

Original Article

Comparison of clinical management of young and elderly asthmatics by respiratory specialists and general practitioners

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Abstract

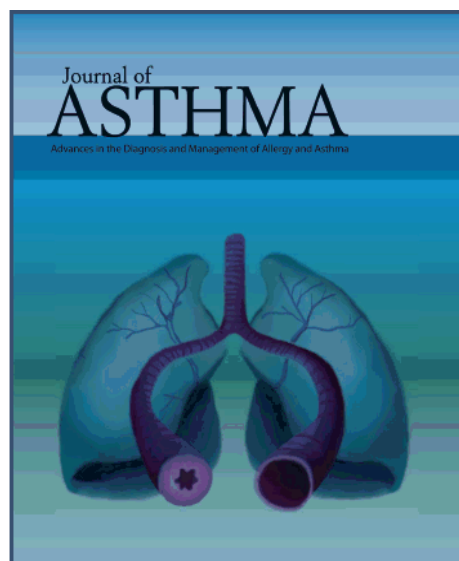
Background: Asthmatic death in the elderly is a serious problem worldwide. Differences in clinical skill between respiratory specialists (RS) and general practitioners (GP) are important in asthma control. The aim of this study was to compare asthma management between RS and GP.

Methods: A cross-sectional survey was carried out in Shimane, Japan, in February 2009 using a questionnaire about patient background, treatment, asthma control test (ACT) and adherence to treatment. We secured the cooperation 48 clinics (39 private clinics, 9 general hospitals). Asthmatics were divided into the elderly and young groups, and also into the RS and

GP groups.

Results: Clinical data of 779 patients were available for analysis. Elderly patients constituted 464 (RS group: 192, GP group: 272), while those of the young group were 315 (RS group: 207, GP group: 108). RS prescribed inhaled corticosteroids (ICS) to their elderly and young patients more than GP. The total ACT score was higher in young RS group than young GP group, but no such difference was noted in the elderly. Despite more asthma-related symptoms, the ACT showed that elderly-GP asthmatics used fewer rescue inhalers than elderly-RS. Self-assessment was higher in elderly-GP than elderly-RS asthmatics. Adherence to therapy was better in elderly patients than young patients.

Conclusions: Elderly asthmatics treated by GPs underestimated the severity of their asthma and asthmatics seen by GPs were undertreated. The results stress the need to engage patients in educational activities, to adhere to guidelines, and to improve the coordination between GP and RS.



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ORIGINAL ARTICLE

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Running head: Asthma management by specialists and generalists

Key Words

Adherence, Asthma, Asthmatic death, Asthma control test, Elderly patient

Author contribution

M. Tada performed the statistical analysis and wrote the manuscript. T. Kuraki, Y. Tooka, A. Sutani and T. Isobe (guarantor) designed the study, contributed to data analysis and writing of the manuscript. H. Fuchita helped in completing statistical analysis. F. Karino, K. Miura, S. Hamaguchi and M. Ohe collected the data. All authors read and approved the final manuscript.

Abstract

Background: Asthmatic death in the elderly is a serious problem worldwide. Differences in clinical skill between respiratory specialists (RS) and general practitioners (GP) are important in asthma control. The aim of this study was to compare asthma management between RS and GP.

Methods: A cross-sectional survey was carried out in Shimane, Japan, in February 2009 using a questionnaire about patient background, treatment, asthma control test (ACT) and adherence to treatment. We secured the cooperation 48 clinics (39 private clinics, 9 general hospitals). Asthmatics were divided into the elderly and young groups, and also into the RS and GP groups.

Results: Clinical data of 779 patients were available for analysis. Elderly patients constituted 464 (RS group: 192, GP group: 272), while those of the young group were 315 (RS group: 207, GP group: 108). RS prescribed inhaled corticosteroids (ICS) to their elderly and young patients more than GP. The total ACT score was higher in young RS group than young GP group, but no such difference was noted in the elderly. Despite more asthma-related symptoms, the ACT showed that elderly-GP asthmatics used fewer rescue inhalers than elderly-RS. Self-assessment was higher in elderly-GP than elderly-RS asthmatics. Adherence to therapy was better in elderly patients than young patients.

Conclusions: Elderly asthmatics treated by GPs underestimated the severity of their asthma and asthmatics seen by GPs were undertreated. The results stress the need to engage patients in educational activities, to adhere to guidelines, and to improve the coordination between GP and RS.

Introduction

The increase in the number of asthmatics in recent decades has become a serious public health problem worldwide. Although several guidelines for the treatment of asthma are currently available, such as the Global Initiative for Asthma (GINA) guidelines, one large-scale study showed that the control of asthma remains unsatisfactory¹. It is estimated that about 250,000 people per year die of asthma worldwide². Therefore, asthma-related death, hospitalization, and emergency visit impose enormous social and economic burdens³.

In Japan, the prevalence of asthma and related mortality rate are higher than in other developed countries³, making asthma one of the major social problems. In many countries, the majority of asthma-related deaths involves elderly patients (≥ 65 years)^{4,5}. Based on aging of the population of Japan, the proportion of elderly asthmatics is increasing according to The Ministry of Health, Labour and Welfare of Japan (reported in 2010 in Japanese only). Shimane prefecture is located in western Japan and the rural area forms a large part of the prefecture, with higher proportion of aged people compared to other prefectures. According to the Statistics Bureau of The Ministry of Internal Affairs and Communications, the percentage of Shimane prefecture population aged 65 or older was 29.0% in 2009,

compared with that of Japan as a whole (22.7%)⁶. The excess elderly population in Shimane prefecture makes it easier to study asthma management in the elderly.

