

Janna Plett

PROJECT TITLE:

**Operation Inspiration: Patients, puffers and plans for action:
Effect of web-based asthma management on asthma patient care and satisfaction**

STUDENT'S NAME: Janna Plett

SUPERVISORS' NAMES: Dr. Karen Toews
Dr. Jamie Falk

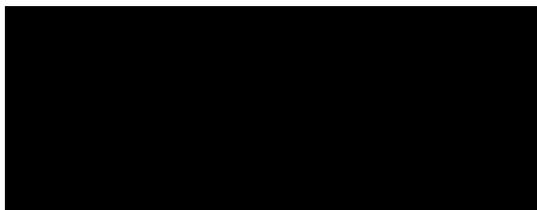
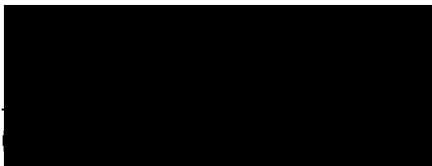
DEPARTMENT AFFILIATIONS: Family Medicine

SUMMARY:

Asthma is a common health problem in Canada and around the world. When asthma is not well controlled, it leads to increased use of SABAs (e.g. salbutamol), an increased number of physician and emergency room visits and a reduced quality of life. Guidelines for asthma management include patient monitoring and the use of a paper asthma action plan. Making asthma action plans available online may improve asthma care. In June and July of 2011, adults diagnosed with asthma aged 18 to 55 were enrolled and randomized to one of two study groups. During the period of August 2011 to June 2012, 41 patients were given normal care including a paper asthma action plan, and 39 patients also had access to their action plans online as well as receiving monthly reminder emails to review their action plan and access informational material through a link to asthma.ca. At the end of 9 months of the intervention there was no statistical difference seen between the two groups in the number of SABA refills or SABA doses per week. There was also no difference seen in asthma-related quality of life. Though this study did not find a statistically significant improvement of asthma care with the addition of an online asthma action plan, future study involving more extensive inclusion criteria and a more developed online tool may determine this to be a worthwhile intervention in the future.

ACKNOWLEDGEMENTS:

We gratefully acknowledge the support entirely or in part by one or all of the following sponsors; H.T. Thorlakson Foundation, Dean, Faculty of Medicine, St. Boniface Research Foundation, Manitoba Health Research Council, Manitoba Institute of Child Health, Kidney Foundation of Manitoba, Leukemia and Lymphoma Society of Canada, CancerCare Manitoba, Manitoba Medical Services Foundation, Associate Dean (Research) Faculty of Medicine, Heart and Stroke Foundation, Health Sciences Centre Research Foundation.



INTRODUCTION

Asthma is a common and significant health problem in Canada and around the world. It is estimated that 235 million people suffer from asthma worldwide.¹ Although asthma is often thought of as a children's disease, it affects many in every age group. In Canada, 15.6% of children and 8.3% of adults have received a diagnosis of asthma.²

Physiologically, asthma is due to episodic narrowing and obstruction of the airway. This is due to inflammation along with some bronchoconstriction.³ Asthma is characterized by symptoms such as cough, shortness of breath, chest tightness and wheeze.² Asthma is associated with significant personal and economic cost. Consequences of asthma symptoms include missed days of work, emergency room visits, hospitalizations and even death. It is estimated that each year there are 15 million disability adjusted life years (DALYs) lost worldwide, which represents 1% of the global disease burden.³

Although asthma carries a high personal and economic cost, with proper management most asthma symptoms can be controlled. The Canadian Thoracic Society (CTS) has published criteria for controlled asthma. The goal of controlling asthma is to minimize symptoms and as a result, minimize morbidity and mortality. The guidelines include daytime symptoms less than four times a week, nighttime symptoms less than once a week, less than four doses of short-acting beta agonist (SABA) needed per week, normal physical activity, and no missed days of work or school.⁴ These guidelines are used to judge whether asthma treatment is sufficient. When asthma is deemed to be poorly controlled, consideration must be given as to how to improve treatment. The two main ways to improve control are medication and environmental control. Environmental control consists of identifying asthma triggers and avoiding them as much as possible. Medications for asthma are divided into different categories including short-acting beta agonists, inhaled corticosteroids, long-acting beta agonists, leukotriene receptor antagonists and oral prednisone.

