
Asthma and other allergic conditions in Colombia: a study in 6 cities

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Background: No detailed information is available on the burden and impact of allergic diseases simultaneously for adults and children in Colombia and most Latin American countries.

Objectives: To investigate the prevalence of asthma, allergic rhinitis, and atopic dermatitis symptoms in 6 cities in Colombia; to measure patient expenses and school days and workdays lost; to describe disease severity; and to determine levels of total and specific IgE in asthmatic subjects.

Methods: A multistage stratified random sample selection of schools with subjects aged 5 to 18 years in each city was used. Guardian subjects selected were contacted, and home visits were arranged. Subjects aged 1 to 4 years and older than 19 years were also selected randomly by systematic sampling based on the addresses of the subjects aged 5 to 18 years. Subjects with asthma symptoms were invited to provide a blood sample.

Results: Information was obtained from 6,507 subjects. The prevalence of asthma, rhinitis, and atopic dermatitis symptoms in the past 12 months was 10.4% (95% confidence interval [CI], 9.7%–11.1%), 22.6% (95% CI, 21.6%–23.6%), and 3.9% (95% CI, 3.4%–4.4%), respectively. Thirty-eight percent of asthmatic subjects had visited the emergency department or have been hospitalized, and 50% reported lost school days and workdays. Seventy-six percent of sampled asthmatic patients were considered to be atopic.

Conclusions: The burden of disease and societal consequences of allergic entities in urban settings in countries such as Colombia are of concern but are largely ignored, perhaps because of the misconception that these diseases are of public health importance only in industrialized nations.

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INTRODUCTION

Although frequency and burden of disease studies are indispensable for learning about historical tendencies and impact of disease, we lack such information for many conditions in Colombia. This is especially the case for asthma, rhinitis, and

dermatitis. The asthma prevalence in a Colombian city was reported to be 8.8% in 1992¹; since then, other epidemiologic aspects of asthma, such as risk factors² and asthma mortality,³ have been studied, but data about asthma prevalence in several regions of the country and several age groups are still lacking. The void of an evidence base for these conditions has generated multiple difficulties, such as delays in public health interventions to raise awareness and education in the community and a lack of basic statistics to guide funding decisions for essential national health research. In other nations, where asthma registries are valid and reliable, there was a clear upward trend in incidence and prevalence figures in the previous decade.^{4–9} For allergic conditions, environmental risk factors are crucial; in a country with such climatic and ecologic diversity as Colombia, it would be unlikely that results observed in other latitudes under other geographic determinants would be applicable. This is supported by the fact that genetic factors play an important role in the pathogenesis of allergic diseases.

The aim of the present study was to determine the prevalence of asthma, rhinitis, and dermatitis in 6 cities in Colombia. We aimed to accomplish this goal using a standardized questionnaire previously validated in other settings and laboratory tests to determine total and specific IgE blood levels. Secondary aims included the evaluation of (1) asthma sever-

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ity, (2) disease impact on out-of-pocket direct patient cost estimates, and (3) absenteeism from school or work. Finally, we wanted to compare our results with research efforts that have followed similar methods, namely, those of the ISAAC (International Study of Asthma and Allergy in Children).^{10,11}

METHODS

The study was cross-sectional in design and was conducted between October 1, 1998, and May 31, 2000, in 6 cities in Colombia: Bogotá, Cali, Medellín, Barranquilla, San Andrés, and Bucaramanga. Subjects older than 1 year and younger than 59 years were included; individuals confined to hospitals, homes for the mentally impaired, and schools for the mentally challenged and those not residing in the urban perimeter were excluded. Ethical approval for the study was obtained from the Colombian Association of Allergy, Asthma, and Immunology ethics committee, and informed consent was obtained from patients or their parents before including any subject in the study.

Sampling Strategy

A multistage stratified sampling strategy¹ was used in each city. Public and private schools were identified, and subjects aged 5 to 18 years were selected randomly. After contacting the parents, a home visit was arranged for interviewing. These homes were in turn used as the index home to select subjects aged 1 to 4 years and older than 19 years. Subjects who met the study definition of asthma were invited to give a blood sample for IgE assays. Informed written consent was obtained in each case. The definition of asthma was based on responding "yes" to either of the following 2 questions from the questionnaire:

- Have you had wheezing (whistling) in the chest during the past year?
- Has your physician ever told you that you have asthma?