Physician's skill is an important aspect of asthma control. Since asthma is a common disease, not only respiratory specialists (RS), but also general practitioners (GP) should be involved in the treatment of patients, with the exception of intractable cases. Under the Japanese health insurance system, asthma patients are allowed to choose their own physician; i.e., either a RS or GP. The standard guidelines about asthma in Japan are GINA guidelines and Asthma Prevention and Management Guideline by the Japanese Society of Allergology⁷. Unfortunately, not all GPs adhere to these guidelines⁸. In fact, evidence suggests under-treatment of asthmatics by Japanese physicians⁹, and some studies have reported that GPs lag behind RS with regard to the management of asthma^{8,10,11}.

The specific interests of this study were elderly asthmatics and differences in asthma management by physicians. Asthma patients were divided into elderly and young groups to analyze the differences in clinical management between the two groups and clarify problems in each of the two groups. To our knowledge, there are only a few studies that have investigated differences in the management of elderly and young asthmatics by RS and GP. The aim of the present study was to compare management of young and elderly asthmatics provided by RS and GP.

Methods

Study design and study subjects

A cross-sectional survey was carried out in Shimane, Japan, in February 2009. We invited 298 hospitals in the Shimane prefecture to participate in this study, and received approval of 48 hospitals (39 clinics and 9 general hospitals). The subjects were asthma patients who visited their GP or RS at private clinics or general hospitals between February 1 and 28, 2009 (28 days). Asthma was diagnosed by the attending physician. We mailed the same questionnaire to each hospital; the questionnaire included questions about patient background, treatment type, status of asthma control and adherence to treatment. The questionnaire was completed by the patients and their attending physicians. Then, we collected the completed questionnaires one month later. All RSs who participated in this study were board-certified chest physicians by the Japanese Respiratory Society. All GPs were board-certified physicians by the Japanese College of Internal Medicine. The study protocol was approved by the ethics committee of Shimane University Faculty of Medicine.

The treatment type was categorized according to the type of controller medication. Controller medications included regularly used inhaled corticosteroids (ICS), long-acting beta agonists (LABA), ICS/LABA fixed combinations, theophylline, leukotriene receptor antagonists (LTRA) and oral corticosteroids. Anti-IgE therapy (omalizumab) was not approved in Japan as an asthma therapeutic agent in 2009, and was thus not included in the survey. Each of the ICS and LABA was counted including ICS/LABA fixed combination. LABA included inhalants, oral agents and patch agents. The treatments were classified into five steps according to the GINA 2009 guidelines².

We divided asthma patients into two groups according to age; the elderly group, consisting of patients aged ≥ 65 years, and the young group (< 65 years). Furthermore, we divided the patients according to the specialty involved in their treatment and overall management; the RS group comprising patients who visited the clinic or hospital for treatment by RS, and the GP group comprising patients who visited the clinic or hospital for treatment by GP.

Evaluation of asthma control (asthma control test)

We used the Japanese version of the Asthma control test (ACT) to evaluate asthma control¹². In Japan, the use of spirometry and peak-flow meter by GP is not common. Accordingly, we considered that the use of the GINA 2009 guidelines was inappropriate for evaluation of asthma control. The ACT is a five-item questionnaire to assess asthma control in the 4-week period preceding visit to the clinic. The sum of the scores of the five questions yields the total ACT score (range, 5–25). The total ACT score of 25 represents complete control of asthma, 20–24 good control, and < 20 represents poor control. A previous study found that the total ACT score correlated with GINA guideline-defined asthma control¹³ and also with the specialist's rating of asthma in adult patients¹⁴. In this study, we defined the total ACT score of ≥ 20 points as high score and < 20 points as low score.

Adherence to treatment

We examined the frequency of forgetting to take medications and nonuse for each of the inhalants, oral agents and patch agents per week. The frequency was classified into four-grades (not at all, 1-2 times, 3-4 times, 5 and more times).

Statistical analysis

Data are expressed as mean $\pm$ SD. The clinical parameters of two groups were compared using the chi square test, Student's t-test and Mann-Whitney's U-test. A p value less than 0.05 was considered statistically significant. Data were analyzed using The Statistical Package for Social Sciences version 20.0 (SPSS Inc., Chicago, IL).

Results

Data of 860 patients were collected from the clinics and hospitals. However, data of 81 patients were excluded due to missing data. Thus, the present study was based on clinical data of 779 asthmatics.

Characteristics of study patients

The study included 464 (59.6%) elderly asthmatics. Of these, 192 patients (41.4% of elderly asthmatics) were treated by RS whereas the remaining 272 elderly asthmatics (58.6%) were treated by GP. Furthermore, the young group comprised 315 (40.4%) patients, including 207 (65.7% of young asthmatics) who belonged to the RS group and 108 patients (34.3% of young asthmatics) of the GP group. Patients of the GP group (69.4 ± 16.0 years) were significantly older than those of the RS group (60.7 ± 16.1 , $p < 0.001$), and the GP group included a large proportion of the elderly patients (71.6%). The young GP group included significantly higher proportion of current smokers (23.1%) than the young RS group (8.2%, $p < 0.001$).

