



SHORT COMMUNICATION

Influence of Demographic Status on Pulmonary Function, Quality of Life, and Symptom Scores in Patients with Mild to Moderate Persistent Asthma



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The association of patient factors such as age, sex, smoking status, asthma duration, and literacy with pulmonary function, quality of life, and symptom scores was examined. Two hundred and forty-two patients were included in this study. Pulmonary function was measured by spirometry and data on the patients' health-related quality of life and asthma symptom scores were obtained from questionnaires. After the drug treatment, younger asthmatics, particularly male patients showed statistically significant ($p < 0.05$) improvement in pulmonary function, day-time and night-time symptom score. Patients with an asthma duration of ≤ 5 years showed a significant improvement in pulmonary function and health-related quality of life scores ($p < 0.05$). Nonsmokers and literate patients had a significantly higher improvement in pulmonary function than smokers and illiterate patients ($p < 0.05$). Demographic factors were independently associated with asthma efficacy parameters. We encourage further studies on the underlying pathways and public health interventions, focusing on reducing socio-demographic inequalities in patients with asthma.

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1. Introduction

Asthma is influenced by many factors, including genetic, socio-economic, socio-demographic, and environmental factors.^{1,2} There is paucity of data relating demographic factors (such as the patients' age, sex, smoking status, asthma duration, and literacy) on efficacy parameters including pulmonary function, quality of life, and symptom scores. We studied the associations of socio-demographic factors and asthma efficacy parameters in patients with mild to moderate persistent asthma.

2. Methods

The study was conducted at the Pulmonary Medicine Department of the SRM Medical College Hospital and Research Center, SRM

University, Kattankulathur, India. Institutional ethics committee approval was obtained for this study.

2.1. Patients

The study participants were patients aged between 18 years and 60 years, clinically diagnosed with mild to moderate persistent asthma with an improvement in their forced expiratory volume in the first second of expiration (FEV₁) greater than 12% after bronchodilator inhalation. Patients were excluded if they had clinically significant renal, respiratory (other than asthma), cardiac, hepatic, endocrine, or hematological disorders, or if they had had an unresolved upper respiratory tract infection within the past 3 weeks. Pregnant and lactating women were also excluded. All patients signed written informed consent.

2.2. Study procedures and study instruments

2.2.1. Spirometric assessments

Spirometric assessments were carried out at baseline and at every follow up visit, except at the start of the run-in period. Spirometry was performed by well-trained pulmonary technicians. The

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Table 1 Effect of sex on efficacy variables

Variables	Male sex	Female sex	Mean difference	95% CI
FEV ₁ (%)	80.16 ± 5.23	74.25 ± 4.86	5.910*	4.862–6.964
Symptom score	36.21 ± 7.24	35.17 ± 6.82	1.040	–0.409–2.490
Activity score	54.26 ± 7.84	56.72 ± 8.82	1.502	–0.220–3.220
Impact score	43.01 ± 9.23	44.67 ± 8.31	1.661	–0.150–3.470
Total score	46.10 ± 8.42	45.98 ± 8.01	0.120	–1.814–1.57
Daytime score	0.65 ± 0.51	0.69 ± 0.56	0.043	–0.062–1.494
Night-time score	0.47 ± 0.61	0.47 ± 0.62	0.012	–0.110–0.134

Data are presented as mean ± SD.

* $p < 0.05$.CI = confidence interval; FEV₁ = forced expiratory volume in the first second of expiration.

patients were assessed individually for their appropriate use of inhalers at baseline and at every follow-up visit. In this study, we recorded FEV₁ divided by the forced vital capacity as a percentage.

2.2.2. Saint George Respiratory Questionnaire for assessing quality of life

Health-related quality of life (HRQoL) was assessed using the Saint George Respiratory Questionnaire (SGRQ), which is a disease-specific instrument designed to measure the impact on overall health, daily life, and perceived well-being. The SGRQ was scored according to the developer's guidelines.³

2.2.3. Asthma symptom score

Patients regularly recorded their daytime and night-time asthma symptom scores on diary cards each day.⁴ Compliance with the study drugs was assessed using medication compliance charts. Patients not obeying the study protocol were withdrawn from the study.