In addition to prescribed medications and environmental changes, patient education is also an important component of asthma care. When patients are educated and understand what asthma is and how to treat it, they are able to participate in their own asthma management. An important part of an asthma education program is the use of a written asthma action plan. It has been shown that when written asthma action plans are combined with an education program and self-management, there is a significant improvement in asthma control.⁵ Asthma action plans generally include directions for asthma monitoring and the medications to take depending on asthma symptoms or level of control. Action plans outline medications to take every day and when it is time to increase or change medications. They also describe when it is time to seek additional medical advice or go to the emergency room.

Despite our growing knowledge of the optimal management of asthma, and the fact that most asthma can be controlled with proper management,⁴ asthma control rates are still poor in practice. The most recent major asthma survey in Canada found that more than half of asthma patients had poorly controlled asthma, and almost all had an episode of

significant worsening of symptoms in the previous year.⁶ This survey suggests that there is still much room for improvement of asthma care.

With the increasing use of computers in medical practice, many studies have been done comparing the use of a web-based intervention with standard care. There have been a few such studies involving the use of a web-based tool in asthma care.^{7,8} These studies have found that the internet can be an effective aid to asthma self-management. Electronic medical records (EMR) have become a common resource in primary care settings. As physicians become more familiar with the system available to them, they can begin to use the EMR for more than charting patient visits. Many EMR systems have the capacity to share aspects of patients' care plans online. This is a potential avenue for web-based interventions.

The purpose of this study was to determine the effectiveness of adding an internet-accessible asthma action plan to asthma care compared to standard care including a paper action plan. The study was done in the rural Manitoba city of Steinbach, at the Steinbach Family Medical Center (SFMC). SFMC is run by 16 family physicians, with no respirologists or asthma nurses on staff. SFMC has been using EMR for the past 13 years. The system they use is JanokeMed™, which along with the typical aspects of charting patient visits allows physicians to make personalized care plans accessible to their patients on the internet. This study aimed to consider practical ways to improve asthma care in a rural setting.

MATERIALS AND METHODS

Study Population and Recruitment

In the spring of 2011, approximately 600 patients with asthma between the ages of 18 and 55 were identified from the Steinbach Family Medical Center (SFMC). Patients were identified based on a diagnosis of asthma by their physician at SFMC or by repetitive prescription of a short-acting beta agonist (e.g. salbutamol). A letter was sent to these patients asking if they would be willing to participate in an asthma research project. Letters were followed up with phone calls to assess desire to enter the study.

Inclusion Criteria

1. Patients seen at SFMC with a diagnosis of asthma
2. Age 18 to 55
3. Patients with an email address and at least monthly access to the internet

Exclusion Criteria

1. Cognitive dysfunction such that the patient could not participate in self-management of asthma as determined by the patient's family physician

Study Design and Objectives

This is a randomized, non-blinded study.

Patients agreeing by phone to participate in the study were randomized by computer generated allocation to either the control or web-based group. All patients had a written asthma action plan produced by their family physician at SFMC. They were then scheduled for an appointment to meet with the student researcher in June of 2011. At the initial visit a written informed consent form was provided to each patient and, if agreed to, signed. A short questionnaire for baseline and demographic information was then given to each patient, followed by the mini asthma quality of life questionnaire (see Figure 1).⁹ Each patient was given a printed copy of their asthma action plan, and this was reviewed with the patient. Those randomized to the web-based group were then shown how to access their asthma action plan and other supplemental asthma educational material online.

Throughout the year from June 2011 to June 2012, all patients received normal care from their family physician. Any changes to asthma care made at doctor's office visits throughout the year were reflected in updated asthma action plans which were given to the patient and made available online for those in the web-based group. Those in the web-based group were sent emails once a month reminding them of their ability to access their asthma action plan online and providing them with a link to asthma education topics at www.asthma.ca. These emails were sent beginning in late August 2011 and for the 9 months following.