Sample Size

Estimating the population of Colombia to be approximately 35 million during 1996, 1,500 subjects would have been appropriate for the study.¹² However, we wanted additional precision for a stratified analysis (city, age, and sex), so it was decided to evaluate data from 2,000 subjects in the largest city (Bogotá), 1,000 in the middle-sized cities (Cali, Medellín, and Barranquilla), and 600 to 800 in the smaller cities (San Andrés and Bucaramanga). Based on our predicted asthma disease prevalence, we estimated that approximately 600 subjects (10%) should be targeted for IgE testing.

Questionnaire and Data Collection

From the ISAAC questionnaire, questions necessary for achieving the main objectives of the study were selected, as were additional questions deemed relevant to evaluating potential risk factors.^{1,13,14} The definition of rhinitis was based on responding "yes" to either of the following questions:

- Have you had persisting nasal symptoms, such as sneezing, watery discharge, obstruction, or itching, during the past year?

• Has your physician ever told you that you have rhinitis? The definition of atopic dermatitis was based on responding "yes" to either of the following questions:

- Have you (or your child) had an intermittent itchy rash for at least 6 months in the past 12 months?
- Has your physician ever told you that you have atopic dermatitis?

Severity of disease was measured with the help of 3 indicators (night awakenings, limiting speech, and the need for an emergency department visit or hospitalization). A pilot study was conducted, and, based on its results, corrections were made to the questionnaire.

IgE Studies

Blood samples were obtained from only 399 asthmatic patients who agreed to be donors. Serum samples were kept at -70°C and were transported on dry ice to the University of Cartagena, where analyses were conducted. Total and specific IgE levels were determined using the UniCAP 100 System based on ImmunoCAP technology from Pharmacia Diagnostic AB, Kalamazoo, MI. For specific IgE assays, d1 and g1 allergens (from *Dermatophagoides pteronyssinus* and *Blattella germanica*, respectively) were used.

Data Analysis

Univariate descriptive analyses were conducted for general demographic variables. We used means, medians, and ranges for all continuous variables and simple accumulated frequencies and percentages for categorical variables. Contingency tables were built for categorical variables, and the χ^2 distribution or Fisher exact test was used to evaluate deviations from null hypotheses. Sample means were also tested for differences using *t* tests and analysis of variance. Age-adjusted rates were similar to crude rates, so we only inform on sex-adjusted rates. The population was divided into the following age groups: 1 to 4, 5 to 11, 12 to 18, and 19 to 59 years.

RESULTS

We obtained information on 6,507 subjects from Bogotá ($n = 2,065$), Medellín ($n = 1,023$), Barranquilla ($n = 1,015$), Cali ($n = 973$), San Andrés ($n = 805$), and Bucaramanga ($n = 626$). Table 1 gives the population distribution by age, sex, education, and city.

Asthma

The prevalence of asthma symptoms in the past 12 months was 10.4% (95% confidence interval [CI], 9.7%–11.1%). Table 2 provides age- and sex-stratified results. The group aged 1 to 4 years had the highest prevalence, which is significantly different from that in the group aged 19 to 59 years ($P < .01$). No significant differences were found for sex. Medellín, San Andrés, and Bucaramanga had the highest prevalence of asthma symptoms. The cumulative prevalence of asthma symptoms (wheeze ever) was 22.7% (95% CI, 21.7%–23.7%), with no significant differences by sex (Table 3). Symptoms of asthma severity were more frequent in

Table 1. Distribution of Sex, Age, and Education in 6,507 Subjects from 6 Cities in Colombia

