

IN THE ELDERLY

Asthma Education for Older Adults: Results from the National Asthma Survey

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Rationale. Although asthma education is effective in younger population, it is unknown whether it is effective in older adults. **Methods.** Using the Four-State National Asthma Survey (NAS) data, asthma control was compared between older adults (≥ 65 years) who had been taught to use a peak flow meter (PFM) and asthma action plan (AAP) with those who had not. We also compared older adults who had taken an asthma course with those who had not. Both short-term (symptoms within last 1 week, day and night symptoms in last 30 days, and the use of steroid in last 3 months) and long-term (asthma attack, emergency department visit, hospitalizations, and activity limitations in the prior year) outcomes were compared. **Results.** Three hundred and ninety-eight older adults with asthma were identified. There were no differences in the short- and long-term asthma outcomes between the older adults who had or had not received instruction on PFM or AAP use. In preliminary analysis, those who took AC were more likely to have at least one poorly controlled long-term outcome measure (81 vs. 65%, $p = 0.034$). However, this difference did not remain significant in a logistic regression analysis. **Conclusions.** Engagement in asthma education course, instruction on action plans, and instruction on PFM use does not appear to affect asthma outcomes in older adults. Education specifically tailored toward older adults is required for better asthma control.

Keywords age, asthma, asthma education, asthma control, elderly, national asthma survey, older adults, young adults

INTRODUCTION

Asthma is a major public health problem in the United States, affecting patients across the age spectrum from infants to older adults. Two million US citizens over the age of 65 years have asthma (1, 2). Elderly asthma deaths account for 50% of asthma fatalities annually, and older adults also have one of the highest hospitalization rates (25.6 per 10,000) (2). Despite the high burden of health care utilization and medical care costs, asthma in the elderly has not been extensively studied, and older adults are under diagnosed and undertreated (1, 3–7). With the aging of the US population, these problems can be expected to increase over the coming years, leading to a greater burden of disease on older patients and their caregivers.

Patient education is an essential component of asthma management and is necessary to help patients gain the motivation, skills, and confidence to control their asthma (8). Asthma education is known to be effective in young adults (9–11). However, most of these trials have either excluded elderly subjects or included very few subjects over the age of 65. No trial has been conducted solely with elderly subjects. Hence, it is unknown whether asthma education is effective in older population.

Asthma control is considered as one of the strongest independent predictors of disease-specific quality of life and general health (12). The current National Asthma Education and Prevention Program (NAEPP) Expert Panel Report-3(EPR-3) guidelines emphasize the concept of asthma control as a goal of asthma management (13). The objective of this study was to evaluate the efficacy of asthma education on short- and long-term indicators of asthma control in the older adults (≥ 65 years). Asthma education was evaluated by two methods: (I) an asthma course or (II) instruction with a peak flow meter (PFM) or asthma action plan (AAP).

METHODS

This study was approved by the Wayne State University Institutional Review Board. Data from the 2003 National Asthma Survey (NAS) was used for analysis. This survey is conducted by the National Center for Environmental Health, part of the Centers for Disease Control and Prevention (CDC). The NAS is a random-digit-dial household telephone survey conducted by the CDC's National Center for Health Statistics. The NAS is designed to produce national prevalence estimates of asthma in adults and children; to describe the health, socioeconomic, behavioral, and environmental predictors that relate to better control of asthma; and to characterize the content of care and limitations of persons with asthma (14). The NAS is a cross-sectional one-time survey, and details regarding construction and administration have been published elsewhere (15).

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The NAS allowed detailed examination of characteristics and behaviors of asthma-positive persons through the use of the Four-State sample. It includes data from Alabama, California, Illinois, and Texas. These states were selected for detailed investigation by the CDC because they collectively provide a geographic mix. Participants for the survey were randomly selected. The sampling period for this survey was from February 2003 to March 2004. The survey contains approximately 160 questions, out of which 114 items relate to asthma and the remaining to survey eligibility and demographics. Our study included the respondents from the Four-State sample of the NAS who were aged 65 years or older and currently had asthma. Current asthma was defined as respondents who answered yes to both of the following questions: “Have you ever been told by a doctor or other health professional that you have asthma?” and “Do you still have asthma?” Asthma was therefore self-reported and no objective measurements (e.g., spirometry or methacholine challenge) were required.

