine auto-injector training: who will teach the teachers? *J Allergy Clin Immunol* 1999; 104: 190–3.
12. SICHERER SH, FORMAN JA, NOONE SA. Use assessment of self-administred epinephrine among food-allergic children and pediatricians. *Pediatrics* 2000; 105: 359–62.
13. SABROE RA, GLENDINNING AK, SABROE I, LAWLOR F, KOBZA BLACK A. An audit of the use of self-administered adrenaline syringes in patients with angio-oedema. *Br J Dermatol* 2002; 146: 615–20.
14. HUANG SW. A survey of Epi-pen use in patients with a history of anaphylaxis. *J Allergy Clin Immunol* 1998; 102: 525–6.
15. MANZELLA BA, BROOKS CM, RICHARDS JM Jr, WINDSOR RA, SOONG S, BAILEY WC. Assessing the use of metered dose inhalers by adults with asthma. *J Asthma* 1989; 4: 223–30.
16. CHIANG AA, LEE JC. Misunderstanding about inhalers. *N Eng J Med* 1994; 330: 1690–1.
17. DIDIER A, et al. Commission tripartite. Conditions to establish a project for individualized management at school of children at risk for food allergy emergencies. *Rev Fr Allergol* 2003; 43: 415–8.
18. PUMPHREY RS. Lessons for management of anaphylaxis from a study of fatal reactions. *Clin Exp Allergy* 2000; 30: 1144–50.
19. ROBERTS G, PATEL N, LEVI-SCHAEER F, HABIBI P, LACK G. Food allergy as a risk factor for life threatening asthma in childhood: a case-controlled study. *J Allergy Clin Immunol* 2003; 112: 168–74.
20. MONERET-VAUTRIN DA, KANNY G, MORISSET M, et al. Food anaphylaxis in schools: evaluation of the management plan and the efficiency of the emergency kit. *Allergy* 2001; 56: 1071–6.
21. NOVEMBRE E, CIANFERONI A, BERNARDINI R, et al. Anaphylaxis in children: clinical and allergologic features. *Pediatrics* 1998; 101: E8.
22. BLYTH TP, SUNDRUM R. Adrenaline autoinjectors and schoolchildren: a community based study. *Arch Dis Child* 2002; 86: 26–7.