

Asthma action plan for proactive bronchial asthma self-management in adults: a randomized controlled trial

Hassan Farag^{1,2}, Ekram W. Abd El-Wahab^{1,3,*}, Nessrin A. El-Nimr⁴ and Hoda A. Saad El-Din^{5,6}

¹Tropical Health Department, High Institute of Public Health, Alexandria University, Egypt; ²WHO Expert Roster S073777, World Health Organization (EMRO), Egypt; ³College of Arts and Science, Ohio State University, Columbus 43210 Ohio, USA; ⁴Epidemiology Department, High Institute of Public Health, Alexandria University, Egypt; ⁵General Director of the General Administration of Alexandria University Health Care Units, Alexandria, Egypt; ⁶Internal Medicine Department, Faculty of Physiotherapy, Pharos University, Alexandria, Egypt

*Corresponding author. E-mail: ekramwassim@mail.com

Received 9 September 2017; revised 1 March 2018; editorial decision 5 June 2018; accepted 5 June 2018

Background: Written personalized asthma action plans are recommended as part of patient education and self-management.

Objectives: To enable asthmatic adults to proactively self-manage bronchial asthma and sustain asthma quiescent status through utilization of the Asthma Action Plan (AAP), and to establish a feasible asthmatic/care taker—health care provider communication.

Design: Randomized controlled trial with cluster sampling by pulmonologists.

Setting and participants: The study comprised 320 chronic asthmatic patients attending the chest department at the main health insurance hospital in Alexandria that were randomly allocated as the intervention group (AAIG; n=160) that received standard care and intervention by the AAP and a control group (AACG; n=160) that received the routine standard of care. Data were collected through an interviewing questionnaire. The study continued over a 6-month period and passed into three phase stations. During the preparatory phase the health care provider managed to explain, fill and simplify the use of the Arabic version of the AAP, to explain the correct utilization of the weekly follow-up form and to emphasize the weekly communication/visit with the health care provider (HCP) to update their weekly follow-up records. Follow-up was done on the 90th and 180th days from the launch of the study, respectively. The study asthmatics were subjected to history-taking of their asthma symptoms, signs and triggers, and a review of their medical/peak expiratory flow records, as well as his/her daily activity and exercise.

Results: The AAIG experienced superiority of the average of the green zone days ('doing well') with significantly more episodes of early asthma flare-up self-management concomitant with prominent fewer emergency department visits, hospitalization, admission at the ICU, private health facility, and days of sickness leaves and absenteeism. A preponderance of the high and medium adherence levels to asthma medications, avoidance of asthma triggers and smoking was achieved by the AAIG.

Conclusions: AAP was the basis for effective patient–health care provider communication and patient real time asthma flare-up self-management to achieve and sustain better asthma control in asthmatic adults.

Keywords: adults, asthma action plan, bronchial asthma, self-management

Introduction

Bronchial asthma is a major global chronic health problem in developed and urbanized developing countries. It afflicts ≈300 million worldwide, mostly before the age of 30, and is expected to amount to 400 million by 2025. It is a major cause of

disability, restricted activity, poor quality of life and health resources utilization. It accounts for annual deaths of 0.25 million; about 80% of them occur in low- and lower-middle income countries.¹ In Egypt, the overall wheezing and physician-diagnosed asthma among adults ranges between 7% and 8%.²

Optimal asthma management indicates proper diagnosis with sustained care, effective enough to abort airway inflammation and symptoms, and prevent episodes. In fact, there is a considerable communication 'gap' between what care providers do and what asthmatics actually perceive that they do.³ The patient interview translates into a conversation with goals for asthma management. The specific clinician communication behaviours predicted reduced health care use, and positive perceptions of quality of care, better medication adherence and helping asthma self-management.⁴

The global initiative for asthma (GINA) proposed four inter-related components for better asthma control. These included the development of doctor/patient partnership, the identification and reduction of exposure to risk factors, the proper assessment, treatment and monitoring of asthma, and management of asthma exacerbations.⁵

The expert patient/self-management programme (EPP/SMP) is a generic approach for patients with long-term illnesses based on the patient-professional partnership that embraces two elements:

- collaborative care or joint patient-professional decision making;
- self-management or to provide patient education, problem-solving skills, capacity to expand resourcefulness, improve communication with HCP, reduce symptom severity and promote quality of life and satisfaction.

Since bronchial asthma is a chronic condition and, together with its poor control and frequent exhausting exacerbation experiences, it impacts upon patient performance. Compliance with the medications without sustained proper education and social support means that a patient with refractory asthma will not achieve positive outcomes and may push him into a dilemma of negativism towards actions to improve his condition. He loses interest and confidence in both health care and compliance with medicines, surrenders to asthma undulation and may even harm his life. The net results are exacerbations and asthma attacks, as well as repeated emergency department (ED) visits, hospitalization, sickness leave and absenteeism.^{6,7}

The present study hypothesizes that an integral personalized asthma action plan (PAAP) with both symptoms and peak flow meter (PFM) domains, and supported by sustained proper education and motivation would enrich patient knowledge, reactivate skills, revive self-efficacy, rejuvenate self-management and empower effective control of asthma.

An asthma action plan (AAP) is a set of individualized written instructions, decided jointly by the physician and patient or their caretaker, to enable control of the disease everywhere. It includes a list of asthma triggers, warning symptoms, medications needed (clear names, doses and schedule) and emergency care (instructions, locations and phone numbers). Based on tailored asthma symptoms or peak expiratory flow (PEF), AAP is divided into three traffic-signal zones (green, yellow, red), which guides patient/caretaker decisions and adjusts the prescribed medicine type and doses to keep asthma under good control. An AAP amalgamates both GINA components and EPP/SMP elements.^{5,8} The GINA guideline⁵ and the British Thoracic Society/Scottish Intercollegiate

Guideline Network/ Scottish Intercollegiate Guideline Network (BTS/SIGN) guidelines cited 261 randomized controlled trials (RCTs) in support of offering all people with asthma, and/or their parents or caretakers self-management education and skills, including a written personalized AAP, and to be supported by regular professional review and partnership to effectively manage their asthma.⁹

Here, it is hypothesized that an AAP is a simple comprehensive communication intervention tool that can promote patient/caretaker knowledge and skills, and render them knowledgeable enough to avoid asthma triggers, identify flare-up early symptoms, and set up a real-time treatment to prevent the flare-up, know how to manage a full-blown flare-up, and when and where to seek emergency care. An AAP was found to result in improved asthma management with a reduction in respiratory morbidity in children.^{8,10} However, the effect of this approach has not been addressed in the adolescent and adult population.

The purpose of the current study was to enable asthmatic adults to proactively self-manage bronchial asthma and sustain an asthma-quiescent status through the utilization of the AAP. The authors extended their analysis to investigate the AAP credibility in terms of the establishment of a feasible asthmatic/caretaker-health care provider communication.

Methods

Study setting and design

A single blind RCT was carried out at the chest disease department of the main health insurance hospital, which pools patients from all over Alexandria city. The study continued for 6 months (August 2014–January 2015).

Study population

It comprised asthmatic adults who were registered and attending the chest clinic in the study setting and pulmonologists who were caring for the asthmatics studied. Both were selected according to pre-designed inclusion criteria (Figure 1).

Sampling, randomization and blinding

For asthmatics

Using a power of 80% to detect the relative risk of having an asthmatic attack in patients on traditional therapy compared with others on guidelines= z , assuming the recurrence rate of attack among controls=22%,¹⁰ $\alpha=0.05$, the minimum required sample size (n) was found to be 150 for each group.¹¹ An additional 10–20% of subjects are required to allow adjustment of other factors such as withdrawals, missing data and loss to follow-up. Accordingly, this number was increased to 200 for each group and thus a total of 400 eligible asthmatics were enrolled in the study by simple random sampling. Those were randomly allocated as intervention group ($n=200$) named the allocated asthmatic intervention group (AAIG) and a control group ($n=200$) named the allocated asthmatic control group (AACG).

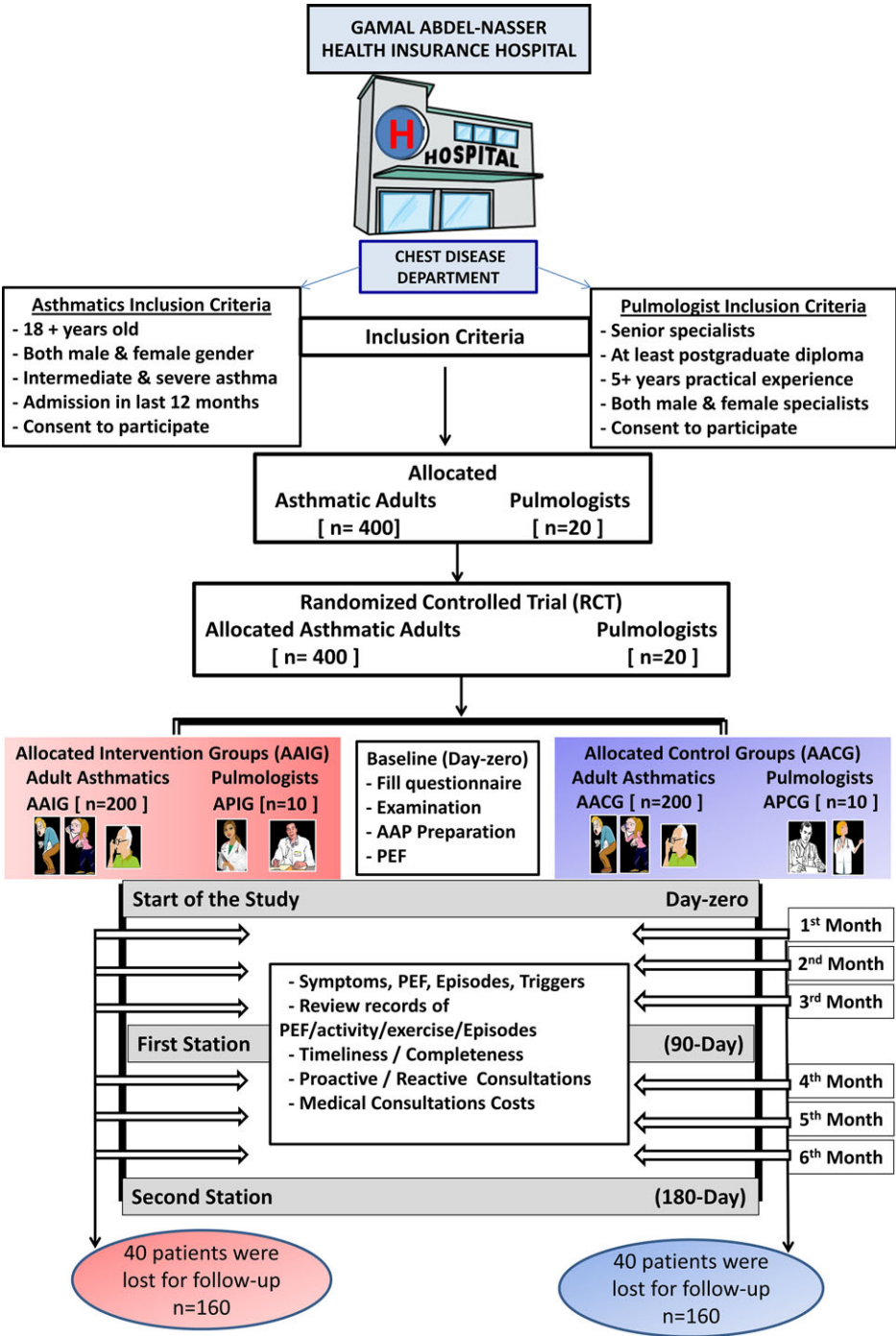


Figure 1. Study population and procedure

Pulmonologists were assigned to control or intervention groups by the toss of a coin. Patients were randomized to pulmonologist by random number table and assignment concealed using sealed envelopes. Patients in each group were randomly assigned to the intervention or control group using a computer random numbers generator (Figure 1 and S.file 1 for detailed randomization).

Distribution of the sample size into subgroups (clusters) by pulmonologists was just done for facilitation of the work and

follow-up. Distribution was randomly done to avoid the bias inherent in pulmonologists selecting patients, some of whom they had treated before. Contamination between the participants was avoided by agreement with the head of the chest department and intervention specialists/nurses during training on the following measures:

- Stopping specialists and nurses during turnover and/or shift change throughout the study.