The use of ICS was significantly higher among the elderly and young RS group than the GP group (elderly patients: 93.8% vs 62.1%, $p < 0.001$; young patients: 98.6% vs 73.1%, $p < 0.001$). The use of LABA and LTRA was significantly higher among the young of the RS group compared with the young of the GP group (LABA: 63.8% vs 50.0%, $p = 0.018$; LTRA: 43.0% vs 29.6%, $p = 0.021$). The use of LABA-ICS fixed combination was significantly higher among the young RS group than the young GP group (44.0% vs 25.9%, $p = 0.002$). The use of theophylline was significantly higher in both the elderly and young patients of the GP group compared with the RS group (elderly patients: 48.2% vs 36.5%, $p = 0.012$; young patients: 38.0% vs 22.2%, $p = 0.003$). The use of oral corticosteroids was significantly higher among elderly patients of the GP group than those of the RS group (4.0% vs 0.5%, $p = 0.018$). However, 5 of 11 patients did not use ICS (inappropriate treatment). Based on the treatment steps of the GINA 2009 guidelines, the majority of patients of the RS group were classified as step 3 or 4, whereas the majority of patients of the GP group were classified as step 1 or 2 or 3. The distribution of patients according to the treatment step were significantly different between the GP and RS groups in both elderly and young patients (elderly patients: $p < 0.001$, young patients: $p < 0.001$, Table 1).

Asthma control test

The proportion of patients with high score was significantly higher in the young RS group compared with the young GP group (75.4% vs 64.8%, $p = 0.048$). However, no such difference was found between the elderly RS and their counterpart of the GP group (66.7% vs 65.1%, $p = 0.722$) (Figure 1).

Figure 2 shows the proportion of patients classified as high score according to the five treatment steps defined by the GINA 2009 guidelines. The proportion of patients with high score was higher in the elderly RS group than the elderly GP group for steps 3-5 and lower for steps 1, 2 (Figure 2A). On the other hand, the proportion of patients with high score was higher in the young RS group than the young GP group for each step except step 1 (Figure 2B). The proportion of patients with high score tended to decrease with increases in the treatment step.

Table 2 summarizes the ACT score distribution for each question. The score for Question 2 (Q2) was significantly lower in the elderly GP group than the elderly RS group ($p = 0.022$). The scores for Q1 and Q3 were, however; not significantly different between the two groups (Q1: $p = 0.213$, Q3: $p = 0.667$). The scores for Q1, Q2 and Q3 were significantly lower in the young GP group compared with the young RS group (Q1: $p = 0.005$, Q2: $p = 0.005$, Q3: $p < 0.001$). Patients of the young GP group had more asthma-

related symptoms than those of the young RS group. For Q4, elderly patients of the GP group used inhalers of short-acting beta-stimulators to relieve asthma-related symptoms significantly fewer times than elderly patients of the RS group ($p < 0.001$). With regard to Q5 about self-assessment of asthma, the score was significantly higher in elderly patients of the GP group compared with their counterparts of the RS group ($p = 0.034$). In contrast, the score was higher in the young RS group than the young GP group ($p = 0.027$).

Adherence to treatment

There were no significant differences between the elderly and young patients of the RS and GP groups with regard to the use of each inhalant, oral and patch agents (Table 3). However, comparison of the elderly patients (including the RS and GP groups) and young patients (including the RS and GP groups) showed significantly better adherence to the treatment by the elderly patients than the young patients for each inhalant ($p = 0.002$), oral agent ($p < 0.001$) and patch agent ($p = 0.011$).

Discussion

The present study identified interesting differences in the management of asthma between the RS and GP in elderly and young asthmatics.

There were no significant differences in the proportion of patients considered high score between the elderly RS and elderly GP groups (Figure 1). As shown in Table 2, patients of the elderly GP group had slightly more asthma-related symptoms compared with patients of the elderly RS group. Elderly patients treated by GP felt more shortness of breath (response to Q2) although the ACT scores of elderly patients treated by GP for Q1 and Q3 were similar to those of elderly patients treated by RS. However, elderly patients treated by GP self-assessed their ACT with higher score than elderly patients treated by RS (response to Q5). It is possible that elderly patients managed by GP tended to underestimate the severity of their asthma condition. Previous studies reported that asthmatic patients underestimate the severity of asthma^{15,16}. In our study, such tendency was accentuated in elderly patients treated by GP. Furthermore, elderly patients managed by GP less frequently used rescue inhalers to relieve asthma-related symptoms compared with elderly patients treated by RS (response to Q4). Also, in young patients treated by GP, the frequency of use of rescue inhalers was similar with those treated by RS, although young patients seen by GP had clearly more asthma-related symptoms than those treated by RS. We speculate that these results were related to insufficient prescription of rescue inhalers and insufficient instructions by GP. The results of GP for Q4 and Q5 might overestimate the total ACT score especially in the elderly GP group. Table 1 shows that GP prescribed significantly less ICS than RS. ICS is known to reduce asthma-related deaths¹⁷. Furthermore, ICS reduces mortality and hospitalization in elderly patients¹⁸. Figure 2 shows higher proportions of low score elderly and young patients in the GP group than the RS group for most of individual treatment steps. Because the treatment step in many of the patients of the GP group was low despite the multitude of asthma-related

symptoms, many patients of the GP group were probably undertreated and required step-up treatment. Our study also showed a higher rate of current smokers in the young GP group than in the young RS group. Cigarette smoking is known to reduce the efficacy of ICS¹⁹. Taken together, we speculate that these differences were related to inappropriate education and insufficient clinical skills by GP^{8,10,11,20}.