In June of 2012, study participants were contacted by phone to collect follow up data. This included repeating the baseline asthma information and the mini asthma quality of life questionnaire as well as a satisfaction questionnaire to determine how people felt about the intervention they received.

97 patients initially agreed by phone to participate in the study. Of these, 80 came to their baseline appointment with the researcher. Of these, 73 completed the follow up interview. All 7 of those lost to follow up were not reachable by the phone numbers on file.

The primary objectives of this study were:

1. SABA use
 - a) Actual numbers of SABA refills in the 6 months prior to randomization were determined for all study participants through the Manitoba DPIN system. We defined "poorly controlled asthma" as patients who filled more than 2 SABA prescriptions in the past 6 months. The use of SABAs was reassessed at 9 months after the intervention initiation. Means and medians at both time points were calculated, as well as the change in means. The proportion of patients filling more than 2 SABA prescriptions was compared between baseline and 9 months post-intervention initiation in both the web-based and

control groups. 6 months was the chosen time frame based on the maximum retrospective view of medication acquisition in the DPIN system.

- b) The mean number of SABA doses needed per week as reported by patients at baseline was compared to the number needed at 9 months post-intervention initiation. The mean change in number of rescue doses needed per week was then compared between groups. We also looked at the number of people in each group who took more than 4 doses of SABA per week. The rationale for this is that the Canadian Thoracic Society has included in their definition of asthma control that less than 4 doses of SABA should be needed per week.⁴
2. Asthma Quality of Life Questionnaire (see Figure 1)
The Mini Asthma Quality of Life Questionnaire⁹ (mAQLQ) was administered to both groups at the time of randomization in June 2011, and again for follow-up in June 2012. This is a validated questionnaire that asks patients to indicate how much of the time they experience a variety of asthma symptoms, as well as the extent to which their asthma limits physical activity. There are 15 questions and a scale from 1 to 7, with a higher score indicating better asthma-related quality of life. Mean total scores at baseline and follow-up were compared between the two groups, and the change in mean total scores was compared between groups.

The secondary objectives of this study were:

1. Patient Satisfaction Questionnaire (see Figure 2)
The patient satisfaction questionnaire was administered at the time of follow-up data collection. It assessed satisfaction, confidence, symptom management, use and usability of the asthma action plan and web-based tool (if applicable). This questionnaire consists of five statements about these different areas, and patients were asked to indicate how strongly they agreed or disagreed with each statement. A 5-point Likert-type scale was used, with 1 being “strongly disagree” and 5 being “strongly agree.” A response of 3 was “neutral.” There was also one question about the number of times the patient referred to their asthma action plan over the 9 months of the study.
2. Other outcome data
Patient-reported number of symptom-free days in the past 2 weeks, asthma related clinic visits (available from EMR data), and patient-reported emergency room visits in the last 6 months were collected at baseline and follow-up. Means at baseline and follow-up were compared within groups and the change in means compared between groups.

Statistical Analysis

A sample size of 200 was chosen for this study. This was based on the statistically significant results found in two recent studies of internet monitoring/education tools vs. standard or specialist care using asthma-related quality of life questionnaires as the basis for their power calculations with 80% power at the 2-tailed, 5% significance level.^{7,8} Due to the limitations of time and patient availability, we were able to enrol 80 patients in the study, with 40 in each arm.

All data was tabulated on an Excel spreadsheet and then exported to the SAS data analysis program. Frequency distribution was compared between the two groups using chi-squared distributions. We compared means using independent sample T-tests. Medians were compared using the Wilcoxon test.

Ethical Considerations

Ethical approval was obtained from the University of Manitoba Health Research Ethics Board and from the South Eastman Health Ethics Board. Authorization for access to DPIN data was obtained from the Manitoba Health Information Privacy Committee. All data was kept in a patient non-identifiable method, using study ID numbers to track data. The Excel database was password protected. All DPIN data containing patient names was destroyed following data tabulation.

