

ORIGINAL ARTICLE

Primary school teachers' knowledge about and attitudes toward anaphylaxis

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Abstract

Background: One in 10,000 children experiences an anaphylactic attack, every year. It has been demonstrated that 82% of these attacks occur in children of school age and that most of the attack-related deaths have occurred in schools. In this study, we aimed to investigate primary school teachers' knowledge about and attitudes toward anaphylaxis.

Method: A total of 237 teachers were questioned: 91 working in elementary state schools and 146 in private schools. A questionnaire was completed to obtain data on their knowledge of anaphylaxis and the availability of emergency treatment facilities in schools.

Results: Fifty-two percent of the teachers knew which students had an allergic disease. When questioned about agents that can potentially cause anaphylaxis, the most significant causes were thought to be pollen by 54% of the teachers, food by 47%, mites by 40%, and drugs by 30%. Of foods, eggs (30.4%) and strawberries (25.3%) were thought to be the two leading causes. The teachers' responses on what would be their initial reaction in the event of an anaphylactic reaction were: he/she would give first aid in 24.3%, notify the school nurse in 39.7%, and call the emergency services in 19.8%. Only 10% were aware of an epinephrine autoinjector, and only 4% knew where to apply it. While 28% of the teachers reported that they had been informed about anaphylaxis previously, most had formed their ideas from brochures or the media. While 25% of the teachers knew all of the symptoms of anaphylaxis, 54% knew some, and 21% none. Only 6% of the teachers reported that there was a management plan for anaphylaxis in their schools.

Conclusion: This study shows that primary school teachers are not well informed about anaphylaxis. Teachers should be given training on the subject, and there should be a re-evaluation of school and health policies with a wider global perspective. There is an urgent need to inquire into the allergy management plans and policies in schools and to develop teacher education organizations on the subject.

Anaphylaxis is a rapidly developing and life-threatening generalized or systemic hypersensitivity reaction (1). One in 10,000 children has an anaphylactic attack per year. Approximately 82% of such episodes occur in school-age children (2). Previous studies have reported that 24% of children with history of anaphylaxis have their first episode at school (3). In school-age children, anaphylaxis is most commonly caused by foods such as peanuts, tree nuts, and cow's milk as well as insect stings, drugs, latex rubber, and exercise (4, 5). Even though anaphylactic reactions are relatively rare in school

settings, in recent years, with the increasing prevalence of allergy, school-age children are at a higher risk of anaphylaxis (6, 7). However, schools are not well prepared for these risks. Despite the implementation plan for potential allergic diseases at school, published by the Task force on the allergic child at school (TACS) 2009, thorough preparation has not been undertaken around the world, particularly in developing countries (8). Previous studies have reported that one in every three school-age children has an allergic disease. However, there is no action plan, known or implemented, for

allergic diseases so far (7, 9). In developing countries where there is a small number of school nurses and infirmaries, teachers spend the most time with children. It is not known whether teachers, especially those working in classrooms and schools, are familiar with anaphylaxis. This study was performed to ascertain whether teachers who may see cases with anaphylaxis in their daily practice have adequate information about the symptoms, signs, and management of anaphylaxis.

Materials and methods

From a random selection of schools, a total of 91 teachers working in state schools and 146 teachers working in private schools were given a questionnaire designed to assess their knowledge of anaphylaxis and emergency treatment facilities in schools. The students attending state schools were from low- and moderate-income families, whereas students attending private schools were from high-income families. Approval for the study was obtained from the Local Ethics Committee. Permission was granted by the school administration for the questionnaire study, and the questionnaires were signed by the teachers. The questions were detailed and contained all the information that a teacher should know to be able to understand, intervene, and administer appropriate first-step treatment for all kinds of anaphylactic reactions, such as whether the teachers knew which students have allergies, symptoms, and causes of anaphylaxis, whether the school has an anaphylaxis action plan, the first reaction of a teacher to children in the event of a serious allergic reaction, the knowledge of teachers about epinephrine. The questionnaire is shown in Table S1.