Adherence to treatment is important in asthma control, and clinical evidence suggests that poor adherence to inhaled corticosteroid correlates with poor outcome, including increased number of hospitalization²¹. Unexpectedly, there were no significant differences in adherence to treatment between the RS and GP groups. Furthermore, elderly patients showed better adherence compared with young patients. One explanation for this observation could be that the elderly were retired and had time to take medications to relieve symptoms.

One limitation of this study was the difference and bias regarding patient background between RS and GP. GP managed a larger proportion of elderly patients compared with RS. Differences in the severity of asthma between the two groups cannot be ruled out. For example, when patients with intractable asthma visit their GP, they are likely to be referred to the RS. For this reason, more patients with severe asthma may have been included in the RS group than the GP group. In this regard, the GINA 2009 guidelines offer no indication for evaluation of the severity of asthma. Therefore, it is difficult to closely match asthma severity between the two groups. In fact, a similar French study¹¹ that examined differences in asthma management between RS and GP did not match the severity of their patients. However, the observation that the GP group included more patients who required step-up treatment deserves attention.

We have also to consider the effect of chronic obstructive pulmonary disease (COPD), especially in elderly patients. Some elderly asthmatics also suffer from COPD. In some cases, it is really difficult to distinguish between pure COPD and asthma complicated by COPD, even by RS. Thus, strictly speaking, the study cannot rule out COPD in the elderly patients treated by either speciality. Despite differences between RS and GP, asthmatics in this study presented with controlled disease with treatment

and with good adherence and had good rate of ICS use compared with previous report^{11,22}. The reasons for these findings could be related to the facts that the physicians (especially GP) who voluntarily participated in this study were interested in asthma management, and that the study design was not based on telephone interviews or internet, but questionnaire by physicians.

Previous studies compared the management of asthmatics by RS and GP using ACT. One French study¹¹ reported higher scores for each ACT question in the RS group than the GP group. However, the age limit in that study was set to 50 years to exclude patients with COPD, and the mean age of their patients was 36 years. Our study showed similar findings in the young asthmatics. However, in the elderly asthmatics, there were large differences especially in Q4 and Q5 between the RS and GP groups. These differences could be due to the fact that our study included a large proportion of elderly patients.

We analyzed in detail asthma control, treatment modality and adherence in this study. We think that this study is very unique based on these points. However, because we cannot exclude the effects of COPD, there is certainly a need for a large-scale investigation based on a more accurate diagnosis of asthma.

Conclusions

The study identified several differences between asthmatics treated by RS and GP. Elderly asthmatics treated by GPs underestimated the severity of their asthma condition and GPs tended to undertreat their asthmatic patients, with some patients treated inappropriately with oral corticosteroids without ICS. A high proportion of the young patients seen by GPs were current smokers. The results emphasize the need for proper education of asthmatics, especially elderly patients who consult their GPs, as well of GP to enhance their clinical skills in asthma management. There is a need to engage patients in educational activities on asthma and to spread adherence to guidelines and to improve the coordination between GP and RS in order to lessen asthma deaths in the elderly.

Declaration of Interest and Acknowledgements

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Declaration of Interest statement

The authors declare no conflicts of interest.

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Table 1: Characteristics of study patients (n=779)

	Elderly patients (n=464)			Young patients (n=315)			All patients (n=779)		
	RSG	GPG	P value	RSG	GPG	P value	RSG	GPG	P value
N	192	272		207	108		399	380	
Age (mean±SD), years	≥65 (76.3±6.5)			<65 (48.2±12.7)			60.7±16.1	69.4±16.0	<0.001 [†]
Gender									
Male	96 (50.0)	121 (44.5)	0.241	85 (41.1)	59 (54.6)	0.022	181 (45.4)	180 (47.4)	0.575
Female	96 (50.0)	151 (55.5)		122 (58.9)	49 (45.4)		218 (54.6)	200 (52.6)	
Smoking status									
Current	8 (4.2)	14 (5.1)	0.411 [‡]	17 (8.2)	25 (23.1)	<0.001 [‡]	25 (6.3)	39 (10.3)	0.013 [‡]
Former	69 (35.9)	105 (38.6)		61 (29.5)	34 (31.5)		130 (32.6)	139 (36.6)	
Never	115 (59.9)	153 (56.3)		129 (62.3)	49 (45.4)		244 (61.2)	202 (53.2)	
Treatment									
ICS	180 (93.8)	169 (62.1)	<0.001	204 (98.6)	79 (73.1)	<0.001	384 (96.2)	248 (65.3)	<0.001
LABA	107 (55.7)	128 (47.1)	0.066	132 (63.8)	54 (50.0)	0.018	239 (59.9)	182 (47.9)	0.001
(ICS/LABA)	59 (30.7)	62 (22.8)	0.055	91 (44.0)	28 (25.9)	0.002	150 (37.6)	90 (23.7)	<0.001
LTRA	63 (32.8)	111 (40.8)	0.080	89 (43.0)	32 (29.6)	0.021	152 (38.1)	143 (37.6)	0.894
Theophylline	70 (36.5)	131 (48.2)	0.012	46 (22.2)	41 (38.0)	0.003	116 (29.1)	172 (45.3)	<0.001
Oral steroids	1 (0.5)	11 (4.0)	0.018	1 (0.5)	2 (1.9)	0.271	2 (0.5)	13 (3.4)	0.003
GINA treatment step									
Step 1	10 (5.2)	59 (21.7)	<0.001 [‡]	0 (0)	20 (18.5)	<0.001 [‡]	10 (2.5)	79 (20.8)	<0.001 [‡]