Demographic variables included age, gender, income, race, education, body mass index (BMI), health insurance, smoking status, daily use of an inhaled corticosteroid (ICS), indoor allergen exposure, and asthma education characteristics. BMI was calculated from self-reported weight and height and then transformed to underweight ($<18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25\text{--}29.9 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$) categories (15). Exposure to indoor allergens was individually assessed by answering yes to: visualization of cockroaches in the home in the past 30 days; visualization or smell of mold in the home in the past 30 days; and ownership of any furry pet or bird that was kept inside.

Engagement in asthma education was assessed based on the answers to the following questions: “Has a doctor or other health professional ever taught you how to use a peak flow meter to adjust daily medications?” or “Has

a doctor or other health professional ever given you an asthma management plan?” or “Have you ever taken an asthma course?” As before, asthma education was only self-reported. Two separate analyses were performed. In Analysis I, asthma control was compared between elderly subjects who had received instruction on either an AAP or a PFM, with elderly subjects who did not have such instruction. In Analysis II, asthma control was compared between elderly subjects who had taken an asthma course with those who had not.

Asthma control was defined employing short- and long-term measures, as shown in Table 1. Data describing daytime asthma symptoms in the past 30 days were divided into two categories: well-controlled (defined as ≤ 8 days in the prior month with symptoms) and uncontrolled (defined as >8 days in the prior month with symptoms). Eight days of symptoms per month was used to distinguish well-controlled from uncontrolled asthma because current guidelines define well-controlled asthma as the presence of symptoms for 2 days or less per week (13). Data describing nighttime symptoms were similarly categorized as well-controlled (2 nights or less per month with symptoms) or uncontrolled (>2 nights per month with symptoms) (13). For both short- and long-term control measures, we also assessed “any measure of poor control,” indicating any poorly controlled response to individual short- and long-term control measures.

Data Analysis

Data were analyzed using SPSS version 17.0 software and comparisons were made using Chi-square and multiple logistic regression. Univariate analysis was performed on the Four-State sample for demographic characteristics. Bivariate analysis was performed to identify associations between elderly subjects and demographic characteristics and between elderly subjects and the short- and long-term asthma control variables. Multivariate logistic regression

TABLE 1.—Definition of short- and long-term measures of asthma control.

Asthma control measure	Definition
Short-term	
Asthma symptoms in past week	Any asthma symptom in the prior week
Uncontrolled daytime symptoms	Greater than 8 days in the prior month with symptoms
Uncontrolled nighttime symptoms	More than 2 nights in the prior month with symptoms
Exacerbations requiring oral corticosteroids	Any asthma exacerbation requiring oral corticosteroid in the past 3 months
Albuterol use in past 1 week	Use of albuterol more than twice a week in the prior week
Any measure of poor short-term control	Any one of the five above short-term measures present
Long-term	
Asthma attack in past 12 months	Episodes of asthma symptoms limiting activity or necessitating medical care in the prior 12 months
Urgent-care visits in past 12 months	Any urgent-care or emergency visits in the prior 12 months for asthma
Hospitalized for asthma in past 12 months	Any hospitalization for asthma in the prior 12 months
Limitation of activity in past 12 months	Any moderate to severe limitation of usual activities due to asthma in the prior 12 months
Any measure of poor long-term control	Any one of the four above long-term measures present

analysis using the simultaneous forced entry method was conducted to identify odds ratios for the effect of education on asthma control variables although controlling for demographic characteristics of the study population. Independent variables used in multiple logistic regression analysis included gender, income ($\leq \$9999$, which is the Federal poverty line), race (Hispanic, white non-Hispanic, and black non-Hispanic), health insurance status, smoking status (never, former, or current smoker), BMI (underweight, normal weight, overweight, or obese), use of ICS, and indoor allergen exposure (mold, cockroach, or pets). For all analyses, a two-tailed $p < 0.05$ was considered significant.