2.3. Statistical analysis

Descriptive analysis was performed on the baseline characteristics. The differences between groups were considered significant if $p < 0.05$. The Student *t* test was performed in GraphPad Software Version 6.0. (GraphPad Software Inc., San Diego, California, USA). Per protocol analysis was performed.

3. Results

A total of 297 patients completed the study. The demographic and baseline disease characteristics were similar between the groups (data not shown). The effects of various baseline parameters such as sex, age, duration of asthma, smoking history, and literacy levels on the outcome of efficacy variables including FEV₁ and scores for symptoms, activity, impact, total score, daytime symptom score,

Table 2 Effect of age on efficacy variables

Variables	≤ 40 years	≥ 40 years	Mean difference	95% CI
FEV ₁ (%)	78.18 ± 6.22	71.32 ± 5.98	6.860*	5.423–8.297
Symptom score	34.98 ± 7.52	34.41 ± 6.98	0.572	–1.145–2.285
Activity score	54.98 ± 7.38	55.49 ± 8.42	0.510	–1.318–2.338
Impact score	42.99 ± 9.27	44.69 ± 9.87	1.700	–0.528–3.929
Total score	46.99 ± 8.72	45.01 ± 8.63	1.980	–0.053–4.013
Daytime score	0.92 ± 0.42	0.42 ± 0.30	0.524*	0.586–0.415
Night-time score	0.62 ± 0.59	0.32 ± 0.65	0.341*	0.156–0.444

Data presented as mean ± SD.

* $p < 0.05$.CI = confidence interval; FEV₁ = forced expiratory volume in the first second of expiration.**Table 3** Effect of asthma duration on efficacy variables

Variable	Disease duration ≤ 5 years	Disease duration ≥ 5 years	Mean difference	95% CI
FEV ₁ (%)	70.66 ± 6.01	78.84 ± 5.62	8.810*	6.807–9.553
Symptom score	33.56 ± 6.94	38.02 ± 7.42	4.660*	2.990–6.330
Activity score	53.49 ± 7.24	56.85 ± 7.65	3.360*	1.631–5.089
Impact score	41.56 ± 8.12	48.12 ± 7.65	4.560*	2.701–6.419
Total score	52.07 ± 9.01	58.14 ± 7.51	6.030*	4.127–7.933
Daytime score	0.669 ± 0.64	0.68 ± 0.51	0.012	–0.120–0.144
Night-time score	0.432 ± 0.72	0.51 ± 0.55	0.080	–0.070–0.231

Data presented as mean ± SD.

* $p < 0.05$.CI = confidence interval; FEV₁ = forced expiratory volume in the first second of expiration.

and night-time symptom score were studied. Tables 1–5 show the effect of sex, age, asthma duration, smoking, and literacy, respectively, on the efficacy variables. All the data shown in Tables 1–5 are self-explanatory. Significant effects of relevant independent variables between groups are noted in the footnotes.

4. Discussion

The effect of various parameters such as age, sex, duration of asthma, smoking history, and literacy levels on the efficacy variables were analyzed. This evaluation was carried out in this study population in particular to determine the roles of these independent variables among the different subclasses in the study outcomes. The subgroup analysis was performed for the entire study population and not between the study groups. As the main treatment arms were separated by different drugs, this would have led to misinterpretations of the study results.

Wijnhoven et al⁵ and Osborne et al⁶ conducted detailed studies comparing the effects of sex on pulmonary function and HRQoL and reported that male sex is associated with a lower pulmonary function and a better HRQoL. These workers stated that sex remains a significant determinant of pulmonary function and may indicate that men are more affected by their disease, resulting in a lower pulmonary function than women. This finding is in contrast with the results from the present study. As shown in Table 1, we found that men with asthma had a better pulmonary function [$80.16 \pm 5.23\%$ (men) vs. $74.25 \pm 4.86\%$ (women), $p < 0.05$] than women and that there was no significant difference in the HRQoL scores. The number of patients in the present study might not be adequate to evaluate the impact of sex on the efficacy variables. A further assessment with full focus on this objective is recommended in the Indian population.

