
Measuring asthma disparities in Hispanics: adherence to the national guidelines for asthma treatment in emergency departments in Puerto Rico

Federico Montealegre, PhD, DVM*; Domingo Chardon, MD*; Wanda Vargas, RN*; Manuel Bayona, MD, PhD†; and Diego Zavala, PhD*

Background: Puerto Rico has the highest prevalence of asthma in the United States. Currently, there are no data on actual care given to asthmatic patients.

Objective: To determine the prevalence of documented adherence to the 1997 National Asthma Education Prevention Program guidelines regarding care given in emergency departments (EDs) in Ponce, Puerto Rico.

Methods: A case series was conducted using 6,002 ED records with a physician-based diagnosis of asthma for 1999 through 2001.

Results: A history of asthma attack was documented in 82.0% of the cases and in all age groups. In-home β -agonist use was recorded in only 5.7% of the medical records. Documentation of previous admissions to the ED and the intensive care unit were found in 3.5% and 0.33% of the records, respectively. Nocturnal symptoms before the ED visit were found in only 6.4% of the records, and asthma treatment at home was found in 39.9%. Accessory muscle retraction was documented in 99.1% of the cases, and oxygen saturation was found in 23.2%. Treatment with nebulized β -agonist was found in 72.1% of the records, and intravenous or oral corticosteroid use was found in 84.1%. Follow-up appointments were detected in 64.8% of the cases, and referrals to specialists were given in only 5.3%. Rate ratios between our data and those of other researchers indicate that there are geographical differences in compliance with the guidelines.

Conclusion: Of the variables tested, only one had acceptable levels of compliance, as evidenced in the patient's records, indicating that there are alarming differences in ED evaluation and treatment compared with the 1997 National Asthma Education Prevention Program guidelines.

Ann Allergy Asthma Immunol. 2004;93:472–477.

INTRODUCTION

National statistics show an increase in asthma prevalence in the past 2 decades. Ethnic minorities, in particular those of low socioeconomic status, are disproportionately represented in the trends of increasing asthma prevalence, morbidity, and mortality.¹ Within these groups, Hispanics are the most affected. Further studies^{2–4} have consistently shown higher asthma prevalence rates in Puerto Ricans than in any other ethnic groups. Results of a recent Behavioral Risk Factor Surveillance System survey indicate that the lifetime prevalence of asthma in Puerto Rico is the highest in the United States.⁵ The causes are unknown, but health care delivery to asthmatic patients with exacerbations could play an important role as a contributing risk factor to the asthma epidemic in our community.

To improve asthma management, the National Asthma Education Program of the National Institutes of Health (NIH) published the 1991 expert panel report (EPR-1) as the *Guidelines for the Diagnosis and Management of Asthma*.⁶ The aim of these guidelines was to assist health care professionals in bridging current scientific knowledge and practice. The EPR-1 provided recommendations for the treatment of asthma based on 4 key areas for effective management of the disease: objective measures of lung function, environmental control measures, comprehensive pharmacologic therapy, and patient education. The current *Guidelines for the Diagnosis and Management of Asthma* is the second expert panel report (EPR-2), published in 1997.⁷ In this report, the 4 concepts of the EPR-1 are enhanced in all previous efforts to provide standard procedures for the treatment and prevention of asthma. This latest report adopts a new scheme for chronic asthma severity, a modified asthma home management strategy, and new peak expiratory flow cutoff values to guide care. The EPR-2 also addresses newer drugs used in long-term therapy and new strategies in acute asthma care. New patient education materials were also developed. In the EPR-1 and the EPR-2, the panel's recommendations for emergency department (ED) asthma care stress the use of

* Department of Microbiology, Ponce School of Medicine, Ponce, Puerto Rico.

† Department of Epidemiology, School of Public Health, University of North Texas Health Science Center, Fort Worth, Texas.

Received for publication November 25, 2003.

