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Original article

Allergic rhinitis in children in pneumo-allergology consultation at the Teaching Hospital Campus of Lomé (Togo)

Mawouto Fiawoo[1,2,3], Nadiedjoa Kokou Douti[1,4], Manani Hemou[4], Koko Lawson-Evi[1,4], Kokoe Bénédicte Kangni[4], Mananté Kamaga[4], Dzayisse Yawo Atakouma[1,2]

[1]Faculty of Health Sciences, University of Lomé, Lomé, Togo
[2]Department of Pediatrics, Lomé Sylvanus Olympio Teaching Hospital, Lomé, Togo
[3]Department of Pediatrics, Kpalimé Hospital Center, Kpalimé, Togo
[4]Department of Pediatrics, Lomé Campus Teaching Hospital, Lomé, Togo

Abstract

Background: Allergic rhinitis (AR) is one of the most common chronic pathologies in children. The objective of this study was to determine the prevalence of AR in children undergoing pneumo-allergology consultation at the Teaching Hospital Campus of Lomé (Togo).

Methods: A cross-sectional study was carried out in the Pneumo-Allergology Unit of the Teaching Hospital Campus of Lomé from January 1, 2018, to December 31, 2019. We included in our study all children (0 to 18 years old) who consulted in our Unit. The parameters studied included demographic and clinical data, home environment (external and internal of the concessions and internal environment of the rooms), total IgE test, results of skin prick tests, and diagnosis.

Results: We identified a total of 179 cases of AR (19 of which were excluded) out of 380 children who had consulted during our study period; the prevalence was 47.11%. Children aged 0 to 5 years accounted for 57.50% of patients. There was male dominance, with a sex ratio of 1.5. Clear rhinorrhoea was the symptom found in 100% of cases, followed by sneezing (85.63%) and nasal obstruction (85.00%). Asthma was frequently associated (47.37%). Rhinopharyngitis accounted for 59.86% of the allergic pathologies identified in the families, followed by asthma (34.51%). The house was old (> 10 years) in 58.75%, the mattress was old (> 5 years) in 44.38%, and the pillow was old (> 5 years) in 44.22% of cases. The majority (55.63%) of patients had pets in the home, and the predominant pet was the cat (67.42%). The skin prick test, carried out in 110 patients, had noted sensitization to dust mites (100%), cat dander (58.18%), cockroaches (58.18%) and molds (28.18%). AR was persistent in 60.63% of cases. Sneezing was more common in moderate to severe persistent AR than in mild persistent AR ($p < 0.0001$).

Conclusion: The prevalence of AR in children was high. Persistent AR was the most common.

Keywords

Allergic rhinitis, allergy, sensitization, children, Togo.

Corresponding author

Dr. Mawouto Fiawoo, Assistant Professor of Pediatrics, Faculty of Health Sciences, University of Lomé, Lomé, Togo, and Department of Pediatrics, Sylvanus Olympio Teaching Hospital of Lomé, Lomé, Togo; tel.: +228 90158639; email: michaelisfirst@yahoo.fr.

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Introduction

Allergic rhinitis (AR) is an immunoglobulin E (IgE)-mediated inflammatory nasal condition resulting from allergen introduction in a sensitized individual [1]. AR was defined in 1929 as a process that included 3 cardinal symptoms: sneezing, nasal obstruction, and mucus discharge [2]. AR is one of the most encountered chronic diseases in children and is a real public health problem. Indeed, AR causes major burden and disability worldwide by its socio-economic impact (missed or unproductive time at work and school, sleep problems and, in children, decreased involvement in outdoor activities) [3, 4]. The prevalence of AR is approximately 10% to 40%, depending on geographic location [5], with the highest incidence occurring in children [6, 7]. AR seems to be the consequence of environmental exposures acting on a predisposed genetic background. AR is often co-morbid with asthma and/or conjunctivitis [3, 6]. The objective of this study was to determine the prevalence of AR in children undergoing pneumo-allergology consultation at the Teaching Hospital Campus of Lomé (Togo).

Methods

Study design and subjects

This was a cross-sectional study carried out in the Pneumo-Allergology Unit of the Teaching Hospital Campus de Lomé from January 1, 2018, to December 31, 2019. We included in our study all children (0 to 18 years old) who consulted in our Unit. AR diagnosis was based on a typical history of allergic symptoms such as rhinorrhea, nasal obstruction or itching, sneezing and clinical examination. A skin prick test was performed in diagnosed patients for more precision [6, 8].

