

Increasing hospital presentations for anaphylaxis in the pediatric population in Hong Kong

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Clinical Implications

- There are limited data on time trends in anaphylaxis hospital admissions among the pediatric population in Asian countries. We show that admissions due to anaphylaxis, and particularly food-related anaphylaxis, have increased significantly in Hong Kong over the past 10 years, with similar patterns to the increases previously reported in western countries.

TO THE EDITOR:

Anaphylaxis, a serious allergic condition that can lead to death,¹ has been reported to be increasing in many developed countries including Finland, Sweden,² Australia,³ Spain, UK, and USA.⁴ In Australia, the youngest age group (0-4 years) has the highest rate of both anaphylaxis and food-related anaphylaxis, yet the group aged 5 to 14 years had the highest fold increase in recent years, with food driving most of the increase in total anaphylaxis.³ Few studies of time trends in anaphylaxis have been conducted in Asian countries, and there have been no previous studies of time trends specifically in food-related anaphylaxis in Asia.⁵⁻⁷ It is therefore unclear whether food-related anaphylaxis has increased in Asia as it has in western countries. Information on food allergy prevalence in Asian countries is also limited, and food-related anaphylaxis may be useful as a surrogate marker to investigate trends in food allergy in these countries.

We investigated the incidence and time trends of hospital and emergency department admissions for anaphylaxis in the Hong Kong pediatric population between July 1, 2001, and June 30, 2015. Anaphylaxis data were obtained from the Clinical Data Analysis and Reporting System, which records data for all public hospitals in Hong Kong. Anaphylaxis was classified using the International Classification of Diseases, Ninth Revision (ICD-9) (995.0, 995.60-995.69). Previous data from these hospitals showed that using these disease codes to identify anaphylaxis had a high specificity, but a low sensitivity.⁸ We classified likely triggers of anaphylaxis based on the diagnosis codes and description. Incidence rates of anaphylaxis were calculated by using population estimates from Centre for Health Protection, Department of Health, the Government of the Hong Kong Special Administrative Region (<http://www.censtatd.gov.hk>) and expressed as rates/100,000 person-years. The first episode of anaphylaxis for each patient was captured to calculate the incidence.⁹ We estimated incidence rate ratios (IRR) and 95% confidence intervals (CI) using Poisson regression models.

Between 2001 and 2015, 523 anaphylaxis episodes in 481 patients (mean age, 11 years; range 0-18 years; 60.3% males) were identified. Increasing trends were seen both in total anaphylaxis (IRR 1.09, 95% CI 1.07-1.12, $P < .001$) and food-related anaphylaxis (IRR 1.16, 95% CI 1.11-1.22, $P < .001$) (Figure 1; Table E1, available in this article's Online Repository at www.jaci-inpractice.org). In contrast, there was a decrease in medication-induced anaphylaxis (IRR 0.95, 95% CI 0.91-0.99, $P = .013$). At the beginning of the study (2001), medication was a more common trigger for anaphylaxis than food (1.61 [95% CI 1.07-2.43] vs 0.21 [95% CI 0.07-0.65] per 100,000 person-years). By 2015, food had become the predominant trigger (1.88 [95% CI 1.22-2.88] vs 0.54 [95% CI 0.24-1.19] per 100,000 person-years for food and medication, respectively) (Figure 2). It is worth noting that the "unspecified" group is very high and also increased ($P < .001$).

The increase in anaphylaxis incidence was most pronounced in children under 15 years for total anaphylaxis and food-related anaphylaxis (Table E2, available in this article's Online Repository at www.jaci-inpractice.org). The youngest age group also had the highest incidence rate of food-related anaphylaxis (Figure 1). The incidence rate of anaphylaxis was significantly higher in boys than girls in the 5- to 14-year ($P = .001$) and 15- to 18-year ($P = .039$) age groups, whereas there was no significant gender difference in the 0- to 4-year age group (Table E3, available in this article's Online Repository at www.jaci-inpractice.org). Boys also tended to have a higher incidence rate of food-related anaphylaxis, but this difference was not statistically significant.

The most common food reported to trigger anaphylaxis was peanut, followed by seafood (fish and crustaceans), eggs, milk products, tree nuts, and seeds (in descending order) (Table E4, available in this article's Online Repository at www.jaci-inpractice.org). Peanuts accounted for 8.8% of food-related anaphylaxis cases. Anaphylaxis due to eggs was only reported in children under 4 years of age, whereas anaphylaxis caused by crustaceans was reported only in the 15- to 18-year age group.