Accepted for publication in revised form July 24, 2004.

objective measures of pulmonary function to evaluate severity, aggressive inhaled β_2 -agonist therapy, early systemic corticosteroid administration, and early disposition decisions. These guidelines have been subjected to an intensive dissemination program with the expectation of improving ED care for asthmatic patients. Their implementation rates, however, have been variable.⁸⁻¹¹

Available information regarding health care use by asthmatic patients in Puerto Rico is limited. Montealegre and Bayona¹² documented that 56% of asthmatic patients have required ED medical attention at least once in their lives owing to exacerbations in their asthma. Additional data by Pérez-Perdomo et al¹³ showed that the larger proportion of users of the ED owing to asthma were in the 18- to 44-year-old group, whereas hospital admissions were more frequent in the 45- to 64-year-old group. The authors also reported that more than half (56%) of the cost per service was attributed to hospital admissions. These findings indicate that asthma may have a significant impact on health care services and may reflect inadequate patient management in the EDs of our institutions. The objectives of the present study were to determine the prevalence of documented adherence to selected 1997 national guidelines for the treatment and management of asthmatic patients in the ED with care given in EDs in Ponce, Puerto Rico, and to compare our data with those previously published.

METHODS

Study Design

In this case series, all available medical records from cases of asthma seen in the EDs of the major hospitals in Ponce were reviewed, which required a minimum of 1,059 records for each age group (0-5, 6-17, and >17 years), as reported by Milks et al.¹⁴ This sample size was calculated as described by Daniels¹⁵ using EpiInfo statistical software, version 6.04 (Centers for Disease Control and Prevention, Atlanta, GA). Using this sample size provided the opportunity to detect rates of adherence to the 1997 NIH guidelines as low as 3% (80% power, 95% confidence interval, and 1.5% precision) compared with the ideal 90% adherence rate, as proposed by Cabana et al.¹⁶ The sample size was calculated based on an estimated 20,000 cases of asthma in the 3-year period at the ED. The study was conducted between December 1999 and September 2001. The medical records from asthmatic patients receiving medical care in the ED because of asthma at any of the participating hospitals were identified. A nurse abstractor accessed the medical records and obtained only the relevant information regarding ED treatment for asthma during the last visit. The inclusion criterion for the record to be abstracted was a physician-based diagnosis of asthma exacerbation.

Epidemiologic and Demographic Data

A medical record data abstraction instrument was developed and used to obtain specific information on the patient's sex and age. The following variables, based on the national

guideline recommendations for ED treatment of asthmatic patients, were analyzed: history of asthma attack, history of β -agonist use at home and before the ED visit, nocturnal symptoms of asthma before the ED visit, hospitalizations owing to asthma, admissions to the intensive care unit and intubations, accessory muscle retraction, objective measures of lung function, nebulized β -agonist treatment every 30 minutes, oral or intravenous corticosteroid use, follow-up appointments, referrals to a specialist, and prescriptions given for any asthma medication.

Although not part of the guidelines, the frequency of documentation for ED use of aminophylline was also analyzed. The abstraction form was optimized following the recommendations of Kelsey et al.¹⁷

Data Entry and Analysis

Data were analyzed using Stata SE statistical software version 8.0 (Stata Corp, College Station, TX). For each variable, the frequency distribution was calculated and provided the overall percentage of adherence to the NIH guidelines. Cross-tabulation was used to obtain the percentage of adherence to national guidelines by age group. The χ^2 or the Fisher exact test was used to evaluate the statistical significance of the difference in the NIH guidelines adherence proportions among age groups. The rate ratios were calculated to evaluate the difference in NIH guideline compliance by age group compared with previously published data.⁷ The Student *t* test was used to compare continuous variables, such as age.

RESULTS

A total of 6,002 ED records from asthmatic patients were reviewed; of these, 31% were patients aged 0 to 5 years, 35.9% were aged 6 to 17 years, and 33.1% were older than 17 years. The mean $\pm$ SD age of the asthmatic patients was 23.4 ± 21.9 years. The sex distribution included 52.6% females and 47.3% males. The female population was significantly older than their male counterparts (mean $\pm$ SD age: 27.6 ± 22.1 vs 19.15 ± 20.7 years; pairwise, $P < .001$). A seasonal variation was observed in the frequency of asthmatic patients attending the EDs (Fig 1).