- None of the patients should visit the pulmonologist at his own private practice for any reason.
- That each pulmonologist/nurse should receive and check only the patients they were responsible for was strongly emphasized. Change of patients and health care providers was not allowed.
- The pulmonologist stressed the fact that the written AAP is personalized (PAAP) for that patient only. Therefore, the patient/caretaker should strictly follow it, neither changing it themselves nor sharing it with either physician or patients.
- Care and education of the intervention group.

Intervention and control group

The control group (AACG) received the routine standard of care. At the first visit, the pulmonologist checked the patient, prescribed the drugs, gave instructions, and informed him about the time of the forthcoming visit in a short time, due to the high number of patients. The patient was often the recipient and was told to comply with the instructions dictated to him. He had little or no chance to discuss his experience, nor did the patient/caretaker get written instructions. In the follow-up visits, the patient/caretaker came to the chest clinic, sat in the hall waiting their turn for a long time and entered into conversation with others. During the visit, in a short time (approximately 3–5 min), the pulmonologist often repeated the same medications and asked the patient/caretaker to follow the same instructions. Sometimes, he made small changes in the medication type and/or dose. As regards the patient's education, there was an established health education programme. It tackled various acute and chronic health problems. In addition, the education sessions were not conducted regularly. Thus, there was no specific asthma education programme and asthma self-management was lacking.

The intervention group (AAIG) received the AAP and the routine standard of care. A self-management plan was derived for each patient and the patient was taught to use it with the aid of a PFM. The pulmonologists were instructed to give ample time (25–30 min) for patients to talk, and to deal with the patients as a real partner in the AAP, which should be prepared based on concordance, rather than compliance to ensure their adherence. The pulmonologist simply educated patients/caretakers about asthma regarding:

- basic facts, pathogenesis;
- symptoms/signs, triggers, complications;
- control/worsening symptoms/signs;
- exacerbations;
- treatment;
- controller/drugs for medications (types, actions, uses, doses, administration and side effects);
- comorbid conditions, control assessment, setting up partnership and concordance.

Patients identified their asthma triggers and expressed their experience with asthma medications, control and exacerbation and came to an agreement jointly with the pulmonologists on the preferable medications and regimen with least side effects.

The pulmonologist also elaborated on self-management (behaviours), including measures:

- to avoid asthma triggers;
- asthma symptom self-monitoring, asthma status self-assessment;
- actions taken with early exacerbation symptoms/signs;
- skills of administration of different asthma controllers and relievers, proper use of asthma inhalers, proper use of PFMs and reading of PEFs, asthma prophylaxis before exercise/sports; when and where to seek care.

This would:

- enrich patients/caretakers knowledge;
- rectify their misbelief (e.g. asthma inhalers prescription signifies hopelessness of cure and patient is about to die) that negatively impact their self-efficacy;
- easily pull them out of risky behaviours/habits;
- attract their attention to the control plan.

Standard procedure

At the start of the study, the pulmonologist/nurse jointly with the patient/caretaker prepared both the patient written AAP and the schedule of the follow-up visits throughout the study.

Before each visit the patient/caretaker called the nurse concerned to determine the visit time. On arrival at the chest department, the patient/caretaker was immediately allowed to meet their concerned specialist to avoid having to wait for a long time, entering into conversation and controversy with other patients. At each visit, the patient/caretaker should come and bring all utilized medications with them. The specialist/nurse should revise the patient's asthma control status and PAAP with them to ensure that they clearly understand and followed it strictly, ask about/check the medications used by the patient and its side effects, revise/observe the use of inhalers, ask about the patient activities, sickness leave/absenteeism, and answer their inquiries. By the end of the visit, the nurse made sure that the patient/caretaker left without discussing any therapeutic plan with other patients

Data collection

A pre-designed structured interview questionnaire was used to collect data about patients':

- *sociodemographics*: age, sex, marital status, occupation, residence, educational level, crowding index, family income, housing conditions, etc;
- *habits/addiction*: physical exercise, smoking, substance abuse, alcohol intake, etc;
- *clinical history*: of cough, wheezes, dyspnoea, orthopnoea, expectoration, etc;
- *asthma triggers*: contact, inhalants, ingested, etc;
- interference with daily activities, sick leaves/absenteeism, medications used, allergy and atopy including allergic rhinitis/hay fever, allergic conjunctivitis, contact dermatitis, eczema.

All asthmatics were subjected to general and systemic examination and assessment of body mass index¹² and waist circumference.¹³ Baseline HCP–patient communication and medication adherence were also assessed using the Morisky 8-Item Medication Adherence Questionnaire.¹⁴ Asthmatic satisfaction with received health care was assessed using the Short-Form Patient Satisfaction Questionnaire 18-PSQ.¹⁵

Study phases

The preparatory phase started immediately after allocating the study asthmatics and pulmonologists. During this phase, the authors carried out the preparation and finalization of the data collection tools, and the AAP. The AAP adopted was that of the District of Colombia, USA.⁸ It was translated into an Arabic version (forward and backward) that was evaluated by an expert panel at Gamal Abdel-Nasser health insurance hospital and tested along with the questionnaire tool in a pilot study (Suppl. Figure 1), the latter comprising 10 adult asthmatics that were not involved in the RCT.

Clustering was done so that each cluster comprised 15–20 patients and one pulmonologist. The cluster members recognized each other and set up convenient communication tools with their pulmonologist in charge and between themselves. Each HCP managed, communicated and followed the corresponding asthmatic group throughout the study.

Training of the AAIG and HCPs was done to explain the study concept, objectives, procedures and outcomes, the component and usage of the AAP, the medications and dosages agreed upon for use in the AAP, and the proper usage of the flow meter and recording of the PEF.

As per the original plan, each asthmatic of the AAIG should get, at the end of training, a functioning flow meter, a daily record of his own PEF readings, and clinical assessment and weekly communications with his HCP (Plan A). Due to unavailability of flow meters in Egypt, 20 flow meters were imported, with difficulty, and distributed to the HCPs who took the PEF readings for their cluster asthmatics weekly (Plan B).

The authors used two types of PFM in this study, the Personal Best REF 755EU¹⁶ [RESPIRONICS *Health Scan Asthma & Allergies Products*, New Jersey, USA, <http://www.respironics.com>], and the e-Mini Wright Peak Flow Meter [Clement Clarke International Ltd, Edinburgh, UK].^{16,17}

The implementation phase passed through three visits

Baseline (initial/day zero) visit

At the baseline visit, every HCP of the allocated pulmonologists interviewed each of his/her AAIG patients in the presence of the assisting nurse and intimate caregiver in order to ensure that they were included as per criteria, in controllable status and ready for the study. They were capable of filling the interview questionnaire to get all basic information; explain, fill and simplify the use of the Arabic version of the AAP; give instructions about triggering allergens/irritants in order to avoid them; explain symptoms/PEF readings, distinguishing the green, yellow and red zones; prescribe controller/reliever medicines types, doses and routes of administration; give basic information/cell numbers

of the patient, caregiver and HCP; and explain the proper utilization of the weekly follow-up form. They also needed to emphasize at the weekly communication/visit with the HCP updating their weekly follow-up records.

The HCP kept the original AAP in his medical record, gave a copy to the asthmatic/intimate caregiver and ensured that the patient/intimate caregiver fully assimilated the proper utilization of the AAP, the PFM and interpretation of PEF readings, the weekly follow-up form and the real-time communication/proactive consultation schedule.

90-day and 180-day follow-up visits

These were done on the 90th and 180th day from the launch of the study, respectively. At each follow-up, the study asthmatics were subjected to history-taking of asthma symptoms, signs and triggers; review of medical/PEF records; and recording of his/her daily activity and exercise.

In each weekly follow-up communication/proactive consultation, the HCP revised the AAP with the patient/caregiver and updated the weekly results, including:

- days with green, yellow and red zones, and PEF readings;
- days and levels of adherence to prescribed medicines and instructions;
- times of communications/proactive consultations with HCP and level of patient satisfaction;
- times of reactive consultation (emergency visits, admission at ICU and hospitalization);
- level of satisfaction with routine activities and exercise;
- asthma severity, control status and reasons for exacerbation;
- times of early intervention at home, days of sickness leave and absenteeism;
- costs of reactive consultations (a consultation that occurred because the patient had an exacerbation of asthma symptoms).¹⁰

Asthma severity has been categorized as mildly intermittent, mildly persistent, moderately persistent and severely persistent, based on asthma severity classification.^{5,18} Bronchial asthma control was assessed and asthma symptom control was classified into controlled, partially controlled or uncontrolled according to GINA guidelines.⁵

Asthmatic–health care provider (As–HCP) communication has been assessed by two indicators—completeness and timeliness.¹⁹ The As–HCP communication timeliness indicated the in-duration of As–HCP communication. It is the frequency of asthmatics who spontaneously communicated with or visited their HCPs at the proper time from the expected total number of As–HCP communication and can be calculated using:

As–HCP communication timeliness

$$= \frac{\text{no. of asthmatics who spontaneously communicated with or visited their HCP in time}}{\text{expected total no. of As–HCP communication}} \times 100$$

the As–HCP communication completeness denoted the frequency of all As–HCP communications or visits that took place in and beyond the proper time from the expected total number of As–HCP communication.

As–HCP communication completeness

Timely As–HCP communication

$$= \frac{+ \text{no. of asthmatics who communicated with or visited their HCP outside the proper time}}{\text{expected total no. of As–HCP communication}} \times 100$$

Asthmatic adherence to self-management guidelines was assessed using the Morisky 8-Item Medication Adherence Questionnaire;¹⁴ a score >2 was considered low adherence, 1 or 2 medium adherence and a score of 0 indicated high adherence.

Asthmatic satisfaction with received health care was assessed using the Short-Form Patient Satisfaction Questionnaire 18-PSQ.²⁰ The original English questionnaire was translated into an Arabic version and back translation into English was done by senior health care/quality assurance experts. The face validity was endorsed by senior experts. The calculated pilot study sample size was five patients; however, the full study surveyed 20. Seven experts verified the questionnaire content validity (items were complete and it measured what it was purported to measure, Kappa [k]>0.8), construct validity (evident concordance, confirmatory factor analysis [CFA]=0.95) and concurrent validity (evident correlation, r=0.85). The patients were asked to indicate how they felt about the medical care they received in general with no reference to a specific time frame or visit. Responses to each item were given on a five-point scale ranging from strongly agree (1) to strongly disagree (5). The score range was 18–90 and was scaled as 18–<23 Good, 24–<35 Acceptable, 36–<59 Fair and 60–90 Poor.

Other measurable outputs were the asthmatic sustained asthma controllable status, capability of performing daily activities and exercise, attendance at EDs, admission at hospitals and/or ICUs, and absenteeism.

Statistical analysis

Data were collected, revised, coded and fed to statistical software SPSS Version 16.0 (SPSS, Chicago, IL, USA). All statistical analysis was done using two-tailed tests and an alpha error of 0.05 p value. The means with standard deviation and percentage were used to describe the scale and categorical data, respectively. For categorical data, Pearson's χ^2 test, Fishers exact test and Mont Carlo exact test were used for several independent groups. A two-sample F-test for variance was used for testing the vertical variance in means for the two groups. t-Test (for parametric data) and Mann–Whitney U-test (for non-parametric data) were used to test the horizontal mean difference between the two groups.

Results

Characteristics of the studied participants and asthma-associated factors are shown in (Table 1). The AAIG was, on average, 2 years older than the AACG (46.5 years vs 44.1 years), although this difference was not significant. Apart from marital status, there were no significant differences between the AAIG and AACG regarding their socio-demographic features (p>0.05).

Table 2 demonstrated the mean of the weekly readings with 80–100%, 50–<80% and <50% PEF personal best among the studied AAIG and AACG. Those means were consistently higher in the AAIG than the AACG throughout the study. The means of the green and yellow zones PEF personal best readings at the first and second visits were significantly higher in the AAIG (p<0.05). On the other hand, the means of the red PEF personal best readings at the first and second visits did not differ significantly among both groups (111.9±28.6 vs 111.3±30.7 and 122.5±29.3 vs 114.3±26.3, respectively). Likewise, there was persistent superiority of the symptom-based average of the green zone days in the AAIG over the AACG by month, as well as at the first (85.0±4.9 AAIG vs 78.0±6.2 AACG) and second (168.4±9.1 AAIG vs 156.2±8.2 AACG [t=11.1, p<0.05]) visits of the study. On the contrary, the symptom-based means of the yellow and red zones were much higher in the AACG than the AAIG throughout the study, both by month as well as at the first (8.4±4.2 AACG vs 3.1±4.2 AAIG [t=−9.1, p<0.0001]) and (2.1±3.0 AACG vs 0.16±0.6 AAIG4, [t=−5.3, p<0.05]) and second (13.9±6.7 AACG vs 6.1±7.8 AAIG [t=−8.3, p<0.05]) and (4.7±3.9 AACG vs 0.23±8.1 AAIG [t=10.5, p<0.05]) visits, respectively (Table 3).

