Effectiveness of the eCARE Programme: A Short Message Service (SMS) for Asthma Monitoring

Dear Editor,

The short message service (SMS) has become widely used by researchers[1] and medical practitioners for chronic disease management programmes.[2-4] In Singapore, the eCARE home monitoring service via SMS was developed in 2007 to monitor patients' asthma symptoms and remind patients to take their medication. The pilot study on discharged in-patients suggested that SMS reminders were effective to improve asthma control scores but did not reduce the number of emergency department (ED) visits or hospital admission. Compliance to responding to SMS messages was high (82%) and the majority of patients (95%) were satisfied with the programme.[5]

In 2012, adjustments were made to the eCARE programme. In this study, we evaluated the upgraded eCare monitoring system on discharged ED patients. Our primary objectives were to: 1) evaluate the effectiveness of the eCARE programme on asthma control; 2) determine satisfaction level of patients on eCARE programme; and 3) evaluate the health care utilisation amongst patients in eCARE programme with control group.

Materials and Methods

Study Subjects

This was a randomised controlled study which was approved by the National Healthcare Group Domain Specific Review Board. Participants were recruited from the EDs of 2 main teaching institutions in Singapore (Tan Tock Seng Hospital and National University Hospital). All patients who visited the ED with a primary diagnosis of asthma between 1 March 2013 and 28 February 2015 were screened by asthma nurses for enrolment into the study. The inclusion criteria were: 1) age 21 years and above; 2) owned a mobile phone; 3) know how to use an SMS system; 4) had reported poor or partly controlled asthma (asthma control test [ACT] score of 5 to 19); and 5) willing to participate in the study and give written consent. Patients were excluded if they: 1) had significant comorbidity, e.g. bronchiectasis, heart failure, diabetes mellitus with complication, stroke, renal impairment, chronic obstructive pulmonary disease; 2) did not know how to use an SMS system; and 3) had mild intermittent asthma. Eligible patients were recruited for the study while they were at the ED.

Study Design

Randomisation

Patients were randomised to the intervention or control group. Patients in the control group received routine care, i.e. patients were left to self-manage their asthma for 3 months. Patients in the intervention group were enrolled into the eCARE programme. The workflow of the eCARE monitoring is shown in Figure 1.

Asthma Education

All enrolled patients in the intervention and control groups went through an individualised asthma education with a trained asthma nurse at the ED. This session was tailored to the patients' educational needs. The assessment was carried out through the use of a proforma. The nurse obtained the patients' asthma history, frequency of healthcare utilisations, past near-fatal asthma episodes, triggers and adherence to medication. The asthma control score of the patient—in addition to other measures such as age, gender and duration of asthma symptoms—were measured on enrolment to the study. The asthma nurse also assessed patients' inhaler techniques and identified possible barriers to their treatment. This face-to-face asthma education programme involved discussion on the basic mechanisms of asthma, including common triggers and an explanation of the changes which occur to the airways resulting in the symptoms experienced by the patient. Lifestyle influences that can trigger asthma including occupation were discussed (where appropriate with the individual). The need for "preventer" and "reliever" medication was also emphasised during this session. Patients were provided post-emergency discharge plans and asthma first-aid advice to assist them in managing subsequent episodes of asthma attack. These sessions last on average 30 minutes.

Outcome Assessment

Outcome of asthma control using the ACT[6] and healthcare utilisation were assessed over the phone at 5 weeks and 3 months for all patients. For patients in the intervention group, a survey on satisfaction with programme was also done at 5 weeks.

Termination of monitoring could take place under any of the following 4 circumstances: 1) patient completed the