The documented history of the current asthma attack was recorded in all age groups (Table 1). Documented evidence of asthma treatment at home was found in 39.9% of the cases, and β -agonist home use was documented in 5.7%. The frequency of previous hospitalizations because of asthma was 3.5%. Admissions to the intensive care unit or intubations were reported in 0.33% of the cases. Nocturnal symptoms were documented in 6.4% of the cases, and younger cases had significantly higher documentation prevalence of this guideline than older cases.

The physical examination and treatment of asthmatic patients in the ED showed that use of accessory muscle retraction was similarly documented in almost all cases (99.1%) (Table 1). In contrast, objective measures of lung function were recorded only in a limited number of cases (23.2%), and a significantly higher percentage of documentation of this

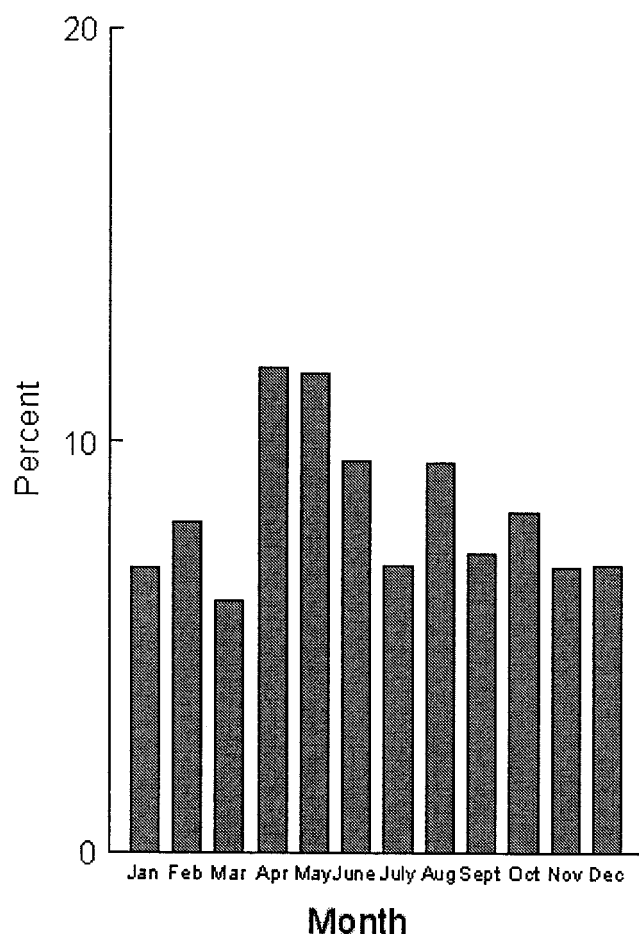


Figure 1. Frequency distribution of asthma cases by month.

guideline was observed in older patients (>17 years). Treatment with nebulized β -agonists was high for all age categories, ranging from 70.0% in older patients to 75.7% in younger patients; in addition, younger patients (≤ 17 years) had significantly higher documentation rates for this guideline than older patients. Documentation of either oral or intravenous corticosteroid use was 84.1%, and use of aminophylline was significantly higher in patients older than 17 years than in younger asthmatic patients.

Follow-up appointments were documented in 64.7% of the cases and were significantly higher in older patients. Documentation of referrals was found in only 5.3% of the cases, but older patients had a significantly greater proportion with referrals than younger patients. Prescriptions were documented in 66.6% of the cases (Table 1). Time spent in the ED was found in 99.0% of the records, and the mean asthma attack duration was 3.5 hours.