RESULTS

The Four-State sample of the NAS had a total of 5741 respondents. The age of 11 respondents was missing, and they were excluded. Of the remaining respondents, 87 respondents denied having current asthma. A total of 398 respondents identified as having current asthma and age ≥ 65 years were included for analysis in this study. Of these respondents, asthma control of 232 elderly subjects who had instruction on AAP or PFM use was compared with 166 who did not have such instruction. Next, asthma control in 42 elderly subjects who took an asthma course was compared with 356 subjects who had not taken an asthma course.

Comparison of Elderly Patients with PF-AAP Instruction to Those without Such Instruction

Elderly asthma patients who had been provided instruction on PFM or AAP use were more likely to be white, have lower incomes, and were more likely to have household exposure to indoor mold (Table 2). However, on analysis of outcome measures, we did not find any difference in short- and long-term control of asthma between

the older adults based on receiving instruction on the use of a PFM or AAP (Table 3).

Comparison of Elderly Who Took AC to Those Who Did Not

Elderly asthma patients who had taken an asthma course were more likely to be male and more likely to have exposure on household pet (Table 4). Those who took AC were more likely to have at least one poorly controlled long-term outcome measure (81 vs. 65%, $p = 0.034$) (Table 5). However, this did not remain significant in a multivariate logistic regression analysis ($p = 0.285$).

Finally, we compared elderly asthma patients who had taken an AC, had received instruction on PFM use, or had received instruction on AAP use with those who had not. Using this analysis to try to capture as many older adults who had received any type of asthma education, we again did not find any difference in the short- and long-term measures of asthma control (data not shown).

DISCUSSION

Analysis of the Four-State sample of the NAS demonstrated no significant differences in the short- and long-term asthma outcomes between the older adults based on receiving instruction on PFM or AAP use. In addition, no differences were found between older adults who had taken an asthma course and those who had not.

As current NAEPP EPR-3 guidelines suggest the importance of asthma control, we chose to compare asthma control between older adult populations who had access to self-management resources with those who did not. Asthma control can be divided into short- and long-term control measures and control of both domains is important (13, 16, 17). In this study, we included all short- and long-term measures that were available from NAS database.

TABLE 2.—Characteristics of elderly subjects from the NAS by PF/AAP (Analysis I).

Characteristics		PF/AAP+ <i>n</i> = 232 % (<i>n</i>)	PF/AAP– <i>n</i> = 166 % (<i>n</i>)	<i>P</i> value
Sex	Male	29.3 (68)	28.3 (47)	0.829
	Female	70.7 (164)	71.7 (119)	
Race	Hispanic	4.9 (11)	10.3 (16)	0.048
	White, non-Hispanic	74 (166)	77.4 (120)	
	Black, non-Hispanic	13.4 (30)	7.7 (12)	
Income	$\leq \$9999$	16.1 (27)	19 (22)	0.526
Education	> 12 school graduate	50.7 (114)	45.1 (73)	0.131
BMI	Overweight/Obese	67.4 (149)	74.8 (119)	0.266
Insurance status	Yes	97.4 (226)	96.4 (160)	0.554
Exposure	Mold	4.4 (10)	9.8 (16)	0.036
	Indoor pet	31.5 (73)	34.3 (57)	
	Cockroach	12.1 (28)	10.9 (18)	
Smoking Status	Never	50.4 (116)	45.8 (76)	0.306
	Former	43 (99)	50 (83)	
	Current	6.5 (15)	4.2 (7)	
ICS use		49.1 (114)	34.9 (58)	0.005

Note. PF/AAP+, peak flow or asthma action plan educated; PF/AAP–, peak flow or asthma action plan not educated; ICS, inhaled corticosteroid. Bold = $p > .05$.

TABLE 3.—Analyses of asthma control by PF/AAP (Analysis I).