Statistical analysis

The results are presented as mean $\pm$ standard deviation (s.d.), median, or number and percentage of children as appropriate. The Mann–Whitney *U*-test and chi-square tests were used to assess the significance of differences between the state school and private school teachers. The level of statistical significance was set at $p < 0.05$. Statistical analysis was performed by the SPSS 16.0 (Chicago, IL, USA) computer program.

Results

The analysis of the study was based on the responses of 237 teachers who completed the questionnaire. The mean duration of the teachers' pedagogic life was 11.1 ± 9.7 years (Table 1). Of all participants, 49.4% reported that they previously had students with a history of an acute allergic reaction (63.0% for private school teachers versus 27.5% for the state school teachers, $p < 0.001$). In total, 53.2% of participating teachers were aware of which students had an allergic disease (71.9% for private school teachers versus 23.1% for the state school teachers, $p < 0.001$). Twenty-eight percent of the teachers stated that they had previously been informed about anaphylaxis; the most commonly mentioned tools were booklets and the media. Twenty-five percent of the teachers were aware of all the symptoms of anaphylaxis; 54% were aware

Table 1 Teachers' experience on children with anaphylaxis

	Overall n = 237 n (%)	Type of the school the teachers work		p
		Public school teachers n = 91 n (%)	Private school teachers n = 146 n (%)	
How long have you been a teacher (years)	11.1 $\pm$ 9.7	10.6 $\pm$ 6.1	11.4 $\pm$ 11.4	>0.05
Have you ever had a student having an serious allergic reaction?				
Yes	117 (49.4)	25 (27.5)	92 (63.0)	<0.001
Have you ever seen someone having an serious allergic reaction?				
Yes	54 (22.8)	20 (22.0)	34 (23.3)	>0.05
Do you know of which of your students have allergies?				
Yes	126 (53.2)	21 (23.1)	105 (71.9)	<0.001
Are you aware of the symptoms of a serious allergic reaction?				
No	50 (21.1)	24 (26.4)	26 (17.8)	0.001
Aware of all of the symptoms	58 (24.5)	12 (13.2)	46 (31.5)	
Aware of some of the symptoms	129 (54.4)	55 (60.4)	74 (50.7)	
Have you been informed about anaphylaxis before?				
Yes	67 (28.3)	24 (26.4)	43 (29.5)	>0.05
How were you informed?				
Booklet	25 (37.3)	7 (29.2)	18 (42.0)	>0.05
Seminar	15 (22.4)	5 (20.8)	10 (23.0)	
Internet	12 (17.9)	3 (12.5)	9 (21.0)	
Media	15 (22.4)	9 (37.5)	6 (14.0)	

of some of the symptoms; the remainder were aware of none (Table 2). Causes of anaphylaxis were reported as pollens by 54%, foods by 47%, mites by 40%, and medications by 30%. Among the foods, eggs (30.4%) and strawberries (25.3%) were ranked first and second, whereas only 7.2% of the teachers mentioned nuts and peanuts as the potential causes of allergic reactions. In addition, 37.1% and 57.8% of the teachers reported exercise and rubber as causes of anaphylaxis, respectively. The responses of teachers on questions about treatment of anaphylaxis are shown in Table 3. Eighty-four percent of the teachers, irrespective of the schools where they worked, believed that children with life-threatening allergies should wear something alerting others to their allergy. Only 24.5% of the teachers reported that he/she would deliver emergency first aid in the event of an anaphylaxis. The most commonly reported first intervention was calling the emergency services in state school teachers and notifying school nurses in private school teachers. Of all participants, 93.7% reported that he/she did not know the initial drug to be used in the event of a serious allergic reaction, whereas those who thought they knew cited antihistamines and/or salbutamol. None of the teachers reported epinephrine as the first drug to be used for anaphylaxis. Only 10% were aware of an epinephrine autoinjector, and only 4%