Rate ratios of selected guidelines in the present study were compared with those in the study by Milks et al¹⁴ (Fig 2). Data obtained in Ponce showed higher rates of documented accessory muscle retraction, use of corticosteroids, and prescriptions given to patients. Data obtained by Milks et al¹⁴ showed higher rates of documented history of asthma attacks, β -agonist use at home, history of nocturnal symptoms, use of inhaled β -agonists, follow-up appointments, and specialist referrals.

DISCUSSION

Published data show that there is considerable national variation in compliance with the national guidelines for ED asthma treatment.¹⁸ Our study follows this variation but with alarming disparities. Overall, compliance rates varied from 99.1% in use of accessory muscle retractions to an almost nonexistent documentation rate of 0.33% for admissions to

Table 1. Frequency of Adherence to NIH Guidelines by Age Group

NIH Guideline	Patients, No. (%)			Total (N = 6,002; 100%)
	Aged 0–5 y (n = 1,858; 31%)	Aged 6–17 y (n = 1,238; 20.6%)	Aged >17 y (n = 2,906; 48.4%)	
History of asthma attack	1,249 (67.2)	1,070 (86.4)	2,602 (89.5)*	4,921 (82.0)
Treatment at home	670 (36.1)	540 (43.6)	1,186 (40.8)	2,396 (39.9)
β -Agonist use at home	150 (8.1)	115 (9.3)	80 (2.8)†	345 (5.7)
Nocturnal symptoms before ED visit	96 (5.2)	80 (6.5)	205 (7.1)†	381 (6.4)
Hospitalizations owing to asthma	65 (3.5)	27 (2.2)	119 (4.1)*	211 (3.5)
Admissions to intensive care unit or intubations	3 (0.126)	5 (0.4)	12 (0.4)	20 (0.33)
Accessory muscle retraction	1,839 (99.9)	1,231 (99.4)	2,877 (99.0)	5,947 (99.1)
Oxygen saturation for adults or PFT for children	202 (10.9)	172 (13.9)	1,019 (35.1)*	1,393 (23.2)
Nebulized β -agonist treatment every 30 min	1,406 (75.7)	889 (71.8)	2,033 (70.0)†	4,328 (72.1)
Oral or intravenous corticosteroid use	1,444 (77.7)	1,000 (80.8)	2,605 (89.6)	5,049 (84.1)
Follow-up appointment	1,107 (59.6)	727 (58.7)	2,050 (70.5)*	3,884 (64.7)
Referral to a specialist	64 (3.4)	44 (3.6)	212 (7.3)*	320 (5.3)
Prescription given	1,252 (67.4)	835 (67.5)	1,913 (65.8)	4,000 (66.6)
Use of aminophylline	181 (9.7)	179 (14.5)	1,333 (45.9)*	1,693 (28.2)

Abbreviations: ED, emergency department; NIH, National Institutes of Health; PFT, pulmonary function testing.

* Older patients (>17 years) had significantly higher documented adherence than younger patients (≤ 17 years).

† Younger patients (≤ 17 years) had significantly higher documented adherence than older patients (>17 years).

