

The Impact of Literacy Enhancement on Asthma-Related Outcomes among Underserved Children

Lawrence D. Robinson Jr., MD; Daphne P. Calmes, MD; and Mohsen Bazargan, PhD

Financial support: Analysis and manuscript development were supported by the National Center for Research Resources (#G12-RR03026), and the National Center on Minority Health and Health Disparities (#P20MD000148).

Statement of Problem: Despite the availability of improved healthcare access, self-management programs, disease management protocols, and advances in pharmacologic and immunotherapy therapy, the prevalence of asthma in the urban inner city remains one of the major health disparities in the United States. Additionally, sustainability of effective intervention programs after the funding has ended remains a significant issue for asthma programs.

Objective: This study examines the effectiveness of a longitudinal intervention program that was designed with the assumption that improved literacy plays a role in improving asthma-related health outcomes among high-risk children with the most severe forms of asthma.

Methods: A longitudinal intervention over 6 months prospectively addressed the literacy and asthma self-management skills of 110 minority children in South Los Angeles utilizing weekly Saturday-school format.

Results: The results demonstrated that there was a statistically significant decrease in both hospitalization and emergency department (ED) visits during the intervention. In addition, all the children showed significant improvement in their reading level and self-efficacy. Multivariate logistic analysis demonstrated that enhanced self-efficacy was directly related to decreased hospitalizations and ED visits.

Conclusion: This intervention demonstrated that literacy enhancement is an important factor in improving self-efficacy and impacting asthma-related outcomes. Improved literacy is a sustainable factor that will not only improve asthma outcomes but will enhance the potential for educational success.

Key words: asthma ■ minority health ■ children/adolescents

© 2008. From David Geffen UCLA School of Medicine (Robinson, Calmes); and Departments of Pediatrics (Calmes), Family (Bazargan) and Research Centers in Minority Institutions (Bazargan), Charles Drew University of Medicine & Science, Los Angeles, CA. Send correspondence and reprint requests for *J Natl Med Assoc.* 2008;100:892-896 to: Dr. Lawrence D. Robinson Jr., 6156 Avalon Court, Los Angeles, CA 90803; phone: (661) 945-2221; fax: (661) 945-0831; e-mail: baldtronii@aol.com

INTRODUCTION

Since the 1970s, self-management interventions have been utilized among children and adults with persistent forms of asthma to improve their knowledge of asthma and health-related behaviors.¹⁻¹⁶ The programs directed at children have utilized various strategies to improve their self-management skills with designs ranging from group instruction to individualized computer-based problem-solving. These particular interventions have demonstrated a statistically significant reduction in asthma recidivism with individualized facilitation leading to improved adherence to disease management protocols.¹⁷⁻¹⁹ On the other hand, comprehensive multisite programs such as the National Cooperative Inner-City Asthma Study and the Inner-City Asthma Study have demonstrated that addressing major environmental issues in the urban inner city is essential to improving asthma outcomes.²⁰⁻²³ Although a number of interventional strategies have attempted to reduce asthma morbidity and mortality in the urban inner city, the morbidity and mortality statistics remain unchanged for children of African Americans and Hispanic children of African descent. Additionally, sustainability of effective intervention programs following the termination of funding cycles remains a significant issue for asthma programs and may attenuate prolonged intervention effects. Studies conducted in low-income urban populations have documented that low literacy is a predictor of poor health outcomes, even after other sociodemographic variables are considered.²⁴⁻²⁶ Other studies have also reinforced the concept that literacy is vital to health-related outcomes.^{24,25,27-29} To the best of our knowledge, there have not been any asthma-related interventions which have evaluated the relationship between literacy and health by improving both areas simultaneously.

Comprehensive long-term intervention programs that target underserved minority asthmatic children must employ innovative strategies to empower these children to understand their disease and to obtain new information regarding their long-lasting disease management and health status.

