

ORIGINAL RESEARCH

Prevalence of Pediatric Asthma Risk in Santo Domingo, Dominican Republic



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Abstract

BACKGROUND Early detection and treatment of pediatric asthma could reduce morbidity and lessen burden on society. Currently there is no known research on the prevalence of pediatric asthma in the Dominican Republic (DR) and no known asthma risk assessment tool for one-time encounters in a fast-paced clinic.

OBJECTIVES To pilot a streamlined version of previously validated screening tools to estimate the prevalence of pediatric asthma risk in Santo Domingo Norte, DR.

METHODS A combined asthma questionnaire and clinical assessment tool was developed and administered to patients aged 2-12 years.

FINDINGS We found that 25.7% of the 74 study participants were categorized as probable asthma, 21.6% were at high risk for asthma, 14.9% elevated risk, and 37.8% not at risk.

CONCLUSION If the prevalence of 25.7% is representative of the DR as a whole, the DR would have one of the highest national rates in Latin America. The study assessment tool was convenient to use, but tool validation is needed.

KEY WORDS pediatric, asthma, asthma diagnostic tool, prevalence, short term medical mission, risk assessment, Dominican Republic, Latin America, Santo Domingo, public health, patient care, global health

INTRODUCTION

More than half of Latin American countries report a prevalence of childhood asthma >15%, and the disease continues to compromise quality of life and burden health care costs.^{1,2} Despite individual differences in symptom severity, the risk factors affecting development of disease and control of symptoms are consistent and predictable. Asthma is highly influenced by both familial heritability and external factors or “triggers” such as air pollution, environmental smoke, allergens, and

chemical irritants.^{1,2} Given Santo Domingo Norte’s location at the northwest border of the urban center of Santo Domingo and the colocation of risk factors typically associated with periurban communities at the periphery of a city (presence of livestock, unpaved dirt roads, etc),³ all these risk factors are common in Santo Domingo Norte, Dominican Republic, and contribute to the risk of asthma.

Asthma is associated with an early childhood onset and is a leading cause of sleep disturbances, school absences, and childhood hospitalizations, all

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of which contribute to poor performance in school and increased morbidity and mortality.^{4,5} Fortunately, much of the morbidity associated with asthma is preventable with proper patient education and the use of preventative treatment.⁵ However, because of the number of children who are undiagnosed and undertreated, it continues to impose a substantial burden on global health, particularly in pediatric populations.⁶

Asthma is among the 3 most prevalent chronic diseases in the Dominican Republic.⁶ This significant prevalence of disease, its burden on society, and the benefits of preventative treatment all illustrate its significance as a major public health issue and the need for better screening and case detection.^{4,6} According to the American Thoracic Society guidelines, “case detection programs may be appropriate in areas where there is a high prevalence of undiagnosed asthma and where newly identified patients have functional access to consistent, high quality asthma care.”⁴ Given the suspected high rate of pediatric asthma in Santo Domingo Norte, the availability of preventive and acute treatment through public health centers and hospitals, and access to preventive medicines through local pharmacies, this study follows American Thoracic Society guidelines by seeking to assess the prevalence of asthma risk in the community in order to enhance patient care.

Taking into account the numerous risk factors present in the community of Paraíso, Villa Mella, Santo Domingo Norte, and the many patients who present to clinic with a chief complaint of “*gripe*,” a constellation of cough, congestion, and other respiratory symptoms, the children in this community are at high risk of having undiagnosed and untreated asthma. However, the exact prevalence of pediatric asthma among this community is unknown and to our knowledge, there is no streamlined pediatric asthma screening tool designed for one-time clinical encounters in a fast-paced clinic in the Dominican Republic. The goal of this study was to identify the prevalence of children with significant asthma risk in a medical outreach clinic in Santo Domingo Norte and assess the ease of use of an abbreviated, rapid screening tool in this setting and similarly other fast-paced, short-term, free clinics with minimal resources available. The use of this asthma screening tool will allow us to provide better patient education, preventative treatment, and follow-up care, ultimately improving quality of life for children at risk for asthma.