All study participants signed a written consent form after having the study explained to them. Patients were free to withdraw from the study at any time without any consequences to their regular healthcare at SFMC.

RESULTS

Baseline Demographics

The demographic data compared between the two groups is shown in Table I. This data was collected to ensure that the control group and the web-based group did not have any major differences that could confound the results of the study. The two experimental groups were not significantly different in either proportion of males and females, smoking status, or proportion on inhaled corticosteroids. There was significance however, in the education level between the two groups. Most of the people in the study with less than a high school education were randomized to the control group. There was also a significant difference in the mean age of the two groups. The control group had a mean age of 42.7 (standard deviation = 7.81) and the web-based group had a mean age of 36.6 (standard deviation = 11.07), with a p-value of 0.008.

SABA Use and Mini Asthma Quality of Life Survey

The two groups were also compared at baseline on level of asthma control and asthma severity (see Table II). The primary outcomes of the study were tested at baseline and again at the end of the study. In the areas of SABA doses per week, SABA refills and asthma-related quality of life, the two groups were not different at baseline. The mean number of SABA doses per week in the control and web-based groups were 4.40 and 6.29 (p=0.446), mean SABA refills in the 6 months leading up to the study were 1.27 and 1.21 (p=0.850), and mean score on the mAQLQ were 1.32 and 1.08 (p=0.584) respectively. 9 months post intervention at the end of the study, there remained no statistical difference in any of these outcomes (see Table III). Mean SABA doses per week were 3.36 and 3.97 (p=0.776), mean SABA refills in the past 6 months were 1.32

and 1.08 ($p=0.202$) and the mean score on the mAQLQ was 5.04 and 6.84 ($p=0.523$) for the control and web-based groups respectively. Medians were also calculated but did not add to the significance of the data.

Symptom-free Days, Doctor Visits

At baseline, the two groups were not significantly different in any of the secondary outcome measures (see Table II). The control and web-based groups had 10 and 12 patients respectively who had at least one asthma-related doctor visit in the 6 months leading up to the start of the study ($p=0.523$). In the two weeks leading up to the start of the study, 13 people from the control group and 11 from the web-based group had no symptom-free days, while 19 and 11 had more than 11 symptom-free days ($p=0.095$). At 9 months post-intervention, these measures remained not statistically significant (see Table III). At the time of follow up data collection, 10 people from the control group and 6 from the web-based group had had an asthma-related doctor visit in the previous 6 months ($p=0.523$). In the 2 weeks leading up to follow-up data collection, 8 from the control group and 5 from the web-based group had no symptom-free days, while 24 and 18 had more than 11 symptom-free days ($p=0.349$).

Satisfaction Survey

At the time of follow-up, a satisfaction questionnaire was given to all participants, assessing their opinion on the usefulness and practicality of the intervention they received (see Figure 2). Table IV shows the responses compared between the two groups. In the categories of symptom control and help in using medication more effectively, those in the control group were significantly more satisfied with the treatment they received than those in the web-based intervention group. In the areas of practicality and confidence in self-management, the preference of the control group approached significance. The two groups were not significantly different in their responses on their likeliness to recommend their intervention to others with asthma, or in the number of times they referred to their asthma action plan over the 9 months of the study.

Whole Group Outcomes

The two groups were combined to look at whether there was positive change in the group as a whole despite lack of significant change in the web intervention group (see Table V). In each of the five outcomes, the group as a whole improved slightly.

DISCUSSION

This study compared the clinical effectiveness of a web-based asthma action plan with standard care including a paper action plan. The results of this study showed that the web intervention did not make a statistically significant difference in any of the primary outcomes. The two groups were similar in their use of SABAs as well as in their asthma-related quality of life.

There are a small number of previous studies on the use of web-based tools in asthma care. Van der Meer et al⁷ tested the effectiveness of internet-based self-management of 200 adults with asthma. The internet intervention in their study involved weekly asthma monitoring, treatment advice and education. They found that the internet group had more improvement in asthma control, a great improvement in quality of life, and an increase in symptom free days. Rasmussen et al⁸ used an interactive online monitoring tool that included an internet diary, an online asthma action plan, and a decision support system for the physician. Their 3-arm study of 300 adults with asthma compared the use of the internet tool with care from an asthma specialist and standard care from a family physician. This study found a greater improvement in asthma symptoms, quality of life and lung function in the internet group compared with the other two groups.