The objective of this longitudinal intervention was to determine whether improving literacy among a group of children with low rates of literacy would improve their asthma-related health behavior. Through a Saturday-school format, the proposed intervention provided literacy enhancement and asthma education for children with moderate and severe asthma. We have proposed a long-term intervention to provide asthmatic minority underserved children from South Los Angeles with weekly asthma education, literacy enhancement and life skills training. This longitudinal intervention has been designed with the assumption that improved literacy plays a vital role in improving asthma-related health outcomes among high-risk children with the most severe forms of asthma.

METHODS

Sample

This longitudinal study was performed with a non-probability sample of 110 children between the ages of 6–14 from the pediatric allergy clinic at King/ Harbor MAC (formerly known as the King/Drew Medical Center) who met the criteria for moderate or severe persistent asthma according to the 1997 National Guidelines.³⁰ This study was approved by the institutional review board of the Charles Drew University of Medicine & Science.

The service area of this medical center represents the most impoverished and medically underserved community in Los Angeles County.³¹ Asthma is a very common condition in Los Angeles County. Research among school children in urban Los Angeles indicates that 14% are likely to have asthma.³¹ Approximately 37% of the population in this portion of Los Angeles lives below the federal poverty level, and 41% have less than a high-school education.³² According to the 2002–2003 Los Angeles County Health Survey, the public high school drop-out rate in South Los Angeles (SPA-6) is

27.4%.³³ Prior to the reorganization of the medical system in Los Angeles County which reduced the services at King/Drew Medical Center to those of an ambulatory care center, the King/Drew Medical Center provided the only asthma specialty care for approximately 600,000 minority children. The Allergy Division consisted of 4 board-certified allergists, 2 allergy fellows and a mid-level provider.

Of the 110 children who were enrolled in the study, 94 (86%) were retained in the program for ≥ 6 months. Of this remaining sample, 57% were between 6–10 years old, and 43% were between 11–14 years old. Exactly 47% of respondents were female. Eighty percent of the participants identified themselves as African American, and 22% Hispanic Americans. Almost 77% of participants reported living with their parent(s), whereas the other 23% lived with relatives or foster parents.

Statistical Analysis

Descriptive statistics were used to identify the distribution and frequency of all items which were subsequently used to construct the independent scales and indices for examination. Paired t test and analysis of variance tests were performed to measure the impact of demographic characteristics and independent variables on the outcome variables.

Measurements

The severity of asthma was assessed by the allergy and immunology attending physician who provided medical supervision and a chart review for each child. Enrollment in the program was voluntary, and parental informed consent was provided. The parents were assisted by a trained facilitator to complete a database questionnaire relating to demographic information, socioeconomic status, home environment, asthma severity and current management practices. Each child had his/her reading level assessed using the Gilmore Oral Reading Test.³⁴ This instrument evaluates reading accuracy, vocabulary and reading comprehension.³⁴ Each child completed a self-efficacy survey and asthma knowledge questionnaire prior to beginning the intervention. Similar data were collected 6 months after initiation of the intervention. In addition, urgent care/emergency (ED) and hospital admissions related to

Table 1. Hospitalization, emergency room visits, asthma-related self-efficacy and reading levels pre- and postintervention program (n=94)

| Outcome Variables | Preintervention (%) (Mean \pm SD) | During Intervention (%) | P Value |
|----------------------------------|--|-------------------------|---------|
| Hospitalization within 6 months | 37.2 | 22.3 | <0.001 |
| Emergency visits within 6 months | 62.8 | 33.2 | <0.010 |
| Self-efficacy (scale 40–100) | (65.8 \pm 12.6) | (76.2 \pm 12.4) | <0.001 |
| Reading level (scale 1–11) | (3.2 \pm 2.3) | (4.7 \pm 2.3) | <0.001 |

asthma were documented from patient history and medical records for 6 months prior to and after enrollment into program/intervention.