METHODS

Study Population. The study population consisted of pediatric patients aged 2–12 who presented with a parent to a short-term medical outreach clinic in Paraíso, Villa Mella, Santo Domingo Norte, in the Dominican Republic from June 9–12, 2016. Only children who presented to clinic with a parent were eligible to be enrolled in the study.

Questionnaire Design. The goal of the asthma questionnaire and clinical assessment tool developed for this study was to identify prevalence of asthma risk among pediatric patients aged 2–12 who presented to a short-term medical outreach clinic in Santo Domingo Norte in June 2016. The combined asthma questionnaire and clinical assessment tool (“risk assessment”) used in this study was composed of parts of 2 previously validated instruments: (1) the Asthma Screening Parent Questionnaire developed by Busi et al⁶ and (2) the Asthma Predictive Index (API) developed by Castro-Rodriguez et al.⁷ The age range used in this study was determined by the age ranges that these 2 previously validated instruments used.

The first part of the risk assessment was based on the Asthma Screening Parent Questionnaire, which was found to have high sensitivity in identifying pediatric patients at risk for asthma-related respiratory difficulties in Argentina.⁶ This included children with undiagnosed asthma and children with previously diagnosed but uncontrolled asthma. The first section of our study’s risk assessment contained 4 questions for asthma prediction from the Asthma Screening Parent Questionnaire. All 4 questions are asked to the parent because questions directed at a parent were found to have higher sensitivity than those directed at children, and combinations of these questions had sensitivities between 91% and 95% based on prior analyses.^{6,8}

The second part of the risk assessment was based on the API, which identifies pediatric patients at risk for asthma-related respiratory difficulties with high specificity. The goal of the study that developed the API was to determine the accuracy with which the development of asthma could be predicted in a general population sample using simple clinical parameters. The API identifies 2 major risk factors (parental history of asthma and pediatric history of eczema) and 3 minor risk factors (eosinophilia, wheezing without colds, and allergic rhinitis) for development of pediatric asthma in children who exhibited wheezing during the first 3 years of life. A positive API screen is defined as meeting 1 major or

2 minor criteria. The API has been found to be a clinically useful diagnostic tool among a wide range of pediatric age groups and ethnicities, with specificity ranging from 79%–97%.⁹ The second section of our study's risk assessment used all the API major and minor criteria with the exception of eosinophilia, which could not be evaluated because of clinic limitations. By combining aspects of the Asthma Screening Parent Questionnaire and API, the risk assessment developed for our study (Fig. 1) used previously validated case-detection instruments tailored to the context of a fast-paced free clinic with limited resources.

Questionnaire Execution. For children who met the inclusion criteria and consented to participate in the study, a physician completed the questionnaire and clinical assessment during the patient's clinical appointment and the patient's answers were anonymously documented on the survey form (Fig. 1). Part 1 of the questionnaire and clinical assessment tool contained 4 screening questions that were asked to the parent of the participating child in native Spanish. A score of >0 in Part 1 was a positive risk for asthma-related respiratory difficulties and qualified the patient for the second part of the survey. Part 2 of the risk assessment included 1 question directed toward the parent and 3 questions the physician answered based on clinical examination of the child. Allergic rhinitis and eczema were diagnosed via typical physical examination findings (eg, swollen and pale nasal turbinates and allergic shiners for allergic rhinitis, irritated or dry skin in distributions typical of eczema, etc).

Ethical Issues. Participation was strictly voluntary after verbal informed consent; the information gathered was anonymous. Only children who presented with a parent were eligible for the survey. Eligible children and parents were read an informed consent statement. Parental informed consent alone was required for children aged 2–6. Both parental consent and child assent were required for children aged 7–12. The consent statement made it clear that families' decisions to participate would not in any way affect the care they would receive. All questionnaires and consent forms were translated by a professional medical interpreter. The study was approved by the Virginia Commonwealth University Institutional Review Board under study ID HM20007291.

Statistical Analysis. Analysis was performed using STATA/MP (Version 14.1, StataCorp, College Station, TX). Descriptive statistics were generated for the demographics and responses. Cross

tabulations and chi-squared (χ^2) tests were done with age, gender, and survey responses.