Step 2	15 (7.8)	62 (22.8)	28 (13.5)	29 (26.9)	43 (10.8)	91 (23.9)
Step 3	94 (49.0)	101 (37.1)	83 (40.1)	34 (31.5)	177 (44.4)	135 (35.5)
Step 4	72 (37.5)	39 (14.3)	95 (45.9)	23 (21.3)	167 (41.9)	62 (16.3)
Step 5	1 (0.5)	11 (4.0)	1 (0.5)	2 (1.9)	2 (0.5)	13 (3.4)

Values are n (%). † Student's t-test, ‡ Mann-Whitney's U test. All other data were analyzed by chi-square test.

The use of each of ICS and LABA was counted including ICS/LABA fixed combination.

- 5 RSG: respiratory specialist group; GPG: general practitioner group; ICS: inhaled corticosteroids; LABA: long-acting beta agonists; ICS/LABA: ICS-LABA fixed combination; LTRA: leukotriene receptor antagonists; GINA: the Global Initiative for Asthma.

Table 2: Asthma control test of study patients (n=779)

For personal use only.

<Question 1> In the past 4 weeks, how much time did your asthma keep you from getting as much done as possible at work, school or at home?						
Score	1 (all of the time)	2 (most of the time)	3 (some of the time)	4 (a little of the time)	5 (none of the time)	P value
elderly RSG	2 (1.0)	6 (3.1)	17 (8.9)	42 (21.9)	125 (65.1)	0.213
elderly GPG	5 (1.8)	10 (3.7)	28 (10.3)	67 (24.6)	162 (59.6)	
young RSG	0 (0.0)	4 (1.9)	9 (4.3)	33 (15.9)	161 (77.8)	0.005
young GPG	3 (2.8)	2 (1.9)	7 (6.5)	28 (25.9)	68 (63.0)	
RSG	2 (0.5)	10 (2.5)	26 (6.5)	75 (18.8)	286 (71.7)	0.001
GPG	8 (2.1)	12 (3.2)	35 (9.2)	95 (25.0)	230 (60.5)	
<Question 2> During the past 4 weeks, how often have you had shortness of breath?						
Score	1 (>1 a day)	2 (Once a day)	3 (3-6 times/week)	4 (1-2/week)	5 (none)	P value
elderly RSG	15 (7.8)	6 (3.1)	13 (6.8)	62 (32.3)	96 (50.0)	0.022
elderly GPG	29 (10.7)	20 (7.4)	27 (9.9)	82 (30.1)	114 (41.9)	
young RSG	9 (4.3)	5 (2.4)	9 (4.3)	63 (30.4)	121 (58.5)	0.005
young GPG	7 (6.5)	7 (6.5)	7 (6.5)	41 (38.0)	46 (42.6)	
RSG	24 (6.0)	11 (2.8)	22 (5.5)	125 (31.3)	217 (54.4)	<0.001
GPG	36 (9.5)	27 (7.1)	34 (8.9)	123 (32.4)	160 (42.1)	
<Question 3> During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night than usual in the morning?						
Score	1 (≥4 nights/week)	2 (2-3 nights/week)	3 (Once a week)	4 (1 or 2)	5 (none)	P value
elderly RSG	8 (4.2)	11 (5.7)	14 (7.3)	32 (16.7)	127 (66.1)	0.667
elderly GPG	8 (2.9)	20 (7.4)	15 (5.5)	44 (16.2)	185 (68.0)	
young RSG	2 (1.0)	11 (5.3)	8 (3.9)	31 (15.0)	155 (74.9)	<0.001
young GPG	6 (5.6)	7 (6.5)	8 (7.4)	29 (26.9)	58 (53.7)	
RSG	10 (2.5)	22 (5.5)	22 (5.5)	63 (15.8)	282 (70.7)	0.044
GPG	14 (3.7)	27 (7.1)	23 (6.1)	73 (19.2)	243 (63.9)	
<Question 4> During the past 4 weeks, how often have you used your rescue inhaler medication (such as salbutamol)?						

Score	1 (≥3 times/day)	2 (1-2 times/ day)	3 (2-3 times/week)	4 (≤1/week)	5 (none)	P value
elderly RSG	4 (2.1)	38 (19.8)	20 (10.4)	33 (17.2)	97 (50.5)	<0.001
elderly GPG	7 (2.6)	39 (14.3)	16 (5.9)	15 (5.5)	195 (71.7)	
young RSG	3 (1.4)	40 (19.3)	25 (12.1)	38 (18.4)	101 (48.8)	0.485
young GPG	2 (1.9)	21 (19.4)	12 (11.1)	13 (12.0)	60 (55.6)	
RSG	7 (1.8)	78 (19.5)	45 (11.3)	71 (17.8)	198 (49.6)	<0.001
GPG	9 (2.4)	60 (15.8)	28 (7.4)	28 (7.4)	255 (67.1)	
<Question 5> How would you rate your asthma control during the past 4 weeks?						
Score	1 (not at all)	2 (poorly controlled)	3 (somewhat controlled)	4 (well controlled)	5 (completely controlled)	P value
elderly RSG	1 (0.5)	12 (6.3)	74 (38.5)	61 (31.8)	44 (22.9)	0.034
elderly GPG	1 (0.4)	15 (5.5)	84 (30.9)	87 (32.0)	85 (31.3)	
young RSG	2 (1.0)	12 (5.8)	58 (28.0)	69 (33.3)	66 (31.9)	0.027
young GPG	4 (3.7)	6 (5.5)	38 (35.2)	38 (35.2)	22 (20.4)	
RSG	3 (0.8)	24 (6.0)	132 (33.1)	130 (32.6)	110 (27.6)	0.824
GPG	5 (1.3)	21 (5.5)	122 (32.1)	125 (32.9)	107 (28.2)	

Data are n (%).