The Intervention

The ARAP was based on the Saturday-school format, with sessions held each Saturday from 9–12. The program was designed to provide each child with 2 hours of literacy training and 30 minutes of asthma education, separated by a 15-minute break. The minimum intervention period for each child was 6 months; however, 60% of participants enrolled for ≥ 1 year. The educational curriculum was designed by an educational specialist based on information collected from focus groups and needs-assessment surveys. The educational curriculum stresses reading accuracy, reading comprehension, writing and oral language skills. The facilitators consisted of college students, medical students and volunteer physicians who participated in a 3-hour orientation and followed the prescribed workbook educational plan. The results of the Gilmore Oral Reading Test determined the appropriate reading curriculum at which the child would begin.³⁴ An adult facilitator supervised a maximum of 3 children for 2 hours of reading instruction during each session. Each child's reading progress is reassessed every 6 months. Asthma education was provided in a 6-week module utilizing the Open Airways Program.³⁵⁻³⁸ The American Lung Association of Los Angeles certified each asthma education instructor. After the initial 6-week intervention, each child had a refresher asthma class every 4–6 weeks.

In addition to the Saturday program, the Asthma Reading Advocacy (ARAP) Camp is held on a university site. This unique experience provides the children with exposure to the university campus in lieu of the traditional wilderness camp sites. The university site provides the campers with access to classroom, computer services and the resident college students who serve as passive role models. The camp experience included 4 hours of daily activities consisting of reading and language instruction, computer-based asthma education, activities that accentuate team building, communication skills, goal-setting, cultural diversity and interpersonal skills. The 5-day camp provides the children with onsite allergy and immunology specialists as well as nursing,

educational and recreational specialists with expertise and experience in teaching urban inner-city children.

Each child in the intervention received follow-up in the pediatric allergy and immunology clinic at the medical center. Each child had his/her current asthma status monitored by a weekly questionnaire that included information regarding asthma exacerbations during the past week and peak flow measurements before each Saturday school class. The data from the weekly asthma questionnaire and peak flow measurements were compiled on a prospective basis for the duration in which the child participated in the program.

Additionally, each child's asthma status was monitored using the data compiled from the weekly asthma data sheets as well as retrospective surveillance of ED and hospital recidivism using the medical record chart review. The self-efficacy rating of each child is measured using the Drew Self-Efficacy Scale. The Asthma Self-Efficacy Scale was developed after the Asthma Adult Scale by information based on focus groups to tailor the measurement to children from this underserved community.

RESULTS

The baseline assessment of asthma severity of this sample demonstrated that 80% had at least moderate persistent asthma. Our data show that 5% of children who participated in this study had been intubated within 6 months prior to the intervention. Furthermore, 37% of the subjects had been hospitalized ≥ 1 time within 6 months prior to entering the study. Finally, 63% of participants had asthma-related ED visits within the 6-month period prior to entering the intervention program. However, our data show that hospital and ED admissions were reduced to 22% and 33 during the six months of the intervention program, respectively (Table 1). The mean and SD of the self-efficacy scale reported in Table 1 indicate that in addition to the decrease of recidivism, the children have developed more internal mastery and control over their asthma.

The multivariate logistic regression technique was employed to examine independent correlates of asthma-related ED visits and hospitalizations. Independent variables included in the equation are age, gender and ethnicity, changes in reading levels in baseline and 6-month follow-up assessment, and changes in asthma-related self-

Table 2. Multivariate logistic analysis (adjusted odds ratio and 95% confidence interval of self-efficacy and reading level for hospitalization and emergency room visits (n=94))

| Independent Variables | Hospitalization | ER Visits |
|-----------------------|---|------------------|
| | Adjusted Odds Ratio (95% Confidence Interval) | |
| Self-efficacy | 0.33 (0.20–0.56) | 0.27 (0.17–0.43) |
| Reading level | 1.31 (0.82–2.10) | 0.34 (0.22–0.52) |

Adjusting for age, ethnicity, and gender

efficacy. The estimated Nagelkerke R-square indicates that after adjusting for age, these independent variables explain >13% and 12% of the variance in the emergency visits and hospitalization from pre- to postintervention program, respectively [(ER -2 log likelihood = 667; $p < 0.0001$; percent of correctly predicted=64%) (Hospitalization -2 log likelihood=570; $p < 0.0001$; percent of correctly predicted=74%)]. Adjusting for age and controlling for gender and ethnicity, participants whose reading had improved were less likely to experience asthma-related ED recidivism (OR=0.34, $p < 0.001$). In addition, our data show that adjusting for age and controlling for gender and ethnicity, improvement in self-efficacy was directly linked to both asthma-related emergency visits (OR=0.27, $p < 0.01$) and hospitalization (OR=0.33; $P < 0.001$). Even though, improvement in reading was not directly related to reduction of asthma-related hospitalization, it indirectly reduced hospitalization by improving self-efficacy. (Table 2)