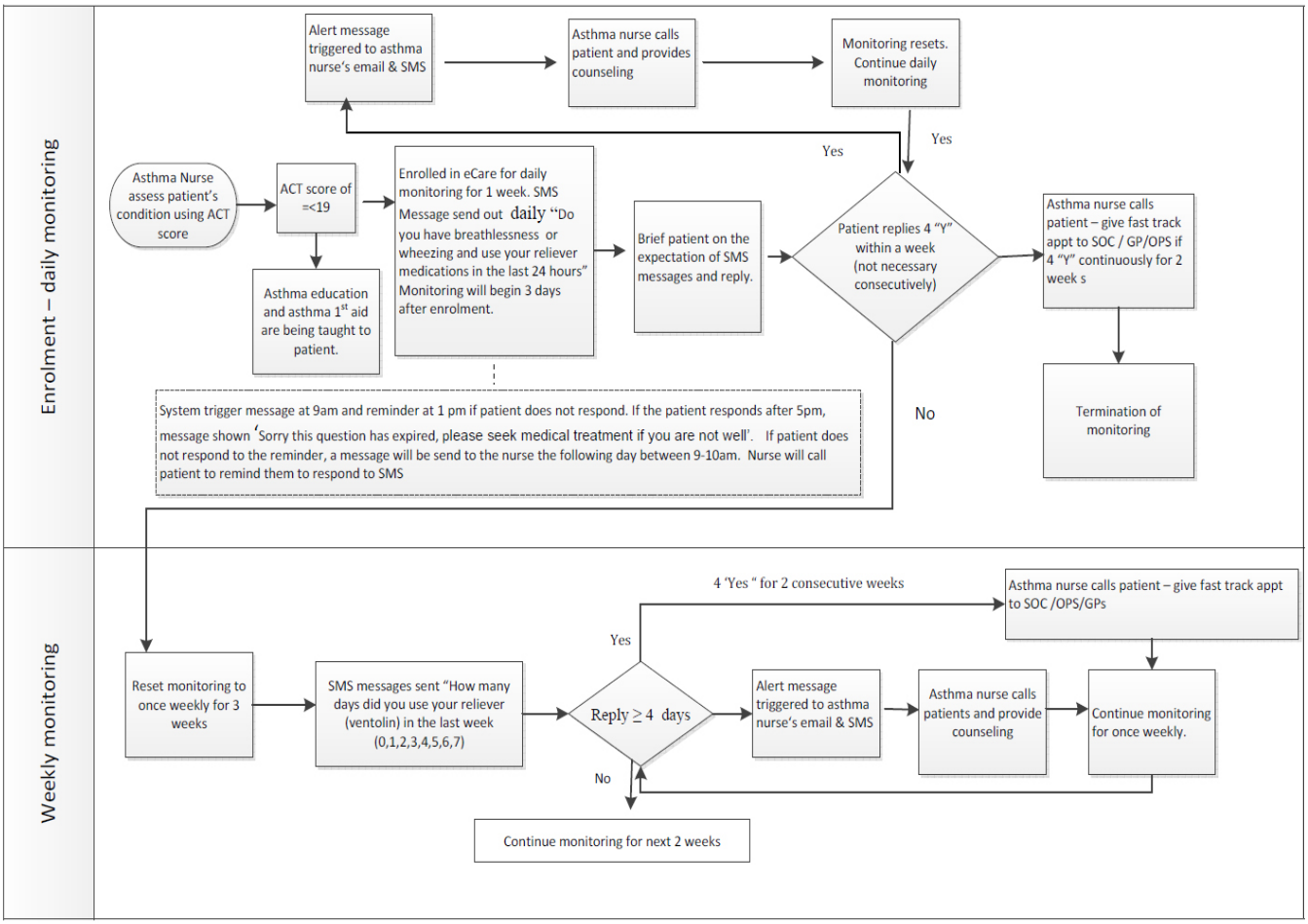

Fig. 1. Chart showing workflow of the eCARE monitoring.

cycle of monitoring (daily and weekly) without triggering any alerts; 2) patient refused to reply to SMS; 3) patient requested to end monitoring; and 4) patient was hospitalised.

Results

A total of 424 patients were randomised for the eCARE programme (n = 212) and for routine care (n = 212). Figure 2 describes the study population at each stage. The baseline characteristics are given in Table 1. It can be seen that patients under the eCARE programme were generally younger (mean age, 37.1), had shorter asthma duration (23.6 years) and had worse asthma control (50.0% had poor control) compared to those in the routine care group (38.7% had poor control).