This is the first study to report time trends in anaphylaxis in the pediatric population of Hong Kong using a database that covers all public hospitals and accident and emergency departments in Hong Kong and also the first one to show time trends in food-related anaphylaxis in Asia. According to the latest Hospital Authority Statistical Report,¹⁰ in-patients from hospital authority institutions (public hospitals) account for 78% of total in-patients in Hong Kong; therefore, we expect that this analysis captured most of the incidents of anaphylaxis in the Hong Kong population. We show an increasing incidence of anaphylaxis between 2001 and 2015, from 2.46 (95% CI 1.76-3.42) to 6.63 (95% CI 5.27-8.32) per 100,000 person-years, similar to the magnitude of increase seen western countries during this period,²⁻⁴ even though the incidence remains lower than in western countries.³ The increase in incidence appeared largest from 2012 onward, and the reasons for this warrant further exploration. We also completed a sensitivity analysis including only data before 2012, which still showed an increase in total anaphylaxis (IRR 1.05, $P = .004$) and food-related anaphylaxis

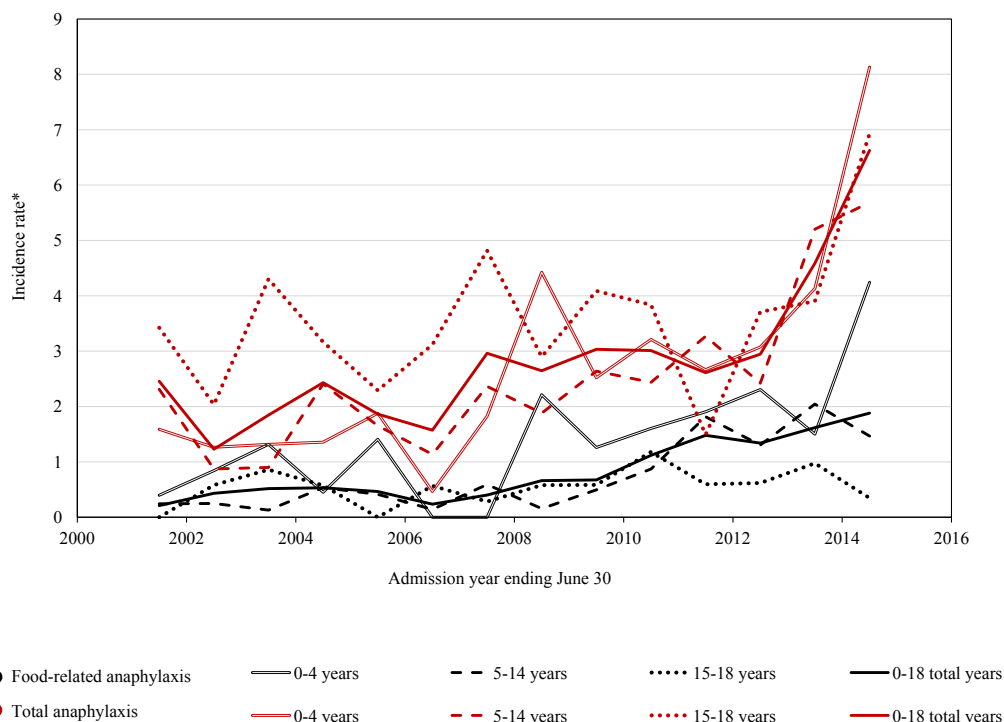


FIGURE 1. Incidence rate of hospital and emergency department admissions for anaphylaxis and food-related anaphylaxis among Hong Kong children by age group: 2001-2002 to 2014-2015. (*Incidence rate per 100,000 person-years.)