Variable	Subjects, No. (%)						
	Bogotá (n = 2,065)	Cali (n = 973)	Barranquilla (n = 1,015)	Medellín (n = 1,023)	San Andrés (n = 805)	Bucaramanga (n = 626)	Total (n = 6,507)
Sex							
Male	814 (39.4)	396 (40.7)	449 (44.2)	412 (40.3)	321 (39.9)	256 (40.9)	2,648 (40.7)
Female	1,251 (60.6)	577 (59.3)	566 (55.8)	611 (59.7)	484 (60.1)	370 (59.1)	3,859 (59.3)
Age, y							
1–4	221 (10.7)	126 (12.9)	103 (10.1)	116 (11.3)	89 (11.1)	73 (11.7)	728 (11.2)
5–11	266 (12.9)	132 (13.6)	138 (13.6)	147 (14.4)	96 (11.9)	93 (14.9)	872 (13.4)
12–18	506 (24.5)	174 (17.9)	215 (21.2)	198 (19.4)	131 (16.3)	137 (21.9)	1,361 (20.8)
19–59	1,070 (51.8)	541 (55.6)	558 (55.0)	562 (54.9)	489 (60.7)	323 (51.6)	3,543 (54.5)
Missing	2 (0.1)		1 (0.1)				
Education							
None	350 (16.9)	83 (8.5)	163 (16.1)	184 (18.0)	118 (14.7)	147 (23.5)	1,045 (16.1)
Primary	595 (28.8)	266 (27.3)	336 (33.1)	344 (33.6)	243 (30.2)	174 (27.8)	1,958 (30.1)
Secondary	860 (41.6)	443 (45.5)	412 (40.6)	386 (37.7)	355 (44.1)	227 (36.3)	2,683 (41.2)
College	94 (4.6)	70 (7.2)	38 (3.7)	33 (3.2)	47 (5.8)	16 (2.6)	298 (4.6)
University	165 (8.0)	100 (10.3)	49 (4.8)	76 (7.4)	39 (4.8)	61 (9.7)	490 (7.5)
Other	1 (0.0)	7 (0.7)	15 (1.5)	0	3 (0.4)	1 (0.2)	27 (0.4)
Missing	0	4 (0.4)	2 (0.2)	0	0	0	6 (0.1)

Table 2. Prevalence of Current Asthma by Sex, Age, and City

	Subjects No. (%) [95% CI]	
	Total	With asthma
Sex		
M	2,648	263 (9.9) [8.8–11.0]
F	3,859	416 (10.8) [9.8–11.8]
Age, y		
1–4	728	169 (23.2) [20.1–26.3]
5–11	872	101 (11.6) [9.5–13.7]
12–18	1,361	140 (10.3) [8.7–11.9]
19–59	3,543	269 (7.6) [6.7–8.5]
City		
Barranquilla	1,014	82 (8.1) [6.4–9.8]
Bogotá	2,063	194 (9.4) [8.1–10.7]
Cali	973	104 (10.7) [8.8–12.6]
Bucaramanga	626	72 (11.5) [9.0–14.0]
San Andrés	804	94 (11.7) [9.5–13.9]
Medellín	1,023	133 (13.0) [10.9–15.1]
Overall	6,507	679 (10.4) [9.7–11.1]

Abbreviation: CI, confidence interval.

children (Table 4) and in San Andrés and Bucaramanga (Table 5). Thirty-eight percent of asthmatic subjects had visited the emergency department or had been hospitalized. The overall prevalence of physician-diagnosed asthma (asthma ever) was 6.2% (95% CI, 5.6%–6.8%), and it was highest in the group aged 5 to 11 years (8.4%; Table 4).

We obtained responses about the economic impact of asthma from 283 subjects. Sixty-three percent of this group reported having out-of-pocket expenses in the past 6 months. Almost 7% of this group reported monthly expenses in excess of \$215, which is almost the minimum wage in the country (\$235). More than 48% of these participants reported missing

days of school or work in the past 6 months, and 36% of parents lost workdays to care for the subject with asthma (Table 6).

Allergic Rhinitis

The prevalence of rhinitis symptoms in the past 12 months was 22.6% (95% CI, 21.6%–23.6%). The group aged 12 to 18 years had the highest prevalence of rhinitis symptoms. No significant differences were found by sex. Cities with the highest prevalence were Medellín and Bucaramanga (Table 7). The cumulative prevalence of rhinitis was 31.3% (95% CI, 30.2%–32.4%). The overall prevalence of physician-diagnosed rhinitis was 7.0%, very close to that for asthma.

Atopic Dermatitis

The prevalence of atopic dermatitis symptoms in the past 12 months was 3.9% (95% CI, 3.4%–4.4%). The group aged 1 to 4 years had the highest prevalence (Table 8). The cumulative prevalence of atopic dermatitis symptoms was 7.1% (95% CI, 6.5%–7.7%). Physician-diagnosed prevalence was 1.7%. The severity of disease was measured with the help of 1 indicator (night awakenings), which was present in 29.5% of subjects affected.