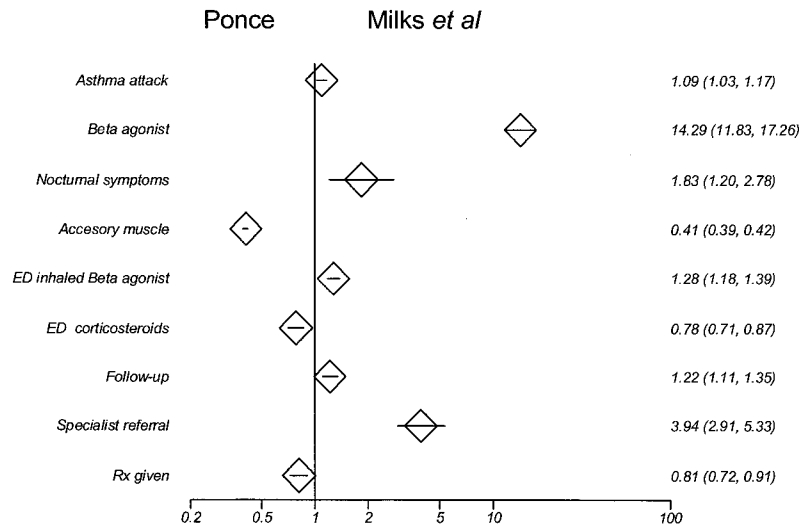


Figure 2. Rate ratios (95% confidence intervals) of adherence to National Institutes of Health guidelines. ED indicates emergency department; Rx, prescription. Horizontal lines represent 95% confidence intervals; rhomboids, sample sizes.

the intensive case unit or intubations. The important limitation of the present study is that it was based on what was documented in the patient's record, which may differ from what was actually carried out with each asthmatic patient.

Cabana et al¹⁶ suggested that a minimum standard for adherence rates to the guidelines should be 90% of documented compliance. Therefore, in our study, only accessory muscle retraction is in compliance with the NIH guidelines. The data presented herein allowed us to identify several areas with deficiencies that may lead to low compliance with the ED guidelines for asthma treatment in Ponce, including lack of objective measurement of lung airflow, incomplete pharmacologic treatment, incomplete patient disposition, and overall lack of proper documentation of ED asthma treatment.

Documented evidence of the objective measure of lung airflow in the ED was extremely low, which is of great concern. In our community, it is possible that at the institutional level, decision making regarding the acquiring or upgrading of ED equipment for lung airflow measurement may not be prioritized. In accordance with the 1997 guidelines, lung evaluation must be conducted by peak expiratory flow rate measurement, pulse oximetry, arterial blood gas analysis, or spirometry (forced expiratory volume in 1 second). The applicability of each of these tests in the ED may depend on each institution's good clinical practices. For example, Emond et al⁸ showed before the implementation of the guidelines, only 20% of patients underwent peak expiratory flow testing before intervention compared with 83% after intervention. McDermott et al¹⁹ conducted a survey in several hospitals in Chicago, IL, and their results show that 95.8% of asthmatic patients in the ED had their objective lung measures by pulse oximetry. A follow-up survey by Lenhardt et al²⁰ of the same institutions reported that in the ED manage-

ment of asthma, the use of peak expiratory flow rate has decreased and the use of pulse oximetry has increased. Regardless of the test used for lung evaluation, these results demonstrate that the implementation of objective measures of lung function is feasible in the ED and will respond to the EPR-2 recommendations for proper management of the asthmatic patient.

Regarding incomplete pharmacologic therapy, our data show expected moderately high documentation rates of β -agonist use while the patient received medical attention because of asthma. Nevertheless, they are lower than those reported by others with acceptable rates.^{11,13} It is likely that ED physicians may prescribe β -agonists according to the severity of each individual case. Our compliance rate in the use of oral or intravenous corticosteroids reached 84.1%, which is higher than that reported by Reid et al²¹ (59%). The documentation compliance with β -agonist use and the unsatisfactory compliance with corticosteroid therapy are indicative that ED physicians in our community are following an individual routine for the treatment of asthma, not the guidelines.

The low prevalence of documented referral of the asthmatic patient to lung specialists in the ED by physicians is of concern because patients are not receiving adequate medical attention, especially those who require additional follow-up. Our results may be explained by the fact that asthmatic patients who are discharged from the ED are linked to a managed care program (health maintenance organization). In this case, patient follow-up is conducted by the primary care physician rather than by a lung specialist. It is likely that the ED physician may require additional specialized education to establish criteria for when to refer a patient to a lung specialist. It has been demonstrated in national surveys that inconsistencies exist among physicians regarding the management and treatment of asthma.²² Therefore, emphasis should be

placed on providing physicians with training that is associated with patient compliance.²³⁻²⁵

The overall lack of proper documentation may be due to lack of a universal form to monitor compliance. The shortage of personnel, coupled with the fact that ED physicians may not have sufficient knowledge and time to document the followed guidelines in the patient's record, may explain in part the low documentation rates.