The means of mild intermittent and moderate persistent asthma events of the two groups differed significantly at the first (mild intermittent: 13.0±2.1 AAIG vs 12.4±0.9 AACG; moderate persistent: 0.6±1.1 AAIG vs 1.2±0.7 AACG, [p<0.05]) and second (mild intermittent: 25.2±3.4 AAIG vs 24.2±1.2 AACG [Z=−8.5]; moderate persistent: 0.95±1.4 AAIG vs 1.9±0.98 AACG [Z=7.9, p<0.05]) visits. The mild persistent attacks occurred more in the AAIG than in the AACG throughout the study, although the difference was not statistically significant (p<0.05). On the contrary, severe persistent asthma events were significantly higher in the AACG than the AAIG per month, as well as at the first (0.05±0.2 AAIG vs 0.3±0.5 AACG) and second (0.1±0.2 AAIG vs 0.7±0.6 AACG [p<0.05]) visits (Table 4).

The AAIG self-managed their early asthma flare-ups at home more often than the AACG, at the first (86.6±3.5 AAIG vs 83.0±5.5 AACG [t=7.0]) and second visits (173.3±3.6 AAIG vs 165.1±7.9 AACG [t=11.3, p<0.05]). Asthma exacerbation-induced times of ED visits, admission at the ICU, hospitalization, private health facility visits, and days of sick leave and absenteeism were significantly higher in the AACG than the AAIG at the first and second visits (p<0.05; Table 5).

The vertical differences in the times of ED visits, hospitalization, admission at the ICU, and private health facility visits, as well as the days of sick leave and absenteeism between the 6-month period before and after the study for each of the AAIG and AACG were summarized (S. Table 1). Those variables decreased significantly in the AAIG by 85.1%, 92.6%, 11.1%, 61.4%, 2.6% and 68.6%, respectively (p<0.05). On the other hand, the AACG experienced significant increase of the times of hospitalization, admission to an ICU and hospitalization, and sick leave days by 64.0, 37.3, and 60.1, respectively, as well as a significant and insignificant drop in the number of ED visits by 44.9%, days of absenteeism and the times of private sector consultations by 16.8%.

The average number of days of adherence to medications, satisfaction with daily physical activity days were significantly higher among the AAIG compared with the AACG at the first (86.9±3.2 AAIG vs 84.6±4.5 AACG [t=5.2, p<0.0001]; 173.3±3.6

Table 1. Socio-demographic features of studied patients

Variable	Group				Total		p
	AAIG (n=160)		AACG (n=160)				
	n	%	n	%	n	%	
Age (years)							
20–	29	39.7	44	60.3	73	22.8	0.19
35–	54	50.9	52	49.1	106	33.1	
50–	72	55.4	58	44.6	130	40.6	
65+	5	45.5	6	54.5	11	3.4	
Mean±SD	46.5±11.4		44.1±12.7		45.3±12.1		0.072 ^a
Gender							
Male	55	45.8	65	54.2	120	37.5	0.24
Female	105	52.5	95	47.5	200	62.5	
Residence							
Urban	156	49.5	159	50.5	315	98.4	0.37
Rural	4	80	1	20	5	1.6	
Ethnicity							
Lower Egypt	158	49.7	160	50.3	318	99.4	0.24
Nubian	2	100	0	0	2	0.6	
Marital status							
Single	18	37.5	30	62.5	48	15	0.001 ^b
Married	136	56.2	106	43.8	242	75.6	
Widowed	5	23.8	16	76.2	21	6.6	
Divorced	1	11.1	8	88.9	9	2.8	
Education level							
Read and write	5	38.5	8	61.5	13	4.1	0.34 ^b
Preparatory	3	60	2	40	5	1.6	
Secondary	78	54.9	64	45.1	142	44.4	
University education	74	46.2	86	53.8	160	50	
Working status							
Full-time employee	147	50.2	146	49.8	293	91.6	0.8
Retired	13	48.1	14	51.9	27	8.4	
Crowding index							
<1–<2	139	50.0	139	50.0	278	87.9	0.1
2–3	21	50.0	21	50.0	42	13.1	
Monthly income							
100– (very low)	10	55.6	8	44.4	18	5.6	0.051
500– (low)	73	48.3	78	51.7	151	47.2	
1000– (enough)	70	48.6	74	51.4	144	45	
2000+ (enough and saving)	7	100	0	0	7	2.2	
BMI							
Overweight (25–)	42	42.9	56	57.1	95	29.7	0.09 ^b
Obese (>30)	118	53.2	104	46.8	22	69.4	
Waist circumference ^c							
Average	10	45.5	12	54.4	22	7.9	0.23
High risk	150	58.6	106	41.4	256	92.1	
Smoking							
Never	130	53.5	111	46.5	241	75.3	0.065
Current smoker	12	34.3	23	65.7	35	10.9	
Ex-smoker	19	43.2	25	56.8	44	13.8	0.78
Passive smoker	128	50.4	126	49.6	254	79.4	

a=t-test.

b=value based on Fisher's exact test (FET); p<0.05 is significant.

c=For women: risk is increased at ≥80 cm, risk is high at ≥88 cm. For men: risk is increased at ≥94 cm, risk is high at ≥102 cm¹⁶

Table 2. Follow-up of the personal best of PEF studied groups

Follow-up	Personal best 80–100%		Personal best 50–<80%		Personal best <50%	
	AAIG	AACG	AAIG	AACG	AAIG	AACG
	$\chi^2 \pm \text{SD}$	$\chi^2 \pm \text{SD}$	$\chi^2 \pm \text{SD}$	$\chi^2 \pm \text{SD}$	$\chi^2 \pm \text{SD}$	$\chi^2 \pm \text{SD}$
First visit (90-day)	279.1±60.4	256.9±69.5	221.0±51.3	195.5±53.1	111.9±28.6	111.3±30.7
t-Test/p~	t=5.3 p<0.0001		t=3.7 p=0.0003		t=0.15 p=0.8	
Second visit (180-day)	278.7±60.9	255.3±72.1	227.3±52.5	195.6±57.6	122.5±29.3	114.3±26.3
t-Test/p~	t=7.7 p<0.0001		t=5.8 p<0.0001		t=1.1 p=0.3	

~p for t-test and Mann–Whitney U-test (for non-parametric data).

Table 3. Follow-up of asthma action plan zones in studied groups

No. of patient days						
Follow-up	Green zone		Yellow zone		Red zone	
	AAIG	AACG	AAIG	AACG	AAIG	AACG
First visit (90-day) (mean±SD)	85.0±4.9	78.0±6.2	3.1±4.2	8.4±4.2	0.16±0.6	2.1±3.0
t Test/p~	t=11.1 p<0.0001		t= -9.1 p<0.0001		t= -5.3 p<0.0001	
Second visit (180-day) (mean±SD)	168.4±9.1	156.2±8.2	6.1±7.8	13.9±6.7	0.23±8.1	4.7±3.9
t Test/p~	t=12.6 p<0.0001		t= -8.3 p<0.0001		t= -10.5 p<0.0001	

~p for t-test and Mann–Whitney U-test (for non-parametric data)

Table 4. Follow-up of asthma attack severity among studied asthmatic groups

No. of patient attacks								
Follow-up	Mild intermittent		Mild persistent		Moderate persistent		Severe persistent	
	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG
First visit (90-day) (mean±SD)	13.0±2.1	12.3±0.9	0.36±1.51	0.07±0.37	0.63±1.07	1.22±0.7	0.05±0.2	0.34±0.5
t Test/p~	Z= -8.1 p<0.0001		Z= -1.4 p=0.15		Z= -7.9 p<0.0001		Z= -6.5 p<0.0001	
Second visit (180-day) (mean±SD)	25.2±3.4	24.2±1.2	0.03±0.18	0.2±0.8	0.95±1.4	1.92±0.98	0.05±0.22	0.7±0.6
t-Test/p~	Z= -8.7 p<0.0001		Z= -2.1 p=0.03		Z= -8.2 p<0.0001		Z= -10.9 p<0.0001	

~p for t-test and Mann–Whitney U-test (for non-parametric data).

AAIG vs 168.2±6.3 AACG [t=8.8, p<0.05]) and second follow-up visit (84.2±5.7 AAIG vs 77.2±7.5 AACG [Z=9.3, p<0.05]), (167.0±11.4 AAIG vs 153.0±14.2 AACG [Z=9.1, p<0.05]), whereas that of HCP-patient communication were significantly higher among the AACG at the first (17.0±2.9 AACG vs 15.0±0.7 AAIG [Z= -9.5, p<0.05]) and second (31.0±4.5 AACG vs 28.0±0.9 AAIG [Z= -9.5, p<0.05]) follow-up visit. Adherence to AAP instructions and avoidance of asthma triggers were profoundly higher in the AAIG than the AACG per month, as well as at the first (87.2±3.1 AAIG vs 00.00 AACG [t=5.2, p<0.05]) and second visits (173.8±3.5

Table 5. Number of asthma flare-up self-management, emergency department visits, ICU admission, hospitalization, private sector visits and sickness leave/absenteeism noted in the study

Follow-up	No. of early flare-up self-management		No. of ED visits		No. of admission at ICU		No. of hospitalization		No. of private sector visits		Sickness leave/absenteeism days	
	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG
First visit (mean±SD)	86.6±3.5	83.0±5.5	0.2±0.6	0.6±0.9	0.1±0.6	0.2±0.7	0.04±0.3	1.5±2.4	0.6±1.1	2.5±0.7	2.6±3.0	6.7±4.9
t/U-test/p~	t=7.0 p<0.0001		Z=-2.8 p=0.003		Z=-2.1 p=0.04		Z=-8.7 p<0.0001		Z=-6.6 p<0.0001		Z=-7.4 p<0.0001	
Second visit (mean±SD)	173.3±3.6	165.1±7.9	0.2±0.6	1.0±1.1	0.1±0.6	0.5±1.1	0.07±0.3	3.0±3.1	0.8±1.4	3.6±1.2	3.8±4.7	11.0±6.9
t/U-test/p~	t=11.3 p<0.0001		Z=-6.2 p<0.0001		Z=-1.7 p=0.007		Z=-4.2 p<0.0001		Z=-8.1 p<0.0001		Z=-9.0 p<0.0001	

~p for t-test and Mann-Whitney U-test (for non-parametric data).

Table 6. Days of adherence to medications, avoidance of asthma triggers and HCP-patient communication days among participants of the study

Follow-up	Days of adherence to medications		Days of asthma trigger avoidance		Days of smoking cessation		Days of satisfaction with daily activity		Days of HCP-patient communication	
	No. of patient days									
	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG
First visit (mean±SD)	86.9±3.2	84.6±4.5	87.2±3.1	0.0±0.0	0.08±0.87	3.0±8.6	84.2±5.7	77.2±7.5	15.0±0.7	17.0±2.9
t/U-test/p~	t=5.2 p<0.0001		t=5.2 p<0.0001		Z=-4.3 p<0.0001		Z=9.3 p<0.0001		Z=-9.5 p<0.0001	
Second visit (mean±SD)	173.3±3.6	168.2±6.3	173.8±3.5	0.0±0.0	0.11±1.35	4.3±12.4	167.0±11.4	153.0±14.2	28.0±0.9	31.0±4.5
t/U-test/p~	t=8.8 p<0.0001		t=5.2 p<0.0001		Z=-4.2 p<0.0001		Z=9.1 p<0.0001		Z=-9.5 p<0.0001	

~p for t-test and Mann-Whitney U-test (for non-parametric data).

AAIG vs 00.00 AACG [t=5.2, p<0.05]). Smoking cessation was seen significantly to occur in the AAIG than the AACG by month, as well as at the first (0.08±0.87 AAIG vs 3.0±8.6 AACG [Z=4.3, p<0.05]) and second visit (0.11±1.35 AAIG vs 4.3±12.4 AACG [Z=4.2, p<0.05]; Table 6).