RESULTS

Over the study period, 74 (100%) children consisting of 35 (47.3%) boys and 36 (48.6%) girls aged 6.3 ± 3.0 years were seen at the brigade clinic in Paraíso, Villa Mella, Santo Domingo Norte. The demographic characteristics of the study participants are shown in Table 1.

Of these, 46 (62.2%) patients screened positive and 28 (37.8%) screened negative via Part 1 of the asthma risk assessment. Differences observed among gender ($P = .222$) and ages ($P = .653$) for asthma risk assessment were not statistically significant ($P > .05$, χ^2 test). Responses from Part 1 of the risk assessment are shown in Table 2.

Of the 46 children with positive screenings from Part 1 of the risk assessment, 19 (25.7% of the total sample, $n = 74$) met criteria under Part 2 of the risk assessment for probable asthma. Results from Part 2 of the risk assessment responses are shown in Table 3.

Pediatric patients involved in the study were placed into categories based on their risk of asthma as identified by the questionnaire and clinical assessment tool. Based on clinical usefulness and the limit of a single patient contact, 4 categories were defined:

- Not at risk, defined by those who answered “Never” or “I don't know” to all 4 initial screening questions.
- Elevated risk, defined by those who answered “Sometimes” or “Frequently” to at least 1 of the 4 initial screening questions but did not answer “Yes” to any of the API questions for asthma.
- High risk, defined by those who answered “Sometimes” or “Frequently” to at least 1 of the 4 initial screening questions and answered “Yes” to 1 of the API minor criteria.
- Probable asthma, defined by those who answered “Sometimes” or “Frequently” to at least 1 of the 4 initial screening questions and met criteria (at least 1 major or both minor criteria) under the API for asthma.

Among all 74 study participants, 28 (37.8%) children were classified to be not at risk for asthma via the asthma screening patient questionnaire. Eleven (14.9%) children were considered to be at elevated risk, 16 (21.6%) were considered to be at high risk, and 19 (25.7%) were considered to have probable asthma via Part 2 of the asthma risk assessment. Overall asthma risk is shown in Table 4.

Cuestionario - Asma

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Edad Age:	2	3	4	5	6	7	8	9	10	11	12
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Sex:	Male	Female
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Part 1:**ASK THE PARENT: Su hijo/hija** *Does your child ...*

	<i>Never</i>	<i>Sometimes</i>	<i>Often</i>	<i>Doesn't know</i>
1. ¿Le cuesta respirar hondo? <i>Has difficulties taking a deep breath?</i>	Nunca (0)	A veces (1)	Frecuente-mente (1)	No lo sé (0)
2. ¿Hace ruidos o “silbidos” cuando respire? <i>Makes noisy or wheezy sounds when breathing (awake)?</i>	Nunca (0)	A veces (1)	Frecuente-mente (1)	No lo sé (0)
3. ¿Se queja de que le aprieta el pecho o le duele el pecho después de correr, jugar mucho o hacer deporte? <i>Complain about a chest that feels tight or hurts after running, playing hard, or doing sports?</i>	Nunca (0)	A veces (1)	Frecuente-mente (1)	No lo sé (0)
4. ¿Tose cuando corre, sube escaleras o hace deportes? <i>Cough when running, climbing stairs or playing sports</i>	Nunca (0)	A veces (1)	Frecuente-mente (1)	No lo sé (0)

TOTAL SCORE from ítems 1-4 above: _____.

CONTINUE TO PART 2 IF SCORE >0 (i.e. if 1 or more responses of “sometimes/a veces” or “often/frecuente-mente” were provided)

Part 2:**ASK THE PATIENT:**

5. Tiene padres que han sido diagnosticados con asma según un medico? <i>Do you have a parent who has asthma diagnosed by a physician?</i>	Sí	No	No lo sé
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PERFORM CLINICAL EVALUATION TO DETERMINE:

6. Un diagnóstico de eczema? <i>Eczema diagnosed by a physician?</i>	Sí	No
7. Un diagnóstico de rinitis alérgica? <i>Allergic Rhinitis diagnosed by a physician?</i>	Sí	No
8. Respira con ruidos o “silbidos” a tiempos cuando no tiene gripe? <i>Is the patient wheezing apart from colds?</i>	Sí	No

Figure 1. Combined asthma questionnaire and clinical assessment tool (“risk assessment”).