We also found age-related differences: older cases had significantly less compliance with home use of β -agonists than younger patients. This may reflect deficiencies in patient education and lack of a written action plan for the patient to follow. Older patients had significantly higher compliance rates for documented hospitalizations and objective measures of lung function. The higher hospitalization rates by older patients could reflect additional health complications and possibly a refusal to visit their primary care physician and the ED for medical attention. Aminophylline use was significantly higher in older patients than in younger ones, which may be because of policies imposed by health care insurance in Puerto Rico. These policies require intravenous medication use during hospital care to receive reimbursement for the visit. In contrast, nebulized β -agonist treatment had higher compliance rates in younger patients than in older patients. Follow-up appointments and specialist referrals had higher documentation rates in older patients than in younger patients, possibly reflecting other conditions.

We compared the compliance rates for selected guidelines in the present study with those in the study by Milks et al.¹⁴ In both studies, the prevalence of documented adherence to the selected guidelines varied from low to high, and we found several significant differences between studies (Fig 2). In our institutions, patient records were more likely to have documented adherence to use of accessory muscle retractions, ED use of oral or intravenous corticosteroids, and prescriptions given to patients than those obtained by Milks et al.¹⁴ In contrast, history of asthma attack, home β -agonist use, nocturnal symptoms, follow-up visits, and specialist referrals were more likely to have documented evidence in the study by Milks et al.¹⁴ than in Ponce. These comparative results demonstrate that even 11 years after the first NIH guidelines to standardize asthma treatment were distributed, there is an alarming variability in the implementation of asthma treatment, and when so, adherence is low, except for those that may be part of the ED routine as established by each institution. Nevertheless, documented evidence may reflect daily practices that vary among institutions.

Despite the limitations of the present study, the data provide important evidence of the deficiencies in compliance with the guidelines for ED asthma treatment in our institutions. There are 2 key questions. (1) Which guidelines can be implemented across institutions? (2) What will it take to accomplish these goals? Currently, the most important solution has been aggressive educational campaigns directed toward physicians and patients, which has resulted in varying success, depending on the institution. Therefore, we suggest

that hospitals with low compliance rates, such as ours, must establish a collaborative effort to standardize an ED protocol that complies with guidelines, implement a universal surveillance system in which a standard form with minimum data elements is used, and provide a written action plan to all asthmatic patients so that the quality of asthma care can be improved.

ACKNOWLEDGMENTS

Thanks to Dr. Martin Hill of the Department of Pharmacology and Toxicology, Ponce School of Medicine, for critically reviewing the present manuscript. This work was fully supported by grant in aid 25-P-91151/2-02 from the Centers for Medicare and Medicaid Services and grant RR03050 from the National Institutes of Health—Research Centers in Minority Institutions.

REFERENCES

1. Homa DM, Lara M. Asthma mortality in US Hispanics of Mexican, Puerto Rican and Cuban heritage, 1990–1995. *Am J Respir Crit Care Med*. 2000;161:504–509.
2. Corter-Pokras OD, Gergen PJ. Reported asthma among Puerto Rican, Mexican-American, and Cuban children, 1982–1984. *Am J Public Health*. 1993;83:580–582.
3. Crain EF, Weiss KB, Bijur PE, Hersh M, Westbrook L, Stein RK. An estimate of the prevalence of asthma and wheezing among inner-city children with asthma. *Pediatrics*. 1994;94:356–362.
4. Beckett WS, Belanger K, Gent JF, Holford TR, Leaderer BP. Asthma among Puerto Rican Hispanics: a multi-ethnic comparison of risk factors. *Am J Respir Crit Care Med*. 1996;154:894–899.
5. Centers for Disease Control and Prevention. Self-reported asthma prevalence and control among adults—United States, 2001. *JAMA*. 2003;289:2639–2640.
6. National Asthma Education and Prevention Program. *Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute; 1991. NIH publication 91-3042.
7. National Asthma Education and Prevention Program. *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute; 1997. NIH publication 97-4051.
8. Emond SD, Woodruff PG, Lee EY, Singh AK, Camargo CA Jr. Effect of an emergency department asthma program on acute asthma care. *Ann Emerg Med*. 1999;34:321–325.
9. Legorreta AP, Christian-Herman J, O'Connor RD, Hasan MM, Evans R, Leung KM. Compliance with national asthma management guidelines and specialty care: a health maintenance organization experience. *Arch Intern Med*. 1998;158:457–464.
10. Hakim RB, Ronsaville DS. Effect of compliance with health supervision guidelines among US infants on emergency department visits. *Arch Pediatr Adolesc Med*. 2002;156:1015–1022.
11. Scribano PV, Lerer T, Kennedy D, Cloutier MM. Provider adherence to a clinical practice guideline for acute asthma in a pediatric emergency department. *Acad Emerg Med*. 2001;8:1147–1152.