Total and Specific IgE Levels

Defining atopy as having high (>100 kU/L) levels of total IgE^{15,16} or specific IgE to at least 1 allergen, we found that 76% of asthmatic patients were atopic; 68.5% had total IgE levels higher than 100 kU/L, and 52.2% had clinically significant levels (>0.35 kU/L) of specific IgE to *D pteronyssinus* and 27.7% to cockroach.

The mean IgE levels were 578 kU/L for asthmatic patients only, 612 kU/L for asthmatic patients with rhinitis, and 1,001 kU/L for asthmatic patients with atopic dermatitis. Total IgE level was related to asthma severity, as evaluated using

Table 3. Frequency of Wheezing Symptoms by Sex

	Subjects, No. (%) [95% CI]	
	Females (n = 3,859)	Males (n = 2,648)
Wheeze ever	854 (22.1) [20.8–23.4]	625 (23.6) [22.0–25.2]
Wheeze disturbing sleep, past 12 mo	268 (6.9) [6.1–7.7]	159 (6.0) [5.1–6.9]
Severe wheeze limiting speech, past 12 mo	143 (3.7) [3.1–4.3]	69 (2.6) [2.0–3.2]
Severe wheeze requiring an emergency department visit or hospitalization, past 12 mo	148 (3.8) [3.2–4.4]	108 (4.1) [3.3–4.9]
Asthma ever	236 (6.1) [5.3–6.9]	165 (6.2) [5.3–7.1]

Abbreviation: CI, confidence interval.

Table 4. Frequency of Wheezing Symptoms by Age

	Subjects, No. (%) [95% CI]			
	1–4 y (n = 728)	5–11 y (n = 872)	12–18 y (n = 1,361)	19–59 y (n = 3,543)
Wheeze ever	292 (40.1) [36.5–43.7]	245 (28.1) [25.1–31.1]	343 (25.2) [22.9–27.5]	599 (16.9) [15.7–18.1]
Wheeze disturbing sleep, past 12 mo	112 (15.4) [12.8–18.0]	62 (7.1) [5.4–8.8]	87 (6.4) [5.1–7.7]	166 (4.7) [4.0–5.4]
Severe wheeze limiting speech, past 12 mo	34 (4.7) [3.2–6.2]	29 (3.3) [2.1–4.5]	48 (3.5) [2.5–4.5]	101 (2.9) [2.3–3.5]
Severe wheeze requiring an emergency department visit or hospitalization, past 12 mo	55 (7.6) [5.7–9.5]	49 (5.6) [4.1–7.1]	84 (6.2) [4.9–7.5]	143 (4.0) [3.4–4.6]
Asthma ever	57 (7.8) [5.9–9.7]	73 (8.4) [6.6–10.2]	100 (7.3) [5.9–8.7]	171 (4.8) [4.1–5.5]

Abbreviation: CI, confidence interval.

Table 5. Frequency of Wheezing Symptoms by City

	Subjects, No. (%) [95% CI]					
	Bogotá (n = 2,065)	Cali (n = 973)	Barranquilla (n = 1,015)	Medellín (n = 1,023)	San Andrés (n = 805)	Bucaramanga (n = 626)
Wheeze ever	469 (22.7) [21–24.5]	207 (21.3) [19–24]	154 (15) [13–17.4]	304 (29.7) [27–32.5]	152 (18.9) [16.2–21.6]	193 (30.8) [27.2–34.4]
Wheeze disturbing sleep, past 12 mo	92 (4.5) [3.6–5.4]	76 (7.8) [6.1–9.5]	51 (5) [3.7–6.3]	90 (8.8) [7.1–10.5]	74 (9.2) [7.2–11.2]	44 (7.0) [5.0–9.0]
Severe wheeze limiting speech, past 12 mo	52 (2.5) [1.8–3.2]	31 (3.2) [2.1–4.3]	26 (2.6) [1.6–3.6]	35 (3.4) [2.3–4.5]	43 (5.3) [3.8–6.8]	25 (4.0) [2.5–5.5]
Severe wheeze requiring an emergency department visit or hospitalization, past 12 mo	51 (2.5) [1.8–3.2]	50 (5.1) [3.7–6.5]	32 (3.2) [2.1–4.3]	48 (4.7) [3.4–6]	48 (6.0) [4.4–7.6]	27 (4.3) [2.7–5.9]
Asthma ever	73 (3.5) [2.7–4.3]	70 (7.2) [5.6–8.8]	57 (5.6) [4.2–7.0]	81 (7.9) [6.2–9.6]	65 (8.1) [6.2–10.0]	55 (8.8) [6.6–11.0]