Children with other types of rhinitis representing differential diagnosis of AR (drug-induced rhinitis, rhinitis medicamentosa, chemical rhinitis, smoke-induced rhinitis, infectious rhinitis, food- and alcohol-induced rhinitis, non-allergic rhinitis with eosinophilia syndrome, vasomotor rhinitis, empty nose syndrome and atrophic rhinitis, autoimmune, granulomatous, and vasculitic rhinitis, rhinosinusitis) were not included.

Children whose parents did not consent to answer the questionnaires and children whose diagnosis of AR was made but the parameters studied were not well documented were excluded from this study.

The parameters studied were demographic data (prevalence of AR, age and sex); clinical data (reason for consultation, personal and family history of allergy, symptoms, severity of symptoms, associated pathologies); the domestic environment (oldness of the house, frequency of hygiene in the room, nature of the bedding, existence of pets in the house); the external environment of the concession in the investigation of aggravating factors (existence of an unpaved road, wild dump, carpentry, unexploited land, breeding); the Allergic Rhinitis and its Impact on Asthma (ARIA) classification [1, 6, 9], the results of prick tests, total IgE test, radiography of the cavum and the diagnosis resulting.

We have considered as old housing any housing built more than 10 years earlier, and as old mattresses and pillows those used for more than 5 years. The big cleaning consists in clearing everything in the room, cleaning it and washing the room.

Sample size considerations

Sample size was determined by using single population proportion formula: $n = z^2_{\alpha/2}\, p\,(1\text{-}p) / d^2$ with assumption of 40% prevalence (p) of AR [6], 95% confidence level (1.96), 5% desired precision (d). The final sample size was at least 369 (n) children.

Skin prick testing

It was verified in these children that there were no contraindications to these tests (extensive dermatosis, history of anaphylactic accident) or recent medication

that may interfere with results such as antihistamines, corticosteroids, codeine products or dermocorticoids. The prick test in our study consisted of pricking the skin through a drop of allergen extract. We used plastic needles (Stallerpoint®). We performed control tests in order to control the skin reactivity (positive control) and to remove a dermographism (negative control). Histamine hydrochloride 10 mg/ml was used for the positive control and a glycerin solution for the negative control. The location of each allergen was made shown with a ballpoint pen, and we respected a safety distance of 2 cm between the allergens, and then we measured the diameter of the papules. The criterion of positivity is defined by induration diameter. A papule greater or equal to 3 mm compared to the negative control was considered positive [10, 11].

A series of allergens (dust mites, cat dander, cockroaches, molds, dog dander, peanut, egg, shrimps, crabs, soy, milk, latex, feathers) was tested. The choice of allergens was made after a presumption in the patients' history.

Ethics statement

Verbal consent was sought and obtained from the children's parents prior to their inclusion in the study. All study materials and data (questionnaire) were stored in a secure location. To maintain anonymity, the data collection forms were identified only by a code number, which made it possible to link the participant, the questionnaire, and the results.

Statistical analysis

The data entry was done by the software EpiData version 4.6.0.2. The R software was used for data processing and analysis. The Zotero software allowed us to write the references. The significance threshold was $p < 0.05$.

Results

We identified a total of 179 cases of AR out of 380 children who consulted during our study period; the prevalence was 47.11%. Of the 179 patients, 19 children were excluded because their parents refused to answer the questions. Our sample was then 160. The most represented age group was children under 5 years old with a frequency of 57.50% (n = 92). Children aged 5 to 9 years represented 24.38% (n = 39) of the patients. Children aged 10-14 and 15-18 years represented 8.75% (n = 14) and 9.38% (n = 15) of the patients, respectively. We noted a dominance of males (60%) with a sex ratio of 1.5.

Tab. 1 shows the distribution of patients according to different characteristics. The most recurrent symptom was clear rhinorrhea in 100% (n = 160), followed by sneezing (85.63%, n = 137) and nasal obstruction (85%, n = 136). Symptoms progressed from the neonatal period (0-28 days) in 51.25% (n = 82) of patients. A pathology was associated with AR in 35.63% (n = 57) of patients. Asthma (47.37%, n = 27) was the most common pathology associated with AR, followed by tropical endemic limbo-conjunctivitis (19.30%, n = 11).