There are several possibilities as to why this study failed to achieve statistical significance in the primary outcomes. One possibility is that because the sample size was quite small, the power of the study was too low to find significance, even in the presence of true effectiveness of the online tool. However, the very small actual differences observed between the two study groups would make it difficult to justify as clinically significant, even if statistical significance would be achieved with a larger sample size.

There are several things that may have caused the web-based tool to be ineffective. First of all, some participants in the study had barriers to accessing the web-based tool. All in the study had access to the internet, but in follow up conversations, some patients reported that they had discontinued their internet connection. Others had changed their email address and therefore had stopped receiving the reminder emails. In addition, an unanticipated feature of the online tool was that if a patient didn't access their action plan on the internet for several months in a row, their password was reset and they had to call SFMC to get access again. Barriers such as these made people less likely to check their action plans as often as they may have if it had been easier to access.

As a result of fairly broad inclusion criteria, it is possible that there were too few people in the study with severe enough asthma to benefit from the intervention. Everyone who was enrolled in the study was diagnosed with asthma, but in follow up conversations at the end of the study period, several participants who had referred to their action plans very few times commented that they felt their asthma was too well controlled to necessitate regular use of an action plan. Some of these patients indeed met all the asthma control criteria in the survey however others admitted in the quality of life questionnaire that they experienced asthma symptoms regularly. It is understandable that patients who feel that their asthma is not a significant problem are unlikely to take the time to refer to an asthma action plan, whether in paper form or online. The way to improve on this problem for future studies would be to only include patients who fit a definition of moderate to severe asthma, as well as to improve patient education on the goals of asthma care. This would ensure that study participants had a reasonable potential for improvement of asthma care, and that they were aware that improvement was possible.

One area of the study where statistical significance was seen was in the satisfaction questionnaire that was given at follow up (Table IV). Patients from both groups were asked about their opinion on the usefulness of the intervention they received. For those in the control group, this consisted of the baseline meeting with the researcher and the paper asthma action plan that was given to them. For the web-based group, the monthly emails, online action plan and links to asthma education topics were also included. The control group's answers were significantly higher in response to the statements "The asthma tool has helped me manage my asthma symptoms," and "The asthma tool has helped me to use my asthma medication more effectively." The control group's answers were also higher regarding the practicality and confidence statements, though they did not reach statistical significance. On first glance, it appears that the people in the web-based group did not like the online intervention however several aspects need to be considered. Firstly, both groups had a mean score of greater than 3 for each of the five statements. This shows that although the web-based group didn't answer as strongly as the control group, both groups on average did agree with each of the statements. Secondly, a potentially confounding factor in this questionnaire is the fact that some of those in the web-based group who had never accessed the online resources still answered the questions. These people in some cases answered "neutral" to every question because they felt that they didn't have enough experience with the intervention to make strong statements about their opinion. Others refrained from answering the questions at all. The fact that some participants answered with a 3 when they had not accessed the intervention may have lowered the overall mean scores for the web-based group.

It is interesting to note that although there were no significant improvements of the web-based group compared to the control group, the two groups combined improved in all areas (Table V). This may have been due to increased awareness of asthma from participating in an asthma study, as well as the asthma action plan review that was done with each patient at the baseline meeting with the researcher.

There remains the possibility that, in general, online asthma action plans do not improve asthma care compared to a standard paper based action plan. With the ever increasing prevalence of internet use in our culture, it seems surprising that a web-accessible action plan wouldn't improve asthma care compared to the paper action plan, which has been shown to improve care.⁵ There is potential to improve the online tool by increasing the amount of user interaction that is possible. Perhaps with more attention to removing potential barriers to access, as well as a study group with more severe asthma, a study could show a significant improvement of care with an online action plan. Regardless, there are possibly individual patients who could benefit from such an intervention, even if it wasn't useful for every asthma patient. Since there is little to no risk to a patient to have access to their action plan online, and since it takes a small amount of administrative time or cost to make it accessible, it is possible that even in the absence of a study that shows a large scale improvement, there may still be a place for such a tool in individualized family medical care.