Table 7 shows the level of adherence of the AAIG and AACG to the dosage and times of the prescribed medications according to Morisky-Mosby score. Achievement of high (H) and medium (M) adherence was significantly higher in the AAIG than the AACG per month, as well as at the first (1.04±3.0 H and 11.0±4.1 M for AAIG vs 0.14±0.7 H and 3.1±4.6 M for AACG [Z=1.9 {H} and 11.8 {M}, p<0.05]) and second (1.63±3.4 [H] and 22.2±6.5 [M] for AAIG vs 0.24±1.0 [H] and 6.4±9.2 [M] for AACG [Z=4.1 {H} and 12.0 {M}, p<0.05]). On the contrary, low adherence was significantly profound in the AACG in comparison to the AAIG; by month, as well as at the first (1.9±3.6 AAIG vs 10.8±4.8 AACG) and second visits (3.2±6.4 AAIG vs 20.2±9.7 AACG; p<0.05).

The reasons for non-adherence to medications were more frequently admitted by the AACG compared with the AAIG. Patient-related factors, mainly forgetfulness, were significantly higher among the AACG at the first (5.0±6.8 AAIG vs 8.0±6.8

AACG) and second (11.0±13.6 AAIG vs 16.0±13.4 AACG) visit (p<0.05). Treatment-related factors in terms of fear of side effects were also higher among the AACG compared with the AAIG at the first (6.0±6.8 AAIG vs 8.0±6.8 AACG) and second (12.0±13.4 AAIG vs 17.0±13.7 AACG) visit (p<0.05; S. Table 2).

Table 8 traces the study group patients' satisfaction with their daily and fitness activities. High and good satisfaction scores were observed more in the AAIG compared with the AACG by month and at the second visit were significantly higher than the corresponding values of the AACG (7.7±6.2 and 672.8±85.2) vs (00.0 and 571.2 ±62.2); p<0.05. On the other hand, fair, low and poor satisfaction scales were significantly noted frequently in the AACG than the AAIG per month, as well as at the first and second visits (p<0.05).

Significant differences between the costs of AAIG and AACG ED visit, hospitalization, admission to the ICU, private sector visits and total costs were noticed by the end of the study (p<0.05). The differences in the cost of asthma management between the 6-month period prior to the study and the 6-month period of the study showed significant decrease in the AAIG by 18.7% (t=10.2, p<0.05) and an increase in the AACG by 5.04% (t=3.2, p<0.05; S. Table 3).

Table 7. Level of adherence of studied asthmatic patients to medications according to Morisky–Mosby score

Follow-up	High adherence		Medium adherence		Low adherence	
	AAIG	AACG	AAIG	AACG	AAIG	AACG
	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days
	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$
First visit (mean $\pm$ SD)	1.04 $\pm$ 3.0	0.14 $\pm$ 0.7	11.0 $\pm$ 4.1	3.1 $\pm$ 4.6	1.9 $\pm$ 3.6	10.8 $\pm$ 4.8
t/U-test/p $\sim$	Z=1.9 p<0.047		Z=11.8 p<0.0001		Z=-12.0 p<0.0001	
Second visit (mean $\pm$ SD)	1.63 $\pm$ 3.4	0.24 $\pm$ 1.0	22.2 $\pm$ 6.5	6.4 $\pm$ 9.2	3.2 $\pm$ 6.4	20.2 $\pm$ 9.7
t/U-test/p $\sim$	Z=4.1 p<0.0001		Z=12.0 p<0.0001		Z=-12.1 p<0.0001	

~p for t-test and Mann–Whitney U-test (for non-parametric data).

Table 8. Satisfaction of studied asthmatics with their daily and physical activities

Follow-up	High		Good		Fair		Low		Poor	
	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG
	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days	No. of patient days
	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$	$\chi^2 \pm SD$
First visit (mean $\pm$ SD)	0.2 $\pm$ 1.7	0.01 $\pm$ 0.08	12.9 $\pm$ 2.7	10.6 $\pm$ 4.6	0.8 $\pm$ 1.6	2.6 $\pm$ 3.4	0.08 $\pm$ 0.4	0.7 $\pm$ 0.8	0.0 $\pm$ 0.0	0.1 $\pm$ 2.8
t/U-test/p $\sim$	Z=0.4 p=0.7		t=7.0 p<0.0001		Z=-6.3 p<0.0001		Z=-6.3 p<0.0001		Z=-1.4 p=0.2	
Second visit (mean $\pm$ SD)	0.3 $\pm$ 2.7	0.01 $\pm$ 0.08	25.2 $\pm$ 4.5	21.0 $\pm$ 8.4	1.4 $\pm$ 2.6	4.4 $\pm$ 5.5	0.1 $\pm$ 0.43	1.2 $\pm$ 0.9	0.0 $\pm$ 0.0	0.2 $\pm$ 5.5
t/U-test/p $\sim$	Z=0.4 p=0.7		t=8.0 p<0.0001		Z=-7.3 p<0.0001		Z=-9.7 p<0.0001		Z=-2.5 p<0.012	

~p for t-test and Mann–Whitney U-test (for non-parametric data).

Completeness of patient–caregiver communication was 100% by month, as well as the first and second visits for the two groups. Unlike completeness, timeliness was slightly, but insignificantly higher in the AAIG than the AACG throughout the study (p>0.05; S. Table 4).

Discussion

Outcomes of AAP use

Clinical outcomes (asthma severity, control, exacerbations)

In agreement with several studies,^{21–25} the authors found that individual education and the use of self-management plans in outpatients with asthma produced a significant improvement in clinical outcome measures within the AAIG and compared with the AACG. Meanwhile, the AAIG markedly exceeded the AACG in the daily adherence to AAP instructions and avoidance

of asthma triggers, and satisfaction with daily physical activities throughout the study. The authors used a conjoined symptom and individualized personal best PEF-based AAP instead of a sole symptom or personal best PEF-based one. This encouraged the recruited asthmatics to comply with investigators and HCPs. The findings encountered in this study clearly endorsed the clinical benefits of the adopted AAP. It referred to the AAP as a simple instrument that can strongly push asthmatics towards avoidance of asthma triggers, alertness for early self-management of asthma exacerbations, and consequently ameliorate asthma manifestations, improve lung function, decrease health care consultations and costs, and improved satisfaction with daily physical activities.²¹

The use of a PFM may not be the only way to achieve treatment objectives and reduce morbidity. Malo and colleagues²⁶ showed symptom recognition to be as effective as PEF monitoring in recognizing an exacerbation of asthma in patients with

moderate to severe asthma. Moreover, symptoms were found to herald inflammatory changes and measures of airflow obstruction.²⁷ However, the sensitivity of symptoms to alert asthma flare-up depends upon patient perception and responsiveness.²⁸ The evidence in adults was also synthesized in a Cochrane review, citing 36 randomized trials comprising 6090 participants. 'Optimal self-management', defined as including the provision of a written action plan for self-management of exacerbations, together with self-monitoring and regular medical review, almost halved the risk of hospitalization, ED attendances, unscheduled consultations, days off work or school, and nocturnal asthma. Other outcomes that improved considerably with optimal self-management included markers of asthma control and quality of life.²⁵ A more recent meta-analysis found no evidence from RCTs of additional benefit or harm associated with use of PAAP vs no PAAP, or PAAP plus education vs education alone, meaning that it is not possible to be confident about the magnitude or direction of reported treatment effects.²⁹

Adherence to asthma medications

Adherence of patients with chronic diseases to medications is a big challenge. However, an action plan, completed in a clear dialogue with the patient, may contribute to improving adherence by reducing confusion with different treatment options, and reminding patients about the proper way and time to use them. Van Staa et al. referred to adherence of asthmatics to asthma control therapy as notoriously poor, with less than half the patients taking their prescribed medication regularly.³⁰ Non-adherence to asthma medications could be intentional, when patients decide not to take prescribed treatment after considering the perceived necessity for/concerns about taking regular medication, and/or non-intentional, which entails patients misunderstanding, forgetfulness or the inability to afford treatment costs.^{31,32} No doubt, these findings highlight the important role of the AAP in improving the chronically ill patient's adherence to medications. The reasons for non-adherence were similar to a great extent to those listed by Horne et al.³¹ and Nunes et al.³² Forgetting to take medication according to the prescription schedule and fear of the side effects of ad hoc corticosteroids leading them to not use their medication or decrease its dose/frequency were the main reasons for non-adherence as reported by the patients studied.

Although Health Insurance covers the treatment costs of all insured patients, some drugs are too expensive to be given free of charge to all asthmatic patients. Thus, patients can be asked to bear a part of the cost. Therefore, the patient who cannot afford the cost does not buy these medications, or may buy them, but use them less frequently in order to make them last longer.

Economic outcomes (medication costs, ED visits, hospitalization, absenteeism)

The expenses incurred in the treatment of asthma are an important part of the budget allocated for health care in each country. Asthma exacerbations cause significant morbidity and contribute by a disproportionate amount to the cost of asthma management. The economic implication of adopting AAP (intervention) was explicit in the reduction of the net costs of asthma

management in the AAIG compared with the AACG, as well as the changes in the costs between the baseline and end of the current study. However, it is not possible to rely on the data obtained 6 months prior the study due to recall bias, particularly in issues related to costs and dispensing. The base case and secondary cost-effectiveness analysis of AAP-based asthma self-management revealed that, if including all costs, self-management was noticeably cost-effective on all outcomes including base cost of direct health care, programme implementation and patient productivity, and the secondary costs including the number of weeks successfully treated and the change in quality of life compared with baseline data.³³

A literature review of RCTs analysing the cost-effectiveness of peak flow-based action plans in reducing costs associated with ER visits and hospitalizations due to acute asthma exacerbation revealed that these plans, coupled with patient education, are the most cost-effective alternative for reducing ER visits. The BFM self-management programme had a significantly higher incremental cost-effectiveness ratio per ER visit averted or hospitalization prevented compared with a symptom-based AP or the usual care/non-action plan.³⁴

Asthmatic-health professional partnership and communication

Asthma self-management education involves a collaborative partnership built between the education provider and the patient. The National Asthma Education and Prevention Program guidelines emphasize that HCPs providing respiratory care should teach and promote asthma self-management education at every occasion and in all settings.^{35,36} The authors design an AAP prescribing medications, and instruct the patient on how to monitor, recognize and respond to asthma symptoms. The AAIG in the present study was educated to develop the knowledge and skills to recognize when their asthma is worsening, to take appropriate action, and to be motivated to avoid triggers and adhere to the management regimen.³⁷ In the present study, the HCP-patient communication and patient satisfaction score were scaled as accepted among the majority of participants in the 6-month period prior to the study. The days of HCP-patient communication were significantly higher among the AACG, notably due to incidental poor asthma control, frequent occurrence of symptom flare-up and the consequent seeking of medical advice. This was expected as the purpose of the AAP is to empower patients to self-manage their asthma, minimizing visits to the physician and health care settings. However, this conflicts with the concept of a patient expert programme, which aims also to improve HCP-patient communication. The patient is the key decision-maker, but in partnership with the HCP.³⁸ It is worse noting that some participants used to contact the HCP for other purposes like having sick leave or to obtain extra medication free of charge.

Among programmes that looked at self-management options, written action plans that instructed patients about how to self-adjust their medication had better outcomes, including HCP-patient communications,^{39,40} compared with programmes that only provided information in the form of brochures or pamphlets that only provide basic asthma knowledge. Ring et al. stressed the role of HCP-patient communication in asthma self-management in his evidence-based intervention model to

promote AAP use and stated four crucial elements—‘professional education, patient/carer education, patient/carer and professional partnership and communication’.^{41,42} In fact, HCP–patient communication facilitates change in patient attitudes, beliefs and/or behaviours towards asthma as professionals actively encourage patient involvement in decision-making and/or valuing the personal experience.⁴³

Boosting AAP use was ensured through telephone consultation with a HCP in the current work. In fact, this increased the regular use of written AAPs in the intervention group and improved the HCP–patient communication in both groups. This allowed for continuity of asthma care to provide on-going opportunities for asthma education, promoting active involvement and shared decision-making within asthma consultations, promoting patient empowerment, offering additional opportunities for patient asthma review and encouraging accordingly joint development of tailored asthma action plans.