Family allergy was found in 88.75% (n = 142) of patients. Among these patients, rhinopharyngitis accounted for 59.86% (n = 85) of the allergic pathologies identified in the families, followed by asthma (34.51%, n = 49), urticaria (9.86%, n = 14), sinusitis (5.63%, n = 8), tracheitis (3.52%, n = 5), eczema (2.82%, n = 4), allergic conjunctivitis (1.41%, n = 2), atopic dermatitis (1.41%, n = 2), tropical endemic limbo-conjunctivitis (0.70%, n = 1). Rhinopharyngitis and asthma (**Tab. 2**) were the main clinical findings encountered as family atopy in first-degree parents (father and mother).

Sixty-nine point thirty-eight percent (n = 111) of patients used a ventilator, 4.38% (n = 7) used a ventilator and air conditioner, and 5.00% (n = 8) used an air conditioner.

The energy used for cooking food in the kitchens was gas and charcoal in 61.25% (n = 98), charcoal alone in 21.88% (n = 35), gas alone in 15.00% (n = 24) and wood alone in 1.88% (n = 3) of cases.

The skin prick tests were performed by 68.75% (n = 110) of patients, of whom 97.27% (n = 107) were polysensitized and 2.73% (n = 3) were monosensitized. Dust mites were the most common inhalant allergens and were present in all 110 patients (100%) who performed the skin prick tests. Peanut was the most common food allergen (69.09%, n = 76). Persistent AR was diagnosed in 60.63% (n = 97) of the patients with a preponderance (34.38%, n = 55) of the moderate to severe form. **Tab. 3** shows the distribution of patients by type of sensitization and diagnosis according to the ARIA classification.

The total IgE test performed in 92 patients was elevated in 4.35% (n = 4) of cases. Cavum radiography in 11 patients revealed hypertrophy of the Luschka adenoid vegetations in 45.45% (n = 5) of the cases.

Sneezing was more common in moderate to severe persistent AR than in mild persistent AR ($p < 0.0001$). Cough was more common in mild persistent AR than in moderate to severe persistent AR ($p = 0.023$) (**Tab. 4**).

Table 1. Distribution of patients by characteristics (continues on the next page).

Characteristics		n	%
School attendance (n = 160)	Not attending school	69	43.13
	Kindergarten	37	23.13
	Primary	26	16.25
	Secondary	17	10.62
	University	11	6.87
Symptoms [a] (n = 160)	Clear rhinorrhea	160	100.00
	Sneezes	137	85.63
	Nasal obstruction	136	85.00
	Nasal pruritus	96	60.00
	Cough	68	42.50
	Snoring at night	11	6.88
	Conjunctivitis	8	5.00
	Rash	3	1.88
	Breathing difficulties	1	0.63
Onset of symptoms (n = 160)	0-28 days	82	51.25
	29 days - 30 months	41	25.63
	30 months - 5 years	28	17.50
	5-11 years	6	3.75
	11-18 years	1	0.62
	Do not remember	2	1.25
Associated pathologies (n = 57)	Asthma	27	47.37
	Tropical endemic limbo-conjunctivitis	11	19.30
	Eczema	9	15.79
	Atopic dermatitis	8	14.04
	Prurigo	6	10.53
	Urticaria	4	7.02
Environment outside the concession [a] (n = 160)	Unpaved road next to the house	97	60.63
	Unexploited land	53	33.13
	Wild dump	52	32.50
	Breeding	7	4.38
	Car repair garage	4	2.50
	Carpentry	3	1.88
	Garden	3	1.88
State of housing (n = 160)	Old (> 10 years)	94	58.75
	New (≤ 10 years)	62	38.75
	Renovated	4	2.50
Pet at home [a] (n = 89)	Cat	60	67.42
	Dog	38	42.70
	Poultry	23	25.84
	Sheep	1	1.12
Frequency of large/big cleaning (n = 160)	Daily	1	0.62
	Every 3 days	1	0.62
	Weekly	2	1.25
	Every 2 weeks	5	3.13
	Monthly	12	7.50
	Every 3 months	4	2.50
	Rarely	4	2.50
	Never	131	81.88
Type of mattress (n = 160)	Foam	153	95.63
	Mat	6	3.75
	Straw	1	0.62

[a] Some patients had more than one symptom or factor.