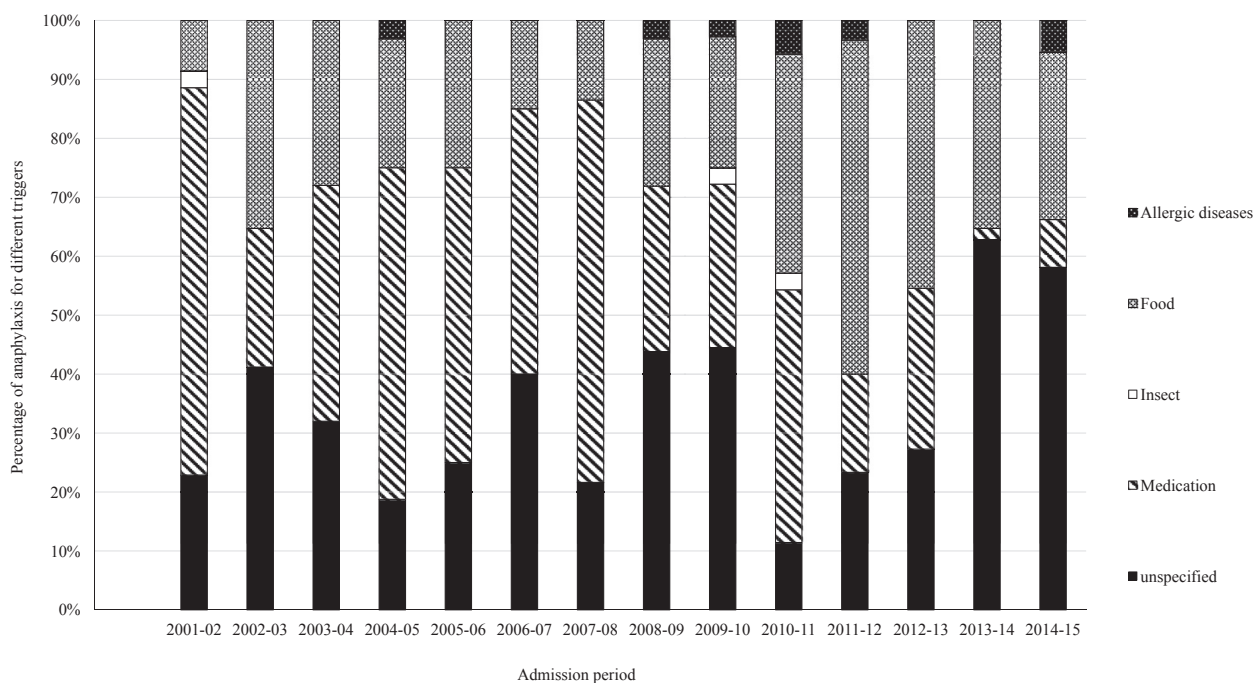


FIGURE 2. Patterns of anaphylaxis for different triggers from July 1, 2001, to June 30, 2015, in Hong Kong Population (0-18 years).

(IRR 1.16, $P < .001$). This increase appeared to be mainly attributed to increases in food-related and unspecified anaphylaxis, particularly in young children (0-4 years of age). Similar trends were seen in Australia around 10 years ago.³

Previous studies reported the most common food allergen in Hong Kong to be shellfish,¹¹ and in 2005, seafood was reported to be the most common trigger for anaphylaxis presentations in a university teaching hospital including both children and adults.¹²

However, our study found that peanut is the most common reported food trigger for anaphylaxis in children. This is somewhat surprising because peanut allergy was previously considered uncommon in Asian countries, and may reflect an increase in peanut allergy in Asia. Missing data on food triggers for a large proportion of the food cases is a limitation of the dataset and limits the conclusions that can be drawn about the relative importance of various foods.

The main strength of this study is the availability of data from all public hospitals and accident and emergency departments in Hong Kong over a 14-year period. Our study also has some limitations. It is possible that our results underestimate the true incidence of anaphylaxis because there might be cases presenting to private hospitals. We used ICD-9 to diagnose anaphylaxis, which provides consistent data over the 14-year period; however, it is possible that increasing recognition and knowledge of anaphylaxis over time could have contributed to increasing anaphylaxis diagnoses. The unspecified anaphylaxis that we cannot verify could be composed of medication-related anaphylaxis or food-related anaphylaxis, which may revise the decreasing trend of medication-related anaphylaxis or intensify increasing trend of food-related anaphylaxis.

Hospital admissions due to anaphylaxis, and particularly food-related anaphylaxis, have increased significantly in Hong Kong over the past 10 years, with similar patterns to the increases previously reported in western countries.