DISCUSSION

Among California children, the prevalence of active asthma varies by racial and ethnic groups with the highest prevalence among African Americans (17%) and American Indians/Alaska natives (17%), followed by Caucasians (10%), Latinos (7%) and Asians (7%).³⁹ The ARAP is a unique intervention as it addresses both the academic and specialty healthcare needs of minority children with moderate and severe persistent asthma in this underserved community. Although the children's hospital service population was 70% Hispanic, African Americans represented 65% of the children in the allergy clinic population, and the majority of children with moderate and severe persistent asthma. The program provided each participant with literacy training, asthma education and self-management skills, as well as access to high-quality care from board-certified allergists. The literacy component of the intervention provided the children with the substrate to initiate significant enhancement of their reading aptitude. The asthma self-management component provided the children with the necessary information, problem-solving skills and techniques to improve their asthma-related health behavior.

Children who reside in the service area of the King/Harbor MAC, which is predominately comprised of Latino and African-American families, have the least access to lung care specialists, the worst performance on standardized tests scores for reading and mathematics, and represent the most impoverished population in Los Angeles County.³¹ Asthma severity is highest among African Americans and Latinos with African heritage.^{31,40} Therefore, this unique population provided the opportunity to evaluate the effectiveness of this intervention by implementing it in the highest-risk population with an elevated prevalence of asthma severity and poor academic performance.

The National Assessment of Adult Literacy, based on a large survey conducted by the National Center for Education Statistics, recently estimated that 14% of adults in the United States are unable to use printed and written information to function in society.⁴¹ Our data show that only 1 parent of the 110 children who participated in the intervention had attended college and >40% had not completed high school (data not shown). Therefore, an intervention that provides children in an urban inner-city environment with literacy enhancement provides them with an essential tool that a poorly performing educational system and even their parents often cannot adequately address.

The ARAP provided these children with asthma self-management skills as well as improved literacy, which has the potential to enhance their ability to understand their disease, to obtain knowledge independently and to build self-efficacy.^{28,42} The enhancement of literacy is the differentiating element of the ARAP. Unlike other asthma interventions that dissipate with time, literacy enhancement in most cases will provide the impetus for continued academic success.⁴³ Improved literacy provides children in urban inner-city communities with a sustainable benefit that in the future globally will give them the opportunity to become successful productive citizens. Academic achievement not only improves a child's career and economic opportunities, but concomitantly will provide the asthmatic child with the ability to purchase high-quality asthma specialty care in adulthood if necessary.

Our findings are subject to limitations related to the study design. This study was conducted using a pre- and postintervention design with no comparison group. Additionally, we documented the impact of this educational intervention in a 6-month period; however, its sustainability subsequent to the intervention period is not known. Finally, the potential seasonal effects on asthma exacerbations were not evaluated by this intervention.

Prospective

Unlike in their white counterparts, asthma prevalence, morbidity and mortality in African-American and Hispanic children of African descent remain higher despite improved access, evidence-based treatment algorithms and advances in pharmacologic therapy in the past 10 years. In this study, we have demonstrated that literacy enhancement coupled with asthma self-management skills significantly improve self-efficacy (or internal mastery) resulting in improved asthma-related outcomes. We recommend that interventions with this underserved population prioritize the enhancement of literacy concomitantly with any asthma related research or service intervention.