Asthma control measure	PF/AAP+ % (n)	PF/AAP– % (n)	<i>P</i> value
Short-term measure			
Asthma symptoms in past week	65.5 (150)	62.1 (100)	0.492
Uncontrolled daytime symptoms	71 (130)	65.6 (82)	0.312
Uncontrolled nighttime symptoms	36.2 (59)	36.3 (41)	0.988
Exacerbations requiring oral corticosteroids	9 (12)	5.9 (5)	0.408
Albuterol use in past week	59.4 (41)	50 (18)	0.356
Any measure of poor short-term control	74.6 (173)	70.5 (117)	0.366
Long-term measure			
Asthma attack in past 12 months	60.9 (126)	61.2 (90)	0.946
Urgent-care visits in past 12 months	17.1 (36)	17.2 (22)	0.976
Hospitalized for asthma in past 12 months	12.6 (25)	11.6 (14)	0.780
Limitation of activity in past 12 months	42.7 (97)	40.3 (64)	0.627
Any measure of poor long-term control	66.8 (155)	65.7 (109)	0.811

TABLE 4.—Characteristics of elderly subjects from the NAS by AC (Analysis II).

Characteristics		AC+ <i>n</i> = 42 % (n)	AC– <i>n</i> = 356 % (n)	<i>P</i> value
Sex	Male	42.9 (18)	27.2 (97)	0.035
	Female	57.4 (24)	72.8 (258)	
Race	Hispanic	2.4 (1)	7.7 (26)	0.383
	White, non Hispanic	75.6 (31)	75.4 (255)	
	Black, non Hispanic	17.1 (7)	10.4 (35)	
Income	≤\$9999	20.7 (6)	16.9 (43)	0.605
Education	> 12 school graduate	54.8 (23)	47.5 (164)	0.348
BMI	Overweight/Obese	54.8 (23)	72.5 (245)	0.059
Insurance Status	Yes	95.2 (40)	97.2 (346)	0.484
Exposure	Mold	4.8 (2)	6.9 (24)	0.603
	Indoor pet	50 (21)	30.6 (109)	0.011
	Cockroach	7.1 (3)	12.1 (43)	
Smoking Status	Never	41.5 (17)	49.3 (175)	0.608
	Former	51.2 (21)	45.4 (161)	
	Current	7.3 (3)	5.4 (19)	
ICS use		52.4 (22)	42.1 (150)	0.205

Notes. AC+, took asthma course; AC–, did not take asthma course; ICS, inhaled corticosteroid.

TABLE 5.—Analyses of asthma control by AC (Analysis II).

Asthma control measure	AC+ (%) % (n)	AC– (%) % (n)	<i>P</i> value
Short-term measure			
Asthma symptoms in past week	73.8 (31)	62.9 (219)	0.169
Uncontrolled daytime symptoms	63.9 (23)	69.5 (189)	0.496
Uncontrolled nighttime symptoms	29.4 (10)	37.2 (90)	0.377
Exacerbations requiring oral corticosteroids	16 (4)	6.7 (13)	0.114
Albuterol use in past week	66.7 (10)	54.4 (49)	0.377
Any measure of poor short-term control	83.3 (35)	71.6 (255)	0.107
Long-term measure			
Asthma attack in past 12 months	69.2 (27)	60 (189)	0.265
Urgent-care visits in past 12 months	21.6 (8)	16.6 (50)	0.440
Hospitalized for asthma in past 12 months	13.9 (5)	12 (34)	0.746
Limitation of activity in past 12 months	50 (21)	40.7 (140)	0.248
Any measure of poor long-term control	81 (34)	65 (230)	0.034

Providing adult asthma patients disease-specific education along with information to assess and manage exacerbations has been shown to reduce urgent care visits, decrease asthma-related health care costs, and improve

health status, quality of life, and adherence to medication regimen (4, 9–11, 18–21). These studies have mainly been conducted with young adult population. This study was conducted solely in elderly subjects and suggests that

current asthma education courses, action plans, and PFM use do not appear to affect self-reported asthma outcomes in older adults. However, it may be that instruction and education programs do not adequately account for the management needs of older adults.