Abbreviation: CI, confidence interval.

several questions included in the questionnaire. For example, patients who often visited the emergency department had higher levels than those who did not (600.6 vs 549.8 kU/L; $P = .05$). Sensitization to *D pteronyssinus* was higher in the group aged 10 to 15 years ($P = .002$). The mean value of specific IgE to this mite was 18.1 kU/L, the equivalent of class 4 on a scale from 1 to 5. This value was higher (40 kU/L) if the patients also had rhinitis and atopic dermatitis ($P = .007$). Sensitization to *B germanica* was weaker (1.0 kU/L) than that to *D pteronyssinus* ($P \leq .05$). In addition, this

sensitization was mainly among children in the group aged 1 to 5 years.

DISCUSSION

Our work adds new epidemiologic data on 3 common allergic diseases—asthma, rhinitis, and atopic dermatitis. This is the first such study in Colombia and the first in Latin America to simultaneously include data on the 3 entities in adult patients.

Children aged 1 to 4 years had the highest frequency of current asthma symptoms. This could be biased by the high

Table 6. Patient-Related Direct Medical Costs and Days Lost because of Asthma in the Past 6 Months

	Participants, No. (%) (n = 283)
Monthly out-of-pocket expenses, \$	
None	106 (37.5)
<71	116 (41.0)
71–142	28 (9.9)
142–215	14 (4.9)
215–360	11 (3.9)
>360	8 (2.8)
Workdays or school days lost by patients, No.	
None	145 (1.2)
1–5	88 (31.1)
6–10	28 (9.9)
11–15	9 (3.2)
16–30	9 (3.2)
>30	4 (1.4)
Workdays or school days lost by caregivers, No.	
None	135 (64.0)
1–5	50 (23.7)
6–10	15 (7.1)
11–15	4 (1.9)
16–30	4 (1.9)
>30	3 (1.4)

Table 7. Prevalence of Rhinitis Symptoms by Sex, Age, and City

	Subjects, No. (%) [95% CI]	
	Total	With Asthma
Sex		
M	2,648	574 (21.7) [20.1–23.3]
F	3,859	894 (23.2) [21.9–24.5]
Age, y		
1–4	728	162 (22.3) [19.3–25.3]
5–11	872	205 (23.5) [20.7–26.3]
12–18	1,361	383 (28.1) [25.7–30.5]
19–59	3,543	718 (20.3) [19.0–21.6]
City		
Barranquilla	1,013	182 (17.9) [15.5–20.3]
Bogotá	2,063	445 (21.6) [19.8–23.4]
Cali	973	220 (22.6) [20.0–25.2]
Bucaramanga	626	195 (31.2) [27.6–34.8]
San Andrés	804	138 (17.2) [14.6–19.8]
Medellín	1,022	288 (28.2) [25.4–31.0]
Overall	6,507	1,468 (22.6) [21.6–23.6]

Abbreviation: CI, confidence interval.

prevalence of “acute wheezing disease” in children of these ages. Some of our patients could be those labeled as having “transient early wheezing” according to Martínez et al.¹⁷ The 40% cumulative prevalence in this group is similar to that reported by Martínez et al.¹⁷ for children during the first 6 years of life. However, children younger than 1 year, with more chance of having wheezing without asthma, were not included in our study. If we only consider children aged 5 to 18 years, the point and cumulative prevalences are 10.8% and

