



Evolution of Asthma Self-Management Programs in Adolescents: From the Crisis Plan to Facebook

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Self-management programs for chronic illnesses were first described regarding children with asthma at The Children's Asthma Research Institute and Hospital.^{1,2} This group approached asthma care by involving the patient in his/her own illness management.² The importance of self-management for improved asthma care has long been recognized. In 1976, 3 programs were funded by the National Heart, Lung, and Blood Institute (NHLBI) to develop self-management programs in pediatric asthma: Columbia University, the National Asthma Center, and the American Institutes of Research.^{3,4} Considerable energy and funding have been dedicated to creating and evaluating self-management programs to improve asthma care, and this has been a priority for the Global Initiative for Asthma and the NHLBI.^{5,6} These self-management approaches have evolved over time, and novel technologies are being used for asthma self-management.⁷ We review self-management programs in general and specifically the use of technology as an asthma self-management tool in the adolescent population.

Efficacy of Asthma Self-Management Programs

Self-management programs for pediatric asthma are very likely to work: a meta-analysis of 32 randomized controlled trials demonstrated that participants in the selected self-management programs demonstrated improved lung function and self-efficacy, decreased missed school days, and reduced activity limitations and emergency department visits.⁸ An ideal self-management program would be free, easy to use, and individually tailored for different populations (age, sex, patient preference). The program components may vary depending on the patients' needs, but a comprehensive program would include options for asthma education, an interactive asthma action plan (AAP), a reminder system, adherence monitoring with feedback, and options for interacting with asthma educators/nurses/clinicians.

Why Do We Need Self-Management Programs?

Although some patients with asthma are poorly controlled despite excellent adherence to maximal therapy, most patients with poorly controlled asthma have poor adherence^{9,10} and/or poor recognition of symptoms.¹¹ Indeed, fatal asthma has been attributed, in part, to poor self-management.¹² Tailoring self-management programs to different target

audiences may improve efficacy.¹³ Adolescents cite a variety of reasons for poor adherence, including competing priorities, their belief that medications are unnecessary and/or do not help, and that the medications have too many side effects.^{14,15} Adolescents, therefore, are prime targets for self-management programs that can improve adherence.

Self-Management Evolution

The 1970s and 1980s witnessed the development of several local asthma self-management programs: Asthma Care Training, Open Airways, Air-Power, Air-Wise, Living with Asthma, Family Asthma Program, Superstuff, and Teaching my Parents About Asthma.¹⁶ These programs emphasized asthma education. The NHLBI collaborated with the American Lung Association to disseminate 4 of these programs across the country, all with support from Boehringer-Ingelheim.¹⁶

The "crisis plan" was proposed in the 1980s, with instructions on when to step-up therapy, when to call the physician, when to go to the emergency department, and what to do on vacation.¹² These early crisis plans evolved into the Joint Commission mandated Home Management Plan of Care,¹⁷ more widely known as the AAP. The National Asthma Education and Prevention Program also supports the use of written AAPs.¹⁸ AAPs are the most widespread asthma self-management program. With the implementation of the Children's Asthma Care measures, compliance with provision of AAPs during asthma-related hospitalizations has been 96.2%.¹⁹

In the last decade, novel technology has been piloted and used to improve asthma self-management. Mobile AAPs have been demonstrated to increase AAP use and improve asthma control.²⁰ As 92% of teenagers use the internet on a daily basis and 88% own a cellphone,²¹ technology may be a powerful agent to engage them to improve asthma control. These novel tools address a variety of challenges in asthma control, including education, communication, self-efficacy, and

NHLBI National Heart, Lung, and Blood Institute
AAP Asthma action plan

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Table. Included studies

Authors	Year	Number subjects	Control group	Age (y)	Intervention	Duration (wk)	Primary outcome	Result	Secondary outcome	Result
Britto et al ²⁷	2012	23	Yes	13-18	Text messages	52	Acceptability/usefulness/ease of use	Y	Self-reported asthma control	N
Burbank et al ²⁸	2015	20	No	12-17	Application	8	Use of application/satisfaction	Y	Asthma control	Y†
Dzubar et al ²⁹	2014	20	No	12-17	Application	1	Satisfaction/ease of use	Y		
Farooqui et al ³⁰	2014	21	No	9-16	Application	4	Acceptability/usefulness	Y	Adherence	Y
Haze and Lynaugh ³¹	2013	25	No	13-18	Application	26	Relationship with asthma nurse	Y		
Mosnaim et al ³²	2015	12	No	11-16	Application	8	Tracked adherence	Y	Asthma control	Y
Neville et al ³³	2002	30	No	10-46	Text messages	4	Acceptability/usefulness	Y		
Perry et al ²⁰	2016	34	Yes	*	Mobile AAP	6	Utilization	Y	Asthma control	Y†
Petrie et al ³⁴	2012	147	Yes	16-45	Text messages	18	Understanding of asthma	Y	Self-reported adherence	Y
Searing and Bender ³⁵	2012	43	Yes	*	Text messages	4	Acceptability/usefulness	Y	Asthma control and adherence	Y
Seid et al ³⁶	2012	26	Yes	12-18	Text messages	12	Acceptability/usefulness	Y	Asthma control	Y
Vasbinder et al ³⁷	2016	209	Yes	4-11	Text messages	52	Adherence	Y	Asthma control, quality of life	N