This study attempted to use a resource that was already available in the EMR system being used at SFMC. As EMR systems become more advanced, they gain new potential

for use in addition to simple patient charting. The specific area focused on in this study was the ability to make patient care plans available online. If it was shown that this feature was of use to patients, there would be implications for many different chronic diseases in addition to asthma. Any disease where there is an aspect of ongoing self-management could make use of a regularly available online patient care plan with web-based education. Management of diseases such as diabetes and hypertension could include an internet accessible care plan that patients could access from home. This could be beneficial for those patients who are keen on taking an active part in their disease management and for whom the internet is a regular part of day to day life.

Future research should attempt to find practical ways to implement web-based asthma care in family practice. This may include making more strict inclusion criteria to ensure that those in the study have severe enough asthma to benefit from the intervention, as well as addressing barriers to internet and web-based tool access. More attention should also be given to other potential uses for EMR in clinical practice, including making patient care plans available to them online.

ACKNOWLEDGEMENTS

We would like to thank Dr. Malathi Raghavan at the University of Manitoba for her help with statistical analysis, and Darlene Hildebrand at the Steinbach Family Medical Center for her administrative role in the study.

References

1. WHO asthma fact sheet [homepage on the Internet]. World Health Organization. 2011 [cited June 26, 2012]. Available from: <http://www.who.int/mediacentre/factsheets/fs307/en/index.html>.
2. Life and breath: Respiratory disease in Canada [homepage on the Internet]. Ottawa: Public Health Agency of Canada. 2007 [cited June 26, 2012]. Available from: <http://www.phac-aspc.gc.ca/publicat/2007/lbrdc-vsmrc/index-eng.php>.
3. Global Strategy for Asthma Management and Prevention [homepage on the Internet]. Global Initiative for Asthma. (GINA) 2011 [cited June 26, 2012]. Available from: <http://www.ginasthma.org/>.
4. Loughheed MD, Lemiere C, Dell SD, Ducharme FM, Fitzgerald JM, Leigh R, et al. Canadian thoracic society asthma management continuum--2010 consensus summary for children six years of age and over, and adults. *Can Respir J*. 2010 Jan-Feb;17(1):15-24.
5. Gibson PG, Powell H, Coughlan J, Wilson AJ, Abramson M, Haywood P, et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev*. 2003;(1)(1):CD001117.

6. McIvor RA, Boulet LP, FitzGerald JM, Zimmerman S, Chapman KR. Asthma control in Canada: No improvement since we last looked in 1999. *Can Fam Physician*. 2007 Apr;53(4):672-7.

7. van der Meer V, Bakker MJ, van den Hout WB, Rabe KF, Sterk PJ, Kievit J, et al. Internet-based self-management plus education compared with usual care in asthma: A randomized trial. *Ann Intern Med*. 2009 Jul 21;151(2):110-20.

8. Rasmussen LM, Phanareth K, Nolte H, Backer V. Internet-based monitoring of asthma: A long-term, randomized clinical study of 300 asthmatic subjects. *J Allergy Clin Immunol*. 2005 Jun;115(6):1137-42.

9. Juniper EF, Guyatt GH, Cox FM, Ferrie PJ, King DR. Development and validation of the mini asthma quality of life questionnaire. *Eur Respir J*. 1999 Jul;14(1):32-8.