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TABLE E1. Incidence rates of anaphylaxis by trigger from July 1, 2001, to June 30, 2015, in Hong Kong Children (0-18 years of age)

Year	Food		Medication		Insect		Unspecified		Total	
	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*	No.	Rate*
2001-2002	3	0.21	23	1.61	1	0.07	8	0.56	35	2.46
2002-2003	6	0.43	4	0.29	0	0	7	0.51	17	1.23
2003-2004	7	0.52	10	0.74	0	0	8	0.59	25	1.85
2004-2005	7	0.53	18	1.37	0	0	7	0.53	32	2.43
2005-2006	6	0.47	12	0.93	0	0	6	0.47	24	1.86
2006-2007	3	0.24	9	0.71	0	0	8	0.63	20	1.57
2007-2008	5	0.40	24	1.92	0	0	8	0.64	37	2.96
2008-2009	8	0.66	9	0.74	0	0	15	1.24	32	2.64
2009-2010	8	0.67	10	0.84	1	0.08	17	1.43	36	3.03
2010-2011	13	1.12	15	1.29	1	0.09	6	0.52	35	3.01
2011-2012	17	1.48	5	0.44	0	0	8	0.70	30	2.61
2012-2013	15	1.34	9	0.80	0	0	9	0.80	33	2.95
2013-2014	18	1.62	1	0.09	0	0	32	2.88	51	4.59
2014-2015	21	1.88	6	0.54	0	0	47	4.21	74	6.63
<i>P</i> value	<.001		.013		.827		<.001		<.001	
IRR 95% CI	1.16 (1.11-1.22)		0.95 (0.91-0.99)		0.97 (0.73-1.29)		1.18 (1.13-1.23)		1.09 (1.07-1.12)	

CI, Confidence interval; IRR, incidence rate ratio.

*Incidence rate per 100,000 person-years.

TABLE E2. Incidence cases of total anaphylaxis and food-induced anaphylaxis by different age groups from July 1, 2001, to June 30, 2015, in Hong Kong

Year	Total anaphylaxis			Food-induced anaphylaxis		
	0-4	5-14	15-18	0-4	5-14	15-18
2001-2002	4	19	12	1	2	0
2002-2003	3	7	7	2	2	2
2003-2004	3	7	15	3	1	3
2004-2005	3	18	11	1	4	2
2005-2006	4	12	8	3	3	0
2006-2007	1	8	11	0	1	2
2007-2008	4	16	17	0	4	1
2008-2009	10	12	10	5	1	2
2009-2010	6	16	14	3	3	2
2010-2011	8	14	13	4	5	4
2011-2012	7	18	5	5	10	2
2012-2013	8	13	12	6	7	2
2013-2014	11	28	12	4	11	3
2014-2015	23	31	20	12	8	1
<i>P</i> value*	<.001	<.001	.091	<.001	<.001	.271
IRR 95% CI	1.15 (1.08-1.21)	1.11 (1.07-1.15)	1.03 (0.99-1.07)	1.15 (1.07-1.24)	1.21 (1.13-1.29)	1.06 (0.96-1.16)

CI, Confidence interval; IRR, incidence rate ratio.

**P* value calculated by using annual population data from Centre for Health Protection, Department of Health, Hong Kong.

TABLE E3. Sex difference in incidence rates for anaphylaxis and food-related anaphylaxis in Hong Kong children (0-18 years of age), 2000-2001 to 2014-2015

Age group	Rate ratio male: female sex (95% CI)	
	Anaphylaxis (total)	Food-related anaphylaxis
0-4	1.17 (0.78-1.75)	1.05 (0.60-1.84)
5-14	1.60 (1.21-2.11) (<i>P</i> = .001)	1.30 (0.79-2.15)
15-18	1.38 (1.02-1.88) (<i>P</i> = .039)	2.41 (0.93-4.92)
0-18 total	1.43 (1.19-1.71) (<i>P</i> < .001)	1.32 (0.94-1.85)

CI, Confidence interval.

Bold indicates statistical significance (*P* < .05).**TABLE E4.** Food triggers for food-related anaphylaxis in Hong Kong pediatric patients

Food triggers	0-4 y n	5-14 y n	15-18 y n	Total n
Unspecified food	12	24	14	50
Poison food	14	25	6	45
Peanuts	6	6	0	12
Crustaceans	0	0	4	4
Fruits and Vegetables	2	0	0	2
Tree nuts and seeds	2	1	1	4
Fish	2	2	1	5
Food additives	0	2	0	2
Milk products	3	2	0	5
Eggs	8	0	0	8
Total	49	62	26	137

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