Differences between two groups were analyzed by Mann-Whitney's U test.

RSG: n=399; GPG: n=380; elderly RSG: n=192; elderly GPG: n=272, young RSG: n=207; young GPG n=108.

Abbreviations as in Table 1.

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15 Table 3: Adherence to treatment of study patients (n=779)

	Frequency to forget and nonuse per week				P value
	Not at all	1-2 times	3-4 times	≥5 times	
Inhalants					
elderly RSG (n=180)	149 (82.8)	20 (11.1)	3 (1.7)	8 (4.4)	0.891
elderly GPG (n=169)	138 (81.7)	25 (14.8)	3 (1.8)	3 (1.8)	
young RSG (n=204)	144 (70.6)	50 (24.5)	4 (2.0)	6 (2.9)	0.763
young GPG (n=79)	59 (74.7)	11 (13.9)	1 (1.3)	8 (10.1)	
RSG (n=384)	293 (76.3)	70 (18.2)	7 (1.8)	14 (3.6)	0.413
GPG (n=248)	197 (79.4)	36 (14.5)	4 (1.6)	11 (4.4)	
oral agents					
elderly RSG (n=108)	92 (85.2)	9 (8.3)	0 (0.0)	7 (6.5)	0.140
elderly GPG (n=209)	189 (90.4)	15 (7.2)	2 (1.0)	3 (1.4)	
young RSG (n=117)	90 (76.9)	17 (14.5)	4 (3.4)	6 (5.1)	0.679
young GPG (n=59)	45 (76.3)	4 (6.8)	2 (3.4)	8 (13.6)	
RSG (n=225)	182 (80.9)	26 (11.6)	4 (1.8)	13 (5.8)	0.055
GPG (n=268)	234 (87.3)	19 (7.1)	4 (1.5)	11 (4.1)	
Patches					
elderly RSG (n=16)	12 (75.0)	1 (6.3)	0 (0.0)	3 (18.8)	0.094
elderly GPG (n=57)	51 (89.5)	6 (10.5)	0 (0.0)	0 (0.0)	
young RSG (n=12)	8 (66.7)	1 (8.3)	1 (8.3)	2 (16.7)	0.913
young GPG (n=17)	11 (64.7)	2 (11.8)	0 (0.0)	4 (23.5)	
RSG (n=28)	20 (71.4)	2 (7.1)	1 (3.6)	5 (17.9)	0.114
GPG (n=74)	62 (83.8)	8 (10.8)	0 (0.0)	4 (5.4)	
Inhalants					
elderly(RSG+GPG) (n=349)	287 (82.2)	45 (12.9)	6 (1.7)	11 (3.2)	0.002
young(RSG+GPG) (n=283)	203 (71.7)	61 (21.6)	5 (1.8)	14 (4.9)	

oral agents

elderly(RSG+GPG) (n=317)	281 (88.6)	24 (7.6)	2 (0.6)	10 (3.2)	<0.001
young(RSG+GPG) (n=176)	135 (76.7)	21 (11.9)	6 (3.4)	14 (8.0)	

Patches

elderly(RSG+GPG) (n=73)	63 (86.3)	7 (9.6)	0 (0.0)	3 (4.1)	0.011
young(RSG+GPG) (n=29)	19 (65.5)	3 (10.3)	1 (3.4)	6 (20.7)	

Data are n (%).

Differences between two groups were analyzed by Mann-Whitney's U test.

Abbreviations as in Table 1.

Figure captions

Figure 1: Proportion of patients of the RSG and GPG with high score of the total ACT score. High score was defined as ≥ 20 points of total ACT score.