Table I: *Demographic data*

		Control (n=41)	Web-based (n=39)	p-value
Age (<i>Mean (St.D)</i>)		42.7 (7.81)	36.6 (11.07)	0.008
Gender (<i>N(%)</i>)	Male	13 (31.7%)	7 (18.0%)	0.155
	Female	28 (68.3%)	32 (82.1%)	
Education (<i>N(%)</i>)	Less than high school	11 (26.8%)	2 (5.1%)	0.031
	High school	13 (31.7%)	17 (43.6%)	
	More than high school	17 (41.5%)	20 (51.3%)	
Smoker (<i>N(%)</i>)	Never	26 (63.4%)	24 (61.6%)	0.897
	Former	11 (26.8%)	12 (30.8%)	
	Current	4 (9.8%)	3 (7.7%)	
ICS (<i>N(%)</i>)	Yes	30 (73.2%)	27 (69.2%)	0.697
	No	11 (26.8%)	12 (30.8%)	

*ICS = inhaled corticosteroid

Table II: *Baseline asthma control*

		Control (n=41)	Web-based (n=39)	p-value
SABAs/week (<i>Mean (St.D)</i>)		4.40 (6.15)	6.29 (14.10)	0.446
SABAs/week (<i>N(%)</i>)	<4	27 (65.9%)	26 (66.7%)	0.939
	≥4	14 (34.2%)	13 (33.3%)	
SABA refills in 6 months (<i>Mean(St.D)</i>)		1.27 (1.52)	1.21 (1.45)	0.850
SABA refills in 6 months (<i>N(%)</i>)	<2	30 (73.2%)	26 (66.7%)	0.526
	≥2	11 (26.8%)	13 (33.3%)	
Symptom-free days in last 2 weeks (<i>N(%)</i>)	0	13 (31.7%)	11 (28.2%)	0.095
	1 – 11	9 (22.0%)	17 (43.6%)	
	>11	19 (46.3%)	11 (28.2%)	
Asthma-related doctor visits in 6 months (<i>N(%)</i>)	None	31 (75.6%)	27 (69.2%)	0.523
	≥1	10 (24.4%)	12 (30.8%)	
Mini Asthma QOL survey (<i>Mean (St.D)</i>)		80.52 (15.1)	77.03 (14.7)	0.298

Table III: *Asthma outcomes*

		Control	Web-based	p-value
SABAs/week (<i>Mean(St.D)</i>)		3.36 (6.92)	3.97 (10.66)	0.776
Change in SABAs/week (<i>Mean(St.D)</i>)		-0.885 (8.32)	-2.74 (5.76)	0.267
SABAs/week (<i>N(%)</i>)	<4	31 (79.5%)	27 (79.4%)	0.994
	≥4	8 (20.5%)	7 (20.6%)	
SABA refills in 6 months (<i>Mean(St.D)</i>)		1.32 (2.14)	1.08 (1.74)	0.584

Change in SABA refills (<i>Mean(St.D)</i>)		0.049 (1.53)	-0.13 (1.28)	0.578
SABA refills in 6 months (<i>N(%)</i>)	<2	29 (70.7%)	28 (71.8%)	0.916
	≥2	12 (29.3%)	11 (28.2%)	
Symptom-free days in last 2 weeks (<i>N(%)</i>)	0	8 (20.5%)	5 (14.7%)	0.349
	1 – 11	7 (18.0%)	11 (32.4%)	
	>11	24 (61.5%)	18 (53.0%)	
Asthma related doctor visits in 6 months (<i>N(%)</i>)	None	31 (75.6%)	33 (84.6%)	0.314
	≥1	10 (24.4%)	6 (15.4%)	
Mini Asthma QOL survey change (<i>Mean(St.D)</i>)		5.04 (12.8)	6.84 (10.9)	0.523

**Because 7 participants were lost to follow-up, data for change from pre-study to post-study includes only the 73 participants who completed end-point data collection*

Table IV: *Satisfaction Questionnaire*

	Control	Web-based	p-value
	<i>Mean (St. D)</i>	<i>Mean (St. D)</i>	
Practical	4.308 (1.00)	3.828 (1.14)	0.070
Symptoms	3.846 (1.04)	3.138 (0.99)	0.006
Effectiveness	3.897 (1.10)	3.367 (1.07)	0.048
Confidence	3.923 (1.16)	3.433 (1.04)	0.073
Recommend	4.385 (1.02)	4.233 (0.94)	0.528
Referrals	4.077 (11.8)	2.030 (2.69)	0.299