REFERENCES

1. La Roche MJ, Koinis-Mitchell D, Gualdrón L. A culturally competent asthma management intervention: a randomized controlled pilot study. *Ann*

- Allergy Asthma Immunol.* 2006;96(1):80-85.
2. Anderson ME, Freas MR, Wallace AS, et al. Successful school-based intervention for inner-city children with persistent asthma. *J Asthma.* 2004;41(4):445-453.
 3. Bartholomew LK, Gold RS, Parcel GS, et al. Watch, Discover, Think, and Act: evaluation of computer-assisted instruction to improve asthma self-management in inner-city children. *Patient Educ Couns.* 2000;39(2-3):269-280.
 4. Butz AM, Huss K, Mudd K, et al. Asthma management practices at home in young inner-city children. *J Asthma.* 2004;41(4):433-444.
 5. Butz AM, Syron L, Johnson B, et al. Home-based asthma self-management education for inner city children. *Public Health Nurs.* 2005;22(3):189-199.
 6. Christiansen SC, Zuraw BL. Serving the underserved: school-based asthma intervention programs. *J Asthma.* 2002;39(6):463-472.
 7. Cicutto L, Murphy S, Coufts D, et al. Breaking the access barrier: evaluating an asthma center's efforts to provide education to children with asthma in schools. *Chest.* 2005;128(4):1928-1935.
 8. Clark NM, Brown R, Joseph CL, et al. Effects of a comprehensive school-based asthma program on symptoms, parent management, grades, and absenteeism. *Chest.* 2004;125(5):1674-1679.
 9. Greineder DK, Loane KC, Parks P. A randomized controlled trial of a pediatric asthma outreach program. *Ann Allergy Asthma Immunol.* 1999;103(3 Pt 1):436-440.
 10. Haby MM, Waters E, Robertson CF, et al. Interventions for educating children who have attended the emergency room for asthma. *Cochrane Database of Syst Rev.* 2001;1.
 11. Horner SD. Using the Open Airways curriculum to improve self-care for third grade children with asthma. *J School Health.* 1998;68(8):329-333.
 12. Jones CA, Clement LT, Hanley-Lopez J, et al. The Breathmobile Program: structure, implementation, and evolution of a large-scale, urban, pediatric asthma disease management program. *Dis Manag.* 2005;8(4):205-222.
 13. Robinson LD Jr. Pediatric asthma self-management: current concepts. *J Natl Med Assoc.* 1999;91(8 suppl).
 14. DePue JD, McQuaid EL, Koinis-Mitchell D, et al. Providence school asthma partnership: school-based asthma program for inner-city families. *J Asthma.* 2007;44(6):449-453.
 15. Blackwell AD, Mellinger-Birdsong AK, Wu M, et al. Asthma management practices among children in Georgia. *J Public Health Manag Pract.* 2006;12(4):395-401.
 16. Coffman JM, Cabana MD, Halpin HA, et al. Effects of asthma education on children's use of acute care services: a meta-analysis. *Pediatrics.* 2008;121(3):575-586.
 17. Shiffman RN, Freudigman M, Brandt CA, et al. A guideline implementation system using handheld computers for office management of asthma: effects on adherence and patient outcomes. *Pediatrics.* 2000;105(4 Pt 1):767-773.
 18. Spahn JD, Szefer SJ. Childhood asthma: new insights into management [see comment]. *Ann Allergy Asthma Immunol.* 2002;109(1):3-13.
 19. Szefer SJ, Apter A. Advances in pediatric and adult asthma. *Ann Allergy Asthma Immunol.* 2005;115(3):470-477.
 20. Eggleston PA, Diette G, Lipsett M, et al. Lessons Learned for the Study of Childhood Asthma from the Centers for Children's Environmental Health and Disease Prevention Research. *Environ Health Perspect.* 2005;113(10):1430-1436.
 21. Evans R III, Gergen PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. *J Pediatrics.* 1999;135(3):332-338.
 22. Morgan WJ, Crain EF, Gruchalla RS, et al. Results of a home-based environmental intervention among urban children with asthma [see comment]. *N Engl J Med.* 2004;351(11):1068-1080.