Table 1. Distribution of patients by characteristics (continues from the previous page).

Characteristics		n	%
Type of pillows (n = 160)	Foam	127	79.37
	Kapok/cotton	20	12.50
	Do not use	12	7.50
	Do not know	1	0.63
Mattress duration (n = 160)	> 5 years	71	44.38
	3-5 years	52	32.50
	1-3 years	23	14.37
	≤ 1 year	14	8.75
Pillows duration (n = 147)	> 5 years	65	44.22
	3-5 years	43	29.25
	1-3 years	28	19.05
	≤ 1 year	11	7.48

Table 2. Distribution of patients by family members and type of atopy.

Family members	Patients with familial asthma (n = 49)		Patients with familial rhinopharyngitis (n = 85)		Patients with familial eczema (n = 4)	
	n [a]	%	n [a]	%	n	%
Father	20	40.82	39	45.88	2	50.00
Mother	6	12.24	43	50.59	2	50.00
Brothers	9	18.37	6	7.06	-	-
Maternal grandparents	6	12.24	5	5.88	-	-
Paternal grandparents	6	12.24	1	1.18	-	-
Maternal uncles	3	6.12	2	2.35	-	-
Sisters	2	4.08	5	5.88	-	-
Maternal aunts	2	4.08	-	-	-	-
Paternal aunts	1	2.04	-	-	-	-
Paternal uncles	1	2.04	-	-	-	-
Cousins	1	2.04	-	-	-	-

[a] The type of atopy was sometimes present in several family members.

Table 3. Distribution of patients by type of sensitization and ARIA diagnosis.

Type of sensitization and ARIA diagnosis		n	%
Type of sensitization after skin prick test [a] (n = 110)	Dust mites	110	100.00
	Peanut	76	69.09
	Egg	66	60.00
	Cat dander	64	58.18
	Cockroaches	64	58.18
	Shrimps	34	30.91
	Molds	31	28.18
	Crabs	26	23.64
	Soy	19	17.27
	Dog dander	16	14.55
	Milk	7	6.36
	Latex	7	6.36
	Feathers	6	5.45
ARIA diagnosis (n = 160)	Persistent AR (mild)	42	26.25
	Persistent AR (moderate to severe)	55	34.38
	Intermittent AR (mild)	53	33.13
	Intermittent AR (moderate to severe)	10	6.25

[a] Some patients were polysensitized.
AR: allergic rhinitis; ARIA: Allergic Rhinitis and its Impact on Asthma.

Table 4. Distribution of patients according to the association between the ARIA diagnosis and characteristics.

Characteristics		Persistent AR				Intermittent AR			
		n	Mild (%)	Moderate to severe (%)	p-value	n	Mild (%)	Moderate to severe (%)	p-value
Sex	Male	63	73.8	58.2	0.110 [a]	33	56.6	30.0	0.172 [b]
	Female	34	26.2	41.8		30	43.4	70.0	
Symptoms	Clear rhinorrhea	97	43.3	57.7	-	63	84.1	15.9	-
	Cough	45	55.6	44.4	0.023 [a]	23	87.0	13.0	0.734 [b]
	Nasal obstruction	84	42.9	57.1	1 [b]	52	80.8	19.2	0.187 [b]
	Sneezes	82	35.4	64.6	< 0.0001 [b]	55	83.6	16.4	1 [b]
	Snoring at night	9	77.8	22.2	0.037 [b]	2	50.0	50.0	0.294 [b]
Onset of symptoms	0-28 days	48	39.6	60.4	0.959 [b]	34	82.4	17.6	0.271 [b]
	29 days - 30 months	29	48.3	51.7		12	83.3	16.7	
	30 months - 5 years	13	46.2	53.8		15	93.3	6.7	
	5-11 years	5	40.0	60.0		1	0.0	100.0	
	11-18 years	-	-	-		1	100.0	0.0	
	Do not remember	2	50.0	50.0		-	-	-	
Associated pathologies	Asthma	18	33.3	66.7	0.433 [b]	9	77.8	22.2	0.626 [b]
	Tropical endemic limbo-conjunctivitis	6	50.0	50.0	1 [b]	5	80.0	20.0	1 [b]
	Eczema	7	42.9	57.1	1 [b]	2	100.0	0.0	1 [b]
	Atopic dermatitis	5	40.0	60.0	1 [b]	3	66.7	33.3	0.410 [b]
	Prurigo	2	100.0	0.0	0.185 [b]	3	100.0	0.0	1 [b]
	Urticaria	2	50.0	50.0	1 [b]	-	-	-	-
Pet at home	Cat	41	34.1	65.9	0.106 [b]	19	78.9	16.1	0.479 [b]
	Dog	26	53.9	46.1	0.125 [b]	12	75.0	25.0	0.391 [b]
	Poultry	17	52.9	47.1	0.388 [b]	6	50.0	50.0	0.048 [b]
	Sheep	-	-	-	-	1	0.0	100.0	0.161 [b]