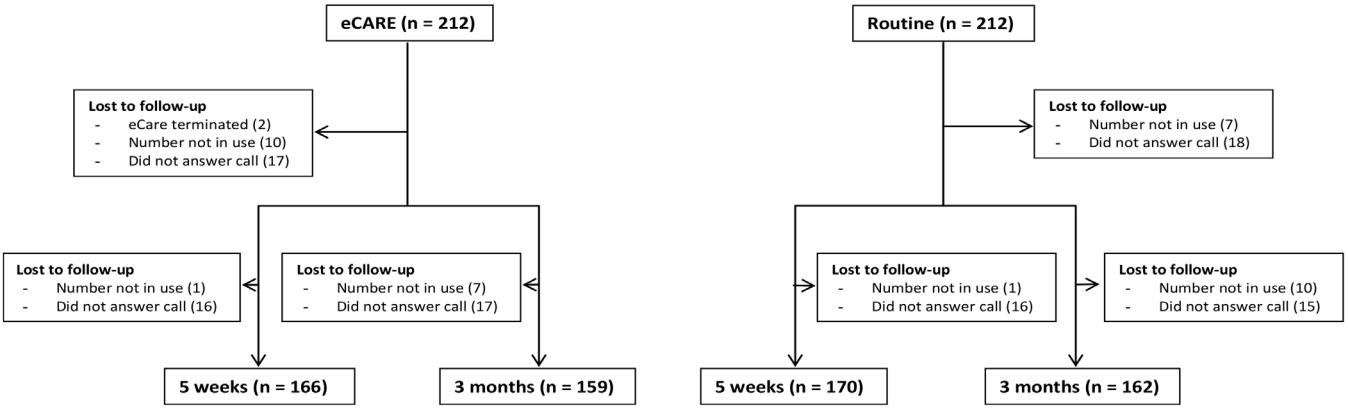

Fig. 2. Chart showing the study population.

Table 1. Baseline Characteristics of Patients

	eCARE (n = 212)	Routine (n = 212)	*P* Value
Age, mean (SD)	37.1 (12.6)	40.5 (15.9)	0.017
Gender			0.377
Male, n (%)	85 (40.1%)	95 (44.8%)	
Female, n (%)	127 (59.9%)	117 (55.2%)	
Race			0.119
Chinese, n (%)	42 (19.8%)	62 (29.2%)	
Malay, n (%)	113 (53.3%)	99 (46.7%)	
Indian, n (%)	47 (22.2%)	45 (21.2%)	
Others, n (%)	10 (4.7%)	6 (2.8%)	
Smoking, n (%)	54 (25.5%)	64 (30.2%)	0.329
Presence of comorbidities, n (%)	31 (14.6%)	42 (19.8%)	0.373
Duration of asthma (years), mean (SD)	23.6 (16.4)	28.2 (18.4)	0.006
ACT score, mean (SD)	13.9 (3.4)	14.4 (3.6)	0.139
Asthma control			0.024
Poor (5 – 14), n (%)	106 (50.0%)	82 (38.7%)	
Partial (15 – 19), n (%)	106 (50.0%)	130 (61.3%)	
Regular follow-up before recruitment			0.668
GP, n (%)	86 (40.6%)	95 (44.8%)	
SOC, n (%)	49 (23.1%)	40 (18.9%)	
Polyclinic, n (%)	46 (21.7%)	49 (23.1%)	
Others, n (%)	31 (14.6%)	28 (13.2%)	

ACT: Asthma control test; GP: General practitioner; SOC: Specialist outpatient clinic

At the 5-week follow-up, there is no statistical difference between the proportion of patients who had asthma-related ED visits (10.2% vs 9.4%) or hospital admissions (4.8% vs 4.1%) between the eCARE and routine care groups ($P = 0.856$ and $P = 0.797$, respectively). Approximately 95% of patients under the eCARE programme were satisfied with the SMS service.

Logistic regression was used to adjust for age, gender, race, asthma duration, baseline ACT score, smoking, number of comorbidities and initial place of asthma treatment. The results showed that patients who had partially controlled asthma at baseline were statistically more likely to achieve well controlled asthma for the routine care group compared to the eCARE group ($P = 0.043$). For patients with poor controlled asthma at baseline, there is no statistical difference in the proportion of patients who attained well controlled asthma between the eCARE and routine care groups ($P = 0.744$).

The eCARE group had a lower proportion of patients with well controlled asthma at the 3-month point (70.4% vs 84.6% for routine care group). There is no difference in the number of asthma-related ED visits (11.3% vs 13.0%, $P = 0.733$) and hospital admissions (7.5% vs 4.9%, $P = 0.364$) in both the intervention and control groups. Logistic regression shows that there is no statistical significant between the proportion of patients who attained well controlled asthma between the eCARE and routine care group.