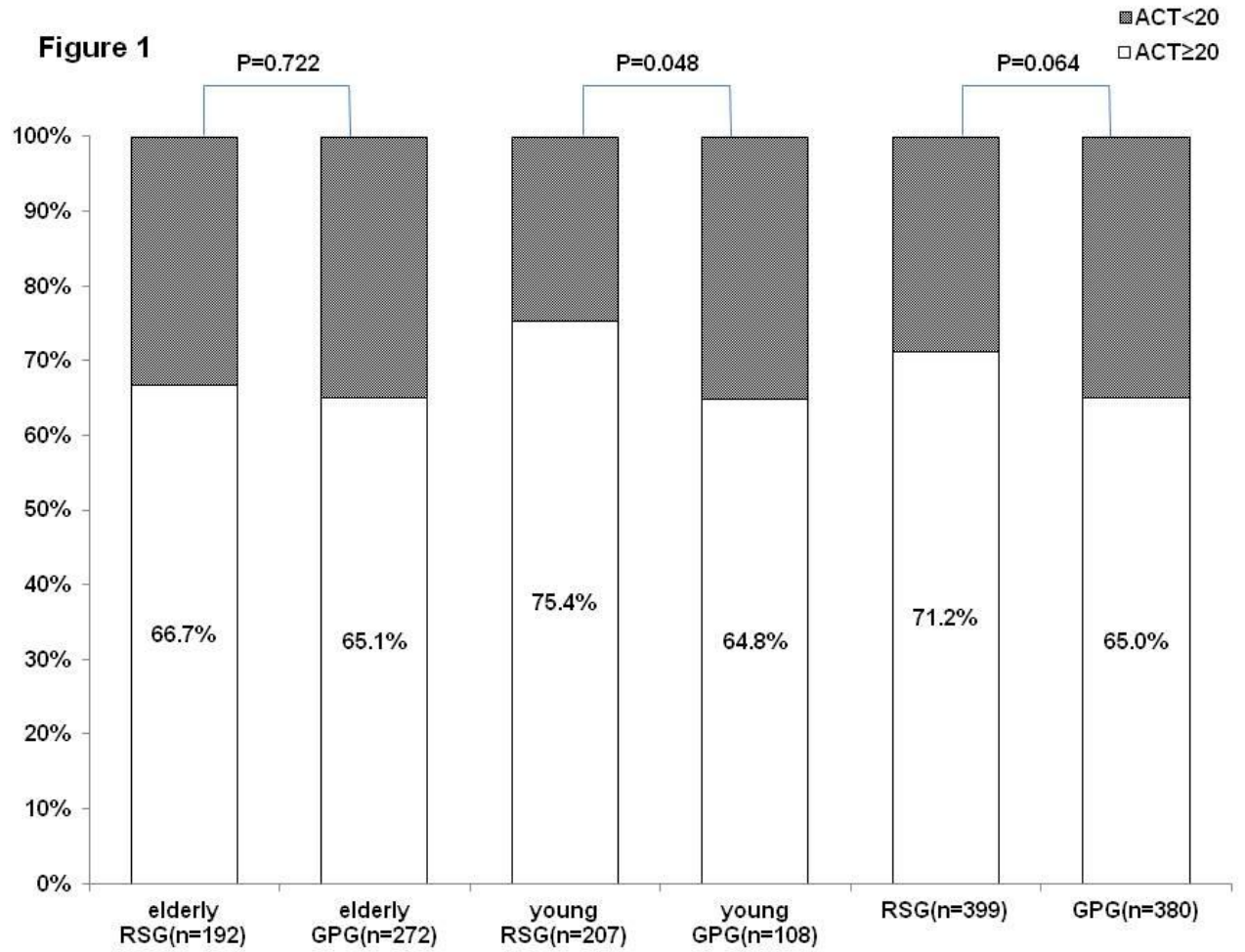
RSG: respiratory specialist group; GPG: general practitioner group; ACT: asthma control test.

Figure 2. (A) Proportion of elderly patients of the RSG and GPG with high score of the total ACT score stratified according to steps of treatment of the GINA 2009 guidelines.

GINA: Global Initiative for Asthma; Other abbreviations as in Figure 1. (B) Proportion of young patients of the RSG and GPG with high score of the total ACT score stratified according to steps of treatment of the GINA 2009 guidelines.

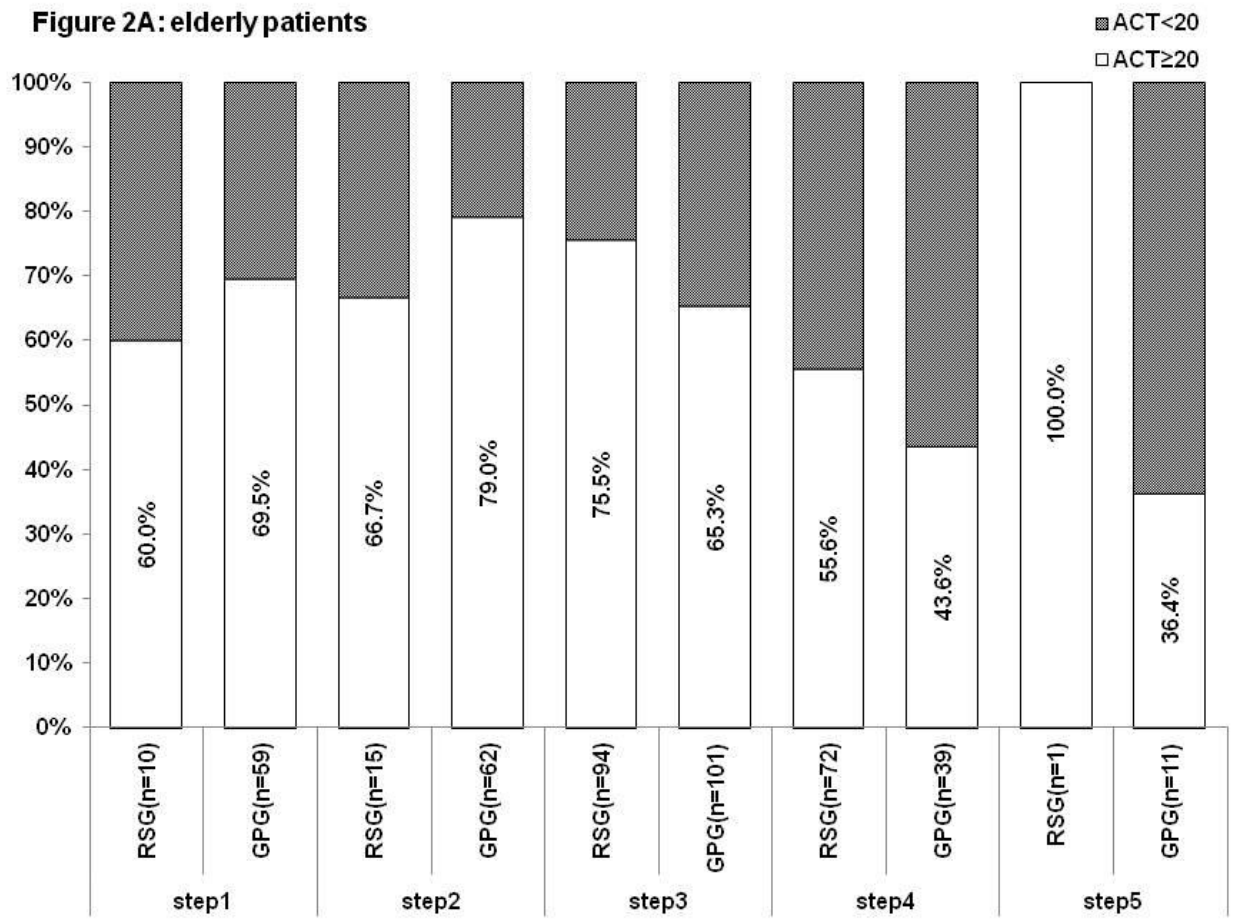
GINA: Global Initiative for Asthma; Other abbreviations as in Figure 1.