Table 2 Teachers' knowledge about symptoms and causes of anaphylaxis

	Overall n = 237 n (%)	Type of the school the teachers work		p
		Public school teachers n = 91 n (%)	Private school teachers n = 91 n (%)	
What type of substances can cause a severe allergic reaction?				
Pollen	135 (57.0)	54 (59.3)	81 (55.5)	>0.05
Food	107 (45.1)	43 (47.3)	64 (43.8)	>0.05
Mite	101 (42.6)	36 (39.6)	65 (44.5)	>0.05
Medications	80 (33.8)	31 (34.1)	49 (33.6)	>0.05
Is exercise one of the causes of serious allergic reactions?				
Yes	88 (37.1)	22 (24.2)	66 (45.2)	0.001
No	103 (43.5)	52 (57.1)	51 (34.9)	
No idea	46 (19.4)	17 (18.7)	29 (19.9)	
Is rubber one of the causes of serious allergic reactions?				
Yes	137 (57.8)	55 (60.4)	82 (56.2)	>0.05
No	72 (30.4)	29 (31.9)	43 (29.5)	
No idea	28 (11.8)	7 (7.7)	21 (14.3)	
What type of foods can cause a serious allergic reaction?				
Egg	72 (30.4)	43 (47.3)	29 (19.9)	0.01
Milk	26 (11.0)	11 (12.1)	15 (10.3)	>0.05
Strawberry	60 (25.3)	24 (26.4)	36 (24.7)	0.059
Peanuts, nuts, walnuts	17 (7.2)	9 (9.9)	8 (5.5)	>0.05
Meat	3 (1.3)	3 (3.3)	0 (0.0)	>0.05

knew where to apply it. Only 6% of the teachers, all working in private schools, reported that there was an action plan for the management of anaphylaxis in their school.

Discussion

Our findings demonstrate that teachers are not well informed about anaphylaxis. The majority of them appeared to be incompetent of recognizing the symptoms of anaphylaxis, were unaware of epinephrine, and lacked the self-confidence to deliver emergency first aid in the event of an anaphylactic reaction. Moreover, the teachers were mostly unaware of whether their school had an action plan for the management of anaphylaxis.

The leading causes of anaphylaxis in children are allergies to foods, stinging insects, and medications (10). In recent years, there have also been reports of exercise-induced anaphylaxis (10). With the increase in prevalence of food allergies over the past several years, there have been many more students under the risk of life-threatening allergic reactions in the school system (11–13). Among children with food allergy, 16–18% have experienced a reaction in school (14, 15). Moreover, 24% of allergic reactions have occurred in individuals who had no history of allergies (3), and 25% of children with peanut allergies have experienced their first reaction in school (15). These findings emphasize the need for schools to have a