**The answers for the first 5 questions ranged from 1-5. See Figure 2.*

Table V: *Whole group change over course of study*

	Pre-study	Post-study	Change
SABAs/week	5.32 (10.75)	3.64 (8.80)	-1.750 (7.25)
QOL survey	78.819 (14.95)	85.021 (15.72)	5.877 (11.89)
Symptom-free days	6.88 (5.62)	9.08 (5.47)	1.966 (4.72)
ER visits in 6 months	0.10 (0.49)	0.068 (0.30)	-0.041 (0.484)
Dr visits in 6 months	0.30 (0.54)	0.25 (0.56)	-0.050 (0.745)
Refills in 6 months	1.24 (1.48)	1.20 (1.94)	-0.038 (1.41)

**All answers are expressed as means with standard deviation in brackets.*

Figure I: *Mini Asthma Quality of Life Questionnaire*

MiniAQLQ

Study ID: _____

Date: _____

Please complete *all* questions by circling the number that best describes how you have been during the *last 2 weeks as a result of your asthma*.

In general, how much of the time *during the last 2 weeks* did you:

	All of the time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	Hardly Any of the Time	None of the Time
1. S Feel SHORT OF BREATH as a result of your asthma?	1	2	3	4	5	6	7
2. En Feel bothered by or have to avoid DUST in the environment?	1	2	3	4	5	6	7
3. Em Feel FRUSTRATED as a result of your asthma?	1	2	3	4	5	6	7
4. S Feel bothered by COUGHING?	1	2	3	4	5	6	7
5. Em Feel AFRAID OF NOT HAVING YOUR ASTHMA MEDICATION AVAILABLE?	1	2	3	4	5	6	7
6. S Experience a feeling of CHEST TIGHTNESS or CHEST HEAVINESS?	1	2	3	4	5	6	7
7. En Feel bothered by or have to avoid CIGARETTE SMOKE in the environment?	1	2	3	4	5	6	7
8. S Have DIFFICULTY GETTING A GOOD NIGHT'S SLEEP as a result of your asthma?	1	2	3	4	5	6	7
9. Em Feel CONCERNED ABOUT HAVING ASTHMA?	1	2	3	4	5	6	7
10. S Experience a WHEEZE in your chest?	1	2	3	4	5	6	7
11. En Feel bothered by or have to avoid going outside because of WEATHER OR AIR POLLUTION?	1	2	3	4	5	6	7

How limited have you been during the last 2 weeks doing these activities as a result of your asthma?

	Totally Limited	Extremely Limited	Very Limited	Moderate Limitation	Some Limitation	A Little Limitation	Not at all Limited
12. A STRENUOUS ACTIVITIES (such as hurrying, exercising, running up stairs, sports)	1	2	3	4	5	6	7
13. A MODERATE ACTIVITIES (such as walking, housework, gardening, shopping, climbing stairs)	1	2	3	4	5	6	7
14. A SOCIAL ACTIVITIES (such as talking, playing with pets/children, visiting friends/relatives)	1	2	3	4	5	6	7
15. A WORK-RELATED ACTIVITIES* (tasks you have to do at work)	1	2	3	4	5	6	7

*If you are not employed or self-employed, these should be tasks you have to do most days.

S: symptoms; En: environment; Em: emotions; A: activities.

©The MiniAQLQ is copyrighted. It may not be modified, translated or sold (paper or software) without the permission of Elizabeth Juniper.

Figure II: *Patient Satisfaction Questionnaire:*

PATIENT SATISFACTION QUESTIONNAIRE

Considering the asthma tool you have been using for the last 9 months (i.e. asthma action plan, web-based education (if applicable)), please circle the number that indicates how strongly you agree or disagree with the following statements:

1. The asthma tool was practical and easy to use.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. The asthma tool has helped me manage my asthma symptoms.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3. The asthma tool has helped me to use my asthma medications more effectively.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

4. My confidence in managing my asthma has improved as a result of using this tool.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. I would recommend using this tool to others with asthma.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

How often in the last 9 months did you refer to your action plan? _____