[a] Chi-squared test; [b] Fisher's test.
AR: allergic rhinitis; ARIA: Allergic Rhinitis and its impact on Asthma.

Discussion

Prevalence

We identified a total of 179 cases of AR out of 380 children who had consulted during our study period; the prevalence of AR was 47.11%. This is higher than the prevalence found in 2008 [12] in the same Unit, which was 34%. This hospital increase in the prevalence of AR could be explained on the one hand by the increase in allergology consultations due to a progressive recognition of the existence of the Allergology Unit and, on the other hand, by an increase in the prevalence of AR in children. Indeed, a progressive increase in AR in the world population has been noted for decades, with a current prevalence close to 40% [13-15]. The increase in AR prevalence has been linked with increased urbanization and improvements in living standards, which have contributed to increased exposure to a variety of indoor and outdoor pollutants and allergens, the potentiating effects of which cannot be ignored on respiratory disorders [13].

Age and sex

The most represented age group was children under 5 years old with a frequency of 57.50%. This age group is often described as the most preponderant and high-incidence age group. Djogbe et al. [16], at the Teaching Hospital for Mother and Child (CHU-MEL) in Cotonou, Benin, in 2019, found a predominance of the 1-month to 5-year age group with a rate of 90.4%. An annual incidence of AR of 3.6% to 4.5% was found in a study in the United States in children aged 1-5 years, with the highest incidence between 2 and 3 years [17]. According to the ISAAC (International Study of Asthma and Allergies in Childhood), the global prevalence of rhinoconjunctivitis in children aged 6-7 years was 8.3% (range between countries 1.8% to 24.2%), and that of children aged 13-14 years was 15.1% (range between countries 4.5% to 45.1%) [18]. There was

male dominance, with a sex ratio of 1.5. Our results are comparable to those of Adegbiji et al. [19] in Nigeria in 2017, who found male dominance with a sex ratio of 1.7.

Diagnosis and comorbidities

Apart from clear rhinorrhea, which was present in 100% of patients, sneezing (85.63%) and nasal obstruction (85.00%) were the other most common symptoms. The classic symptoms of AR are clear rhinorrhea, sneezing, nasal congestion or obstruction and nasal pruritus. Cough (42.50%) is an associated symptom related to the reactivity of the lower airways [1]. Djogbe et al. [16] in Benin found a cough rate of 50.30%.

A pathology was associated with AR in 35.63% (n = 57) of patients.

Asthma (27/57, 47.37%) was the most common associated pathology with AR. In a study conducted at the Necker-Enfant-Malades Hospital in Paris in 2006, Hamouda et al. [20] found that, among children with asthma, the prevalence of AR was 56.8%. AR is a risk factor for developing asthma [8]. The Children's Respiratory Study [21] showed that physician-diagnosed AR during infancy is independently associated with a doubling of the risk of developing asthma at age 11 years. Asthma and AR also share common risk factors. Sensitization to allergens is probably the most important [6, 8].

Tropical endemic limbo-conjunctivitis (11/57, 19.30%) was the second pathology associated with AR after asthma. Allergic conjunctivitis is a frequently occurring comorbidity of AR, particularly in children. The evidence suggests that AR is associated with a 35% to 74% prevalence of allergic conjunctivitis and that among patients with allergic conjunctivitis, the prevalence of AR may be as high as 97% [8, 22, 23].