Table 3 Teachers' knowledge about management of anaphylaxis

	Overall n = 237 n (%)	Type of the school the teachers work		p Value
		Public school teachers n = 91 n (%)	Private school teachers n = 146 n (%)	
What is the initial action to do in the event a serious allergic reaction ?				
I place him/her on a flat surface and perform the first intervention.	58 (24.5)	25 (27.5)	32 (22.0)	<0.001
I notify his/her family	23 (9.7)	11 (12.1)	12 (8.3)	
I call 112 emergency service	47 (19.8)	41 (45.1)	6 (4.2)	
I take him/her to a hospital immediately	15 (6.3)	10 (11.0)	5 (3.5)	
I notify the school nurse	94 (39.7)	4 (4.3)	90 (62.0)	
Should children with serious allergies wear something alerting others to their allergy ?				
Yes	199 (84.0)	78 (85.7)	121 (82.9)	>0.05
What is the initial drug to be used in the event of a life threatening allergic reaction?				
No idea	222 (93.7)	91 (100)	131 (89.7)	0.007
Antihistamines	8 (3.4)	0	8 (5.6)	
Salbutamol inhalation	7 (3.0)	0	7 (4.7)	
Have you ever heard of epinephrine as a drug?				
Yes	122 (51.5)	56 (61.5)	66 (45.2)	0.016
Have you ever heard of an autoinjector?				
Yes	24 (10.1)	10 (11.0)	14 (9.6)	>0.05
Do you know how to use an autoinjector?				
Yes	16 (6.8)	4 (4.4)	12 (8.2)	>0.05
How should adrenaline be administered?				
No idea	222 (93.7)	83 (91.2)	139 (95.2)	>0.05
Subcutaneous	1 (0.4)	1 (1.1)	0 (0.0)	
Intramuscular	9 (3.8)	3 (3.3)	6 (4.1)	
Intravenous	5 (2.1)	4 (4.4)	1 (0.7)	
Is there an action plan to be used in the event of a serious allergic reaction in your school?				
Yes	14 (5.9)	0 (0.0)	14 (9.6)	<0.001
No	204 (86.1)	90 (98.9)	114 (78.1)	
No idea	19 (8.0)	1 (1.1)	18 (12.3)	
What is the correct order of actions to take in the event of a life threatening allergic reaction?				
He/she could make the correct order	24 (10.1)	8 (8.8)	16 (11.0)	>0.05
He/she could not make an order at all	129 (54.4)	44 (48.4)	85 (58.2)	

Table 3 (Continued)

	Overall n = 237 n (%)	Type of the school the teachers work		p Value
		Public school teachers n = 91 n (%)	Private school teachers n = 146 n (%)	
He/she could make the order without the administration of adrenaline	57 (24.1)	25 (27.5)	32 (21.9)	
He/she administered adrenaline but the order was incomplete	27 (11.4)	14 (15.4)	13 (8.9)	
Are the emergency medications to be used in the event of a serious allergic reaction available in your school?				
Yes	75 (31.6)	2 (2.2)	73 (50.0)	<0.001
No	116 (48.9)	88 (96.7)	28 (19.2)	
I do not know	46 (19.4)	1 (1.1)	45 (30.8)	

protocol designed to activate Essential School Health Services immediately, by which school staff are trained to identify the symptoms of and initiate the action plan for the management of anaphylaxis. It is also recommended that all schools have backup supplies of epinephrine autoinjectors (3).

In our study only about one-third of the teachers had been informed about anaphylaxis, mainly by means of booklets and media. The majority of the teachers were unable to identify the causes of anaphylaxis and reported that they were devoid of basic skills to initiate an action plan for its management. Only 10% of the teachers reported having heard of an epinephrine autoinjector, whereas none pointed out epinephrine as the initial drug. In our study, the use of a non-validated questionnaire and reliance on the teachers' self-reports might pose a limitation to assess whether schools have action plans for the prevention and management of anaphylaxis. More studies are needed to inquire about schools' policies on the subject.

Many cases of fatalities owing to allergic reactions have occurred in schools and were associated primarily with significant delays in administering epinephrine (6, 16, 17). Nonetheless, the level of priority and the importance that each school places on the condition may vary; sometimes, anaphylaxis may be perceived as just one of the many problems that schools have to deal with. The fact that significant delays in administration of epinephrine are associated with fatalities,

and prompt administration is advantageous and necessitates that schools seriously take part in the management of children with potential life-threatening allergies. In our study, only 6% of teachers reported that an anaphylaxis action plan was available in their schools, all of which were private schools. The teachers working in state schools were totally unaware of such action plans. Several studies from developed countries have also identified significant defects in school preparedness to treat students with anaphylaxis in one or more of the essential steps: precautions to prevent allergic reactions; initiate a management plan in case of such events; provide written student-specific emergency plans for staff; supply of physician's order or availability of epinephrine in schools for administration (14, 15, 18–20). The improper handling of epinephrine in children with anaphylaxis (21) and the high percentage of mistakes in epinephrine autoinjector use even among physicians illustrate that more effort should be exercised to educate caregivers in the correct use of epinephrine (22).