Table 1. Demographic Characteristics of 74 Participants

Characteristic (100%)	n = 74
Age, yr	
2	5 (6.8%)
3	10 (13.5%)
4	11 (14.9%)
5	6 (8.1%)
6	6 (8.1%)
7	8 (10.8%)
8	7 (9.5%)
9	6 (8.1%)
10	4 (5.4%)
11	5 (6.8%)
12	3 (4.1%)
Unspecified	3 (4.1%)
Sex	
Boys	35 (47.3%)
Girls	36 (48.6%)
Unspecified	3 (4.1%)

Among those screening positive answering “Sometimes” or “Frequently” to all 4 initial screening questions, the positive predictive value for having a high risk of asthma under the API was 76.9% (10 of 13 participants). The relationship between positive screening questions and asthma risk according to the API is shown in [Table 5](#).

Table 2. Part 1 of the Risk Assessment Responses

Question	Frequency	n = 74
Has difficulties taking a deep breath?	Never	42 (56.8%)
	Sometimes	25 (33.8%)
	Often	7 (9.5%)
	Doesn't know	0 (0.0%)
Makes noisy or wheezy sounds when breathing (awake)?	Never	44 (59.5%)
	Sometimes	18 (24.3%)
	Often	11 (14.9%)
	Doesn't know	1 (1.4%)
Complains about a chest that feels tight or hurts after running, playing hard, or doing sports?	Never	45 (60.8%)
	Sometimes	15 (20.3%)
	Often	14 (18.9%)
	Doesn't know	0 (0.0%)
Cough when running, climbing stairs, or playing sports?	Never	46 (62.2%)
	Sometimes	13 (17.6%)
	Often	15 (20.3%)
	Doesn't know	0 (0.0%)

Table 3. Part 2 of the Risk Assessment Responses

Criteria	Response	n = 46	
Major	Previous MD Diagnosis of parental asthma	Yes	11 (23.9%)
		No	31 (67.4%)
		Doesn't know	4 (8.7%)
MD diagnosis of eczema	Yes	8 (17.4%)	
	No	36 (78.3%)	
	Unspecified	2 (4.3%)	
Minor	MD diagnosis of allergic rhinitis	Yes	28 (60.9%)
		No	16 (34.8%)
		Unspecified	2 (4.3%)
MD diagnosis of wheezing (apart from colds)	Yes	8 (17.4%)	
	No	37 (80.4%)	
	Unspecified	1 (2.2%)	

DISCUSSION

Asthma Prevalence. The prevalence of probable asthma among children in this study was 25.7%. Although there are no studies reporting childhood asthma rates in the Dominican Republic, this is high compared with the 14.1% reported for adult asthma in rural Dominican Republic.⁹ However, this finding of 25.7% is comparable to the highest childhood asthma rates of 13–14 year olds in comparable Latin American countries, including Cuba (30.9%), Venezuela (29.7%), Costa Rica (23.2%), Puerto Rico (21.8%), Panama (20.5%), and Honduras (18.3%).² The relatively high probable asthma rate in the community of Paraíso, Villa Mella, Santo Domingo Norte compared with similar Latin American countries is not fully explained by environmental risk factors for asthma, including prominent air pollution, dusty dirt roads, usage of biomass for fuel, unvented cooking areas, local practice of trash burning near homes, open windows, arthropod/animal exposure, and parasitic infection and sensitization. It is possible that underlying population factors may account for this

Table 4. Overall Asthma Risk

Risk Category	n = 74
Not at risk	28 (37.8%)
Elevated risk	11 (14.9%)
High risk	16 (21.6%)
Probable asthma	19 (25.7%)

Table 5. Predictive value of asthma screening parent questionnaire in relationship to the Asthma Predictive Index

No. of Positive Screening Questions	Elevated Risk	High Risk	Probable Asthma	Total
1	6	4	1	11
2	3	4	4	11
3	1	6	4	11
4	1	2	10	13
Total	11	16	19	46

difference or that degrees of environmental exposure differ in Santo Domingo Norte. It was also noted there was a relatively high rate of allergic rhinitis among children in our study screened with the API (60.9%, or 28 of 46 screened), indicating a high level of atopic disease, which is a known risk factor for asthma. It is possible that the measured prevalence is higher than might be expected of the Dominican Republic as a whole given that our study was located in a community with urban characteristics, and asthma risk is known to be higher in urban centers.¹⁰⁻¹²