 23. Sullivan SD, Weiss KB, Lynn H, et al. The cost-effectiveness of an inner-city asthma intervention for children [see comment]. *Ann Allergy Asthma Immunol.* 2002;110(4):576-581.
 24. Weiss BD, Blanchard JS, McGee DL, et al. Illiteracy among Medicaid recipients and its relationship to health care costs. *J Health Care Poor Underserved.* 1994;5(2):99-111.
 25. Weiss BD, Hart G, McGee DL, D'Estelle S. Health status of illiterate adults: relation between literacy and health status among persons with low literacy skills. *J Am Board Fam Pract.* 1992;5(3):257-264.
 26. Wilson JF. The crucial link between literacy and health [see comment]. *Ann Intern Med.* 2003;139(10):875-878.
 27. Baker DW, Parker RM, Williams MV, et al. The relationship of patient reading ability to self-reported health and use of health services. *Am J Public Health.* 1997;87(6):1027-1030.
 28. Paasche-Orlow MK, Rieker KA, Bilderback A, et al. Tailored education may reduce health literacy disparities in asthma self-management. *Am J Respir Crit Care Med.* 2005;172(8):980-986.
 29. Dewalt DA, Berkman ND, Sheridan S, Lohr KN, Pignone MP. Literacy and health outcomes: a systematic review of the literature. *J Gen Intern Med.* 2004;19(12):1228-1239.
 30. National Heart, Lung, and Blood Institute, National Asthma Education and Prevention Program. Bethesda, MD: Expert panel report 2: guidelines for the diagnosis and management of asthma. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, 1997; publication no. 97-4051.
 31. Los Angeles County Department of Health Services. Maternal, Child and Adolescent Health. http://lapublichealth.org/mch/CHI/chi_asthma.htm. Accessed 11/14/06.
 32. Los Angeles County Department of Health Services. Key Indicators of Public Health by Service Area. [http://lapublichealth.org/ph/hae/ha/web-site\[2\].pdf](http://lapublichealth.org/ph/hae/ha/web-site[2].pdf).
 33. Los Angeles County Department of Health Services. Key Indicators of Health By Service Planning Area 2002/2003. 2005; <http://lapublichealth.org/www/files/ph/hae/ha/keyhealth.pdf>.
 34. Oscar KB. *The 8th mental measurements yearbook*. Highland Park, NJ: Gryphon Press; 1978.
 35. Levy M, Heffner B, Stewart T, et al. The efficacy of asthma case management in an urban school district in reducing school absences and hospitalizations for asthma. *J School Health.* 2006;76(6):320-324.
 36. Velsor-Friedrich B, Pigott T, Srof B. A practitioner-based asthma intervention program with African American inner-city school children. *J Pediatric Health Care.* 2005;19(3):163-171.
 37. Evans D, Clark NM, Levison MJ, et al. Can children teach their parents about asthma? *Health Educ Behav.* Aug 2001;28(4):500-511.
 38. Bruzzese JM, Markman LB, Appel D, et al. An evaluation of Open Airways for Schools: using college students as instructors. *J Asthma.* 2001;38(4):337-342.
 39. Meng Y-Y, Babey SH, Hastert TA, et al. California's racial and ethnic minorities more adversely affected by asthma. *Policy Brief.* 2007(PB2007-3):1-7.
 40. Bazargan M, Calderon JL, Heslin KC, et al. A profile of chronic mental and physical conditions among African-American and Latino children in urban public housing. *Ethn Dis.* 2005;15(4 suppl 5):S5-3-9.
 41. Kutner M, Greenberg E, Baer JA. First look at the literacy of America's adults in the 21st century. Washington, DC: National Center for Education Statistics, Department of Education, December 2005. <http://nces.ed.gov/naal/>. Accessed 07/06/06.
 42. Williams MV, Baker DW, Honig EG, et al. Inadequate literacy is a barrier to asthma knowledge and self-care. *Chest.* 1998;114(4):1008-1015.
 43. Tappe MK, Galer-Unti RA. Health educators' role in promoting health literacy and advocacy for the 21st century. *J School Health.* 2001;71(10):477-482. ■



To photocopy, e-mail, post on Internet or distribute this or any part of JNMA, please visit www.copyright.com.