-
12. Montealegre F, Bayona M. An estimate of the prevalence, severity and seasonality of asthma in visitors to a Ponce shopping center. *P R Health Sci J*. 1996;15:113–117.
 13. Pérez-Perdomo R, Suárez-Pérez E, Torres D, Morell C. Prevalencia de asma y utilización de servicios médicos en asegurados de una compañía de servicios de salud en Puerto Rico, 1996–1997. *Bol Asoc Med P R*. 1999;91:91–97.
 14. Milks C, Oppenheimer J, Bielory L. Comparison of emergency room asthma care to National Guidelines. *Ann Allergy Asthma Immunol*. 1999;83:208–211.
 15. Daniels WW. *Biostatistics: A Foundation for Analysis in the Health Sciences*. 5th ed. New York, NY: John Wiley & Sons Inc; 1987:157.
 16. Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med*. 2001;155:1057–1062.
 17. Kelsey J, Thompson WD, Evans A. *Methods in Observational Epidemiology*. New York, NY: Oxford University Press; 1986.
 18. Meng YY, Leung KM, Berkbighler D, Halbert RJ, Legorreta AP. Compliance with US asthma management guidelines and specialty care: a regional variation or national concern? *J Eval Clin Pract*. 1999;5:213–221.
 19. McDermott MF, Grant EN, Turner-Roan K, Li T, Weiss KB. Asthma care practices in Chicago-area emergency departments: Chicago Asthma Surveillance Initiative Project Team. *Chest*. 1999;116(Suppl):167S–173S.
 20. Lenhardt R, Malone A, Grant EN, Weiss KB. Trends in emergency department asthma care in metropolitan Chicago: results from the Chicago Asthma Surveillance Initiative. *Chest*. 2003; 124:1774–1780.
 21. Reid J, Marciniuk DD, Cockcroft DW. Asthma management in the emergency department. *Can Respir J*. 2000;7:255–260.
 22. Davis P, Man P, Cave A, McBennett S, Cook D. Use of focus groups to assess the educational needs of the primary care physician for the management of asthma. *Med Educ*. 2000;34: 987–993.
 23. Wu AW, Young Y, Skinner EA, et al. Quality of care and outcomes of adults with asthma treated by specialists and generalists in managed care. *Arch Intern Med*. 2001;161: 2554–2560.
 24. Vollmer WM, O'Hollaren M, Ettinger KM, et al. Specialty differences in the management of asthma: a cross-sectional assessment of allergists' patients and generalists' patients in a large HMO. *Arch Intern Med*. 1997;157:1201–1208.
 25. Moore CM, Ahmed I, Mouallem R, May W, Ehlayel M, Sorensen RU. Care of asthma: allergy clinic versus emergency room. *Ann Allergy Asthma Immunol*. 1997;78:373–380.
- Requests for reprints should be addressed to:*
Federico Montealegre, PhD, DVM
Department of Microbiology
Ponce School of Medicine
PO Box 7004
Ponce, Puerto Rico 00732
E-mail: fmontealegre@psm.edu
-