Education is an important factor that governs full understanding of the AAP and self-management plan. In older adults, comorbid conditions and literacy problems are more prevalent than in younger patients. Previous studies found that, low literacy was associated with poor knowledge about asthma and self-management skills. Patients with lower literacy are less likely to participate in their health care decisions.^{35,36,44} Since the majority of this study population was educated, there was no significant difference between level of education and days of HCP communication, or the self-management of asthma. However, the verbal and written instructions were given using the simplest terms that correctly and fully explain the concepts and instructions. It was reported that 81% of patients over 60 years old in two public hospitals could not read or did not understand important materials such as prescription labels. It is now recommended, therefore, that all health education materials should be written for a 5th or 6th grade reading level.^{44,45}

Establishment of an asthmatic patient–HCP communication was emphasized during the preparations and followed throughout the current study. During the preparatory phase, the pulmonologists and their concerned patients were instructed to set up a feasible communication pathway(s), convenient enough for them to be able to communicate in a simple way the required information and data. Telephone contact and face-to-face visits were the main ways selected. Evaluation of the selected communication means was done by assessing its completeness and timeliness. Completeness of patient–HCP communication was 100% per month, as well as the first and second visit in each group. Unlike completeness, timeliness was around 70% in both groups. It was slightly higher in the AAIG than the AACG throughout the study, but the differences between them were insignificant. Completeness and timeliness are important parameters that evaluate the communication feasibility and reporting efficiency in the public health programme ad hoc disease surveillance.⁴⁶ In fact, this achievement in the weekly communication with patients having chronic illness (and their caretakers) at the outpatients clinics was a big success in the present study. Patient with chronic diseases responded to the gain advantage of having new treatment modalities. Commitment of the caregivers/paramedics, as well as the participant adult and young adult being well educated (university and high school graduates) females, supported by educated caretakers/spouses, and

living in urban areas were the main factors behind the high compliance, cooperation and response of the participants.

Challenges facing the use of an AAP

Several patient attitude, cultural beliefs, enabling and reinforcing factors were important in the design and delivery of an AAP for patients in terms of their ultimate behaviours and health. Patel et al. in their evaluation of self-management among asthmatic women found that women without an AAP were less likely to consult their HCP, adhere to their medication plan or own a PFM to monitor their asthma, and tended to be less satisfied with their care.³⁸ Many patients prefer face-to-face verbally delivered asthma education, rather than education via reading, which enabled patient participation in decision-making and self-management of their asthma, especially if time is allowed for mutual discussion and explaining complex ideas in simple terms.³⁹

The authors expected from the care/education of patients of the two groups that PAAP intervention would surpass the usual (routine) care. It has multiple benefits, succeeded in correcting the deficiencies and filled the gap in the asthma management:

- It coped with the culture of the Egyptian patients who prefer interview consultation.
- It created a real partnership between pulmonologist/nurse and patient/caretaker.
- It empowered patients in decision-making and built confidence in their asthma management.
- It improved patient–caregiver interpersonal communication
- It increased patient satisfaction and gave him an ample chance to talk, clearly understand bronchial asthma pathogenesis and management, helped to identify the triggering factors, described his condition, expressed his experience with asthma control and exacerbation and enabled him to take part in his asthma management plan.
- The sense that the AAP was personalized for him helped to regain his trust in the HCP, as well as motivating him to strictly adhere to the prescribed medication regimen and to avoid triggering factors to get the best outcome.

Several surveys have pointed out that, even in countries that have a proactively recommended patient-centred approach for asthma management, three-quarters of people living with asthma manage their condition without the benefit of a written personalized AAP, which could guide their self-management and help them make appropriate clinical decisions.^{40–43}

Due to financial shortages and the unavailability of flow meters, the authors could not provide a PFM to each patient as was originally planned to allow for home use for asthma monitoring and self-management. Instead, a PFM was given to each HCP (20 in total) participating in the study to monitor the PEF on a weekly basis for each patient. The patients were educated in how to adjust the treatment dosage according to the symptoms. This was previously reported to be equally effective as a PEF-triggered action plan when combined with individual asthma education, as issuing patients with PFMs alone would not improve asthma control.^{38,47} Data from several studies^{26–28,47–51} did not

support the routine use of a PFM in all patients with asthma as a necessary part of their management plan.⁵² Nevertheless, a few controlled studies do support the use of and efficiency of mini-PFMs in asthma self-management, although some were lacking evidence.^{53,54}

The present study could not reinforce the mounting evidence that peak flow self-monitoring does not improve morbidity, as this outcome was not compared with a group not monitoring PEF. No study has been able to reproduce the improvements reported by Beasley et al., who evaluated their patients several times over the study period. This close monitoring of patients in hospital clinics may have considerably improved patient compliance with treatment,⁵³ although some studies showed only marginal improvements for patients owning a PFM, who were educated about self-management and closely followed-up quarterly over a year.^{28,50}

Future directions and the potential use of mobile apps for improving asthma self-management

In principle, mobile health (mHealth) apps could enable effective asthma self-management interventions that improve a patient's quality of life, while simultaneously reducing the overall treatment costs for health care systems. However, mHealth apps for asthma lack clinical evaluation and are often not based on medical guidelines. Many apps suffer from low quality, and no current app combines reliable, comprehensive information about the condition with a supportive tool for self-management. Thus, it does not meet the needs of every patient.^{55,56}

From the culture viewpoint, Egyptian patients, female ones in particular, prefer face-to-face interview consultations, and take advantage of the ample opportunities to talk about their condition and experiences. They commonly stop visiting a physician who does not listen to them carefully. This is a key element in the compliance with instructions and adherence to medication. Telemedicine, tele-health care and tele-research are expected to be less efficient than interviews. Mobile phones were used in the study as a hotline. Each pulmonologist shared his cell call with each patient in his subgroup for any important and urgent consultation.

Conclusions

This present study adds to the existing evidence for the effect of patient-HCP communication intervention and patient self-management of asthma control in asthmatic adults. The present findings endorse the hypothesis of the current RCT that AAP is a simple tool specifically designed to enhance patient knowledge, skills, capacity, confidence and real-time flare-up self-management in order to achieve and sustain better asthma control. It sufficiently enabled the asthmatic patients:

- to understand the problem and to be a key person in the decision-making about its management in partnership with the HCPs;
- to better understand, identify, focus on and avoid asthma triggering factors;

- to set up a feasible patient-HCPs communication plan for exchanging instructions and data;
- to strictly adhere to the HCP instruction and prescribed medications dosage and schedule;
- to be vigilant enough to recognize early symptoms of an asthma flare-up for real-time self-management;
- to achieve better asthma control and satisfaction with their daily physical activities, with a consequent drop of EDs visits, hospitalization, admission to the ICU and private sector visits;
- to save the costs of the additional medication and medical consultations.

Further large-scale population- and hospital-based studies are warranted to specifically assess the cost-effectiveness of the AAP and asthma self-management approach.

Supplementary data

Supplementary data are available at International Health online (<http://inthehealth.oxfordjournals.org>).

Authors' contributions: HMF conceived the study and was responsible for the design, development of the study questionnaire and tools, interpretation of data. He undertook critical revision of the manuscript for intellectual content, supervision of the study implementation, and technical support. EWAE-W was responsible for the study design, development of the study questionnaire and tools, statistical analysis, drafting of the manuscript; interpretation of data, critical revision of the manuscript for important intellectual content, supervision of the study implementation and technical support. NAE-N was responsible for the study design, interpretation of data, critical revision of the manuscript for important intellectual content. HASE-D was responsible for the recruitment of study cases, executing the study plan, and data collection.

Acknowledgements: We would like to thank Dr. Shehata Farag, lecturer of Biostatistics, High Institute of Public Health, Alexandria University, Egypt, for his great help and advices on the statistical analysis. The authors are indebted to all the asthmatics participants that accepted to participate in this study as well as the health care providers, the pulmologists, the paramedical staff at the chest department, and the administrative staff at Gamal Abdel Nasser Hospital. Their kind participation, endless support are deeply acknowledged and appreciated. We would like to express our deepest gratitude to the director of the Gamal Abdel Nasser Hospital for his great help in organizing and facilitating our study procedure.

Funding: None.

Competing interests: All authors declare no conflict of interest.

Ethical approval: The study was approved by the institutional review board and the ethics committee of the High Institute of Public Health affiliated to Alexandria University, Egypt. The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki 2013 and the International Conference on Harmonization Guidelines for Good Clinical Practice. All participants were invited to sign an informed written consent form after explaining the aim and concerns of the study. Data sheets were coded to ensure anonymity and confidentiality of patient's data. The trial was registered at the Pan African Clinical Trial

Registry (www.pactr.org) database. The unique identification number for the registry is PACTR201609001793108.

Availability of data and materials: The datasets supporting the conclusions of this article are included within the article and its additional files. All other relevant raw data are freely available to any scientist wishing to use them for non-commercial purposes, without breaching participant confidentiality.

References

- 1 To T, Stanojevic S, Moores G et al. Global asthma prevalence in adults: findings from the cross-sectional world health survey. *BMC Public Health* 2012;12:204.
- 2 Boehringer-Ingelheim. Asthma control is far from ideal in the MENA region as bronchial asthma is significantly rising and remains a major challenge. Boehringer Ingelheim 3rd Respiratory Regional Expert Forum. 2014. http://www.boehringer-ingelheim.info/mena/media/press_releases/respiratory-forum.html.
- 3 Price D, Thomas M. Breaking new ground: challenging existing asthma guidelines. *BMC Pulm Med* 2006;6(Suppl 1):S6.
- 4 Sleath B, Carpenter DM, Slota C et al. Communication during pediatric asthma visits and self-reported asthma medication adherence. *Pediatrics* 2012;130(4):627–33.
- 5 Global Initiative for Asthma. Global strategy for asthma management and prevention. Global Initiative for asthma. 2018. <https://ginasthma.org/2018-gina-report-global-strategy-for-asthma-management-and-prevention/>.
- 6 Gaude GS, Hattiholi J, Chaudhury A. Role of health education and self-action plan in improving the drug compliance in bronchial asthma. *J Family Med Prim Care* 2014;3(1):33–8.
- 7 Al-Muhsen S, Horanieh N, Dulgom S et al. Poor asthma education and medication compliance are associated with increased emergency department visits by asthmatic children. *Ann Thorac Med* 2015;10(2):123–31.
- 8 Fenty AM. Asthma Action Plan. Government of the District of Colombia. <http://www.palisesadepreschooldc.org/images/Asthma-Action-Plan.pdf> (accessed August 2014).
- 9 British Thoracic Society. Scottish Intercollegiate Guidelines Network. British guideline on the management of asthma. *Thorax* 2014;69 (Suppl 1):1–192.
- 10 Glasgow NJ, Ponsonby AL, Yates R et al. Proactive asthma care in childhood: general practice based randomised controlled trial. *BMJ* 2003;327(7416):659.
- 11 McClave JT, Benson PG, Sincich T. *Statistics for Business and Economics*, 9th edn. Upper Saddle River, NJ: Pearson Prentice Hall; 2005.
- 12 Centers for Disease Control and Prevention. Body Mass Index. [Last updated 15 May 2015] Available at: <https://www.cdc.gov/healthyweight/assessing/bmi/index.html>.
- 13 World Health Organization. Waist Circumference and Waist-Hip Ratio. Report of a WHO Expert Consultation GENEVA, 8–11 DECEMBER 2008. Available at: http://apps.who.int/iris/bitstream/handle/10665/44583/9789241501491_eng.pdf;jsessionid=5FF2B17332F75AD3732AC57ED30C2471?sequence=1.
- 14 Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. *Med Care* 1986;24(1):67–74.
- 15 Thayaparan AJ, Mahdi E. The Patient Satisfaction Questionnaire Short Form (PSQ-18) as an adaptable, reliable, and validated tool for use in various settings. *Med Educ Online* 2013;18:21747.
- 16 National Asthma Education and Prevention Program. How to use a peak flow meter. How to use a metered-dose inhaler. https://www.nhlbi.nih.gov/files/docs/public/lung/asthma_tipsheets.pdf (accessed May 2014).
- 17 GlaxoSmithKline. How to use a peak flow meter. <http://www.fhpc.com/health//Asthma/how-to-use-a-peak-flow-meter.pdf> (accessed October 2015).
- 18 National Asthma Education and Prevention Program. Guidelines for the Diagnosis and Management of Asthma. Washington, DC: Department of Health and Human Services: National Heart, Lung, and Blood Institute. NIH 1997 Contract No.: Publication No. 97–4051.
- 19 World Health Organization. Communicable disease surveillance and response systems. Guide to monitoring and evaluating. Geneva WHO/CDS/EPR/LYO. 2006. Available at: http://www.who.int/csr/resources/publications/surveillance/WHO_CDS_EPR_LYO_2006_2/en/.
- 20 Marchal GN, Hays RD. Short Form Patient Satisfaction Questionnaire 18-PSQ. 1994:P-7865.
- 21 Levy ML, Robb M, Allen J et al. A randomized controlled evaluation of specialist nurse education following accident and emergency department attendance for acute asthma. *Respir Med* 2000;94(9):900–8.
- 22 Morice AH, Wrench C. The role of the asthma nurse in treatment compliance and self-management following hospital admission. *Respir Med* 2001;95(11):851–6.
- 23 Huang TT, Li YT, Wang CH. Individualized programme to promote self-care among older adults with asthma: randomized controlled trial. *J Adv Nurs* 2009;65(2):348–58.
- 24 Bobb C, Ritz T, Rowlands G et al. Effects of allergen and trigger factor avoidance advice in primary care on asthma control: a randomized-controlled trial. *Clin Exp Allergy* 2010;40(1):143–52.
- 25 Gibson PG, Coughlan J, Wilson AJ et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev* 2000(2):CD001117.
- 26 Malo JL, L'Archeveque J, Trudeau C et al. Should we monitor peak expiratory flow rates or record symptoms with a simple diary in the management of asthma? *J Allergy Clin Immunol* 1993;91(3):702–9.
- 27 Effectiveness of routine self monitoring of peak flow in patients with asthma. Grampian Asthma Study of Integrated Care (GRASSIC). *BMJ* 1994;308(6928):564–7.
- 28 Turner MO, Taylor D, Bennett R et al. A randomized trial comparing peak expiratory flow and symptom self-management plans for patients with asthma attending a primary care clinic. *Am J Respir Crit Care Med* 1998;157(2):540–6.
- 29 Gatheral TL, Rushton A, Evans DJ et al. Personalised asthma action plans for adults with asthma. *Cochrane Database Syst Rev* 2017;4: CD011859.
- 30 van Staa TP, Cooper C, Leufkens HG et al. The use of inhaled corticosteroids in the United Kingdom and the Netherlands. *Respir Med* 2003;97(5):578–85.
- 31 Horne R. Compliance, adherence, and concordance: implications for asthma treatment. *Chest* 2006;130(1 Suppl):65S–72S.
- 32 Nunes V, Neilson J, O'Flynn N. Medicines adherence: involving patients in decisions about prescribed medicines and supporting adherence. London: National Collaborating Centre for Primary Care and Royal College of General Practitioners. 2009.
- 33 Schermer TR, Thoonen BP, van den Boom G et al. Randomized controlled economic evaluation of asthma self-management in primary health care. *Am J Respir Crit Care Med* 2002;166(8):1062–72.
- 34 de Asis ML, Greene R. A cost-effectiveness analysis of a peak flow-based asthma education and self-management plan in a high-cost population. *J Asthma* 2004;41(5):559–65.