Usefulness of Combined Rapid Asthma Screening Tools in Short-Term Clinics. The combined use of the abbreviated Asthma Screening Parent Questionnaire and API appeared to identify children at risk for undiagnosed asthma without the need for specialized equipment and without slowing patient care. Stand-alone questionnaires such as the Asthma Screening Parent Questionnaire and the International Study of Asthma and Allergies in Childhood questionnaires are longer and rely solely on information reported by patients and families without additional clinical assessment.¹³ These questionnaires ask patients about the timing of various symptoms, signs, and prior diagnoses; hence, their reliability depends not only on families' memories but also on their level of formal education, access to medical evaluations, and understanding of their medical history. As a result, these available Spanish questionnaires are not feasible in fast-paced clinics focused on delivering high-volume care to underserved patients who may have low levels of health education or literacy. The risk assessment developed by the investigators, consisting of verbal questions and on-site clinical assessments, proved to be a clinically useful yet rapid screen easily incorporated into the clinical encounter. This tool may also prove useful for providers in other clinics serving Spanish-speaking patients.

Strengths and Limitations. To our knowledge, this study is the first of its kind to determine the prevalence of childhood asthma risk in the Dominican

Republic. The results of this study therefore may be useful for health policymakers within the Dominican Republic when creating asthma treatment programs and initiatives. These data are also immediately useful for continuing medical work in this community as well as having potential use for short-term medical work elsewhere in the Dominican Republic. Patient education programs, medication purchases, and team preparation can be adapted based on the high level of asthma risk. In fact, although asthma treatment options are reasonably available in Santo Domingo, the finding of high asthma risk underscores the importance of facilitating adequate access to medications and health care. This study's combined asthma questionnaire and clinical assessment tool may also be useful for future short-term free clinic trips to Latin American countries given its simplicity and versatility.

However, study limitations must also be acknowledged. In order to ensure the privacy of our participants and their parents, only children presenting with parents were eligible to enroll. This inclusion criterion limited our sample size to $n = 74$, roughly one-half of our otherwise eligible pediatric patients seen in the clinic, and may have introduced a selection bias. Additionally, symptoms of eczema, wheezing, and allergic rhinitis were diagnosed using a one-time clinical encounter, where ideally diagnosis would be made via long-term follow-up to document persistence. It should also be noted that some children with chronic atopic illness may have been missed if not symptomatic at the time of evaluation. Another limitation is that the prevalence of probable asthma measured in this study may not be readily generalizable to the Dominican Republic as a whole, given that the study was conducted in a periurban setting. Finally, the sensitivity and specificity of our risk assessment is not known, though both the full-length Asthma Screening Parent Questionnaire and API were validated for use with other populations. The API was truncated by removing the minor criterion of eosinophilia because of limited resources

available at the clinic, but the diagnostic standard was maintained by still requiring 2 minor criteria for high risk diagnosis. Because an API diagnostic criterion was eliminated, the risk assessment may have underestimated risk by relying on 1 fewer diagnostic criterion. Additional possible limitations of the diagnostic and screening tool described earlier may include parental ability to recognize wheezing (“*silbidos*”) in their children and parental and patient understanding of the questions used in the survey.

Future Research. Further studies, such as prospective longitudinal research, are needed to better understand the risk factors, causal mechanisms, and role of atopy. Similarly, the combined questionnaire and API screening tool used in this study should be validated and compared with the original Asthma Screening Parent Questionnaire and API as well as spirometry and other diagnostic measures

recommended by the National Asthma Education and Prevention Program.

CONCLUSION

The present study found that approximately 26% of children in this community had probable asthma and 62% were at risk of asthma. Overall, the rate of probable asthma among children in Paraíso, Villa Mella, Santo Domingo Norte, would rank among the highest national rates in Latin America. The high prevalence of atopic disease may explain this finding, as might specific local environmental risk factors.

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