This study does have limitations. NAS data are collected through self-report and are subject to recall bias. No objective measurements were performed to verify that the patient definitively had asthma, nor that they had actually received asthma education. The survey did not include comorbidities present in older adults, which could also present as symptoms similar to asthma (1, 4–6, 22). The study was cross-sectional in design, and no assumptions of causality can be made. It is therefore not known whether the education was provided before an adverse asthma outcome, or in response to an adverse outcome. As this is a post-hoc analysis, no power calculations were done; however, to date this is the largest study of older adults with asthma. Finally, a more detailed description of the asthma education courses was not available.

It cannot be determined whether patients who took an asthma course or had access to instruction on PFM/AAP had more severe asthma at baseline. We did find that older adults who had received instruction on PFM or AAP use were more likely to use an ICS, potentially indicating that their asthma was more severe or persistent. However, a recent randomized control trial conducted by Buist et al. (23) on 296 older adults found that peak flow monitoring had no advantage over symptom monitoring as an asthma management strategy. The baseline asthma severity of patients in this study was similar between intervention and control groups, indicating that even after accounting for this variable, peak flow monitoring may be ineffective for older adults.

Previous trials involving adults have not consistently shown improvement in outcomes with asthma education (9–11, 18–21). However, it has been posited that to be maximally effective, self-management instruction should be tailored to the population of interest and should specifically address the barriers that population might face. For example, in adolescents with asthma these barriers include negativity toward providers and the medication regimen, cognitive difficulty, peer/family influence, and denial (24). In women with asthma, barriers include gender-related effects of social role and/or hormonal factors (25). In inner city populations, lack of insurance, racism, and inadequate transportation have been identified as barriers (26). These findings have allowed researchers, health care systems, and community organizations the ability to develop asthma self-management strategies that might be maximally effective for a specific population.

Given the negative results of this study with generalized asthma education, tailored education toward older adults may be required for better asthma control. Unfortunately, no comprehensive asthma self-management intervention has been developed specifically for individuals over the age of 65. Some of these barriers have recently been defined (27) and could be included in future interventions. Identified barriers included memory

impairment, difficulty in distinguishing asthma symptoms from comorbidities like cardiac disease, and feelings of isolation in asthma care, among others. An individualized approach to educate and empower elderly patients and their caregivers to take charge of their disease, tailored to patients' age, level of education, wishes for autonomy, and social and psychological status may be beneficial in the treatment of asthma in elderly population (6).

In summary, this analysis of the NAS suggests that current asthma education courses, action plans, and PFM use do not appear to affect self-reported asthma outcomes in older adults. Education tailored toward older adults is required for better asthma control.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

ABBREVIATIONS

NAS: National asthma survey
 EAAI: early asthma attack intervention
 PFM: peak flow meter
 AAP: asthma action plan
 NAEPP: National Asthma Education and Prevention Program
 EPR-3: Expert Panel Report—3
 CDC: Centers for Disease Control and Prevention
 BMI: Body mass index
 ED: emergency department
 OR: Odds ratio
 AOR: Adjusted odds ratio
 IgE: Immunoglobulin E ****

REFERENCES

1. Stupka E, deShazo R. Asthma in seniors: Part 1. Evidence for under-diagnosis, undertreatment, and increasing morbidity and mortality. *Am J Med* 2009; 122(1):6–11.
2. Jeanne E, Moorman M, Rose Anne Rudd, MSPH, Carol A. Johnson, MPH, Michael King, PhD, Patrick Minor, MSPH, Cathy Bailey, MS, Marissa R. Scalia, MPH, Lara J. Akinbami, MD National Surveillance for Asthma—United States, 1980–2004. *MMWR Surveill Summ* 2007; 56(SS08):1–14, 18–54.
3. Braman SS, Kaemmerlen JT, Davis SM. Asthma in the elderly. A comparison between patients with recently acquired and long-standing disease. *Am Rev Respir Dis* 1991; 143(2):336–340.
4. Busse PJ, Kilaru K. Complexities of diagnosis and treatment of allergic respiratory disease in the elderly. *Drugs Aging* 2009; 26(1):1–22.
5. Diette GB, Krishnan JA, Dominici F, Haponik E, Steinwachs D, Wu AW. Asthma in older patients: Factors associated with hospitalization. *Arch Intern Med* 2002; 162(10):1123–1132.
6. Barua P, O'Mahony MS. Overcoming gaps in the management of asthma in older patients: New insights. *Drugs Aging* 2005; 22(12):1029–1059.
7. Busse PJ. Allergic respiratory disease in the elderly. *Am J Med* 2007; 120(6):498–502.
8. Anderson CJ, Bardana EJ, Jr. Asthma in the elderly: The importance of patient education. *Compr Ther* 1996; 22(6):375–383.