- 35 Expert panel report 3. Guidelines for the diagnosis and management of asthma. Bethesda MD: National Institutes of Health, National Asthma Education and Prevention Program 2007; NIH Publication No 08-4051. <https://www.nhlbi.nih.gov/files/docs/guidelines/asthsumm.pdf>.
- 36 Jones MA. Asthma self-management patient education. *Respir Care* 2008;53(6):778-84; discussion 84-6.
- 37 Williams MV, Parker RM, Baker DW et al. Inadequate functional health literacy among patients at two public hospitals. *JAMA* 1995; 274(21):1677-82.
- 38 Patel MR, Valerio MA, Sanders G et al. Asthma action plans and patient satisfaction among women with asthma. *Chest* 2012;142(5):1143-9.
- 39 Powell H, Gibson PG. Options for self-management education for adults with asthma. *Cochrane Database Syst Rev* 2003(1):CD004107.
- 40 Adams RJ, Appleton S, Wilson DH et al. Participatory decision making, asthma action plans, and use of asthma medication: a population survey. *J Asthma* 2005;42(8):673-8.
- 41 Kaferle JE, Wimsatt LA. A team-based approach to providing asthma action plans. *J Am Board Fam Med* 2012;25(2):247-9.
- 42 Ring N, Jepson R, Pinnock H et al. Developing novel evidence-based interventions to promote asthma action plan use: a cross-study synthesis of evidence from randomised controlled trials and qualitative studies. *Trials* 2012;13:216.
- 43 Khan MS, O'Meara M, Stevermuer TL et al. Randomized controlled trial of asthma education after discharge from an emergency department. *J Paediatr Child Health* 2004;40(12):674-7.
- 44 Kutner M, Greenberg E, Jin Y et al. Health literacy of American adults: results from the 2003 National Assessment of Adult Literacy (NCES 2006-483). US Department of Education Washington DC: National Center for Education Statistics. 2006.
- 45 Doak CC, Doak LG, Root JH. Teaching Patients with low literacy skills. Philadelphia, PA: Lippincott Williams & Wilkins. 1996.
- 46 Overhage JM, Grannis S, McDonald CJ. A comparison of the completeness and timeliness of automated electronic laboratory reporting and spontaneous reporting of notifiable conditions. *Am J Public Health* 2008;98(2):344-50.
- 47 Charlton I, Charlton G, Broomfield J et al. Evaluation of peak flow and symptoms only self management plans for control of asthma in general practice. *BMJ* 1990;301(6765):1355-9.
- 48 International consensus report on diagnosis and treatment of asthma. National Heart, Lung, and Blood Institute, National Institutes of Health. Bethesda, Maryland 20892. Publication no. 92-3091, March 1992. *Eur Respir J* 1992;5(5):601-41.
- 49 Ignacio-Garcia JM, Gonzalez-Santos P. Asthma self-management education program by home monitoring of peak expiratory flow. *Am J Respir Crit Care Med* 1995;151(2 Pt 1):353-9.
- 50 Cote J, Cartier A, Robichaud P et al. Influence on asthma morbidity of asthma education programs based on self-management plans following treatment optimization. *Am J Respir Crit Care Med* 1997; 155(5):1509-14.
- 51 Boulet LP, Becker A, Berube D et al. [Summary of the recommendations of the Canadian Consensus Conference on Asthma 1999. Canadian Asthma Consensus Group]. *CMAJ* 1999;161 (11 Suppl Resume):SF1-14.
- 52 Cowie RL, Revitt SG, Underwood MF et al. The effect of a peak flow-based action plan in the prevention of exacerbations of asthma. *Chest* 1997;112(6):1534-8.
- 53 Beasley R, Cushley M, Holgate ST. A self management plan in the treatment of adult asthma. *Thorax* 1989;44(3):200-4.
- 54 Janson-Bjerkie S, Shnell S. Effect of peak flow information on patterns of self-care in adult asthma. *Heart Lung* 1988;17(5):543-9.
- 55 Huckvale K, Car M, Morrison C et al. Apps for asthma self-management: a systematic assessment of content and tools. *BMC Med* 2012;10:144.
- 56 Tinschert P, Jakob R, Barata F et al. The potential of mobile Apps for improving asthma self-management: a review of publicly available and well-adopted asthma Apps. *JMIR Mhealth Uhealth* 2017;5(8):e113.

الخطة العلاجية للربو عند البالغين بداية من سن ١٨ سنة

.....:السن

.....:التليفون

.....:أسم المريض

.....:الوظيفة

.....:الطبيب المعالج

تجنب الأشياء الاتية التي تجعل الربو يسوء (المهيجات للربو):

- ❑ نزلات البرد ❑ الحيوانات ❑ الحشرات ❑ التدخين (سجائر/شيشة) ❑ الرياضة ❑ الأتربة ❑ الأنفعالات ❑ الرطوبة
❑ اختلاف فصول السنة (شتاء- خريف- ربيع- صيف) ❑ أخذ بعض الأدوية (تحتاج الى استشارة الطبيب.....)
❑ بعض المأكولات (مثل الفراولة - البيض- السمك - الشيكولاته -.....) ❑ حبوب القاح ❑ بعض الروائح (.....)

المنطقة الخضراء (الحالة مستقرة) - تعطي أدوية التحكم (الوقائية) كل يوم

- تأخذ الأدوية التحكم (الوقائية) كل يوم:
الجرعة كم من الوقت

-----	-----	-----
-----	-----	-----
-----	-----	-----

- إذا كان هناك أعراض دائمة مع التمارين (النشاط الرياضي) يأخذ الدواء
الأتى:----- ٢ بخة قبل التمارين ب ١٥ دقيقة
- في حالة حساسية الأنف أو تغير الجو خذ ----- أقراص
٣٠ دقيقة قبل الأكل مرتين يوميا

قم دائما بغسل الفم بعد استخدام أدوية الإستنشاق (البخاخة أو النوبليزر)



- الشخص في صحة جيدة:
(١) يتنفس بسهولة
(٢) لا يوجد كحة أو تزيق في الصدر
(٣) لا يوجد ضيق بالصدر
(٤) يستطيع النوم طوال الليل
- كمية الهواء التي تخرج من الرئة في الثانية باستخدام جهاز الفلوميتر
..... لتر (١٠٠%- ٨٠%) أو من ٤٠٠- ٥٠٠ لتر



المنطقة الصفراء (حالة تيقظ و انتباه) - الاستمرار باعطاء أدوية التحكم المعتادة للربو يوميا و إضافة الأدوية المخففة سريعة المفعول

- الاستمرار في أخذ أدوية التحكم (الوقائية) المستخدمة في المنطقة الخضراء:

الجرعة كم من الوقت

-----	-----	-----
-----	-----	-----
-----	-----	-----

إضافة الأدوية المخففة (الموسعة للشعب الهوائية) سريعة المفعول
----- تأخذ بخة واحدة كل ٤-٦ ساعات حسب الحاجة
- أو استعمال نوبليزر كل ٤-٦ ساعات حسب الحاجة
- ممكن إعطاء كورتيزون وريدي ٢٠-٤٠ مج كل ١٢ ساعة
- يتم الاتصال بالطبيب المعالج في حالة تكرار هذه الأعراض أكثر من مرتين
في الأسبوع أو اذا لم تحسن الأدوية المخففة سريعة المفعول الحالة



- الشخص يشكو من:
(١) بداية أعراض البرد
(٢) كحة أو تزيق بالصدر
(٣) ضيق بالصدر
(٤) صعوبة النوم والعمل
- كمية الهواء التي تخرج من الرئة في الثانية باستخدام جهاز الفلوميتر
..... لتر (٨٠%- ٥٠%) أو من ٢٥٠- ٤٠٠ لتر



المنطقة الحمراء (تحذير طبي) منطقة الخطر- الاستمرار باعطاء أدوية التحكم (الوقائية) - الأدوية المخففة سريعة المفعول + طلب مساعدة

- الاستمرار في إعطاء أدوية المنطقة الصفراء و لكن بجرات و توقيتات مختلفة:

الجرعة كم من الوقت

-----	-----	-----
-----	-----	-----
-----	-----	-----

- إذا كان هناك أعراض دائمة يأخذ الدواء الأتي:
----- ٢ بخة (بختان) كل ١٥ دقيقة و يكرر ٣ مرات
- أو استعمال نوبليزر كل ١٥ دقيقة و يكرر ٣ مرات
- ممكن إعطاء كورتيزون وريدي ٢٠-٤٠ مج كل ٦ ساعات
- الاتصال بالطبيب المعالج أثناء إعطاء الأدوية
- في حالة صعوبة الاتصال بالطبيب يطلب
المريض الإسعاف ١٢٣ أو الذهاب مباشرة
الى قسم الطوارئ بالمستشفى



- الشخص في حالة صحية سيئة:
(١) لا يستجيب للعلاج
(١) لا يستطيع الكلام والمشي و الأكل
(٢) صعوبة و سرعة التنفس
(٤) ظهور الإضلع
(٥) زرقان في الشفاة و الأصابع
(٦) الأحساس بأجهاد شديد
- كمية الهواء التي تخرج من الرئة في الثانية باستخدام جهاز
الفلوميتر..... لتر (أقل من ٥٠%) أو أقل من ٢٥٠ لتر