Figures



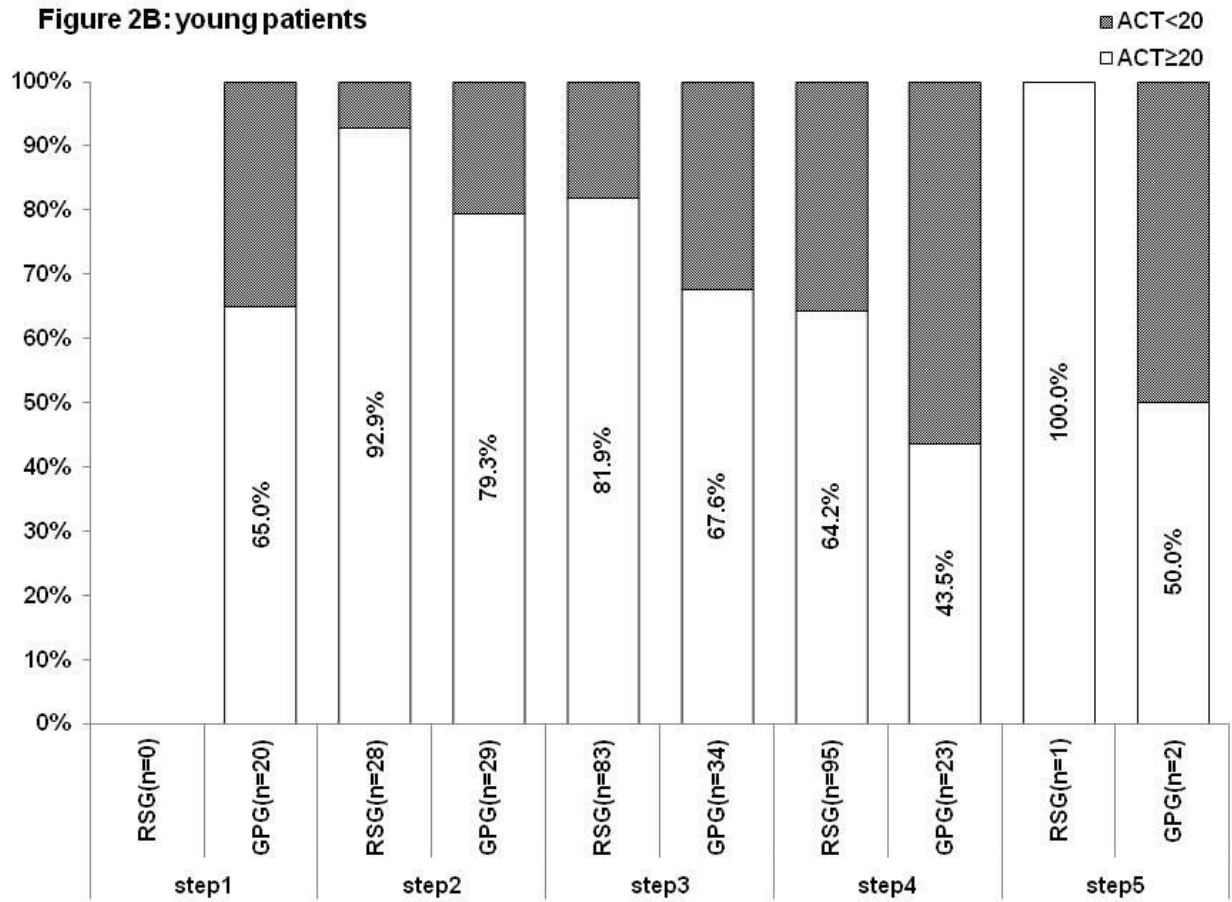
JUST A

Figure 2A: elderly patients



JUSTA

Figure 2B: young patients



JUST A