Associated risk and aggravating factors

Familial allergy was noted in 88.75% of patients, and first-degree relatives were the most concerned. AR is well-known to run in families, and one of the strongest risk factors is the presence of disease in first-degree family members [24]. The estimated heritability of AR has been suggested to be as high as 70% to 80%, and strong associations have been identified with genes involved in T-cell activation (*LRRC32*) and innate immunity (TLRs) [8].

In this study, 60.63% of the patients lived near unpaved roads and were therefore directly exposed to dust and pollutants from vehicle exhaust. Dust would be an aggravating factor in AR. Dust consists of large particles that can cause irritation of the nasal and bronchoalveolar mucosa. Vehicle exhaust contains nitrogen oxide known as an ozone precursor (O_3), which is strongly associated as an aggravating factor in conditions such as AR, asthma, and atopic dermatitis [25, 26]. Shirinde et al. [27], in 2015 in Ekurhuleni Metropolitan Municipality (Gauteng Province, South Africa), showed an association between AR and road traffic; and pointed out that children living in areas with heavy road traffic would suffer more from AR than children living in areas with less road traffic.

The majority (55.63%) of patients had pets in the home, and the predominant pet was the cat (67.42%). Our results are superior to data from Douti et al. [12] in 2008, which found a rate of 55.88% for cats. According to Rancé et al. [28], the cat is the most sensitizing domestic animal. For these authors, the cat allergen is volatile and resistant. It can remain suspended in the air in the house for up to 6 months after the animal's departure.

Most patients (95.63%) slept on foam mattresses; 44.38% slept on an old mattress. Douti et al. [29] made a similar finding in a study carried out in Togo in 2011 and found that 81.16% of asthmatic children slept on foam mattresses and that 63.23% of these mattresses were old. These old mattresses would be a breeding ground for dust mites that cause AR in these children.

In 81.88% of cases, patients' parents had never performed a big cleaning of their house, and 76.87% had never dusted or dried their mattresses. The lack of hygiene, in the bedroom in general and in the bedding, would favor the deposition and accumulation of house dust rich in pneumallergenic substances capable of causing allergic pathologies such as AR and asthma.

We found that, in 61.25% of cases, our patients used gas and charcoal. This high rate of parents of children who use both charcoal and gas is probably explained by the socio-economic difficulties in our country that force parents to use one or the other type of energy depending on the fluctuation of the two types of energy. Experimental work had shown that the inhalation of NO_2 and CO_2 released by stoves would increase the respiratory tract's reactivity to allergens and dust mites [30].

Sensitization and ARIA classification

Dust mites were the inhalant allergens to which all patients (100%) who performed the tests were

sensitized, followed by cat dander (58.18%), cockroaches (58.18%) and molds (28.18%). AR and asthma are IgE-mediated type 1 hypersensitivity illnesses triggered by a spectrum of environmental allergens like pollen (mainly of outdoor origin), arthropod- or mammalian-derived allergens (mainly of indoor origin) such as dust mites, cockroaches, cat allergens or molds [8, 26, 31].

The high sensitization of children to dust mites in our study could be explained by the increasingly precarious lifestyle and the parents' lack of knowledge of basic hygiene rules. This factor would be particularly important in young children whose lives are mainly spent at home, thus increasing the degree of exposure to inhalant allergens.

Food allergens (peanuts, eggs, crabs, shrimps, soy...) have been tested positive in some patients. Early sensitization to food allergens has been linked to the development of AR in childhood [32]. A meta-analysis by Alduraywish et al. [33] demonstrated that food sensitization in the first 2 years of life was associated with an increased risk of AR during childhood (OR = 3.0; 95% CI, 2.1 to 4.2).

In 34.38% of cases, patients had moderate to severe persistent AR. Our results are superior to those of Khireddine et al. [34] at Casablanca University Hospital in Morocco in 2014, who found moderate to severe persistent AR in 27% of children.

Conclusion

The prevalence of AR in pneumo-allergology consultations at the Teaching Hospital Campus of Lomé was high and persistent AR was the most common. Children under 5 years of age were the most affected, and there was a male predominance. AR was characterized by three symptoms: clear rhinorrhea, sneezing and nasal obstruction. Asthma was the most frequently associated pathology. Special attention should be given to AR in children due to its high prevalence.

Declaration of interest

The Authors declare that they have no conflicts of interest.

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