Y, outcome achieved; N, outcome not achieved.

*Adolescents.

†In patients with uncontrolled asthma only.

adherence monitoring, but are certainly limited by socioeconomic status. Because the burden of asthma morbidity and mortality is higher among inner city and minority children with lower socioeconomic status,^{22,23} using technology more prevalent in groups with higher socioeconomic status may increase this gap in asthma morbidity and mortality.

A variety of novel, technology-based self-management strategies have been developed in the last decade, many as small pilot projects, often assessing feasibility and acceptability. These programs provide education, monitor asthma control, assess adherence, and may or may not provide feedback. A Cochrane review found insufficient evidence, as of June 2013, to support smartphone and tablet applications for asthma self-management programs in adolescents and adults.²⁴ However, with 88% of teenagers having cellphones,²¹ capitalizing on cell phone usage may be a powerful tool to improve asthma self-management in teenagers. A recent review on asthma self-management and social media showed that text message interventions are well-accepted, but asthma control did not improve.²⁵ Over 200 applications for asthma exist in the iPhone application store. An evaluation of available applications for asthma revealed that there is an explosion of applications over time, but many of these applications are not evidence based, and 25% were actually deleted from the application store.²⁶

A summary of these studies, which describes interventions using text messages, applications, and social media, can be found in the **Table**. Studies were found in Google Scholar and PubMed if they focused on children and adolescents and contained “asthma” and “text message,” or “application,” or “smartphone.” Further studies were found through those articles’ references or if they cited the previously selected articles. The **Table** includes study characteristics (number of subjects, ages, controlled or not, type of intervention, and duration), as well as evaluated outcomes and results.

Use of Technology for Self-Management in Chronic Diseases

Self-management programs employing novel technology have been successfully developed for other chronic diseases in children.

Sweet Talk is a text messaging program that incorporates diabetes information, tailored text messages, blood glucose tracking, and a forum to ask diabetes-related questions.³⁸ Sweet Talk incorporates “hip” vernacular in the text messages, (eg, “Don’t 4get 2 inject!” and “Boost ur daily activity—play ur favourite music and dnz!”)³⁹ In a randomized controlled trial, Sweet Talk demonstrated an improvement in self-efficacy scores, patient-reported adherence, perceived support, and hemoglobin A1c levels.³⁹ Although patients were enthusiastic to participate in this trial (70% recruitment rate) and overwhelmingly found this system helpful and wanted to continue using the program (90%), Sweet Talk did not improve blood glucose control, decrease diabetes complications, or increase diabetes knowledge score. Some text message burnout likely occurred given that 20% reported that they received repeated text messages.³⁹ Novel technologies, such as text messages have improved medication adherence in chronic disease management in adults.⁴⁰

Use of Technology for Asthma Self-Management: Text Messages

Several studies have evaluated text messaging for patients with asthma, and these trials have ranged in size and scope. In a focus group on novel technology for improved asthma control, all of the adolescents surveyed agreed that text messaging would be a great way to receive information and reminders.⁴¹ A variety of studies have proposed text messaging as a tool to improve asthma care. One group helped 12 adolescents generate their own automatic text message reminders that would be randomly sent out (eg, “Hay [sic], don’t forget to take your meds” and “take ur[sic] damn meds”); the teenagers thought these messages were helpful, but there was no change in asthma control scores using a modified Asthma Control Test.²⁷ Adolescents and adults were randomized to receive normal care or normal care and tailored text messages; asthma perceptions improved (using the Brief Illness Perception Questionnaire), and reported adherence was significantly higher in the treatment group than in the control group.³⁴

Tailored text messages (along with motivational interviewing) were also used with the In Vivo intervention; adolescents

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