BRONCHIAL ASTHMA RISK ASSESSMENT QUESTIONNAIRE

Patient Name.....Tel..... Code

I. Sociodemographic data			
1- Age (in Years)			
2- Gender		(1) Male	(2) Female
3- Residence		(1) Urban	(2) Rural (3) Slum
4- Ethnicity		(1) Nubian	(2) Upper Egypt (3) Lower Egypt (4) Arabian (5) Nubian
5- Marital status		(1) Single	(2) Married (3) Widowed (4) Divorced
6- Education		(1) Illiterate	(2) Read and write (3) Primary school (4) Preparatory school (5) Secondary school (6) University education
7- Crowding index :			
8- Income per capita :			
9- Working status		(1) Working	(2) Not working (3) Retired
10- Occupation : (1) full time employment (2) part time/casual employment (3) home duties (4) clerical work (5) student (-1) Not Working			
11- Do you feel that your asthma symptoms are related to your occupation ?		No	DK Yes
12- Have you ever changed occupation because of asthma symptoms before ?		No	DK Yes
13- Are there other people at work with symptoms similar to yours ?		No	DK Yes
14- Do you feel your asthma symptoms at home after work ?		No	DK Yes
15- How you are satisfied with your work performance and activity ? (1) very good (2) Good (3) Moderate (4) Little (0) not satisfied			

III. Life style	
A- Smoking and Drug use	
16- Smoking (1) Never (2) current smoker (3) ex-smoker (include as smoker if quitted less than 1 year ago)	
17- Passive Smoking (someone who smokes at home or work) (1) No (2) Yes	
18- Age at start smoking (0) N/A (1) <20 years (2) 20-30 years (3) > 30 Years	
19- Age at stopping smoking (0) N/A	
20- Smoking index (No. of cigarettes smoked per day X years of smoking) (0) N/A	
21- Smoking other than cigarettes (1) N/A (2) hubble bubble (Shisha, Goza,.....) (3) snuff (4) Smokeless Tobacco (tobacco gum, patch, snuff, electronic cigarette, ...)	
22- Drug use (1) No (2) Cannabis (3) Opium (4) Tamol/Tramadol (5) heroine/cocaine (6) others.....	
23- Alcohol (1) Never (2) occasional (3) 1-3 cups/day (4) > 3 cups per day (5) ex-drinker	

B- Physical Activity	
24- Working activity affected by asthma (1) NA (2) Retired (3) Mild (4) Moderate (5) unable to work	
25- Additional Activity/work (1) No (2) little interrupted (3) Moderate un interrupted (4) excessive as normal	
26- Regular exercise (1) Nil (2) occasional (3) 1-2 times a month (4) 1-2 times a week (5) +3 times/week	
27- exercise affection by asthma (1) NA (2) Mild (3) Moderate (must take ICS before (5) sever and stopped	
28- How you are satisfied with your extra work, effort, exercise or sport? (1) very good (2) Good (3) Moderate (4) Little (0) not satisfied	
29-	

IV. Family History	
30- Family History (1) irrelevant (2) Bronchial Asthma (3) allergic rhinitis/hey fever/ conjunctivitis/ urticarial/eczema (4) others.....	

V. Medical History	
31- At what age did your asthma begin (-1) Do not Know	
32- Was your asthma confirmed by a doctor? (1) No (2) Yes (3) Do not Know	
33- Co-morbidities: (0) None (1) COPD (2) TB (3) Obesity (4) Hypertension (5) IHD/CHD (6) Diabetes mellitus type 1 (7) Diabetes mellitus type 2 (8) Hyperlipidemia (9) Rheumatic disorders (10) Others	

VI. Clinical Symptoms	
34- Generalized Symptoms : (0) None (1) skin rash; Urticaria (2) Fatigue, weakness (3) Fainting / Dizziness (4) Buffiness, swelling of the face (5) Numbness and tingling (6) Allergic rhinitis/ conjunctivitis (7) itching, burning and swelling around the mouth (8) itchy palms of the	

hands and soles of the feet (9) Weight loss (10) food regurgitation (11) Others					
35- Chest symptoms (0) None (1) dyspnea (breathlessness) mention grade..... (2) orthopnea (breathlessness at night) (3) current daytime cough/wheezes (4) exertion daytime cough/wheezes (5) night cough (6) chest tightness (7) phlegm (8) Ever Wheezing attacks in the last 12 months (9) Speech limited by wheezing in the last 12 months (10) Others					
36- Medication taken prior to the attack (1) No (2) Yes (-1) N/A					
37- If yes mention them.....					
1. In the <u>past 4 weeks</u>, how much of the time did your <u>asthma</u> keep you from getting as much done at work, school or at home?					SCORE
All of the time [1]	Most of the time [2]	Some of the time [3]	A little of the time [4]	None of the time [5]	
2. During the <u>past 4 weeks</u>, how often have you had shortness of breath?					
More than Once a day [1]	Once a day [2]	3 to 6 times a week [3]	Once or twice a week [4]	Not at all [5]	
3. During the <u>past 4 weeks</u>, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?					
4 or more nights a week [1]	2 to 3 nights a week [2]	Once a week [3]	Once or twice [4]	Not at all [5]	
4. During the <u>past 4 weeks</u>, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?					
3 or more times per day [1]	1 to 2 times per day [2]	2 or 3 times per week [3]	Once a week or less [4]	Not at all [5]	
5. How would you rate your asthma control during the past 4 weeks?					
Not Controlled at All [1]	Poorly Controlled [2]	Somewhat Controlled [3]	Well Controlled [4]	Completely Controlled [5]	
38-					Total.....
Asthma severity and control :					
39- Frequency of daytime symptoms (cough, wheezy, chest tightness) in last 6 months: (1) < 2 times a month (2) < 1time a week (3) > 1time a week (4) daily (5) continual with limited activities					
40- Frequency of nighttime symptoms (cough, wheezy, chest tightness) in last 6 months: (1) < 2 times a month (2) > 2 times a month (3) > 1 time a week (4) frequent					
41- Sleep disturbance by nighttime symptoms in last 6 months: (0) nil (1) < 1 time a week (2) > 2 times a week (3) every night					
42- Daily activity interruption due to asthma : (1) Nil (2) mild (3) moderate (4) totally stopped					
43- Asthma severity: (1) Mild intermittent (2) Mild persistent (3) Moderate persistent (4) severe persistent					
44- Asthma control: (1) poorly controlled (2) moderately controlled (3) well controlled					
45- Times of observation at emergency department in last 6 months (1) zero (2) times.					
46- Times of hospital admission in last 6 months (1) zero (2) times.					
47- Times of admission at ICU in last 6 months (1) zero (2) times.					
48- Times of treatment at private clinic/ hospital in last 6 months : (1) zero (2) 1-5 times (3) >5 times					
49- Sickness leave due to asthma in last 6 months : (1) zero (2) 1-2 days (3) 3 – 5 days (4) 6-9 days (5)10-14 days (6) 15 or more days					
50- No of working days lost in last 6 months : days					
Clinical Signs and Laboratory Investigations :					
51- Blood pressure (mean of 2 measurements) SBP..... DBP.....					
52- Heart Rate					
53- Respiratory Rate					
54- Weight..... Height BMI.....					
55- Edema (1) No (2) Yes (grade).....					
56- Waist circumference cm.					
57- Pallor (1) No (2) Yes					
58- Congested neck veins (1) No (2) Yes					
59- Cyanosis (1) No (2) Yes					
60- Skin rash or spots (1) No (2) Yes					
61- Patient specified baseline (day 0) flowmeter study :					
(1) Maximum flowmeter result : ----- liters					
(2) Green area (80-100%) : Between ----- and ----- liters					
(3) Yellow area (50-80%) : Between ----- and ----- liters					
(4) Red area (< 50%) : Less than ----- liters					

VI. ASTHMA SELF-MANAGEMENT

Etiology (triggering factors) :

- 62- Do you know what things trigger your asthma ? (1) DK (2) Dust (3) Flu (4) pollens (5) Exercise
(6) smoke((tobacco, incense, coal, wood) (7) strong odor/ perfumes (8) Animals (cats, dogs)
(9) Food (eggs, strawberry, chocolate..etc) (10) Pests (rodents, cockroaches) (11) Mold /moisture
(12) Emotion / Stress (13) Season: Fall, Winter, Spring, Summer (14) Gastroesophageal reflux (GER)
(15) Drugs: NSAIDs, other (16) Others:

Management of asthma :

- 63- Investigations done for asthma ? (1)Nil (2) Spirometry (3) Flowmetry (4)CBC
(5) skin sensitivity test (6) Others
- 64- Life style change (control of triggering factors) : (1) No (2) Yes
- 65- Stoppage of smoking : (1) No (2) Yes
- 66- Medications you use for your asthma ? (1) Nil (2) ICS (3) ICS+ SABAs (4) Oral LABAs
(5) Oral CS (6) Anti-histaminics (7) Bronchodilators (8)Nebulizer (9)Others.....
- 67- When do you take your medications ?
(1)On having cough or breathing problems
(2) Before recess, physical education class, or sports
(3) Every day, even when I am feeling well, to prevent asthma symptoms
- 68- I use medications as :
(1) relievers (.....) - times / day
(2) preventers (.....) - times / day
(3) Controller (.....) - times / day
- 69- Other medications you use ? (1) Nil (2) anti-diabetics (3) hypolipidemics (4) anti-hypertensives
(6) coronary dilators (6) Aspirin (7) NSAIDs (8)Others.....

Devices / techniques :

- 70- Do you have a peak flow meter? (1) No (2) Yes
- 71- Do you use a Peak Flowmeter ? (1) No (2)Yes, regularly (3)Yes, sometimes
- 72- Do you know how to use inhalers properly? (Ask for demonstration) (-1)NA (2)No (2) Yes
- 73- Do you rinse your mouth after your preventer? (-1)NA (2)No (2) Yes

Health seeking behavior :

- 74- Where you often seek medical advice for your asthma? (1) Nil (2) Health insurance clinic/ hospital
(3) Private clinic/ hospital (4) pharmacy (5) Traditional healer (6) others.....
- 75- Do you have one main HCP who usually checks your asthma? (1) No (2) Yes
- 76- On having breathing problems, can you easily communicate your HCP for advice? (1) No (2) Yes

Asthma monitoring :

- 77- Do you know how to control your asthma? (1) No (2)Yes by symptoms (3)Yes by Flowmeter readings
- 78- Do you have a written plan from your doctor? (1) No (2) Yes
- 79- Are you confident you can usually manage your asthma symptoms? (1) No (2) Yes
- 80- Are you confident you can prevent your asthma symptoms from getting severe? (1) No (2) Yes
- 81- Are you confident you know what to do when your asthma becomes worse? (1) No (2) Yes

MOSBEY 8 ITEMS MEDICATION ADHERENCE

- 82- Patient adherence to treatment : (1)Low adherence (2)Medium adherence (3)High adherence
- 83- Causes of non adherence : (1) Patient –related factors (2)Disease-related factors
(3)Treatment-related factors (4)Health professional-related factors

HCP-PATIENT COMMUNICATION AND PATIENT SATISFACTION

- 84- HCP-Patient communication and patient satisfaction score :

Morisky 8-Item Medication Adherence Questionnaire

Patient Name:-----

الرقم الدال :

Months : ----- 201-----

Patient answer: **Yes = 1** and **No = 0**

Item	Patient Answer	Score
Do you sometimes forget to take your medicine?	Yes ☐	☐
People sometimes miss taking their medicines for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your medicine?	Yes ☐ No ☐	☐
Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	Yes ☐ No ☐	☐
When you travel or leave home, do you sometimes forget to bring along your medicine?	Yes ☐ No ☐	☐
Did you take all your medicines yesterday?	Yes ☐ No ☐	☐
When you feel like your symptoms are under control, do you sometimes stop taking your medicine?	Yes ☐ No ☐	☐
Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	Yes ☐ No ☐	☐
How often do you have difficulty remembering to take all your medicine? - A : Never / rarely - B : Once in a while - C : Sometimes - D : Usually - E : All the time	A= 0 ☐ B ☐ = 1 C ☐ = 1 D ☐ = 1 E ☐ = 1	
Total Score		

Scores Interpretation:

- **>2 = low adherence**
- **1 or 2 = medium adherence**
- **0 = high adherence**

CAUSES OF NON ADHERENCE TO MEDICATION

1. Patient-Related Factors

1. Misunderstanding or lack of instruction
2. Fears about side effects
3. Unexpressed/undiscussed fears or concerns
4. Anger about condition or treatment
5. Cultural issues
6. Forgetfulness
7. Religious issues
8. Attitudes toward ill health

2. Disease-Related factors

1. Inappropriate expectations
2. Underestimation of severity
3. Stigmatization

3. Treatment-Related Factors

1. Difficulties with inhaler devices
2. Awkward regimes
3. Side effects
4. Cost of medication
5. Dislike of medication
6. Distant pharmacies