9. Abdulwadud O, Abramson M, Forbes A, James A, Walters EH. Evaluation of a randomised controlled trial of adult asthma education in a hospital setting. *Thorax* 1999; 54(6):493–500.
10. van der Meer V, Bakker MJ, van den Hout WB, et al. Internet-based self-management plus education compared with usual care in asthma: A randomized trial. *Ann Intern Med* 2009; 151(2):110–120.
11. Marabini A, Brugnami G, Curradi F, Siracusa A. Does an asthma education program improve quality of life? A two-year randomized trial. *J Asthma* 2005; 42(7):577–581.
12. Chen H, Gould MK, Blanc PD, et al. Asthma control, severity, and quality of life: Quantifying the effect of uncontrolled disease. *J Allergy Clin Immunol* 2007; 120(2):396–402.
13. Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007. *J Allergy Clin Immunol* 2007; 120(5 Suppl):S94–138.
14. Prevention CfDcA. National Center for Health Statistics, State and Local Area Integrated Telephone Survey, National Asthma Survey. 2003.
15. O'Connor KS OL, Olson L, Blumberg SJ, Frankel MR, Srinath KP et al. Design and operation of the National Asthma Survey. National Center for Health Statistics. *Vital Health Stat* 2008; 1(46).
16. Humbert M, Holgate S, Boulet LP, Bousquet J. Asthma control or severity: That is the question. *Allergy* 2007; 62(2):95–101.
17. Koshak EA. Classification of asthma according to revised 2006 GINA: Evolution from severity to control. *Ann Thorac Med* 2007; 2(2):45–46.
18. Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J* 2008; 31(1):143–178.
19. Janson SL, Fahy JV, Covington JK, Paul SM, Gold WM, Boushey HA. Effects of individual self-management education on clinical, biological, and adherence outcomes in asthma. *Am J Med* 2003; 115(8):620–626.
20. Report NWG. Considerations for diagnosis and managing asthma in the Elderly; 1996, Bethesda, MD. NIH Publication No. 96-3662. 2006 February.
21. Perneger TV, Sudre P, Muntner P, et al. Effect of patient education on self-management skills and health status in patients with asthma: A randomized trial. *Am J Med* 2002; 113(1):7–14.
22. Braman SS, Hanania NA. Asthma in older adults. *Clin Chest Med* 2007; 28(4):685–702, v.
23. Buist AS, Vollmer WM, Wilson SR, Frazier EA, Hayward AD. A randomized clinical trial of peak flow versus symptom monitoring in older adults with asthma. *Am J Respir Crit Care Med* 2006; 174(10):1077–1087.
24. Rhee H, Belyea MJ, Ciurzynski S, Brasch J. Barriers to asthma self-management in adolescents: Relationships to psychosocial factors. *Pediatr Pulmonol* 2009; 44(2):183–191.
25. Clark NM, Gong ZM, Wang SJ, Lin X, Bria WF, Johnson TR. A randomized trial of a self-regulation intervention for women with asthma. *Chest* 2007; 132(1):88–97.
26. Dinkevich EI, Cunningham SJ, Crain EF. Parental perceptions of access to care and quality of care for inner-city children with asthma. *J Asthma* 1998; 35(1):63–71.
27. Baptist AP, Deol BB, Reddy RC, Nelson B, Clark NM. Age-specific factors influencing asthma management by older adults. *Qual Health Res* 2010; 20(1):117–124.

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