Table 8. Prevalence of Atopic Dermatitis Symptoms by Sex, Age, and City

	Subjects, No. (%) [95% CI]	
	Total	With Asthma
Sex		
M	2,463	82 (3.3) [2.6–4.0]
F	3,629	157 (4.3) [3.6–5.0]
Age, y		
1–4	667	33 (4.9) [3.3–6.5]
5–11	810	37 (4.6) [3.2–6.0]
12–18	1,260	53 (4.2) [3.1–5.3]
19–59	3,352	116 (3.5) [2.9–4.1]
City		
Barranquilla	984	36 (3.7) [2.5–4.9]
Bogotá	1,933	40 (2.1) [1.5–2.7]
Cali	877	54 (6.2) [4.6–7.8]
Bucaramanga	571	27 (4.7) [3.0–6.4]
San Andrés	758	43 (5.7) [4.0–7.4]
Medellín	969	39 (4.0) [2.8–5.2]
Overall	6,092	239 (3.9) [3.4–4.4]

Abbreviation: CI, confidence interval.

26.3%, respectively, which are more realistic data on asthma symptoms in our pediatric population, located midpoint among figures from other studies^{18,19} but lower compared with point prevalences in some Latin American cities.²⁰

Approximately 54% of the study population (n = 3,534) was adult (19–51 years old). This is an unusually high number of adults to survey for asthma prevalence, severity, and related risk factors, including atopy. The prevalence of asthma symptoms in adults has been reported to vary from 2.4% to 30.3%, as described in the Global Initiative for Asthma document.²¹ This wide range of variation may reflect actual differences but also may be due to the use of different asthma definitions and questionnaires. So, to compare our results, we have to focus on similar questions shared by questionnaires from other studies. For example, the prevalence of wheezing during the past year, which was 7.6% in our study, was 9.5%, 22%, and 30.3% in adults aged 24 to 44 years in Italy, Spain, and England, respectively.^{21,22}

Symptoms of asthma severity were frequent, the most in San Andrés and the least in Bogotá (Table 5), with severe and poorly controlled asthma being more frequent in children (Table 4). Asthma severity was not significantly different between the sexes (Table 3). Of the 3 diseases studied, asthma generated the most treatment expenses, disabilities, and work absenteeism. According to our results, asthma has an important financial impact in Colombia and is frequently associated with lost workdays and school days. However, we did not perform an independent validation of the information related to expenses and school absenteeism. For this reason, our results should be interpreted as a trend because they could be biased by subjects’ memory.

The actual prevalence of rhinitis symptoms in the general population was 22.6%, mainly distributed among subjects

aged 12 to 18 years. The cumulative prevalence in the general population was 31.3%. Our data are similar to those in 4 studies that included general populations from North America, Europe, and Asia,^{23–26} so it will be interesting to identify common risk factors that affect people from very different geographic locations.

The actual prevalence of atopic dermatitis symptoms was 3.9%, and in one third of cases, symptoms were severe. Prevalence figures decreased from 4.9% in children aged 1 to 4 years to 3.5% in adults aged 19 to 59 years. The cumulative prevalence was 7.1%. The highest prevalence was detected in Cali and the lowest in Bogotá. Compared with England, Finland, Mexico, and Spain,^{27–30} the actual prevalence of atopic dermatitis symptoms in Colombia is low, although it is the same as that reported in Hong Kong and Nigeria.^{31,32}

A relevant aspect of asthma is its association with atopy, a condition operatively defined as high levels of total IgE or clinically significant levels of specific IgE against allergens.^{33,34} Our results show that the frequency of atopy in Colombian asthmatic patients is high. Even if we disregard IgE levels and take into account specific IgE only, the prevalence is 57.8%. However, because we tested for only 2 allergens, the actual prevalence of atopy in asthmatic patients could be underestimated in our survey. The prevalence of atopy in asthmatic patients has been shown to be different between countries,^{34–42} but most studies from the tropics demonstrate a high prevalence of atopy in the asthmatic population, especially when evaluating sensitization to several house dust mites.^{2,43,44}

The burden of disease and societal consequences of allergic entities in urban settings in countries such as Colombia are of concern but are largely ignored, perhaps because of the misconception that these diseases are not of public health importance in underdeveloped countries. Our results also support the necessity of developing unified criteria for asthma diagnosis and management, especially regarding allergic status, that should be defined in the clinical evaluation of all asthmatic patients. Also, because of the well-known increase in allergic diseases during the past few decades worldwide, our study will allow for future surveys to evaluate epidemiologic trends in allergic diseases in Colombia.

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