Discussion

The daily and weekly SMS reminders were thought to create a higher patient awareness of asthma symptoms, while also reminding patients to adhere to their medication. However, after adjustment using logistic regression, the results showed no statistical difference in the proportion of patients who attained well controlled asthma in the eCARE group versus the routine care group. These findings were dissimilar to those of our initial study where greater improvement in ACT (to greater than 20 points) was seen in the intervention group compared to the control group, but this result was not statistically significant either.[5] It is well known that provision of information and empowerment of patients in any form of self-management programme typically leads to achievable asthma control.[7] In this study, the combination of eCARE and asthma counselling led more patients with poor baseline asthma control to achieve well controlled asthma, but no isolated statistical difference was found for eCARE or asthma counselling.

It can be argued that the eCARE monitoring in this study was shorter compared to the initial study, where the intervention group had 3 months of SMS monitoring.[5] The frequency and length of monitoring was reduced to 5 weeks consequent of the feedback received from the first study, where some patients found the daily monitoring irritating and preferred weekly monitoring. Similar findings were reported by Ulla et al.[8] Further studies should focus on methods to enhance monitoring according to patients' requirements whereby a patient can adjust the monitoring duration according to their needs on their own.[1,9] This can potentially increase effectiveness and lead to positive clinical outcomes.

Limitations

This study had a limited sample size and a short follow-up period. As such, further studies with a greater number of participants and a longer follow-up period are required before clear conclusions can be made about the effect of the SMS monitoring system on clinical outcome. In addition, many factors contribute to clinical outcome of asthma patients. These include asthma severity, comorbidities, triggers and medication adherence. SMS monitoring system can only address a small portion of these factors in overall asthma care and thus other intervention methods

are required to complement and enhance the effectiveness of SMS monitoring system.

Conclusion

In this study, the majority of patients under the eCARE programme were satisfied with the SMS service. However, patients in the eCARE programme did not have better asthma control than those receiving routine care. Conversely, patients in the eCARE programme appeared to have poor asthma control, though a larger sample size will be required to confirm this finding.

Acknowledgement

The authors would like to thank Ms Nora Said and Ms Shu Yi Lee for their contribution and assistance with this study.

REFERENCES

1. Macedo LG, Maher CG, Latimer J, McAuley JM. Feasibility of using short message service to collect pain outcomes in a low back pain clinical trial. Spine 2012;37:1151-5.
2. Anhøj J, Møldrup C. Feasibility of collecting diary data from asthma patients through mobile phones and SMS (short message service): response rate analysis and focus group evaluation from a pilot study. J Med Internet Res 2004;6:e42.
3. Ostojic V, Cvoriscec B, Ostojic SB, Reznikoff D, Stipic-Markovic A, Tudjman Z. Improving asthma control through telemedicine: a study of short-message service. Telemed J E Health 2005;11:28-35.
4. Kwon HS, Cho JH, Kim HS, Lee JH, Song BR, Oh JA, et al. Development of web-based diabetic patient management system using short message service (SMS). Diabetes Res Clin Pract 2004;66:s133-7.
5. Prabhakaran L, Chee WY, Chua KC, Abisheganaden J, Wong WM. The use of text messaging to improve asthma control: A pilot study using mobile phone short messaging service (SMS). J Telemed Telecare 2010;16:286-90.
6. Schatz M, Sorkness CA, Li JT, Marcus P, Murray JJ, Nathan RA, et al. Asthma control test: reliability, validity, and responsiveness in patients not previously followed by asthma specialists. J Allergy Clin Immunol 2006;117:549-56.
7. Van der Meer V, van Stel HF, Detmar SB, Otten W, Sterk PJ, Sont JK. Internet-based self-management offers an opportunity to achieve better asthma control in adolescents. Chest 2007;132;112-9.
8. Strandbygaard U, Thomsen S, Backer V. A daily SMS reminder increases adherence to asthma treatment: a three-month follow-up study. Respir Med 2010;104:166-71.
9. Charles T, Quinn D, Weatherall M, Aldington S, Beasley R, Holt S. An audiovisual reminder function improves adherence with inhaled corticosteroid therapy in asthma. Clin Immunol 2007;119:811-6.

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