Vignola et al⁷ stated that their elderly patients had a poorer response than the younger patients with asthma. They compared

Table 4 Effect of smoking on efficacy variables

Variable	Smoker	Nonsmoker	Mean difference	95% CI
FEV ₁ (%)	71.15 ± 6.01	79.21 ± 5.24	8.062*	6.692–9.304
Symptom score	34.99 ± 9.5	36.39 ± 8.89	1.432	–0.773–3.573
Activity score	56.08 ± 8.01	56.08 ± 7.54	1.820	–0.016–3.656
Impact score	43.01 ± 8.89	44.67 ± 9.42	1.660	–0.492–3.818
Total score	45.05 ± 9.14	47.03 ± 8.96	1.980	–0.143–4.102
Daytime score	0.69 ± 0.61	0.65 ± 0.59	0.044	–0.115–0.195
Night-time score	0.47 ± 0.49	0.47 ± 0.51	0.002	–0.128–0.132

Data presented as mean ± SD.

* $p < 0.05$.CI = confidence interval; FEV₁ = forced expiratory volume in the first second of expiration.

Table 5 Effect of literacy on efficacy variables

Variable	Educated	Uneducated	Mean difference	95% CI
FEV ₁ (%)	80.01 ± 6.81	69.49 ± 7.01	10.524*	8.905–12.133
Symptom score	33.56 ± 18.97	37.82 ± 16.98	4.262	–0.013–8.533
Activity score	55.33 ± 7.96	55.01 ± 7.56	0.323	–2.150–1.510
Impact score	42.96 ± 7.96	44.72 ± 9.23	0.244	–2.26–1.746
Total score	45.56 ± 7.90	46.52 ± 9.21	0.963	–1.023–2.943
Daytime score	0.66 ± 0.64	0.68 ± 0.69	0.021	–0.130–0.178
Night-time score	0.48 ± 0.42	0.46 ± 0.52	0.020	–0.022–1.746

Data presented as mean ± SD.

* $p < 0.05$.CI = confidence interval; FEV₁ = forced expiratory volume in the first second of expiration.

patients with asthma with normal participants and found that the FEV₁ of healthy people varies among the different age groups, i.e., elderly patients have lower FEV₁ values than younger patients, but this difference was not seen in patients with asthma.⁷ In our study, however, younger patients with asthma had significantly better FEV₁ values than older patients ($78.18 \pm 6.22\%$ vs. $71.32 \pm 5.98\%$, $p < 0.05$, Table 2). Younger patients with asthma also had significantly better daytime ($p < 0.05$) and night-time ($p < 0.05$) symptom scores than older patients. Sharma and Goodwin⁸ stated that there is marked variation in the effect of aging on lung function. The lung matures until the age of 20–25 years; thereafter, aging is associated with a progressive decline in lung function. This could be the reason for the better lung improvement in younger patients with asthma.

There was no statistically significant difference between groups based on the selected age categories in the HRQoL outcomes. As our study had a cutoff age of 60 years, elderly patients older than this limit were excluded. People aged being less than 60 years might have behaved in a similar way to older adults, which is why our HRQoL results were not influenced by different age groups.

It is known that patients with asthma with a shorter duration of disease are expected to have a better quality of life, pulmonary function, and a greater improvement compared with those with a longer duration of disease. The statistically significant results (Table 3) obtained in this study ($70.66 \pm 6.01\%$ in longer disease duration vs. $78.84 \pm 5.62\%$ in shorter disease duration; $p < 0.05$) confirmed this finding, as did the results reported by Cassino et al.⁹ In terms of daytime and night-time symptoms, the duration of disease did not have any significant effect.

It has been observed in previous studies^{10,11} that smoking has an effect on pulmonary function and HRQoL. Eisner and Iribarren¹⁰ indicated that smokers have a poor outcome in the improvement of both efficacy variables. They reported that smoking increased the severity of asthma, gave a poorer asthma-specific quality of life, a poorer generic mental health status, and greater longitudinal risk of admission to hospital for asthma. In the study of Gallefoss et al.,¹¹ the negative effect of smoking on HRQoL, as measured by SGRQ scores, was highly significant. The study team commented that smoking decreases the HRQoL score as measured by the SGRQ.