4. Health Professional-Related factors

- 1- Dissatisfaction with health-care Professionals
- 2- Poor supervision, training or follow-up

Short Form Patient Satisfaction Questionnaire 18-PSQ

(On each line, encircle one number that exactly coincide with the patient verbatim response)

SN	Item	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
01	Doctors are good about explaining the reasons for medical tests	1	2	3	4	5
02	I think my doctor's office has everything needed to provide complete medical care	1	2	3	4	5
03	The medical care I have been receiving is just about perfect	1	2	3	4	5
04	Sometimes doctors make me wonder if their diagnosis is correct	1	2	3	4	5
05	I feel confident that I can get the medical care I need without being set back financially	1	2	3	4	5
06	When I go for medical care, they are careful to check everything when treating & examining me	1	2	3	4	5
07	I have to pay for more of my medical care than I can afford	1	2	3	4	5
08	I have easy access to the medical specialist I need	1	2	3	4	5
09	Where I get medical care, people have to wait too long for emergency treatment	1	2	3	4	5
10	Doctors act too businesslike and impersonal toward me	1	2	3	4	5
11	My doctors treat me in a very friendly and courteous manner	1	2	3	4	5
12	Those who provide me medical care sometimes hurry too much when they treat me	1	2	3	4	5
13	Doctors sometimes ignore what I tell them	1	2	3	4	5
14	I have some doubts about the ability of the doctors who treat me	1	2	3	4	5
15	Doctors usually spend plenty of time with me	1	2	3	4	5
16	I find it hard to get an appointment for medical care right away	1	2	3	4	5
17	I'm dissatisfied with something about the medical care I received	1	2	3	4	5
18	I'm able to get medical care whenever I need	1	2	3	4	5
Sub-Totals						
Total						

الرقم الدال :

المتابعة اليومية لآعراض السريرية والنشاط
لمرضى الربو الشعبي خلال 2014

ملخص أحداث الشهر



اسم المريض : 2. السن:..... سنة الجنس: ذكر أنثى

() مقياس تدفق الهواء :..... لتر

() (1) قياس المنطقة الخضراء: لتر (2) قياس المنطقة الخضراء: لتر (3) قياس المنطقة الخضراء:..... لتر [

تاريخ بدء الدراسة : 2015/ / 201/ / تاريخ انتهاء الدراسة :

البيان	الاسبوع الأول	الاسبوع الثاني	الاسبوع الثالث	الاسبوع الرابع	الاسبوع الخامس	الشهر
1. قياس تدفق الهواء	لتر	لتر	لتر	لتر	لتر	لتر
2. أعراض سريرية يومية						
3. متوسط القراءات الخضراء						
4. عدد أيام المنطقة الخضراء						
5. متوسط القراءات الصفراء						
6. عدد أيام المنطقة الصفراء						
7. متوسط القراءات الحمراء						
8. عدد أيام المنطقة الحمراء						
9. عدد أيام التدخين						
10. عدد أيام تعاطي المكيفات						
11. عدد أيام نشاط يومي عادي مريض						
12. عدد أيام ملاصقة للأرشادات						
13. عدد أيام ملاصقة لجرعات الأدوية						
14. عدد أيام عدم ملاصقة لجرعات الأدوية						
15. سبب عدم التواصل مع الطبيب						
16. عدد مرات التواصل مع الطبيب						
17. نقاط التواصل مع الطبيب و رضاء المريض						
18. عدد أيام ضبط العلاج ذاتياً بالبيت						
19. عدد مرات الذهاب للعلاج بقسم الطوارئ						
20. عدد مرات الحجز بالعناية المركزه						
21. عدد مرات الحجز الداخلي بالمستشفى						
22. تكلفة نفقات العلاج بالتأمين الصحي (تسأل من المستشفى)						
23. عدد مرات الذهاب للعلاج الخاص						
24. تكلفة نفقات الذهاب للعلاج الخاص (تسأل من المريض)						
25. عدد أيام أجازته المرضيه						
26. عدد أيام التغيب عن العمل						
27. درجة الملاصقة للدواء حسب Mosbey						
28. سبب عدم الملاصقة للدواء						
29. درجة شدة الربو (Asthma severity)						
30. سبب ازدياد شدة أعراض الربو						
31. درجة رضائك عن نشاطك اليومي المعتاد						
32. درجة رضائك عن مجهودك الزائد أو الرياضي						

ما هو سبب رجوع أو ازدياد شدة أعراض هذا الشهر ؟ (1) أهمل العلاج (2) التدخين الزائد/ تعاطي المكيفات (3) المجهود المفرط (4) عدم اتباع التعليمات (5) أخرى

ما هي أعراض الأزمه التي شعرت بها هذا الشهر ؟ (1) كحه (2) تزييق (3) ضيق بالصدر (4) نهجان (5) بلغم (6) ازرقاق (7) ضعف شديد (8) ارهاق (9) أخرى

درجة رضائك عن نشاطك اليومي المعتاد: (1) عال (2) جيد (3) متوسط (4) قليل (5) غير راض

درجة رضائك عن مجهودك الزائد أو الرياضي: (1) عال (2) جيد (3) متوسط (4) قليل (5) غير راض

Supplementary data and tables

Sampling, Randomization and Blinding:

For pulmonologist: alphabetical letters (A, B, C, D,..) were given to the eligible 24 pulmonologists on small white papers pieces and concealed it inside small envelopes. Two nurses from other department were requested to alternatively (one by one) select 4 envelopes for exclusion. Again, each nurse selected alternatively (one by one) 10 from the remaining concealed 20 envelopes. Using a coin, the two groups were assigned for the intervention and control care. Accordingly, HCPs for the intervention group (n=10), nominated as allocated pulmonologists for the intervention group (APIG) and HCPs for the control group (n=10), nominated as allocated pulmonologists for the control group (APCG). All eligible HCPs were briefed about the study (Figure 1). Each group (intervention / usual care) allocated 10 pulmonologist to care of 200 patients; i.e. each pulmonologist would be responsible for a subgroup (cluster) of 20. Patients in each group were given serial number from 1 to 200. Using random tables, a number was selected between 1 and 200. This was the first patient in the first subgroup. Using systematic random sampling, the 2nd, 3rd, 4th, ...10th patients were selected sequentially every 10 numbers. Upon completion of the first subgroup, one envelop from the corresponding envelopes group was to represent the responsible pulmonologist. This similarly continued with selection of the 2nd, 3rd, 4th, 5th, ... 10th patient subgroups and their corresponding concealed pulmonologist envelopes in each of the intervention and usual care group.

Participants were randomly assigned and by the pulmonologists following simple randomization procedure using a computer random number generator. Through computer, 400 eligible patients were selected. To divide those into two first groups, we selected one number between 1 and 400 by random tables. That was the first patient on the top of one group list and the number following it represented the patient on the top of the other group list. The patients were alternatively (every other one) distributed between the two lists till we got two groups of 200 patients per each. Using a coin the two groups were randomly allocated as intervention and control groups.

Supplementary Tables

S. Table 1: Change in Visits to ED, Hospitalization, Admission at ICU, Visits to Private HF, Sickness Leave Days and Absenteeism Days among AAIG and AACG before and after Intervention.

Variable	AAIG							AACG						
	Before		After		Paired t	% Change		Before		After		Paired t	% Change	
	no. pt. days	X±SD	no. pt. days	X±SD				no. pt. days	X±SD	no. pt. days	X±SD			
Times of ED visits	242	1.8±0.9	36	0.2±0.6	17.7*	85.1	↓	303	1.0±1.1	167	1.6±1.5	4.0*	44.9	↓
Times of hospitalization	149	0.8±0.8	11	0.1±0.3	10.8*	92.6	↓	172	1.2±1.0	478	2.9±3.1	-7.0*	64.0	↑
Times of admission at ICU	9	0.09±0.3	8	0.05±0.6	0.8	11.1	↓	47	0.3±0.6	75	0.5±1.1	-2.3*	37.3	↑
Times of visits to private sector	342	2.4±0.5	132	0.8±1.4	14.2*	61.4	↓	417	2.3±0.7	347	2.2±1.6	0.9	16.8	↓
Sickness leave days due to asthma	619	4.0±1.3	603	3.7±4.8	0.6	2.6	↓	695	4.2±1.4	1742	10.9±6.9	-12.1*	60.1	↑
Days of absenteeism due to asthma	1912	10.2±5.5	600	3.6±4.8	10.9*	68.6	↓	1871	13.5±8.0	1748	10.9±7.0	3.1*	6.6	↓

* = $P < 0.05$

S. Table 2: Reasons of Non Adherence of Studied Patients to Medications

Reasons of Non Adherence	First Visit (90 days)				Second visit (180 days)			
	AAIG		AACG		AAIG		AACG	
	no. of patient days	X±SD	no. of patient days	X±SD	no. of patient days	X±SD	no. of patient days	X±SD
Patient-Related Factors:								
Forgetfulness	874	5.0±6.8	1243	8.0±6.8	1766	13.6±11.0	2498	16.0±13.4
Mann Whitney U test / P[~]	Z= -2.6 P=0.0088				Z=2.4 P=0.016			
Treatment-Related Factors:								
Cost of medications	0	0.0±0.0	8	0.4±0.05	8	0.4±0.05	8	0.4±0.05
Mann Whitney U test / P[~]	Z= -2.0 P=0.8				Z=0.0006 P=1			
Fear of side effect	997	6.8±6.0	1358	6.8±8.0	1974	13.4±12.0	2706	17.0±13.7
Mann Whitney U test / P[~]	Z= -2.5 P=0.011				Z=2.4 P=0.017			

~ P for Mann Whitney U test (for non parametric data)

S. Table 3: Comparison of Averaged Asthma Management Cost by Emergency Department Visit, Hospitalization, Admission at ICU and Private Health Facility Visits Before and After Start of Study

Cost (EGP)													
Follow-up		ED Visits Cost		Hospitalization Cost		Admission at ICU		Management		Private Sector Visit		Total Cost	
		AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG	AAIG	AACG
6 Months Before Start of Study	total	24200	30300	14900	17200	16000	47000			102600	125100	157700	219600
	Average per patient±SD	212.3±91.3	236.7±86.6	163.7±50.6	167.0±67.7	1342.9±591.3	1777.8±1986			641.3±163.1	781.9 ±165.2	985.6±703.4	1372.5±699.8
	Mann Whitney U Test / P	Z= -2.9 p=0.0036		Z= -1.1 p=0.3		Z= -2.5 p=0.011				Z= -6.5 p<0.0001		Z= -7.3 p<0.0001	
6 Months After Start of Study	total	800	7600	1400	44750	16200	64400	87810	54496	21966	59415	21966	230661
	Average per patient±SD	800	271.4±124.3	127.3±46.7	481.2±268.8	900±462.7	805±324.1	548.8±306.9	342.7±299.1	147.4±226.4	371.3±329.7	522.3±501.9	402.5±463.9
	Mann Whitney U Test / P	Z= -2.6 p=0.0096		Z= -8.5 p<0.0001		Z= -5.9 p<0.0001		Z= 7.7 p<0.0001		Z= -8.3 p<0.0001		Z= -11.0 p<0.0001	
% reduction/increase (vertical)		-96.60%	-74.90%	-90.60%	+	+	+			-78.50%	-52.10%	-18.70%	+
					160%	1.30%	37.00%						5.00%
paired t test / P		t=12.8 P<0.0001	t=10.1 P<0.0001	t=11.1 P<0.0001	t= -6.4 P<0.0001	t=0.02 P=0.98	t= -1.8 P=0.08			t=21.3 P<0.0001	t=14.3 P<0.0001	t=10.2 P<0.0001	t= -3.2 P=0.0014

S. Table 4: Timeliness and Completeness of Study Asthmatic-HCP Communication

Follow-up	% of Asthmatic- HCP Communication Timeliness		% of Asthmatic- HCP Communication Completeness	
	AAIG (n=160)	AACG (n=160)	AAIG (n=160)	AACG (n=160)
First Month	73.7%	72.5%	100%	100%
Second Month	71.5%	70.7%	100%	100%
Third Month	69.5%	66.1%	100%	100%
Fourth Month	76.9%	72.5%	100%	100%
Fifth Month	68.9%	65.5%	100%	100%
Sixth Month	67.2%	64.1%	100%	100%
First Visit	71.6%	69.8%	100%	100%
F-test / P	F= 0.4 / P= 0.28			
Second Visit	71.3%	68.9%	100%	100%
F-test / P	F= 0.88 / P= 0.44			