Several school guidelines endorsed by professional organizations have proposed models to incorporate multidisciplinary care (23). The primary approach is aimed to organize all those who may have a supervisory role for a child at any time before, during, or after the school day to develop an individualized healthcare plan. Schools may establish a core team involving the school nurse, teacher, principal, school food service and nutrition manager/director, and a counselor to work with parents and the student to establish an action plan. As many state schools do not have school nurses on site, often the teachers have the responsibility for the care of the students, which poses significant challenges. Emergency action plans in these circumstances should be individualized according to the abilities of the responsible caregivers (23). When there is no licensed healthcare professional, the action plan for the assisting person should be as simple as possible. For example, whereas a licensed health professional may be able to administer an antihistamine and observe for progression of symptoms before administering epinephrine, a non-licensed professional should not be expected to make a medical judgement. Instead, the advice may be to give the epinephrine via autoinjector and call for immediate activation of the emergency medical services (23).

In conclusion, our survey showed that primary school teachers largely fail to identify students who have allergies and have very limited knowledge about anaphylaxis. This observation prompts the need to inquire into the allergy management plans and policies in schools. National/international organizations (such as those of education, school boards, pediatric allergy, school nurses, pediatrics) should participate in the development of guidelines for school wellness committees or councils and to boards of education to help them in developing safe policies, regulations, and procedures for children with allergies.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Questionnaire: the primary school teachers' knowledge about and attitudes toward anaphylaxis.

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Supplementary Table 1. Questionnaire: The primary school teachers' knowledge about and attitudes towards anaphylaxis

1. Type of the school : Q Public School Q Private School
2. How long have you been a teacher?
3. Have you ever had a student having an serious allergic reaction ? Q yes Q no
4. Have you ever seen someone having an serious allergic reaction ? Q yes Q no
5. Do you know of which of your students have allergies? Q yes Q no
6. Are you aware of the symptoms of a serious allergic reaction? Q yes Q no
7. Have you been informed about anaphylaxis before? Q yes Q no
8. If yes for question 7; How were you informed? Q booklet Q internet Q seminars Q media
9. What type of substances can cause a serious allergic reaction? Q Pollens Q Foods Q Mites
Q Medications Q cigarette smoking Q close contact to animals Q mold
10. Is exercise one of the causes of serious allergic reactions ? Q yes Q no Q no idea
11. Is rubber one of the causes of serious allergic reactions ? Q yes Q no Q no idea
12. What type of foods can cause a serious allergic reaction?.....
13. What is the intial action to do in the event a serious allergic reaction ?
Q I place him/her on a flat surface and perform the first intervention.
Q I notify his/her family
Q I call 112 emergency service
Q I take him/her to a hospital immediately
Q I notify the school nurse
14. Should children with serious allergies wear something alerting others to their allergy ? Q yes
Q no
15. What is the initial drug to be used in the event of a life threatening allergic reaction?
Q

Q no idea

16. Have you ever heard of epinephrine as a drug ? Q yes Q no

17. Have you ever heard of an autoinjector? Q yes Q no

18. If yes for 17; Do you know how to use an autoinjector? Q yes Q no

19. How should adrenaline be administered? Q I don't know Q Subcutaneous Q Intramuscular Q Intravenous

20. Is there an action plan to be used in the event of a a serious allergic reaction in your school?
Q yes Q no Q no idea

21. What is the order of actions to take in the event of a life threatening allergic reaction?

Q placed him/her on a hard surface

Q make sure that airway is patent

Q elevate his/her legs

Q apply epinephrine autoinjector

Q call 112

Q take a Picture of the child if available

22. Are the emergency medications to be used in the event of a serious allergic reaction available in your school? Q yes Q no Q no idea