We observed a significant increase in the pulmonary function of nonsmokers compared with smokers ($71.15 \pm 6.01\%$ in smokers vs. $79.21 \pm 5.24\%$ in nonsmokers; $p < 0.05$ Table 4). However, variables such as the HRQoL and symptom scores were not affected by smoking status. The nonsignificance between smokers and non-smokers in the improvement of these efficacy variables might be due to routine patient education with respect to smoking cessation.

Patients of either school or graduate level education showed significant improvements in health outcomes compared with uneducated patients ($80.01 \pm 6.81\%$ in the educated group vs. $69.49 \pm 7.01\%$ in the non-educated group; $p < 0.05$). In a cross-sectional study by Williams et al.¹² it was found that asthma patients with a higher level of literacy have a better metered dose inhaler technique. In addition, Dewalt et al.¹³ analyzed the effect of low literacy levels on health outcomes and concluded that patients with low literacy levels were more likely to experience adverse health outcomes. Such findings support our results in this particular subgroup analysis.

In conclusion, our data show that younger patients with asthma, particularly educated male patients with a shorter disease duration, showed greater improvements in the spirometry analysis. With respect to HRQoL and asthma symptom scores, patients with a short disease duration and younger patients also improved. These differences may have implications for asthma management in a managed care setting. Future research may identify factors that mediate the relationship.

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References

1. Apter AJ, Reisine ST, Affleck G, Barrows E, ZuWallack RL. The influence of demographic and socioeconomic factors on health-related quality of life in asthma. *J Allergy Clin Immunol* 1999;**103**:72–8.
2. Koefoed MM, Søndergaard J, Christensen RD, Jarbøl DE. Influence of socioeconomic and demographic status on spirometry testing in patients initiating medication targeting obstructive lung disease: a population-based cohort study. *BMC Public Health* 2013;**13**:580.
3. Wilson SR, Rand CS, Cabana MD, Foggs MB, Halterman JS, Olson L, Vollmer WM, et al. Asthma outcomes: quality of life. *J Allergy Clin Immunol* 2012;**129**:S88–123.
4. Molimard M, Bourcereau J, Gros VL, Bourdeix I, Leynadier F, Duroux P. Comparison between formoterol 12 mg b.i.d. and on demand salbutamol in moderate persistent asthma. *Respir Med* 2001;**95**:64–70.
5. Wijnhoven HAH, Kriegsman DMW, Hesselink AE, Penninx BWJH, Haan MD. Determinants of different dimensions of disease severity in asthma and COPD: pulmonary function and health-related quality of life. *Chest* 2001;**119**:1034–42.
6. Osborne ML, Vollmer WM, Linton KL, Buist AS. Characteristics of patients with asthma within a large HMO: a comparison by age and gender. *Am J Respir Crit Care Med* 1998;**157**:123–8.
7. Vignola AM, Bonanno A, Profita M, Riccobono L, Scichilone N, Spatafora M, Bousquet J, et al. Effect of age and asthma duration upon elastase and a1-antitrypsin levels in adult asthmatics. *Eur Resp J* 2003;**22**:795–801.
8. Sharma G, Goodwin J. Effect of aging on respiratory system physiology and immunology. *Clin Interv Aging* 2006;**1**:253–60.
9. Cassino C, Berger KI, Goldring RM, Norman RG, Kammerman S, Ciotoli C, Reibman J. Duration of asthma and physiologic outcomes in elderly non-smokers. *Am J Respir Crit Care Med* 2000;**162**:1423–8.
10. Eisner MD, Iribarren C. The influence of cigarette smoking on adult asthma outcomes. *Nicotine Tobacco Res* 2007;**9**:53–6.
11. Gallefoss F, Bakke PS, Rsgaard PK. Quality of life assessment after patient education in a randomized controlled study on asthma and chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1999;**159**:812–7.
12. Williams MV, Baker DW, Honig EG, Lee TM, Nowlan A. Inadequate literacy is a barrier to asthma knowledge and self-care. *Chest* 1998;**114**:1008–15.
13. 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**:1228–39.